

Ministry of Works and Supply, Republic of Zambia
Ministry of Transport and Energy, Republic of Zimbabwe

BASIC DESIGN STUDY REPORT

ON

**THE PROJECT FOR THE PROPOSED NEW BRIDGE
OVER THE ZAMBEZI RIVER
AT CHIRUNDU BORDER POST**

BETWEEN

THE REPUBLIC OF ZAMBIA

AND

THE REPUBLIC OF ZIMBABWE

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October 1998

Japan International Cooperation Agency

Chodai Co., Ltd.

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PREFACE

In response to a request from the Government of the Republic of Zambia and the Government of the Republic of Zimbabwe, the Government of Japan decided to conduct a basic design study on the Project for Proposed New Bridge over the Zambezi River at Chirundu Border Post and entrusted the study to the Japan International Cooperation Agency (JICA).

JICA sent a study team to both countries from August 11 to August 30, 1998.

The team held discussions with the officials concerned of the Government of the Republic of Zambia and the Government of the Republic of Zimbabwe and conducted a field survey at the study area. After the team returned to Japan, further studies were made and the report was finalized.

I hope that this report will contribute to the promotion of the Project and to the enhancement of friendly relations between Japan and both countries.

I wish to express my sincere appreciation to the officials concerned of the Government of the Republic of Zambia and the Government of the Zimbabwe for their cooperation extended to the team.

October 1998



Kimio Fujita
President

Japan International Cooperation Agency

October 1998

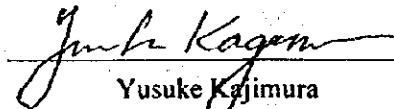
Letter of Transmittal

We are pleased to submit to you the basic design study report on the Project for the Proposed New Bridge over the Zambezi River at Chirundu Border Post in the Republic of Zambia and the Republic of Zimbabwe.

This study was conducted by Chodai Co., Ltd. under the contract to JICA, during the period from July 13 to October 30, 1998. In conducting the study, we have examined the feasibility and rationale of the Project with due consideration to the present situation of Zambia and Zimbabwe and formulated the most appropriate basic design for the Project under Japan's grant aid scheme.

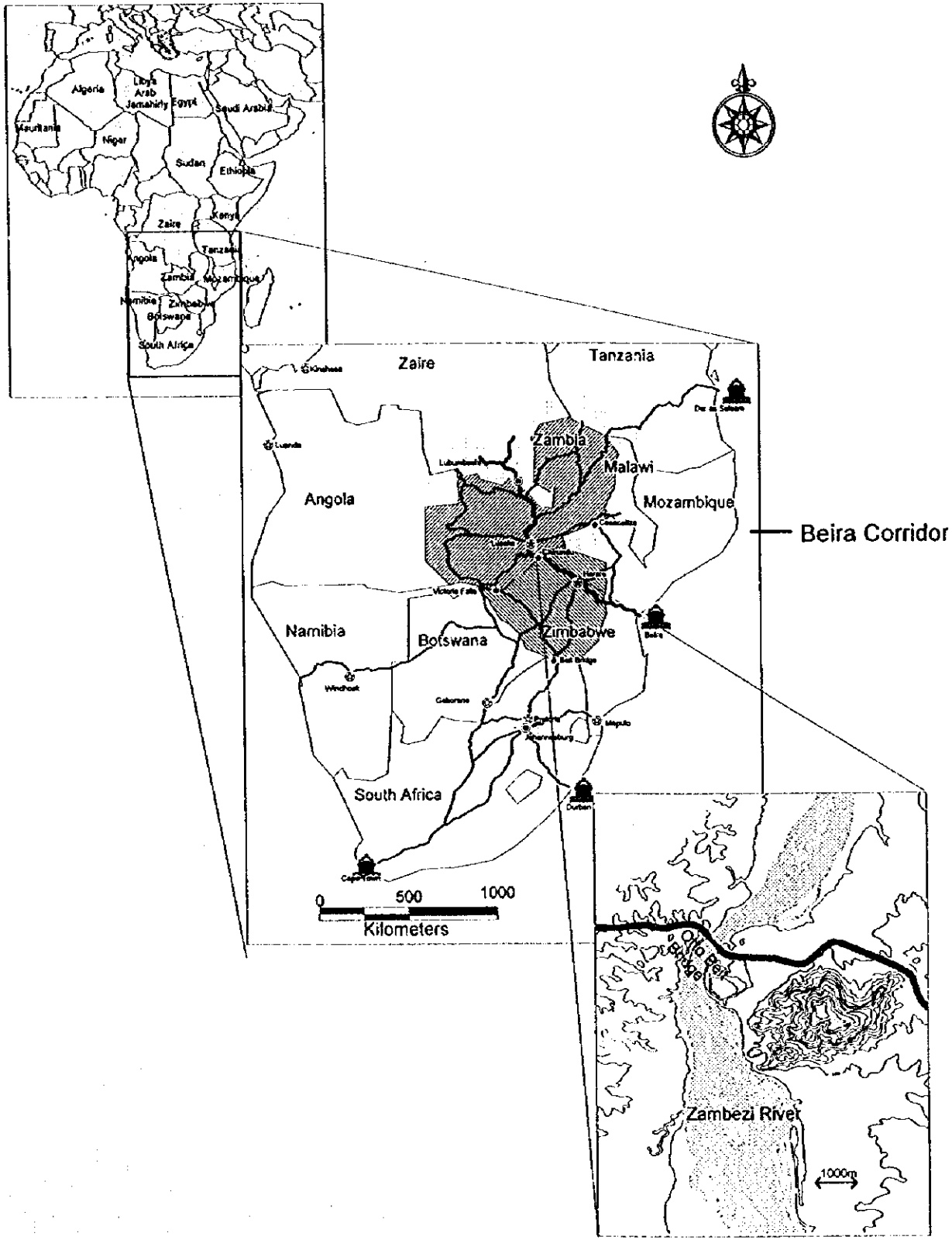
Finally, we hope that this report will contribute to further promotion of the Project.

Very truly yours,

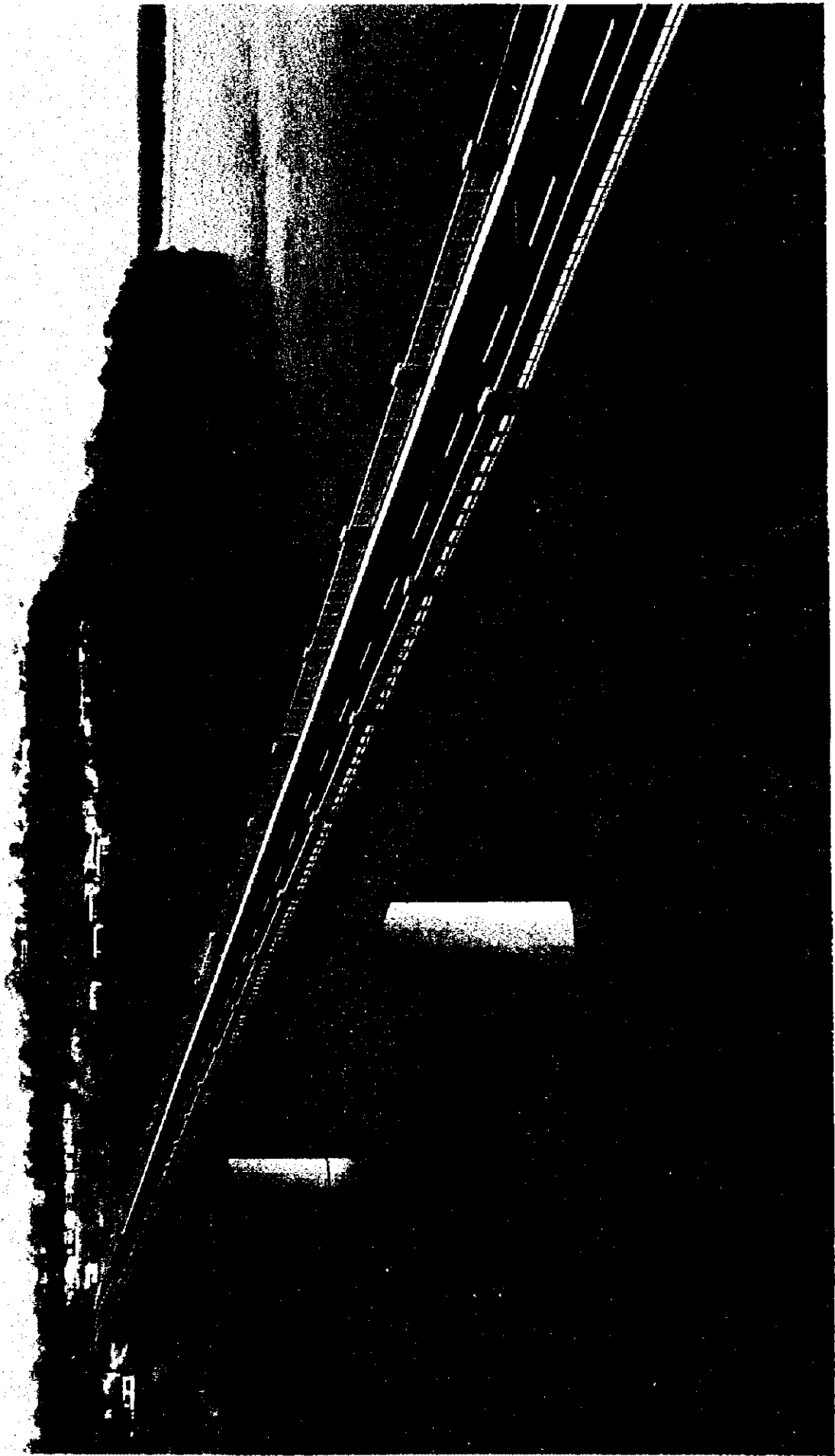


Yusuke Kajimura
Project Manager

Basic Design Study Team on the Project
for the Proposed New Bridge
over the Zambezi River
at Chirundu Border Post in
the Republic of Zambia and
the Republic of Zimbabwe



Location Map



NEW CHIRUNDU BRIDGE (View from Zambian Side)

Abbreviations

A. Authority and Agencies

JICA : Japan International Cooperation Agency
MLGH : Ministry of Local Government and Housing, Zambia
MLGNH : Ministry of local Government and National Housing, Zimbabwe
MOFED : Ministry of Finance and Economic Development, Zambia
MOTE : Ministry of Transport and Energy
MWS : Ministry of Works and Supply
NEPC : National Economic Planning Committee, Zimbabwe
SADC : South Africa Development Community
ZRA : Zambian Revenue Authority
ZRA : Zimbabwean Revenue Authority

B. Other Abbreviations

GL : Ground Level
OD : Origin and Destination Research
PC : Pre-stressed Concrete
VAT : Value Added Tax

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Chapter 1 Background of the Project

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Chapter 1 Background of the Project

Chapter 1 Back Ground of the Project

Both of the Republic of Zambia and the Republic of Zimbabwe are located at middle of inland of southern African continent. The population of each country is 9.2million and 11.3million in 1996, the land are is 753,000km² and 391,000km² and the population density is 12.2/km² and 28.1/km² respectively.

The most of the area at both countries are resting on high plateau of more than 1200m from sea level and have a gentle weather of approx. 20°C of annual mean temperature and approx. 800mm of annual rain fall. There is a clear distinction of dry and wet weather season.

The republic of Zambia achieved the independence in 1964 however, the Republic of Zimbabwe stayed in the British Commonwealth as the British Territorial Southern Rhodesia until 1980. Gross National Product of each country shows US\$400/head and US\$540/head in 1995 respectively.

Since both countries are located at inland, their transportation is relying mainly on railway and road. Railway and road net work connecting the major ports at coastal countries such as Tanzania, Mozambique and South Africa and the major cities of inland in southern African countries are recognized as the important transport infrastructures and of which maintenance is the most important issue of the South African Development Committee (SADC).The road sector is increasing the roll in these days because of which superiority on the transport efficiency.

The road net work in Zambia is poorly provided and maintained due to insufficient investment after the independence. Total length of road is 66,800km however, including gravel paved road, only 8,700km is paved in 1995. On the other hand, the road net work in Zimbabwe is relatively well provided and maintained due to regular investment by the time of the independence. Total length of road is 91,000km and, including gravel paved road, 56,000km is paved in 1996.

Trunk roads at both countries are maintained as tar paved road however, due to insufficient investment for road maintenance work after the independence, road sections exceeding durability period, which requires repair work, are increasing in these days. In order to solve the problem, as their policy, both Governments are planning rather to invest mainly for the maintenance work on the existing trunk road net work than to invest for new road construction.

The international trunk road connecting Beira Port in Mozambique, Harare in Zimbabwe and Lusaka in Zambia is known as Beira Corridor. This trunk road across the Zambezi river at Chirundu, border post between Zambia and Zimbabwe, therefore, the existing Chirundu border post is consisting of a bridge and each border facility at both ends.

At Chirundu border, traffic volume is increasing in these days however, due to lack of capacity of the border facilities and superannuation of the bridge, vehicles are being forced to idle for hours for passing through the border and there is a load limit to heavy vehicles both of which is causing low efficiency of commodity flow on the trunk road.

Under such a circumstance, both Governments requested for the implementation of Feasibility Study on the New Bridge over the Zambezi River at Chidundu to the Government of Japan and Japan International Cooperation Agency (JICA) conducted the study from June, 1997 to March, 1998 and examined the plan in both of technical and social economic aspects.

Chapter 2 Contents of the Project

Chapter I Back Ground of the Project

Both of the Republic of Zambia and the Republic of Zimbabwe are located at middle of inland of southern African continent. The population of each country is 9.2million and 11.3million in 1996, the land are is 753,000km² and 391,000km² and the population density is 12.2/km² and 28.1/km² respectively.

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Chapter 2 Contents of the Project

Chapter 2 Contents of the Project

2-1 Objectives of the Project

The Otto-Beit Bridge over Zambezi river at Chirundu, border between Zambia and Zimbabwe, on the route of the Beira Corridor starting from Beira port in Mozambique and leading to Lusaka in Zambia through Harare in Zimbabwe, was constructed in 1939 by United Kingdom.

The bridge is passable at only one lane due to the old design and further more, the load is limited as max.55t with one vehicle at a time.

In addition to the above condition, passing through Chirundu border becomes a bottle neck of the traffic on the Corridor due to insufficient capacity of border facilities and inefficiency of the procedure of customs clearance, thus a new bridge construction and improvement of border facilities are inevitable.

At SADC, the improvement of border facilities at Chirundu was decided as the most important project for the improvement of Beira Corridor at the meeting held in August 1996.

The objective of the Project is to promote economic development in countries traversed by the Beira Corridor and other countries to the north and south of Zambia and Zimbabwe by;

- a) reducing transportation costs;
- b) reducing constricted cargo flow; and
- c) improving border post facilities.

2-2 Basic Concept of the Project

2-2-1 Capacity of Border Post Facilities

This Project is the improvement of border facilities at Chirundu. Due to increment of traffic volume passing through the border in recent years, the modernization and capacity increase on the border facilities and a new bridge construction at the border between Zambia and Zimbabwe became necessary.

In order to make the target for an improvement plan quantitatively, the planned year is set as 2010 and the capacity of each facility is decided based on the assumed traffic volume of the period.

(1) Traffic Condition

The past trend of traffic volume at Chirundu is as shown in Table-2-1.

	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
Out	36	37	55	82	66	65	111	104	86	90	NA	82	137
In	34	49	56	63	69	61	103	118	93	102	NA	81	119
Total	70	86	111	145	135	126	214	222	179	192	NA	163	256

Out: Outbound from Zambia

1996 is result from SATCC survey

In: Inbound to Zambia

1997 is result from JICA survey

(2) Planned Traffic Volume

Future traffic demand at Chirundu is estimated as shown in Table-2-2; based on the flow of cargo and people and traffic volume trend shown in Fig-2-1.

The estimated volume of traffic was worked out by using the result of O.D. (Origin and Destination) investigation at the Feasibility Study and the estimated cargo volume on road transportation. And the future cargo traffic demand in 2002 and 2010 were worked out taking 7.5% of annual traffic volume increase into account. The future traffic demand of passenger car and bus was worked out based on the estimated number of traveler. As the result, it was known that the traffic demand will exceed the allowable capacity of the existing bridge of 300units/day in 2001.

Further, the actual traffic volume in 1997 reached 250units/day and in case the annual traffic volume increase is constant, the traffic demand will exceed the allowable capacity of the existing bridge even before 2001.

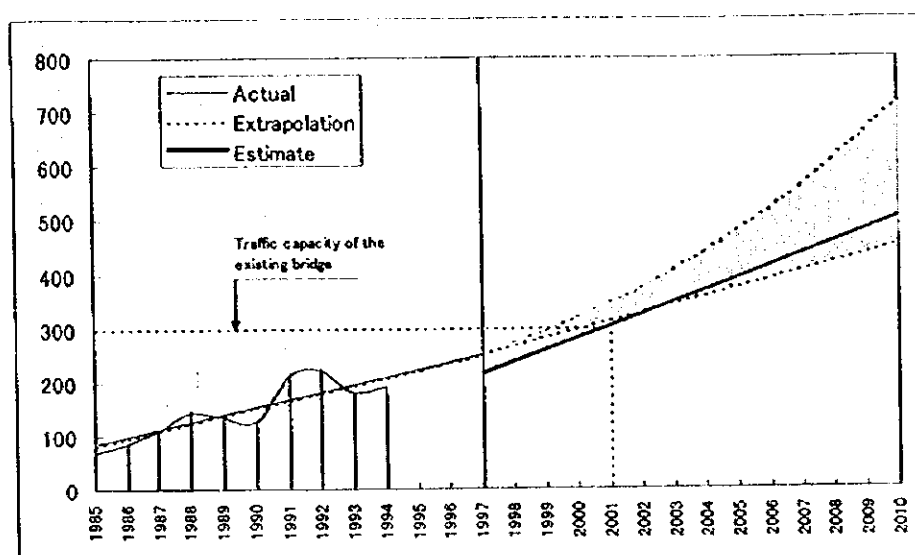


Fig-2-1 Future Traffic Demand at Chirundu Border Post

Table-2-2 Future Traffic Demand

(Unit/D)

Direction	1997	2002	2010
Zambia→Zimbabwe	111	161	252
Zimbabwe→Zambia	110	161	254
Total	221	322	506

(3) Traffic Demand and Existing Facilities

1) Necessity of the New Bridge

As shown in Fig-2-2, traffic capacity of the existing bridge is 300 vehicles per day under 12hours operation. Future traffic demand by the year 2001 will exceed the capacity, and under 14hours operation, traffic demand will exceed the capacity in 2003. Overflowed traffic have to divert to the other route such as Kariba dam, Victoria falls route etc.

2) Necessity of Border Post Facilities Improvement

As shown in Fig-2-3, handling capacity of the border post facilities is estimated as 250 vehicles per day under 12hours operation and as 300 vehicles per day under 14hours operation.

Future traffic demand will exceed the capacity of under 12hours operation in 1999 and even 14hours operation in 2001. Vehicles arrived during the day could be handled in the afternoon however, when the traffic volume exceeds the capacity of the border post, it will cause the malfunction of the border.

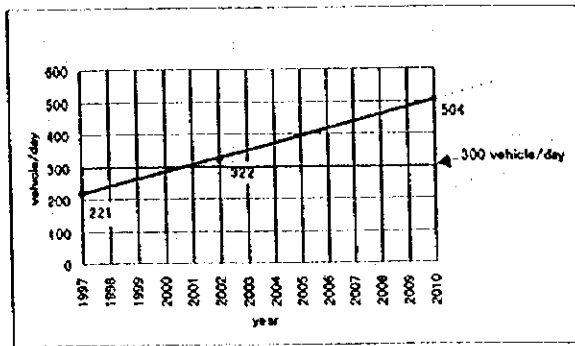


Fig-2-2 Traffic Volume and the Bridge Capacity

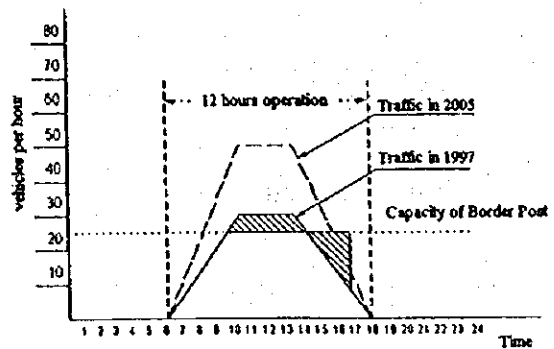


Fig-2-3 Traffic Volume and the Border Post Capacity

(4) Bridge Facility

Existing Otto-Beit bridge is a single span suspension bridge of 360m in length and 5.5m in width built in 1939. Bridge structure is maintained as almost sound condition however, the passage on the bridge is limited as one vehicle at one time with max. 55t in weight due to the old design and limited as 30 units of vehicles per hour at most.

For the new bridge, structure will be built based on the present prevailing bridge design standard at both countries, taking the fact that the most of vehicles (45% of total) passing through the border are large size cargo truck of 5 to 7 axles and there are demands of multiple axle vehicle(over 55t in weight) into consideration. Number of carriage ways is determined as two (2) taking the durability of bridge of more than 100years into consideration.

The existing bridge should be maintained and served for pedestrians, also served for vehicles at the time of emergency, from the point of its effective utilization and historical value.

(5) Border Post Facilities

The border is open for 12hours from 6:00am to 6:00pm and in general, corresponding to the present demand however, holding the problems described below.

- i) Insufficient facilities and capacity
- ii) Lack of the number of staff
- iii) Lack of the standard, size and number of staff housing
- iv) Inadequate passenger facility

As for Phase-1 of border post facilities improvement plan, Zambian Government is implementing the following items:

- i) Improvement of immigration control facility
- ii) Construction of customs facility
- iii) Construction of 40units of staff housing
- iv) Land acquisition for police building
- v) Appointment of consultant for designing related facilities

i) and ii) of the above items have been completed and iii) will be completed by the end of 1998.

As for Phase-1 of border post facilities improvement plan, Zimbabwean Government is implementing and planning the following items:

- i) Negotiation for the relocation of police building
- ii) Commencement of detailed design for civil works from Jan. 1999

As shown in Table-2-3, border post facilities improvement plan by the year of 2010 is being recommended from the above facts.

Table-2-3 Border Post Facilities Improvement Plan (m²)

Facility Name	Zambia		Zimbabwe		Remarks
	2002	2010	2002	2010	
Freight Terminal	2,135	915	2,135	915	New
Passenger Control Building	-	1,739	-	978	New
Pedestrian Control Building	-	400	-	240	Renovation
Drug Enforcement	178	-	209	-	New
Vehicle Inspection Unit	84	-	116	-	New
Police Station	-	-	820	-	New
Guard House	105	-	120	-	New
Staff Housing	18,755	6,550	18,755	6,550	New

1) Freight Terminal

The existing customs facilities at both countries have almost no vehicles inspection area, roof cover, car parking area etc. which are inevitable to carry out proper customs clearance work therefore, these facilities shall be provided at initial stage of the improvement plan to meet traffic volume increase as shown in Table-2-4.

Table-2-4 Freight Terminal Improvement Plan (m²)

Facility Name	Zambia		Zimbabwe		Remarks
	2002	2010	2002	2010	
Terminal Building	2,135	915	2,135	915	
Docking Bay	3,045	4,455	3,045	4,455	
Parking Area	24,540	33,205	20,200	35,793	

2) Passenger Control Building

The same as freight terminal, passenger control facility is improperly arranged. Table-2-5 shows the improvement plan of facility by the year of 2010.

Table-2-5 Passenger Control Facility Improvement Plan (m²)

Facility Name	Zambia		Zimbabwe		Remarks
	2002	2010	2002	2010	
Main Building	-	1,150	-	310	Renovation of existing building
Ditto Alteration	-	305	-	770	
Vehicle Theft Unit	-	84	-	108	
Car inspection Unit	-	200	-	360	
Main Building Expansion	-	-	-	200	
Parking Area	-	12,217	-	14,476	

3) Pedestrian Control Building

It is advisable to fully utilize the existing facilities for pedestrian control and they will have to be renovated according to the increase of users in future.

4) Drug Enforcement

At Chirundu, illegal drug dealings are being serious problem for many years. Therefore, in conjunction with improvement of freight terminal, passenger and pedestrian control facilities, drug control by dogs will be necessary.

5) Vehicles Inspection Unit

Vehicles inspection is an effective method, as the first step of cargo inspections declared and for the road pavement condition control. In both countries, axle load is limited as max.8.3t per axle. In Zambia, weigh bridge is provided in Kafue approx.90km away from Chirundu therefore, the same shall be relocated near to the border and moved into border post facilities in future.

6) Police Station

There is a Police Station both in Zambia and Zimbabwe, however these buildings will have to be relocated due to the construction of Access Road to New Bridge therefore, the new buildings shall be built in the border post facilities.

7) Guard House

Guard house shall be newly built in order to control gate of in and out and guard the fence surrounding the border post facilities.

8) Staff Housing

An operation of border post facility varies depending on the number and quality of staff. The operation of both countries are carried out by shift during the hour of 6:00am and 6:00pm. They have clearing capacity of 20 to 25 units of vehicles per hour however, it is hardly said that proper inspection is made well, due to insufficiency of facilities and lack the number of staff.

At the time of planned year, clearing capacity of 40 to 50 units of vehicles per hour will be necessary and longer time will be required for proper inspection of cargoes therefore, the number of staff shall be increased as shown in Table-2-6.

The number of staff housings shall also be provided as shown in Table-2-7.

Table-2-6 Staff Provision Plan (nos.)

	Zambia		Zimbabwe		Remarks
	Present	Plan	Present	Plan	
Immigration					
Principle Officer	-	1	1	1	
Senior Imm. Officer	1	1	1	3	
Imm. Officer	4	4	4	16	
Asst. Imm. Officer	5	4	4	-	
Imm. Assistant	7	4	2	3	
Support. Staff	2	3	1	3	
Customs					
Asst. Commissioner	1	1	-	-	
Senior Collector	1	2	-	1	
Collector	3	3	1	2	
Exam. Officer	4	8	15	18	
Customs Officer	10	10	-	-	
Asst. Officer	2	8	-	-	
Support. Staff	9	17	10	10	
Total	49	67	39	57	

Table-2-7 Staff Housing Plan (unit)

	Zambia		Zimbabwe		Remarks
Customs					
Floor Area 160m ²	1		1		
140m ²	6	2	6	2	
120m ²	9	3	9	3	
110m ²	24	8	24	8	
100m ²	30	10	30	10	
75m ²	24	8	24	8	
65m ²	34	17	34	17	
Immigration					
Floor Area 140m ²	1		1		
120m ²	6	2	6	2	
100m ²	12	4	12	4	
75m ²	12	4	12	4	
65m ²	12	4	12	4	
50m ²	6	3	6	3	
Drug Enforcement etc.					
Floor Area 120m ²	3		3		
100m ²	18	6	18	6	
75m ²	9	3	9	3	
50m ²	3	3	3	3	
	287		287		

2-2-2 Bridge Route Alternatives

(1) Basic Consideration for Route Location

JICA conducted the various field reconnaissance surveys of the study area and collected data to understand the conditions of the site under the Feasibility Study. As the result of analysis of various data and information collected, the following basic consideration items for route location were identified.

- To select the most economical and rational bridge type.
- To select the route with less technical problems.
- To preserve the natural and social environment as much as possible.

- d) To avoid cutting through the existing and future community area as much as possible.
- e) To utilize the existing border post facilities as much as possible.
- f) To keep a compatibility with the future development plans of the area.

(2) Formulation of Alternative Routes

As the result of field reconnaissance survey and analysis of data collected, three (3) alternative routes, A, B and C were identified as shown in Fig-2-4. Dimensions of each alternative route are shown in Table-2-8.

(3) Evaluation of Alternative Routes

The evaluation of alternative routes study was conducted from the point of technical, economical and environmental aspects. From the Table-2-9, the Alternative Route-A was selected for a new bridge construction and improvement of the border post facilities.

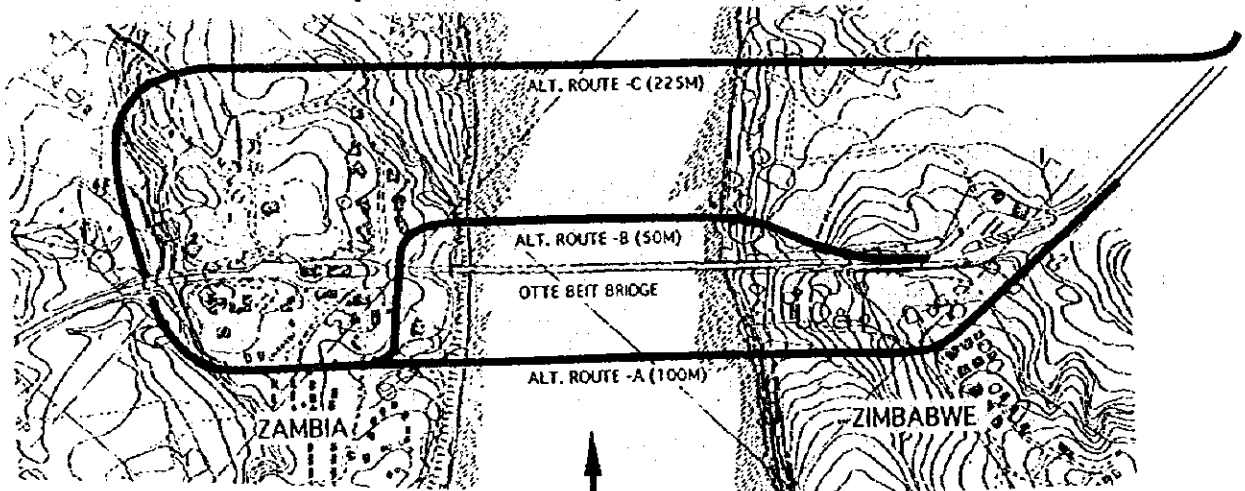


Fig-2-4 Location Plan of Each Alternative Route

Table-2-8 Dimension of Each Alternative Route

Items	Route-A	Route-B	Route-C	Remarks
River cross point (from existing bridge)	upstream about 100 m	downstream about 50 m	downstream about 225 m	
River width (m)	330	300	310	
Bridge length (m)	400	380+100	380	
Road length (m)	Zim=400 Zam=425	Zim=150 Zam=560	Zim=625 Zam=570	
Total length (road +bridge) (m)	1,225	1,190	1,570	
Max. longitudinal grade (%)	3.0	3.0	5.0	
Mini. curvature (m)	55	35	75	
No. of houses to be demolished	25	10	6	
Max. cutting height (m)	15.0	4.0	7.0	
Max. embankment height (m)	4.0	4.0	6.0	
Existing custom facilities	To be used	To be used	difficult	
Excavation volume (m3)	67,000	10,000	23,000	
Embankment volume (m3)	7,000	7,000	42,000	
Pavement volume (m3)	8,200	7,100	12,000	

Table-2-9 Comparison of Each Alternative Route

	Alt. Route -A	Alt. Route -B	Alt. Route -C
a) Economic aspect	A and B are almost equal	A and B are almost equal	Higher than A or B
b) Technical aspect	No major issues	Horizontal alignment is very tight	Difficult to use present facilities
c) Environmental	No major issues	Private housing to be removed	Enormous
d) Community	No major issues	No major issues	Issues in Zambia side
e) Border Post Facilities	Utilized	Utilized	Not utilized
f) Development Plan	Police housing to be removed	Interfere with future plans	Interfere with future plans
g) Others	Traffic control is easy	Horizontal alignment is very tight	
Overall Evaluation	○	△	×

2-2-3 Bridge Type Alternatives

The bridge type alternatives study was carried out based on the selected bridge for Alternative Route-A. Taking the geometric and soil conditions and technical and economical aspects into account, following four (4) alternative bridge types were identified.

- Alt.1 Suspension Bridge
- Alt.2 Cable Stayed Bridge (Symmetric)
- Alt.3 Cable Stayed Bridge (Non Symmetric)
- Alt.4 Three Span Continuous PC Box Girder Bridge

The characteristics of each alternative bridge type are as shown in Table-2-10. As the result of comparative study as shown in Table-2-11, Three Span Continuous PC Box Girder Bridge was selected as the most economical bridge.

Table-2-10 Comparison of Bridge Alternatives

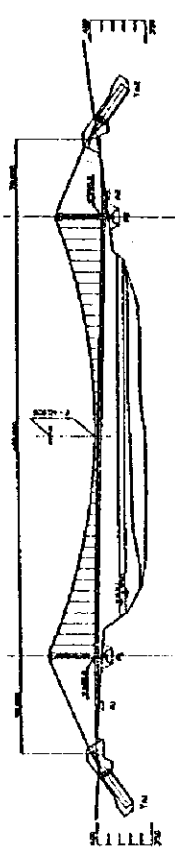
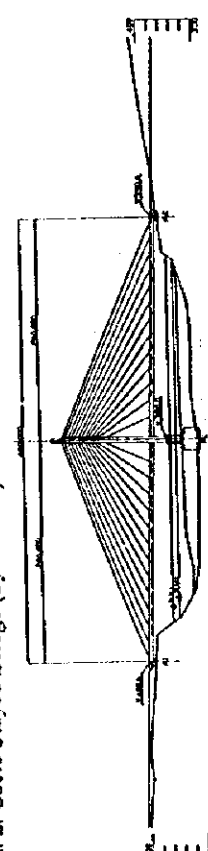
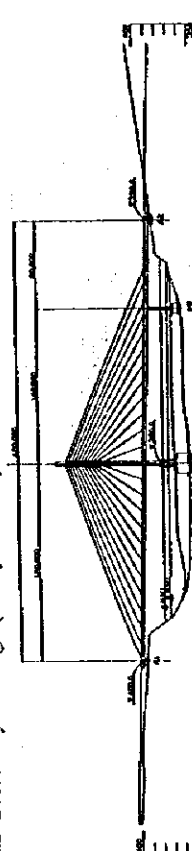
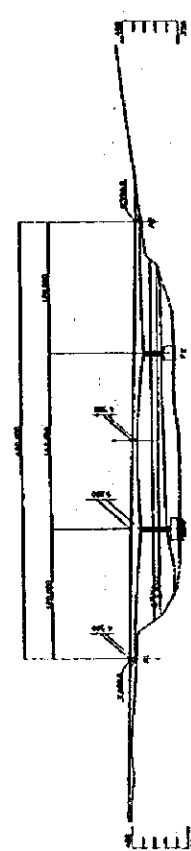
General View	Characteristics
<p>Alt. 1. Suspension Bridge</p> 	<ul style="list-style-type: none"> • Single span suspension bridge with PC box girder • No foundation in the river, no interference with water flow • Foundation work in dry condition • Anchorage is divided into two parts beside the road • Dead load of PC girder is larger than that of steel girder. Therefore, cable cross section and the anchorage become bigger. • Same type as Oto-Beit Bridge, scenic impression is limited.
<p>Alt. 2. Cable Stayed Bridge (Symmetric)</p> 	<ul style="list-style-type: none"> • Main girder is PC box • Main tower is RC solid section. • Cable is multi-fan type of 2 planes • Main girder around the main tower is floating type. No vertical shoe is placed. • Construction is cantilever erection from the tower • Main tower is 2.5 times taller than that of existing bridge • Very impressive, and modern
<p>Alt.3 Cable stayed bridge (not symmetric)</p> 	<ul style="list-style-type: none"> • Main tower is closer to Zambia than alt.2. Auxiliary pier is placed at Zimbabwean side • Tower and cable type is same as alt. 2. • Further study needed to assess pier. (cost and benefit) • Construction period is shorter than alt. 2 • Very symbolic
<p>Alt.4 Three spans continuous PC box girder</p> 	<ul style="list-style-type: none"> • 3 spans continuous girder with varying depth • Cantilever erection from middle piers using four erection platforms • Not very impressive • Foundation at Zambian side is close to the main flow, thus scouring is anticipated. Foundation is embedded deep into the bearing layer which results in larger coffer dam and concrete amount

Table-2-11 Summary of Comparative Study of Each Alternative Bridge Type

Route		Route "A" (100 m upstream from existing bridge); In Zimbabwe side, relocation of houses for police officials is required. High cut of hill also is needed. Existing border facilities are used. Formation level of bridge : 395 to 400 (from Zimbabwe side)								
Bridge Type		Suspension Bridge		Cable Stayed Bridge		Cable Stayed Bridge		PC Girder bridge		
General Description		400 m single span bridge, concrete girder, without pier in the river. Main cable anchored in the ground, no local experience with concrete girder.		Symmetrical type with 2 x 200 m spans, one pier in the river, 105 m high pylons in the middle of bridge, concrete girder, sufficient experience available.		Non symmetrical type with max. 180 m span two piers in the river, some 95 m high pylons, concrete girder, sufficient experience available.		3 spans PC box girder with max. 160 m span, two piers in the river, one of which is very near to current flow, sufficient experience available.		
Evaluation	Construction cost		1.78	X	1.64	△	1.15	△	1.00	⊙
	Construction	Bridge Structure	Careful attention must be paid for girder construction	△	Balanced cantilever-out construction, pier located on shallow river bed	○	Balanced cantilever-out construction, pier located on shallow river bed	○	Two piers construction in the river, near current flow	○
		River Control	No problem	⊙	Temporary bridge Near river center, easy	○	Temporary bridge near river center, easy	○	Temporary bridge near flow center, difficult	△
	Environment	Natural Factors	No serious problem	○	Polluting river water anticipated	△	Polluting river water anticipated	△	Polluting river water anticipated	△
		Social Factors	Relocation of officials' houses	△	Relocation of officials' houses	△	Relocation of officials' houses	△	Relocation of officials' houses	△
	Aesthetic aspect		Harmonizes with existing bridge	⊙	Very impressive	○	Impressive	○	Not impressive	△
	Maintenance		Cable maintenance required	△	Cable maintenance required	△	Cable maintenance required	△	Less maintenance works	⊙
	Local economy contribution		Less than other alternatives	△	Local materials and labor used	○	Local materials and labor used	○	Mostly local materials / labor used	⊙
	Total evaluation		△		○		△		⊙	
Recommendation		No		Second		No		First		

2-2-4 Design Standard

The British Standard is used for designing new bridge structure since both countries are using similar standard modified from the British Standard for designing civil structures.

2-3 Basic Design

2-3-1 Design Concept

(1) Natural Conditions

Both of Zambia and Zimbabwe are relatively cool weather and there is no big difference in annual temperature of high and low because of high plateau. The difference in temperature of all concrete member is set up as $15^{\circ}\text{C}\sim 30^{\circ}\text{C}$ and between members as 5°C .

From the past record of earth quake in the region, seismic factor at horizontal is decided as 0.1.

There is clear distinction of dry and wet season and in wet season which is from December to April, total precipitation is measured as approximately 800mm. Therefore, some protection for concrete placing work against rain fall will be required during the season.

(2) Social Conditions

The Zambezi River Authority was enacted in 1987 to operate, maintain the Kariba complex and also to collect, accumulate and process hydrological and environmental data on the Zambezi River.

At Zambia side of Chirundu, the population reaches 10,000 and at Zimbabwe side, the population is estimated as 3,000 in 1994/5. Both countries are supplying water to the inhabitants by pumping up the river water from upstream of the existing bridge.

Along the river bank of both sides, trees and bushes are forming green belt and further these area are served for wild animal's path. At Zimbabwe side, there is a Game Park at downstream of the river. There are fishing activities at downstream of the river also.

Taking the above fact into account, civil works design shall be carefully conducted in order to minimize the influence to those environmental conditions.

(3) Utilization of Local Contractors and Local Materials

Although there are several experiences such as road and minor construction, Zambian contractors have less experiences on big scale of civil structural work like this Project and there are certain limits in both of number and grade of skilled workers.

rise building construction with full support from their parent companies in European countries and their grade is seemed to be higher, however, there are less experiences on big scale civil structural works too. Further, they almost never have any experience to construct foundations in the river of big flow all through the year.

Therefore, for bridge construction, Japanese side will conduct technical control and the employment of workers will be made either subcontract to a local contractor or direct employment and for access road construction, local contractors will be fully employed.

From the point of price and procurement, following materials will be procured locally and the rest will be procured from South Africa and/or Japan.

- | | |
|------------------------|------------|
| a. Concrete Aggregates | : Zambia |
| b. Cement | : Zambia |
| c. Reinforcing Bar | : Zimbabwe |

- d. Oil and Fuels : Zimbabwe
- e. Timber : Zimbabwe

Relatively small size of construction equipment owned by local contractor are only available in both countries. Heavy construction equipment necessary for this type of Project are to be mobilized either from South Africa or Japan.

(4) Ability for Maintenance and Management of the Implementation Agency

Maintenance work for the existing bridge is being carried out by Chinhoyi office of Ministry of Transport and Energy (MOTE) in Zimbabwe. Three workers are provided in every day for maintenance work such as road surface and drainage cleaning, application of lubrication oil to expansion joints etc. No guidance or manual for maintenance work is provided.

Large scale maintenance work is carried out by a contractor through open bid system, however, no big amount of fund can be allocated for routine maintenance work. Therefore, reinforced concrete structure is selected as the bridge structure which is more or less maintenance free and destructible and corrodible parts such as bridge rail, expansion joint, bridge bearing and drainage pipe are to be designed as non destructible and corrodible one as much as possible.

(5) Scope of Design

The objects of the design are limited as a new bridge and access road at both side.

It is impossible to expect the effect of the border post facilities improvement plan only by a new bridge construction, thus the following works including phase construction will be required as the responsibility of both countries.

- a) Freight Terminal with Car Park.
- b) Passenger Control Building
- c) Pedestrian Control Building
- d) Vehicles Inspection Unit
- e) Drug Enforcement
- f) Guard House

(6) Utilization of the Existing Bridge

The existing bridge will be maintained and served for pedestrians, also served for vehicles at the time of emergency, from the point of its effective utilization and historical value.

(7) Construction Period

There is about 5months' wet season at the project site and the performance of work is drastically dropped by rainfall in 3months during the period. Therefore, the working period is limited as 10months in a year. Also to take the construction of bridge of 400m in length with two foundations in a river into account, total construction period is estimated as 36months.

2-3-2 Basic Design

(1) Over All Plan

The scope of work of the Project is as shown in Fig-2-7.

- a. Bridge : 400m in length, vertical gradient of 1/80 and 100m upstream parallel to the existing bridge
- b. Access Road : 300m in length at Zambia side and 240m in length at Zimbabwe side.

(2) Facility Plan

1) Plane Plan

Plane plan is as shown in Fig-2-7 and the access roads are joined to the existing road with curve.

- a. Bridge : Two carriage ways of 3.5m in width, hard strip of 0.5m in width at both side and maintenance foot way of 0.75m in width at both side. (Fig-2-5)
- b. Road : Two carriage ways of 3.5m in width, hard strip of 1.5m in width at both side and shoulder of 1.0m in width at both side. (Fig-2-6)

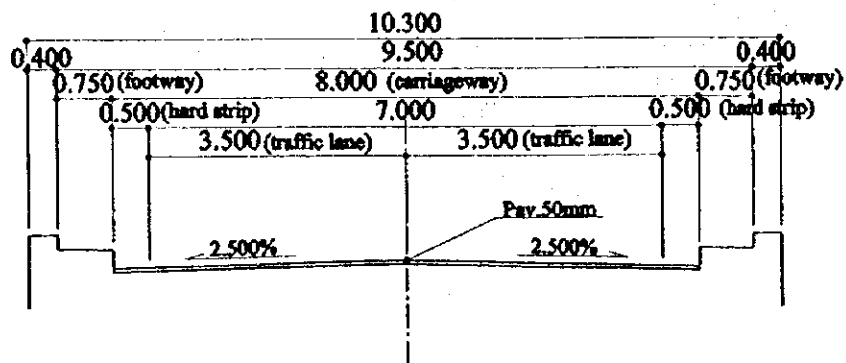


Fig-2-5 Carriage Way Layout

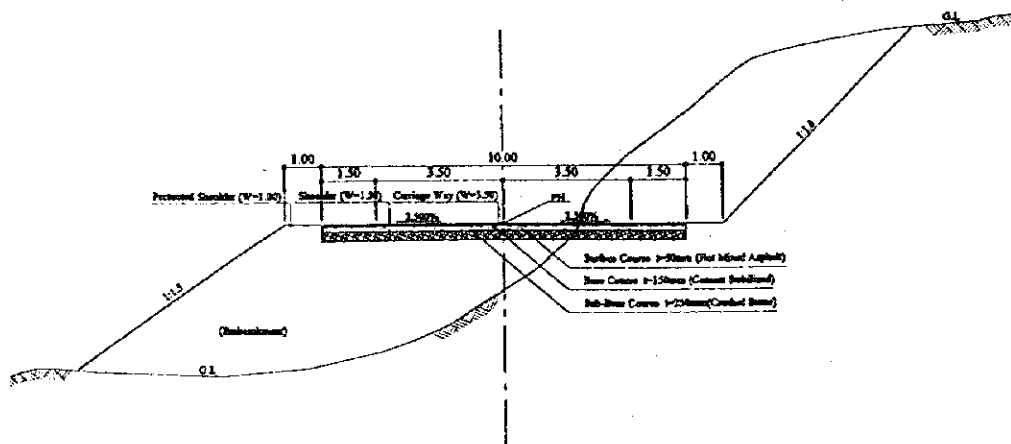






Fig-2-6 Road Section

GENERAL PLAN OF THE PROJECT

ZAMBIA

ZIMBABWE

-  Existing Border Facilities
-  Scope of Work of Japanese Side
-  Border Facilities by 2002
(Renovation and Construction)
-  Border Facilities by 2010
(Renovation and Costruction)

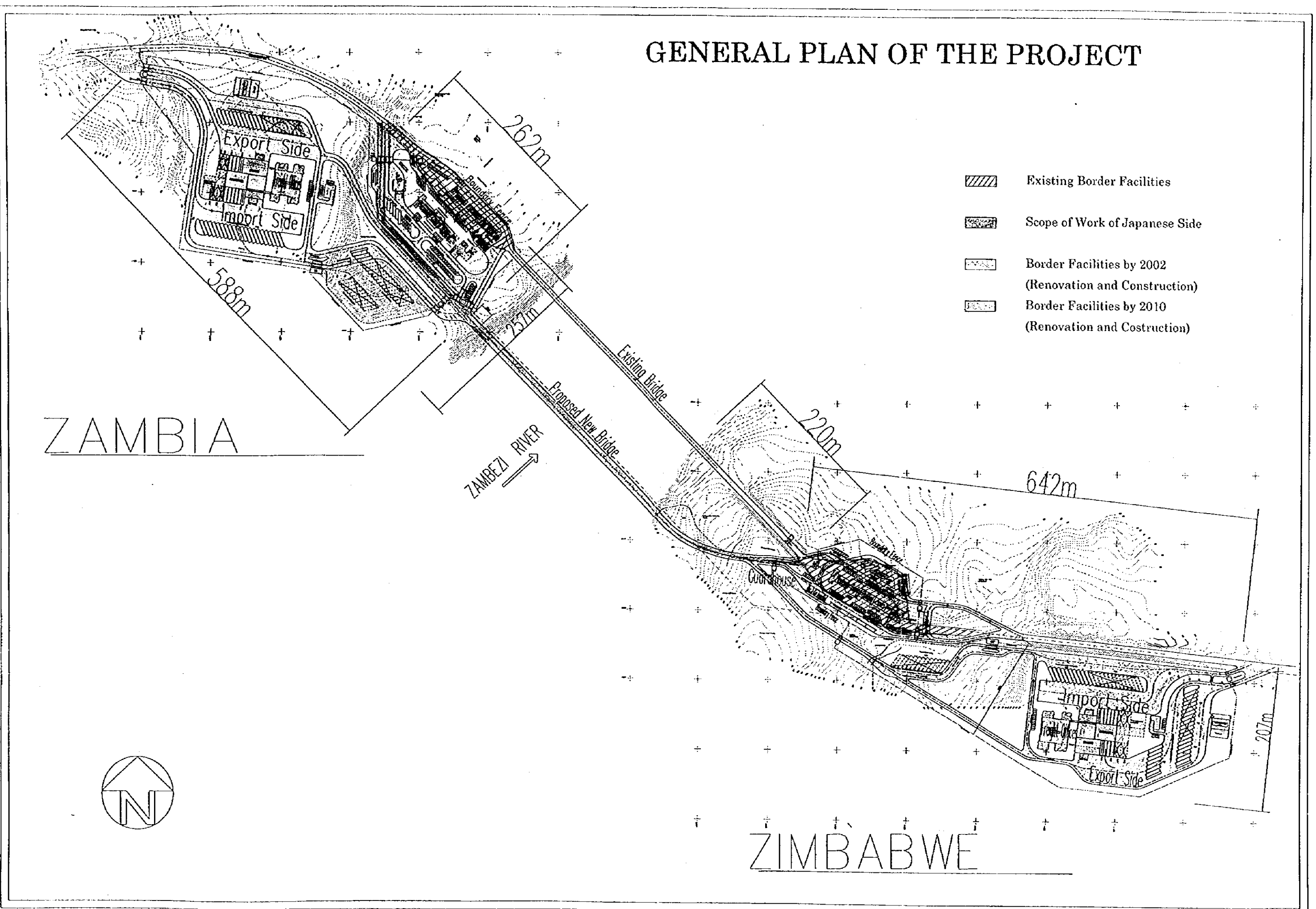


Fig-2-7 Over All Plan

2) Structural Plan

Flow and stream of Zambezi river are controlled by Kariba Dam approximately 60km upstream of Chirundu and there has been no flood since the closure of spill gate in 1981. Controlled discharge of water is being made for power generation purpose in these days.

Mean water level for design is GL372.5m and designed flood water level is GL374.0m. The deck surface of new bridge is GL395.0m~400.0m and there is enough clearance from the river water level. Average speed of flow is 0.6m/sec at normal condition and 1.1m/sec at flood time.

a. Foundation Plan

Foundation of abutments are direct foundation resting on weathered rock.

b. Sub-structural Plan

Foundation of bridge piers are direct foundation and pier body has combined shape of round and rectangle taking the depth and flow of the river into consideration.

Steel tube pile sheet pile cofferdam is adopted as temporary cofferdam in order to secure the safety of work and to minimize the river occupancy area.

c. Super-structural Plan

Three span continuous PC girder (120m+160m+120m) is adopted for super-structure. Side span of 120m in length was decided to secure animal path in front of abutment and from the point of balance.

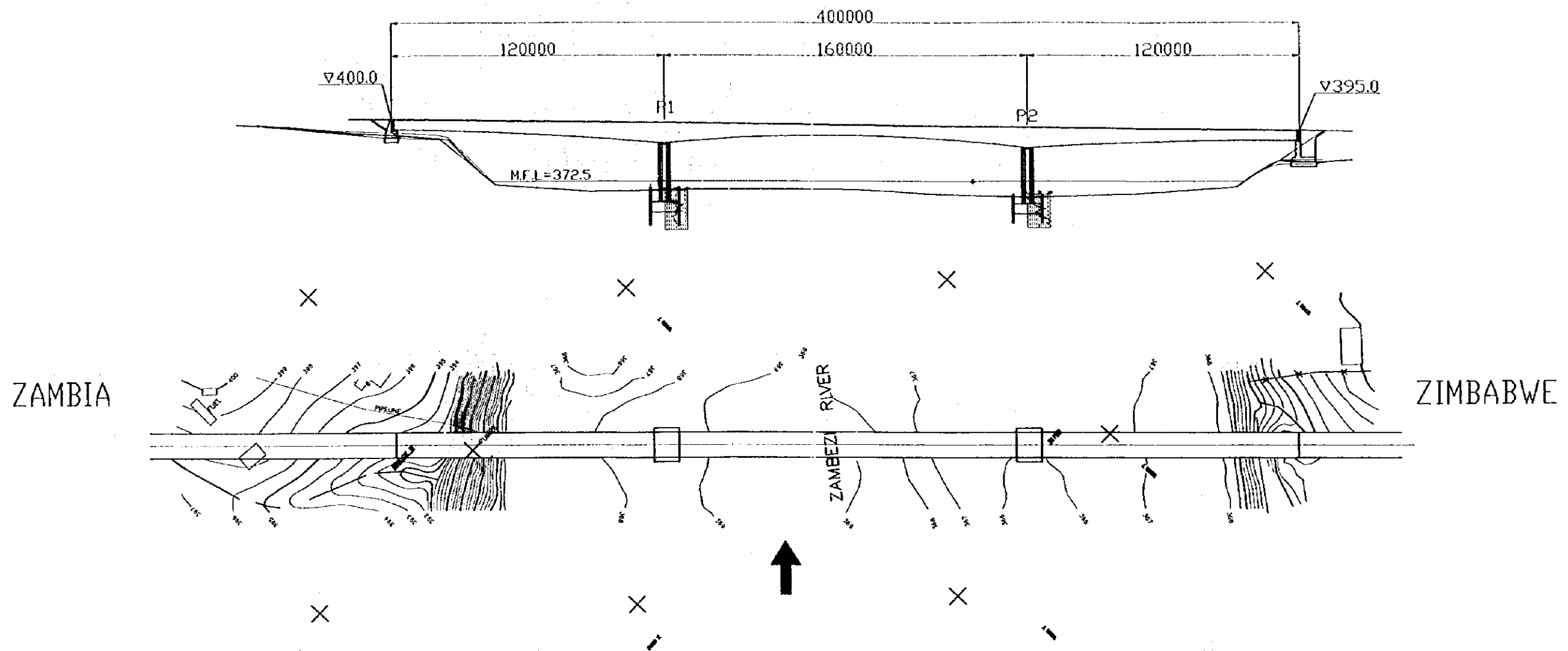
d. River Training

Since the abutment is more than 20m away from the river water and located high place, no river training work will be necessary.

(3) Basic Design Drawing

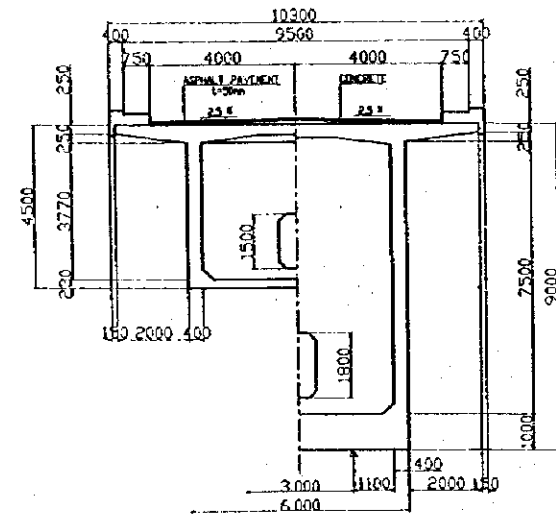
Basic Design Drawing of the bridge is as shown in Fig-2-8.

CHIRUNDU BRIDGE GENERAL VIEW (1:2000)



GIRDER CROSS SECTION (1:200)

CENTER SUPPORT



PIER (1:500)

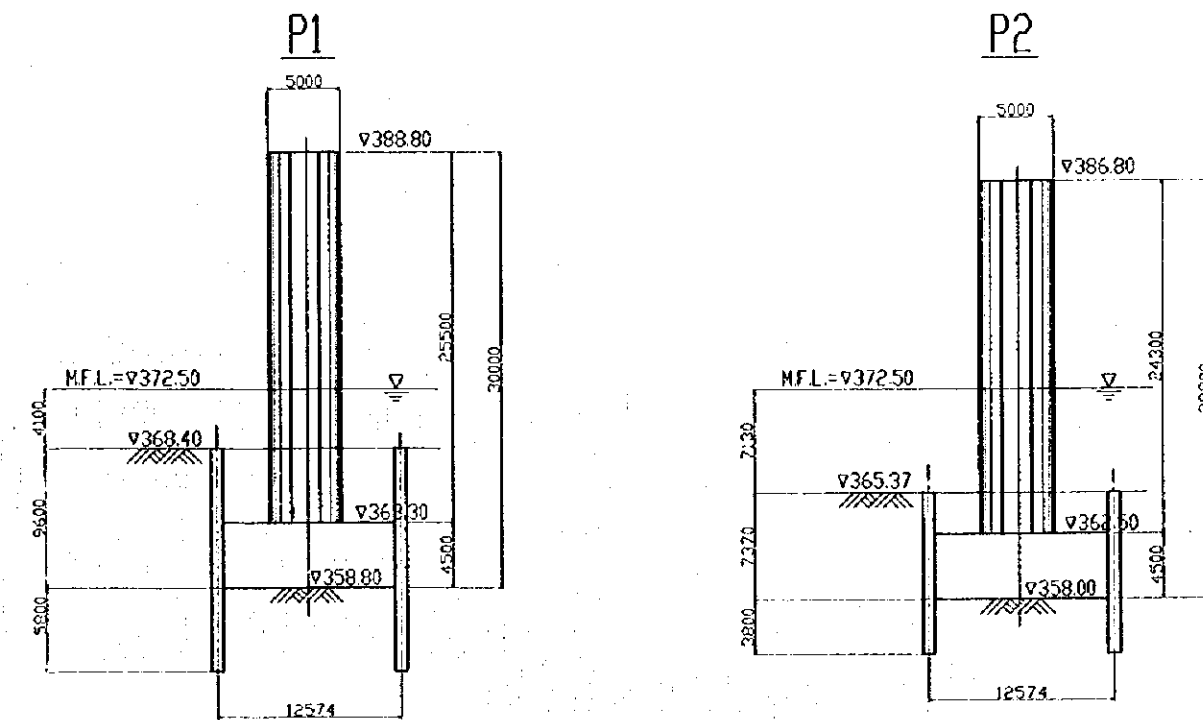


Fig-2-8 Basic Design Drawing

Chapter 3 Implementation Plan

Chapter 3 Implementation Plan

In this chapter, only the implementation plan for the scope of work of Japanese side which is a new bridge construction with access roads at both end is described.

3-1 Implementation Plan

3-1-1 Implementation Concept

(1) Characteristics of the Project

Since the Project is laid across two countries, it is necessary to provide facility and staff for the supervision individually, however, from the topographic condition, it is economical to provide a temporary access road to the river bank and a temporary bridge from Zimbabwe side in order to construct foundations, piers and the cantilever portion of superstructure.

A camp which facilitates offices for both of consultant and contractor, concrete batching plant, material stock yard and contractor's accommodation will be set up at Zimbabwe side and a camp which facilitates offices for both of consultant and contractor, material stock yard and contractor's accommodation will be set up at Zambia side, taking the supply route of construction materials and equipment and the layout of temporary facilities into consideration.

As prescribed in **2-3-1 Design Concept**, procurement of basic materials for construction will be made from both countries and the employment of construction workers will equally be made from both countries in general.

(2) Utilization of Local Contractors and Consultants

As prescribed in **2-3-1 Design Concept**, contractors in both countries have less experiences to construct big scale civil structural works like the Project, however, it is reckoned that they have basic knowledge of construction itself and have enough capacity and ability to carry out the works under the control of Japanese contractor with utilizing heavy construction equipment brought by Japanese.

For the supervision of the Project, engineer(s) from local consultant will be fully employed to aim effective and smooth supervision and also to promote technical transfer of the works to them through on the job training.

(3) Dispatch of Technicians

Since there is almost no experience to build temporary bridge and temporary cofferdam for the construction of bridge piers in the big flow of river and skilled worker for this type of works is not easily available in both countries, technicians will be dispatched to the site from Japan to instruct local workers. A mechanical engineer will also be deployed from Japan to maintain and look after heavy construction equipment.

(4) Implementation Agency in Recipient Country

Both countries have already established the steering committee to promote the Project therefore, all the procedure and related work for the execution of the Project will be done through the committee.

3-1-2 Implementation Conditions

(1) Procurement of Materials and Employment of Workers

Since the base camp will be set up at Zimbabwe side, materials such as concrete aggregate

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(1) Procurement of Materials and Employment of Workers

Since the base camp will be set up at Zimbabwe side, materials such as concrete aggregate

and cement from Zambia will be mainly transported through the border and nearly half number of required workers from Zambia will also come to the work through the border. Therefore, some special arrangement and consideration for them to pass through the border for example issue of the I/D card will be necessary to have smooth progress of the work without causing any delay in the construction schedule.

Further, the project site is located inland country, therefore, the transportation of imported materials and equipment becomes very important factor to keep the construction schedule as planned. Therefore, it is necessary to carry out the schedule control with enough period by confirming customs clearance procedure in each country, securing transportation route and confirming required time of transportation.

(2) Counter Measure for Wet Season

Rain fall is mainly concentrated from December to February and there is long holiday period from the end of year to beginning of the year and performance of work will be dropped drastically, therefore, special care will be required to program the work. Water level of the river will not increase much but some protection work will be required for placing concrete during the period. Some protection work against the erosion of fill portion to prevent the mud to flow into the river will also be required.

(3) Monitoring for Environmental Effect

Following monitoring work shall be carried out during the period of construction to determine and minimize environmental effect caused by the Project.

- 1) Monitoring for River Water Pollution
To carry out periodical river water test at up and down stream of the river.
- 2) Monitoring for Animal and Plant Effect
To carry out monitoring of the effect to wild animal and plant caused by construction works.
- 3) Monitoring for Social Effect
To carry out monitoring of the change to the regional social environment caused by construction worker.

The environment monitoring staff will prepare a monthly report which will summarize the result and shall be included in a general monthly progress report submitted to the MWS and MOTE. The staff shall also attend monthly meeting to report the result whenever required.

3-1-3 Scope of Work

(1) Scope of Work of Japanese side

- a. New bridge of 400m in length
- b. Access roads of 300m at Zambia side and 240m at Zimbabwe side

(2) Scope of Work of Recipient Country

Border facilities

- a. Cargo Terminal with Parking Area
- b. Passenger Control Building
- c. Pedestrians Control Building
- d. Drug Enforcement Commission
- e. Police Station
- f. Vehicle Inspection Unit and Weigh Bridge
- g. Drug Enforcement

h. Guard House and Perimeter Fencing

The cost estimations borne by both Governments are shown in Appendix 5.

3-1-4 Construction Supervision

(1) Basic Plan

Construction supervision will be performed to the following items.

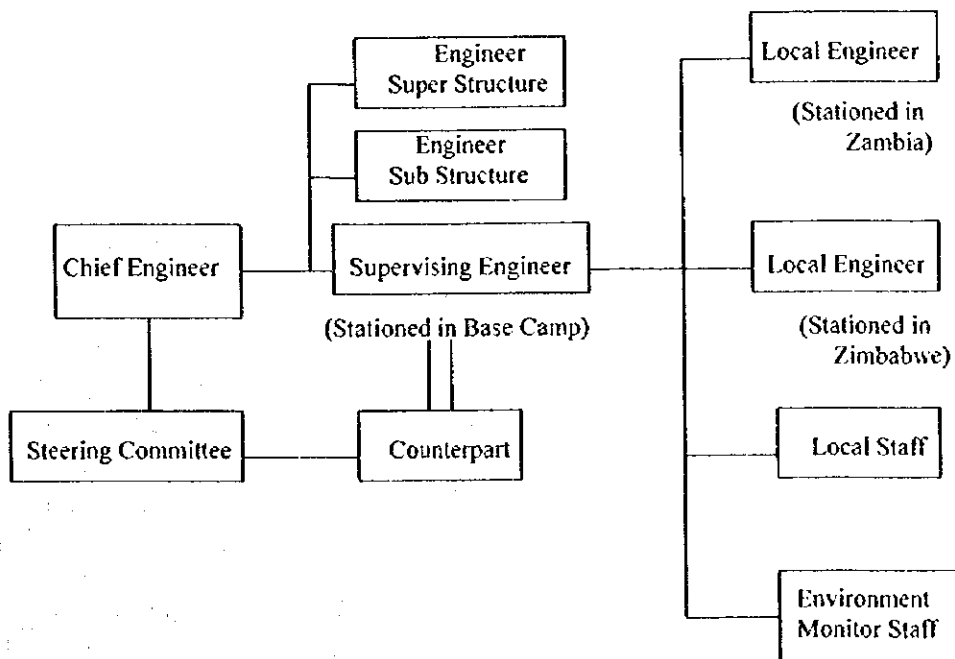
- a. To check method of statement presented by contractor.
- b. To hold a kick-off meeting among the party concerned.
- c. To inspect the works and give instructions.
- d. To check and give approval to construction plans and shop drawings presented by contractor.
- e. To inspect supplied materials.
- f. To monitor work done and issue the certificate.
- g. To prepare progress report of the works.
- h. To monitor and give advise to the works performed by both countries.
- i. To examine completion of works and issue completion certificate.
- j. To assist of handing over the Project after completion.
- k. To prepare final report after completion of construction supervision.
- l. To carry out inspection work at the end of defect liability period of one year from the completion.

(2) Conditions

Implementation conditions are as prescribed in 3-1-2 and for the construction supervision, monitoring to the environmental effect to the surrounding area during construction will be required to minimize the effect.

(3) Organization

Organization of construction supervision is like below and one Japanese engineer, two local engineers and one environmental monitoring staff are to be stationed at full time during the Project.



3-1-5 Procurement Plan

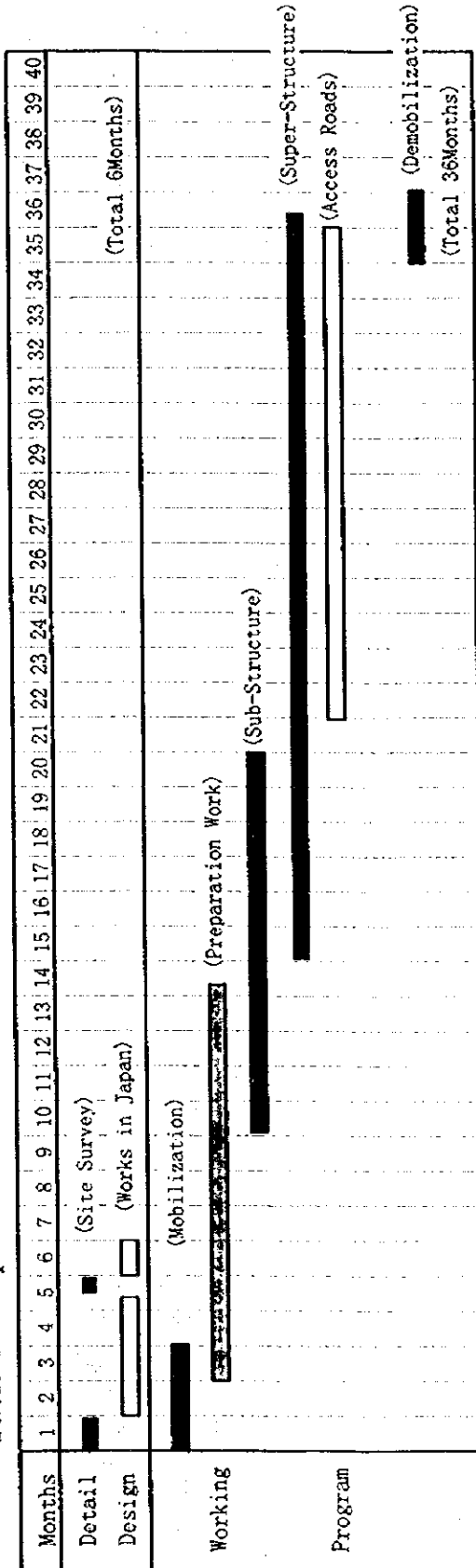
Procurement plan for major construction equipment and materials are as shown in Table-3-1. Local procurement is limited as aggregates, cement, reinforcing bar, timber, shuttering and scaffolding and small scale construction equipment.

Table-3-1 Procurement Plan

Equipment and Materials	Japan	Local	S. Africa	Transport	Reason of Selection
Bulldozer		○		Land	Except for small size of equipment owned by each contractor, heavy equipment are not available locally and they are to be procured in South Africa. Even in South Africa, piling equipment are not easily available therefore, they have to be procured from Japan
Back Hoe		○		Land	
Dump Truck		○		Land	
Cram Shell			○	Land	
Tractor Shovel		○		Land	
Truck Crane			○	Land	
Crawler Crane			○	Land	
Vibro Hammer	○			Sea	
Motor Grader		○		Land	
Road Roller		○		Land	
Tire Roller		○		Land	
Vibration Roller		○		Land	
Concrete Pump			○	Land	
Concrete Plant			○	Land	
Agitator Truck			○	Land	
Engine Generator		○		Land	
Air Compressor		○		Land	
Piling Rig	○			Sea	
Diesel Hammer	○			Sea	
Wagen	○			Sea	
Jack			○	Land	
Grout Pump			○	Land	
Giant Breaker			○	Land	
Portland Cement		○		Land	Not available locally.
Fine Aggregate		○		Land	
Coarse Aggregate		○		Land	
Sand		○		Land	
Crushed Stone		○		Land	
Asphalt		○		Land	
Timber		○		Land	
Metal Form		○		Land	
Reinforcing Bar		○		Land	
PC Wire			○	Land	
Sheath			○	Land	
Anchor			○	Land	
Section Steel	○			Sea	
Steel Pipe Sheet Pile	○			Sea	
Bridge Bearing	○			Sea	
Expansion Joint	○			Sea	
Bridge Railing			○	Land	
Fuel and Oil		○		Land	

Equipment and materials of sea transportation will be unloaded at Durban Port of South Africa and land transported to the site through the border between South Africa and Zimbabwe. Beira Port is nearer to the site however, due to many uncertainty such as inefficiency of cargo handling etc. it is decided that the route will be through more reliable port in South Africa.

Table-3-2 Implementation Schedule



3-1-6 Implementation Schedule

Implementation schedule of the Project is as shown in Table-3-2 of next page.

3-1-7 Responsibility of Two Governments

Both countries and the Japanese Governments share the responsibility for the project implementation as shown in Table-3-3.

Table-3-3 Responsibility of Each Government

No.	Items	To be covered by Grant Aid	To be covered by Recipient
1.	To secure land including camp yard.		●
2.	To clear, level and reclaim the site when needed.		●
3.	To demolish existing buildings and facilities on bridge route and border facilities.		●
4.	To construct bridge and access road.	●	
5.	To construct border facilities.		●
6.	To provide electricity supply to temporary camp yard at both countries.		
	1) Distribution line to the camps with 400v transformer		●
	2) Drop wiring in the camps	●	
7.	To supply potable water to camp yards		●
8.	To provide telephone lines to camp yards.		●
9.	To obtain permit to use satellite communication system.		●
10.	To bear the following commissions to the Japanese foreign exchange bank for the banking services based upon the B/A.		
	1) Advising commission of A/P		●
	2) Payment commission		●
11.	To ensure unloading and customs clearance at port of disembarkation in recipient country.		
	1) Marine (Air, Road) transportation of the products from Japan to the recipient country	●	
	2) Tax exemption and customs clearance of the products at the port of disembarkation		●
	3) Internal transportation from the port of disembarkation to the project site	●	
12.	To accord Japanese nationals whose services may be required in connection with the supply of the products and the services under the verified contract such facilities as may be necessary for their entry into the recipient country and stay therein for the performance of their work.		●
13.	To exempt Japanese nationals from customs duties, internal taxes and other fiscal levies which may be imposed in the recipient country with respect to the supply of the products and services under the verified contracts.		●
14.	To maintain and use properly and effectively the facilities constructed provided under the Grant.		●
15.	To bear all the expenses, other than those to be borne by the Grant, necessary for construction of the facilities.		●

3-2 Operation and Maintenance Plan

Maintenance and operation of the bridge will be equally shared and carried out by both countries. Actual maintenance work will be carried out by the central provincial office of MWS at Zambia side and by Chynhoi office of MOTE at Zimbabwe side.

In the Project, due to the concrete structure bridge, only the periodical check will be the major work, however, the periodical maintenance will be required for pavement, expansion joint, bridge railing, drainage etc.

For the routine work, 2 persons shall be deployed daily.

Maintenance and repair : Routine work ···· Cleaning and inspection for pavement, expansion joint, drainage system, bridge railing, bridge bearings.

Periodical repair ·· Repairing for damaged or defect portion found by routine work and repairing of pavement.

An annual maintenance and control cost is estimated as follow:

1) Cleaning	: US\$	4,500
2) Repairing	: US\$	3,000
3) Others	: US\$	950
<hr/>		
Total	: US\$	8,450

Annual budget for roads and bridges maintenance at both countries in 1998 are US\$36,099,000 in Zambia and US\$13,859,000 in Zimbabwe and percentage of the maintenance cost of the new bridge is 0.01% and 0.03% respectively which being in the range of allocation.

Chapter 4 Project Evaluation and Recommendation

Chapter 4 Project Evaluation and Recommendation

4-1 Project Effect

4-1-1 Technical Propriety

The new Chirundu bridge is a PC concrete bridge of 2 lane carriage way, erected on two number of concrete piers provided in the Zambezi river. The existing Otto-Beit bridge has no pier in the river however, due to the flood control done by Kariba dam, pier and foundation construction in the river became possible which caused lowering the construction cost of bridge. Further, since the materials for concrete structure such as aggregate, cement reinforcing bar and pre-stressing wire are readily available locally, it is effective to utilize them and to employ local workers in order to lower the construction cost.

The whole bridge structure is built on site therefore, it is well expected to transfer the techniques such as construction technique and construction supervision of pre-stressed concrete bridge.

4-1-2 Economic Propriety and Effect

The benefits from the implementation of the Project are considered as follow:

(1) Increase of Traffic Capacity on the Bridge

The traffic capacity on the existing bridge is limited as 30units/hour which is converted as 250units/day due to one way alternative traffic, one vehicle at one time and traveling speed limit. And at time of congestion, vehicles are forced to idle for hours.

The new bridge will be able to correspond to the future traffic demand and will eliminate the idling time of vehicles for passing through the border.

(2) Lift of the Heavy Vehicle Traveling Limit

The load limit of the existing bridge is 55ton however, in southern African countries, vehicles exceeding 55ton are traveling on road quite often and between Harare and Lusaka, those vehicle have to divert to Kariba route at the moment. Those heavy vehicles will be able to travel on the new bridge without diversion.

These effects will influence not only to cargo transport of both countries but also to commodity flow in SADC countries. The benefit from the implementation of the Project will directly be to drivers and/or distributors who use new bridge and indirectly to people of SADC countries by the stabilization of price of goods and the improvement of international competitiveness of export items.

4-2 Recommendation

Due to concrete structure, the new bridge will relatively not require a big cost for the maintenance.

Following work will be required for the maintenance work.

(1) Routine work

Cleaning (Cleaning of pavement and drainage)

Inspection and repair of damaged portion (bridge railing, expansion joint etc.)

Chapter 4 Project Evaluation and Recommendation

Chapter 4 Project Evaluation and Recommendation

4-1 Project Effect

4-1-1 Technical Propriety

The new Chirundu bridge is a PC concrete bridge of 2 lane carriage way, erected on two number of concrete piers provided in the Zambezi river. The existing Otto-Beit bridge has no pier in the river however, due to the flood control done by Kariba dam, pier and foundation construction in the river became possible which caused lowering the construction cost of bridge. Further, since the materials for concrete structure such as aggregate, cement reinforcing bar and pre-stressing wire are readily available locally, it is effective to utilize them and to employ local workers in order to lower the construction cost.

The whole bridge structure is built on site therefore, it is well expected to transfer the techniques such as construction technique and construction supervision of pre-stressed concrete bridge.

4-1-2 Economic Propriety and Effect

The benefits from the implementation of the Project are considered as follow:

(1) Increase of Traffic Capacity on the Bridge

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(1) Routine work

Cleaning (Cleaning of pavement and drainage)

Inspection and repair of damaged portion (bridge railing, expansion joint etc.)

(2) Periodical work

Replace of expansion joint (approx. every 10 years)

Resurfacing of pavement (every 7~10 years)

Item (1) is considered to be light work and will be possible to carry out as a part of trunk road maintenance work currently done in both counties. However, item (2) will require certain amount of cost therefore, proper allocation of fund will be necessary.

Taking the tendency of fund allocation for road sector in both countries into consideration, it is advisable to adopt tolling system for preparing the fund for item (2) to the new bridge in order to maintain the project effect reasonably.

Appendices

(2) Periodical work

Replace of expansion joint (approx. every 10 years)

Resurfacing of pavement (every 7~10 years)

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Taking the tendency of fund allocation for road sector in both countries into consideration, it is advisable to adopt tolling system for preparing the fund for item (2) to the new bridge in order to maintain the project effect reasonably.

Appendices

Appendices

1. Member List of the Survey Team

Mr. S. Umenaga	Team Leader	Grant Aid Project Study Department JICA
Mr. N. Murayama	Grant Aid Specialist	Grant Aid Div. Economic Cooperation Bureau Ministry of Foreign Affairs
Mr. Y. Kajimura	Chief Engineer/Operation and Maintenance Planning	Director, International Div. Chodai Co., Ltd.
Mr. M. Komagamine	Construction Planning/ Cost Estimate	Senior Engineer, International Div. Chodai Co., Ltd.

2. Survey Schedule

Date	Movement	Accommodation	Activities
Aug 12 (wed)	Arrive to Harare	Harare	Courtesy call on the Japanese Embassy, JICA and MOTE Explanation of contents and tentative schedule of the study.
13 (thu)		Harare	
14 (fri)	Harare to Chirundu Chirundu to Lusaka	Harare	Zimbabwe Revenue Authority, Immigration Office and Police Office of Ministry of Home Affairs. Field survey
15 (sat)		Makuti	Field survey
16 (sun)		Lusaka	Courtesy call on the Japanese Embassy and JICA MWS and Ministry of Finance and Economic Development. Explanation of contents and tentative schedule of the study
17 (mon)		Lusaka	Explanation and discussion of the project at the joint meeting.
18 (tue)		Lusaka	Explanation and discussion of the project at the joint meeting.
19 (wed)	Lusaka to Chirundu Chirundu to Harare	Lusaka	Signing of Minutes of Meeting Zambia Revenue Authority Reporting Japanese Embassy and JICA.
20 (thu)		Lusaka	Leave Lusaka (Officials) Visit MOWS, Roads, Building Dept Provincial Office, Central Reporting
21 (fri)		Lusaka	Reporting
22 (sat)		Lusaka	Field survey, Local Government
23 (sun)		Lusaka	Field survey, MOTE Chinhoyi
24 (mon)		Makuti	Discussion with MOTE
25 (tue)		Harare	Visit ZRA, Immigration, Police
26 (wed)		Harare	Reporting, JICA, Embassy of Japan
27 (thu)		Harare	
28 (fri)		Harare	
29 (sat)	Leave Harare		

3. List of Party Concerned in the Recipient Country

Republic of Zambia

MWS	: T.S.Masaka	Acting Permanent Secretary
	J.D.Mawila	Director of Roads
	V.M.Mooya	Deputy Director of Planning
	S.Lungu	Senior Executive Engineer
	P.Banda	Executive Engineer, Roads Dept.
	N.M.Jere	Chief Architect, Building Dept.
	C.N.Chipepo	Environmental Officer
MLGH	: F.B.Mukozomba	Principal Planner, DPPH
ZRA	: S.M.Lisomba	Deputy Commissioner
	: R.S.Nkunika	Project Manager, Building Project
	: B.V.Lumanba	Head of Inspectorate, Customs and Excise Div.
MOFED	: N.C.Ngomalala	Acting Senior Economist, External Resources
Immigration	: P.E.Mutantika	Chief Immigration Officer
	J.Mphepo	Assistant Chief Immigration Officer

MWS : Ministry of Works and Supply

MLGH: Ministry of Local Government and Housing

ZRA : Zambian Revenue Authority

MOFED: Ministry of Finance and Economic Development

Republic of Zimbabwe

MOTE	: N.Kudenga	Director Roads
	G.Nemahchena	Deputy Director, Planning & Design, DoR
	D.Musana	Chief Engineer, Bridge Design
	A.A.Zindoga	Deputy Chief Engineer, Bridge Design
	B.Dziva	Provincial Road Engineer, Mashonaland West
	R. Iizuka	JICA Expert
MLGNH	: T.G.Msusa	Acting Director, Construction & Local Government Works
	G.Odhong	Principal Architect, Housing Develop.
Customs	: W.Kwedza	Assistant Director, Customs & Excise
Immigration	: S.J.Mbewe	Deputy Chief Immigration Officer
	R.Mubaira	Project Manager
NEPC	: C.Dube	Head of Planning
Police	: A.Maxwell	Chief Superintendent

MOTE : Ministry of Transport and Energy

MLGNH: Ministry of Local Government and National Housing

NEPC : National Economic Planning Committee

4. Minutes of Discussion

Minutes of Discussion held on the 18th to 20th of August 1998 is as attached on the next page.

Minutes of Discussions
on
the Basic Design Study
on
the Project for the Proposed New Bridge
Over the Zambezi River at Chirundu Border Post
between
the Republic of Zambia
and
the Republic of Zimbabwe

Based on the results of the Feasibility Study, the Japan International Cooperation Agency (JICA) decided to conduct a Basic Design Study (hereinafter referred to as "the Study") on the Project for the Proposed New Bridge at Chirundu Border Post (hereinafter referred to as "the Project").

JICA sent to the Republic of Zambia and the Republic of Zimbabwe (hereinafter referred to as "both countries") a Study Team (hereinafter referred to as "the Team") headed by Mr. Satoshi Umenaga, Second Project Study Division, Grant Aid Project Study Department of JICA which is scheduled to stay in the countries from August 12 to 29, 1998.

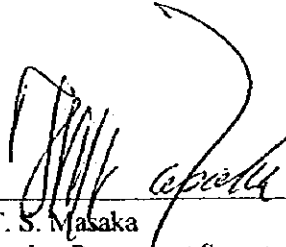
The Team held a series of discussions with the officials of both countries and conducted a field survey of the study area.

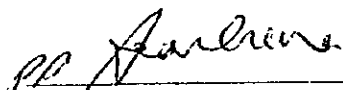
In the course of discussions and field survey, the three parties have confirmed the main items described on the attached sheets. The Team will proceed with the further works and prepare the Basic Design Study Report.

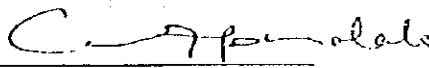
Lusaka, August 20, 1998

梅永哲

Satoshi Umenaga
Leader
Basic Design Study Team
Japan International
Cooperation Agency


T. S. Masaka
Acting Permanent Secretary
Ministry of Works
and Supply
ZAMBIA


Eng. P.M. Kodzwa
Permanent Secretary
Ministry of Transport
and Energy
ZIMBABWE



Witness:
W. C. Ngomalala
Acting Senior Economist
External Resources Mobilization
Ministry of Finance
and Economic Development
ZAMBIA

ATTACHMENT

1. OBJECTIVE

The objective of the Project is to promote economic development in countries traversed by the Beira Corridor and other countries to the north and south of Zambia and Zimbabwe by;

- a) reducing transportation costs;
- b) reducing constricted cargo flow; and
- c) improving border post facilities.

2. PROJECT SITE

The proposed site of the Project is as shown in Annex-1.

3. ORGANIZATION OF PROJECT IMPLEMENTATION

Roads Department of Ministry of Works and Supply (MWS) in Zambia and Department of Roads of Ministry of Transport and Energy (MOTE) in Zimbabwe are responsible for the administration and execution of the Project. The Joint Steering Committee consisting of officials of MWS and MOTE is the coordinating body for the Project implementation including the construction of border post facilities.

4. STATUS OF THIS MEETING

The three parties have been holding Tripartite Meetings from the time of the Feasibility Study and this being the 9th Tripartite Meeting.

5. COMPONENTS OF THE DRAFT BASIC DESIGN

The Government of Zambia and the Government of Zimbabwe (hereinafter referred to as "both Governments") have agreed and accepted in principle the components of the Draft Basic Design Report presented by the Team.

6. JAPAN'S GRANT AID PROGRAMME

Both Governments have understood the system of Japan's Grant Aid Programme as explained by the Team and as described in Annex-2.

7. NECESSARY MEASURES TO BE TAKEN BY BOTH GOVERNMENTS

Both Governments will take necessary measures described in Annex-3 for smooth implementation of the Project provided that the Grant Aid by the Government of Japan will be extended to the Project.

8. FURTHER SCHEDULE OF THE STUDY

8-1 The Team will conduct further studies in both countries until August 29, 1998.

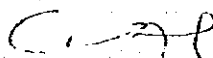
8-2 JICA will complete the Final Report in accordance with the confirmed items and will forward it to both Governments by the end of November 1998.

9. OTHER RELEVANT ISSUES

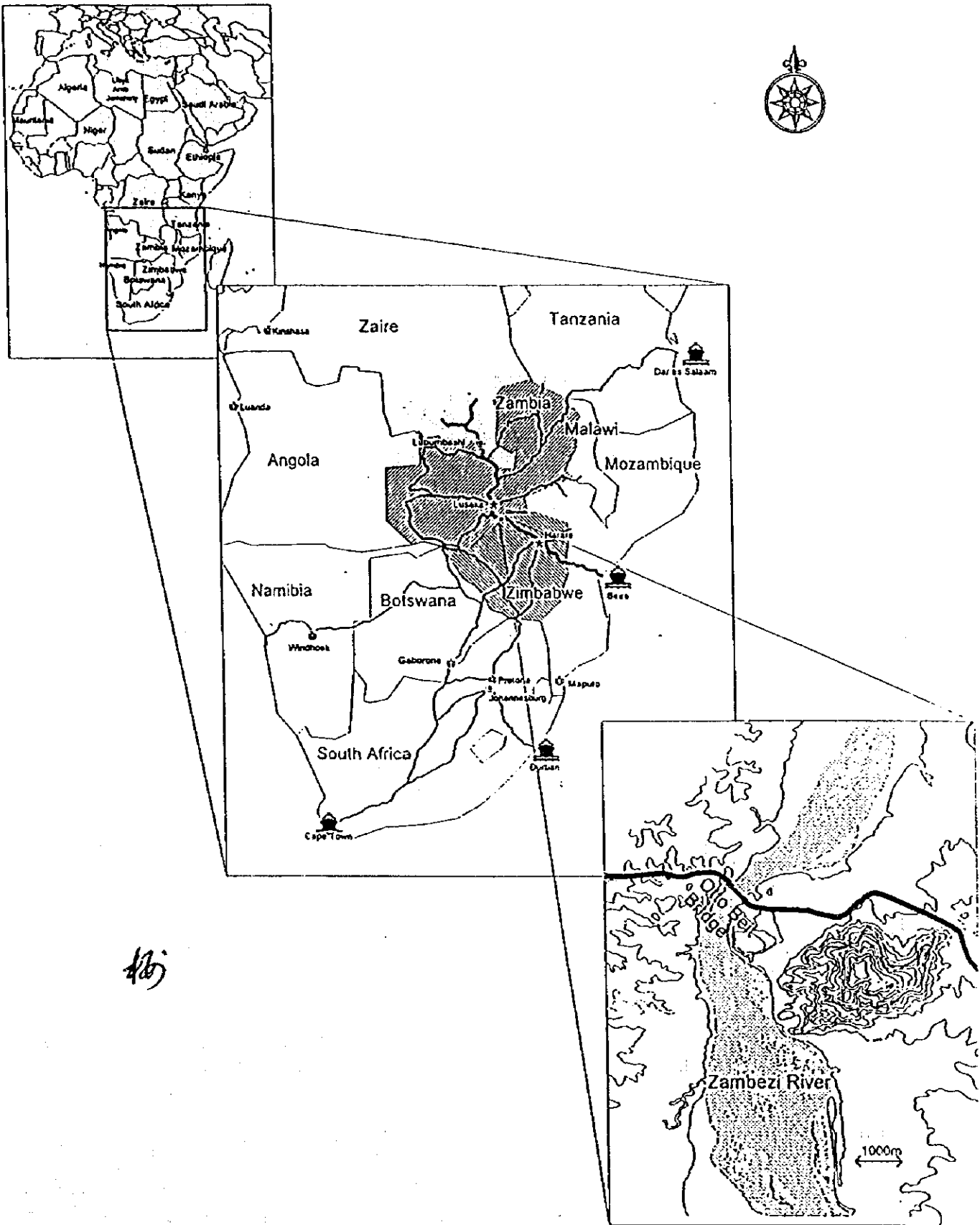
Other relevant issues for implementing the Project are as described in Annex-4.



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Proposed Project Site



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Japan's Grant Aid

I Japan's Grant Aid System

(1) Grant Aid Procedure

1) Japan's Grant Aid Program is executed through the following procedures.

Application Study	(Request made by a recipient country) (Basic Design Study conducted by JICA)
Appraisal & Approval	(Appraisal by the Government of Japan and Approval by Cabinet)
Determination of Implementation	(The Notes exchanged between the Governments of Japan and the recipient country)

2) Firstly, the application or request for a Grant Aid project submitted by a recipient country is examined by the Government of Japan (the Ministry of Foreign Affairs) to determine whether or not it is eligible for Grant Aid. If the request is deemed appropriate, the Government of Japan assigns JICA (Japan International Cooperation Agency) to conduct a study on the request.

Secondly, JICA conducts the study (Basic Design Study), using (a) Japanese consulting firm(s).

Thirdly, the Government of Japan appraises the project to see whether or not it is suitable for Japan's Grant Aid Program, based on the Basic Design Study report prepared by JICA, and the results are then submitted to the Cabinet for approval.

Fourthly, the project, once approved by the Cabinet, becomes official with the Exchange of Notes signed by the Governments of Japan and the recipient country.

Finally, for the implementation of the project, JICA assists the recipient country in such matters as preparing tenders, contracts and so on.

(2) Basic Design Study

1) Contents of the Study

The aim of the Basic Design Study (hereinafter referred to as "the Study"), conducted by JICA on a requested project (hereinafter referred to as "the Project") is to provide a basic document necessary for the appraisal of the project by the Japanese Government. The contents of the Study are as follows:

- a) Confirmation of the background, objectives, and benefits of the requested Project and also institutional capacity of agencies concerned of the recipient country necessary for the Project's implementation.
- b) Evaluation of the appropriateness of the Project to be implemented under the Grant Aid Scheme from a technical, social and economic point of view.
- c) Confirmation of items agreed on by both parties concerning the basic concept of the Project.
- d) Preparation of a basic design of the Project.
- e) Estimation of costs of the Project.

The contents of the original request are not necessarily approved in their initial form as the contents of the Grant Aid project. The Basic Design of the Project is confirmed considering the

guidelines of Japan's Grant Aid Scheme.

The Government of Japan requests the Government of the recipient country to take whatever measures are necessary to ensure its self-reliance in the implementation of the Project. Such measures must be guaranteed even though they may fall outside of the jurisdiction of the organization in the recipient country actually implementing the Project. Therefore, the implementation of the Project is confirmed by all relevant organizations of the recipient country through the Minutes of Discussions.

2) Selection of Consultants

For smooth implementation of the study, JICA uses (a) registered consultant firm(s). JICA select (a) firm(s) based on proposals submitted by interested firms. The firm(s) selected carry(ies) out the Basic Design Study and write(s) a report, based upon terms of reference set by JICA.

The consulting firm(s) used for the Study is(are) recommended by JICA to the recipient country to also work on the Project's implementation after the Exchange of Notes, in order to maintain technical consistency.

(3) Japan's Grant Aid Scheme

1) What is Grant Aid?

The Grant Aid Program provides a recipient country with non-reimbursable funds to procure the facilities, equipment and services (engineering services and transportation of the products etc.) for economic and social development of the country under principles in accordance with the relevant laws and regulations of Japan. Grant Aid is not supplied through the donation of materials as such.

2) Exchange of Notes (E/N)

Japan's Grant Aid is extended in accordance with the Notes exchanged by the two Governments concerned, in which the objectives of the Project, period of execution, conditions and amount of the Grant Aid, etc., are confirmed.

- 3) "The period of the Grant Aid" means the one fiscal year which the Cabinet approves the Project for. Within the fiscal year, all procedures such as exchanging of the Notes, concluding contracts with (a) consultant firm(s) and (a) contractor(s) and final payment to them must be completed. However in case of delays in delivery, installation or construction due to unforeseen factors such as weather, the period of the Grant Aid can be further extended for a maximum of one fiscal year at most by mutual agreement between the two Governments.

46)

- 4) Under the Grant Aid, in principle, Japanese products and services including transport or those of the recipient country are to be purchased.

When the two Governments deem it necessary, the Grant Aid may be used for the purchase of the products or services of a third country.

However the prime contractors, namely, consulting constructing and procurement firms, are limited to "Japanese nationals". (The term "Japanese nationals" means persons of Japanese nationality or Japanese corporations controlled by persons of Japanese nationality.)

5) Necessity of "Verification"

The Government of recipient country or its designated authority will conclude contracts denominated in Japanese yen with Japanese nationals. Those contracts shall be verified by the Government of Japan. This "Verification" is deemed necessary to secure accountability to Japanese taxpayers.

6) Undertakings required of the Government of the Recipient Country

In the implementation of the Grant Aid project, the recipient country is required to undertake such necessary measures as the following:

- a) To secure land necessary for the sites of the Project and to clear, level and reclaim the land prior to commencement of the construction.
- b) To provide facilities for the distribution of electricity, water supply and drainage and other incidental facilities in and around the sites.
- c) To secure buildings prior to the procurement in case the installation of the equipment.
- d) To ensure all the expenses and prompt execution for unloading, customs clearance at the port of disembarkation and internal transportation of the products purchased under the Grant Aid.
- e) To exempt Japanese nationals from customs duties, internal taxes and other fiscal levies which will be imposed in the recipient country with respect to the supply of the products and services under the Verified Contracts.
- f) To accord Japanese nationals whose services may be required in connection with the supply of the products and services under the Verified contracts, such facilities as may be necessary for their entry into the recipient country and stay therein for the performance of their work.
- g) "Proper Use"
The recipient country is required to maintain and use the facilities constructed and equipment purchased under the Grant Aid properly and effectively and to assign staff necessary for this operation and maintenance as well as to bear all the expenses other than those covered by the Grant Aid.
- h) "Re-export"
The products purchased under the Grant Aid should not be re-exported from the recipient country.
- i) Banking Arrangements (B/A)
• The Government of the recipient country or its designated authority should open an account in the name of the Government of the recipient country in a bank in Japan (hereinafter referred to as "the Bank"). The Government of Japan will execute the Grant Aid by making

payments in Japanese yen to cover the obligations incurred by the Government of the recipient country or its designated authority under the Verified Contracts.

- The payments will be made when payment requests are presented by the Bank to the Government of Japan under an authorization to pay issued by the Government of the recipient country or its designated authority.

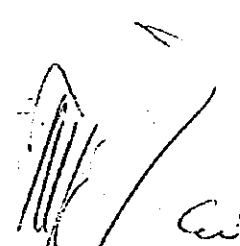
2 Remarks

Both of "Flow Chart of Japan's Grant Aid Procedures" and "Major Undertaking to be taken by Each Government" are shown in following pages.

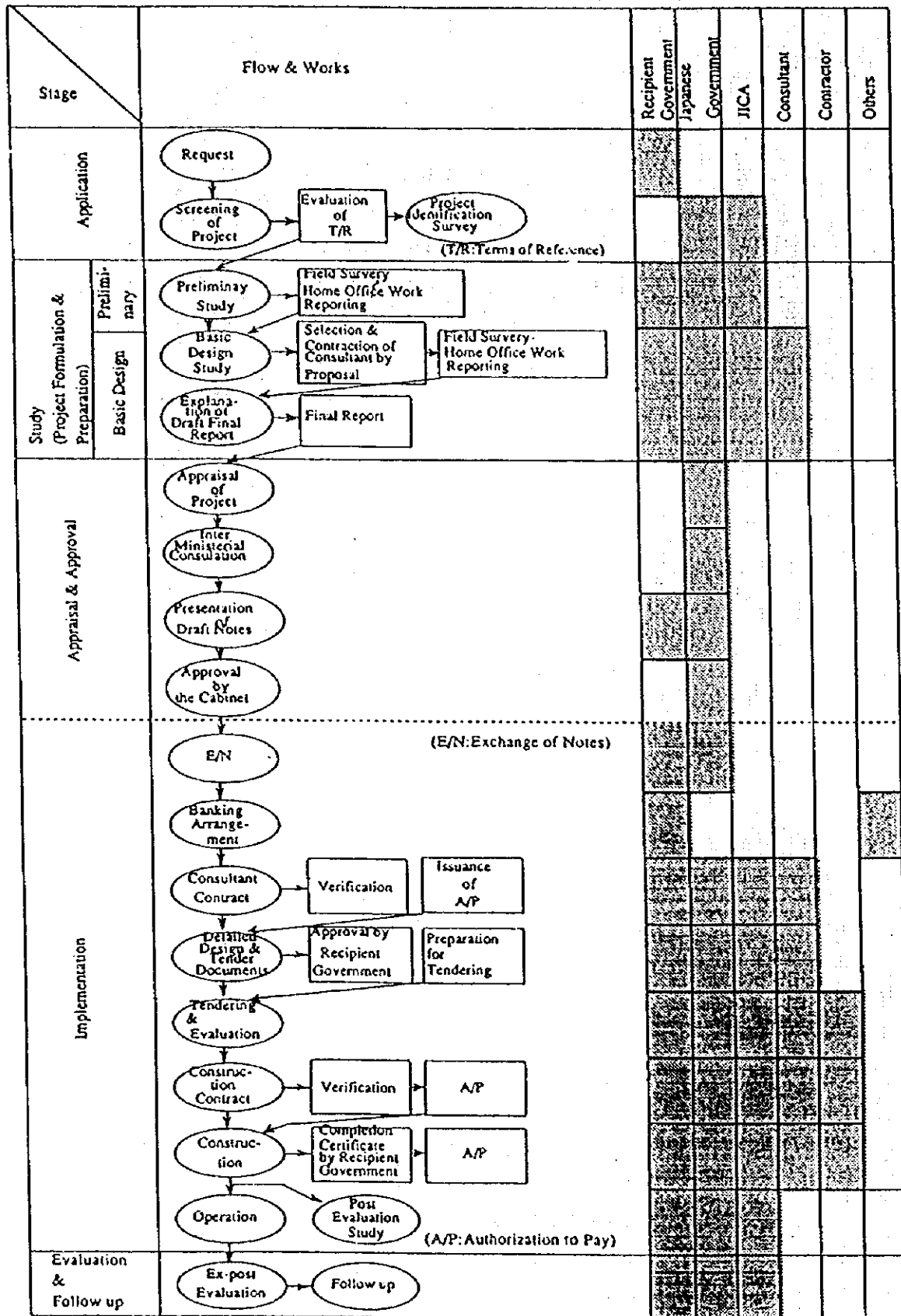
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Flow Chart of Japan's Grant Aid Procedures



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Major Undertaking to be taken by Each Government

No.	Items	To be covered by Grant Aid	To be covered by Recipient
1.	To secure land including camp yard.		●
2.	To clear, level and reclaim the site when needed.		●
3.	To demolish existing buildings and facilities on bridge route and border facilities.		●
4.	To construct bridge and access road.	●	
5.	To construct border facilities.		●
6.	To provide electricity supply to temporary camp yard at both countries.		
	1) Distribution line to the camps with 400v transformer		●
	2) Drop wiring in the camps	●	
7.	To supply potable water to camp yards		●
8.	To provide telephone lines to camp yards.		●
9.	To obtain permit to use satellite communication system.		●
10.	To bear the following commissions to the Japanese foreign exchange bank for the banking services based upon the B/A.		
	1) Advising commission of A/P		●
	2) Payment commission		●
11.	To ensure unloading and customs clearance at port of disembarkation in recipient country.		
	1) Marine (Air, Road) transportation of the products from Japan to the recipient country.	●	
	2) Tax exemption and customs clearance of the products at the port of disembarkation		●
	3) Internal transportation from the port of disembarkation to the project site	●	
12.	To accord Japanese nationals whose services may be required in connection with the supply of the products and the services under the verified contract such facilities as may be necessary for their entry into the recipient country and stay therein for the performance of their work.		●
13.	To exempt Japanese nationals from customs duties, internal taxes and other fiscal levies which may be imposed in the recipient country with respect to the supply of the products and services under the verified contracts.		●
14.	To maintain and use properly and effectively the facilities constructed provided under the Grant.		●
15.	To bear all the expenses, other than those to be borne by the Grant, necessary for construction of the facilities.		●

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NECESSARY MEASURES TO BE TAKEN BY BOTH GOVERNMENTS

The following necessary measures should be taken by both Governments provided that the Grant Aid by the Government of Japan will be extended to the Project:

1. To provide data and information necessary for the Project.
2. To secure the land necessary for the execution of the Project, such as the Right of Way, land for the bridge, access roads, temporary camp yards, working area and others.
3. To clear any structures existing on the Project site before the commencement of the construction.
4. To make passable all roads and bridges leading to the Project site before the commencement of inland transportation of materials and equipment.
5. To provide facilities for the distribution of electricity, water supply and telephone line to camp yard.
6. To obtain permit to use satellite communication system.
7. To bear commissions to the Japanese bank for its banking services based upon the Banking Arrangement, namely the advising commission of the "Authorization to Pay" and payment commission.
8. To ensure prompt unloading, tax exemption, customs clearance at the port of disembarkation in each country and prompt internal transportation of the materials and equipment for the Project purchased under the Grant Aid.
9. To exempt Japanese nationals from customs duties, internal taxes and other fiscal levies which will be imposed in the recipient country with respect to the supply of the products and services under the Verified Contracts.
10. To accord Japanese nationals whose services may be required in connection with the supply of products and the services under the Verified Contracts, such facilities as may be necessary for their entry into both countries and stay therein for the performance of their work.
11. To provide necessary permissions, licenses and other authorizations for implementing the Project.
12. To maintain and use properly and effectively the facilities constructed under the Project.
13. To coordinate and solve any issues related to the Project which may be raised by third parties or inhabitants in the Project area during the implementation of the Project.



OTHER RELEVANT ISSUES

1. Customs and Immigration (Zambian side)

1-1 Imposing of Value Added Tax (VAT)

Import VAT : This may be deferred on capital equipment if the equipment is to be re-exported.

Domestic VAT : a) This is charged on all local purchases. Should the Project register for VAT then the VAT paid shall be refunded. The refund takes place within a month.
 b) On imported materials VAT paid may also be refunded in the same manner.
 c) The Project could also apply for deferment of import VAT but only if they are requested.

1-2 Customs Duty

Customs Duty : Full rebate on capital equipment imported for re-exportation.
 : Imported materials which are scheduled to enjoy full rebate. (Statutory instrument required for this).

Personal Effects : Full rebate on first entry or residence for each member of the construction team.

1-3 Immigration

Inside the Project area, which includes border post facilities, all the personnel engaged in the Project will be entitled to move within the area with no restriction on the production of Identification Cards (ID).

Japanese personnel will require to obtain work permit from both countries.

2. Customs and Immigration (Zimbabwean side)

2-1 Customs Clearance

2-1-1 Equipment

The law provides for the duty free importation of plant and equipment on the understanding that it will be re-exported at the end of the Project.

2-1-2 Materials

The law provides for the duty-free importation of materials which will be incorporated in the construction of the Project subject to the issuance of a duty free certificate by the Secretary for Ministry of Transport and Energy.

2-1-3 Personal effects : Japanese personnel

The law provides for the duty free importation of personal effects by Japanese personnel who will have been given Temporary Work Permits by Zimbabwe Immigration.

2-2 Immigration

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2-2-1 All Japanese nationals who wish to be working on the Project are required to apply and obtain Work Permits.

2-2-2 The Zimbabwe Government will endeavor speedy processing of the permits as was agreed in the Protocol agreement.

2-2-3 Japanese nationals and other personnels working on the Project will only be required to carry the Project ID's which will allow them free movement within the agreed Project area. They will, however, be expected to go through official Security check points.

3 Trucks and Equipment

Trucks and equipment to be used in the Project will be given registration numbers to make them identifiable with the Project for easy access in both countries.

4. Joint Contract for Consultant and Construction Agreement.

Joint signing of the certificates and the contracts was proposed by both Governments.

5. Counterpart Training

Both Governments requested for the technical training in the course of Detailed Design and Bridge Construction.

At Detailed Design stage, the training of two engineers from each country in Japan was proposed and at Bridge Construction stage, provision of two engineers on site from each country for supervising the work on condition that accommodation and transportation costs are covered by the Project was proposed. However the Team responded by advising that the request may not be met in view of the self-help effort philosophy.

6. Bridge Geometry

Both Governments requested to widen the footwalks to one meter on the both side of carriage way of the bridge in order to accommodate pedestrians in case the existing Otto-Beit bridge is closed for unforeseeable reasons.

7. Agreed Minutes between both Governments

Agreed Minutes for the implementation of Grant Aid project between the recipient Governments will be prepared.

8. Tolling System

Introduction of tolling system for securing maintenance cost of new bridge was discussed and further study on the matter is to be pursued.

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List of Attendants

Name	Position
Zambia	
1. T.S. Masaka	: Permanent Secretary, MWS
2. J.D. Mwila	: Director of Roads, MWS
3. V.M. Mooya	: Deputy Director of Planning, MWS
4. L. Njungo	: Journalist, Z.I.S
5. S. Lungu	: Senior Executive Engineer, MWS
6. S. Jostine	: Executive Engineer, Road Dept., MWS
7. P. Banda	: Executive Engineer, Road Dept., MWS
8. L. Boma	: Accountant, MWS
9. N.M. Jere	: Chief Architect, MWS
10. C.N. Chipepo	: Environmental Officer, MWS
11. M. Muliya	: Environmental Officer, MWS
12. F.B. Mukozomba	: Principal Planner, DPPH, Ministry of LGH
13. B.J. Silunawe	: Provincial Planning Officer, DPPH, MLGH
14. S.M. Linsomba	: Zambian Revenue Authority
15. R.S. Nkunika	: Zambian Revenue Authority
16. H. Muchindu	: Zambian Revenue Authority
17. J. Mphepo	: Immigration, Zambia
18. W.C. Ngomalala	: External Resource mobilisation, MOFED
Zimbabwe	
19. G. Nhemachena	: Deputy Director, Planning & Design, DoR, MOTE
20. A.A. Zindoga	: Acting Deputy Chief Eng., Bridge Design Branch, MOTE
21. R. Mubaira	: Project Manager, Immigration, Zimbabwe
22. W.Kwedza	: Assistant Director, Customs & Excise, Zimbabwe
23. G. Odhong	: Principal Architect, Housing Develop., MLGNH, Zimbabwe
Japan	
24. S. Umenaga	: Team leader, Study Team, JICA
25. N. Murayama	: Member, Study Team, Ministry of Foreign Affairs
26. Y. Kajimura	: Member, Study Team, Chodai Co., Ltd.
27. M. Komagamine	: Member, Study Team, Chodai Co., Ltd.
28. R. Iizuka	: JICA Expert, DoR, MOTE
29. O. Tanabe	: Assistant Resident Representative, JICA Zambia

5. Cost Estimation Borne by the Recipient Country

	Zambia US\$1,000	Zimbabwe US\$1,000
1. Due to the construction of New Bridge		
Land acquisition	147.4	—
Demolition of buildings	330.6	220.4
Temporary power supply	110.2	140.8
Temporary water supply	258.4	190.5
Telephone lines	16.1	21.1
Total	862.8	573.0
2. Construction of Border Facilities (-2002)		
Cargo terminal	9,311.0	13,729.9
Passenger terminal	2,334.0	4,000.0
Pedestrian control building	238.0	65.7
Drug enforcement building	201.0	211.7
Vehicle inspection unit	116.0	29.2
Police	550.0	226.3
Guard house	227.0	598.5
Staff quarters	9,765.0	5,138.7
Land acquisition and Compensation	270.0	—
Total	23,012.0	24,000.0

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