CHAPTER 7

CONSTRUCTION PLANNING AND COST ESTIMATES

7. CONSTRUCTION PLANNING AND COST ESTIMATES

7.1 Construction Planning

7.1.1 Construction Procedure

Construction procedure for the Project Bridge and access roads, based on the preliminary design in Chapter 6, is shown in Figure 7.1.1. Following the pre-construction stage, such as land acquisition and resettlement works at the site, preparation works may start prior to the bridge and road construction works.

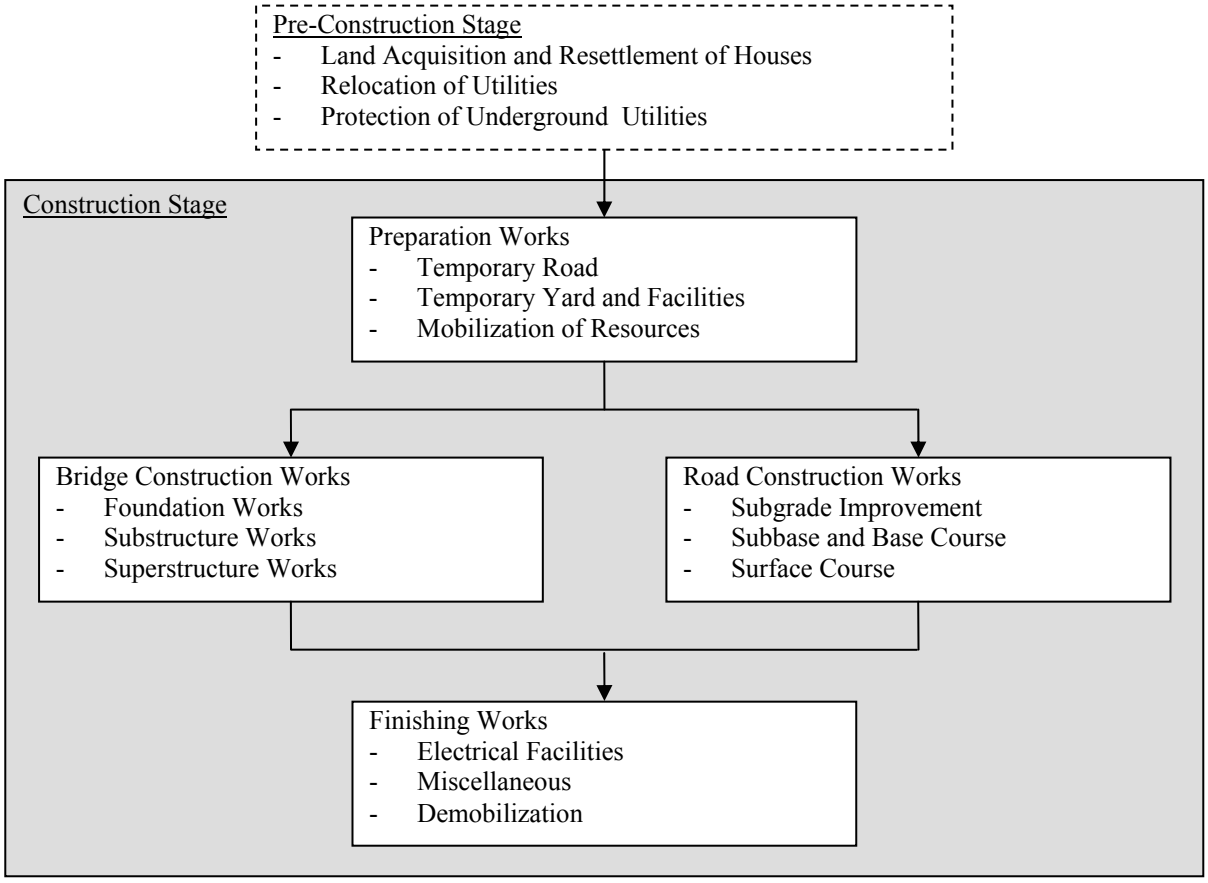


Figure 7.1.1 Construction Procedure of the New Nile Bridge

7.1.2 Preparation Works

(1) Temporary Road

Temporary roads should be well compacted gravel roads 8 m wide and durable to contain heavy loaded trucks and equipment. The road will be 780 m long at the Jinja side and 510 m at the Njeru side from the existing road to the river sides. These temporary roads have to be well maintained with "day work equipment", especially during the substructure works, because a number of heavy loaded dump trucks will pass everyday.

(2) Temporary Yard and Facilities

Temporary yard at the Jinja side should be prepared for the following facilities:

- Contractor's office and accommodation facilities
- Engineer's office and quality control facilities
- Equipment workshop and parking space
- Concrete plant and asphalt plant with aggregate and sand stock yards
- Stockpile for excavated soil and rock
- Stockyard for various materials

Temporary yard at the Njeru side should be prepared for the following facilities:

- Concrete plant with aggregate and sand stock yards
- Stockpile for excavated soil and rock
- Stockyard for various materials

As stated above, concrete plants will be assembled at both sides of the river to sustain adequate capacity for concreting massive footings and preparing unexpected breakdown of the plants. The stockpile at Njeru side requires a larger space than that of Jinja side because larger soil and rock excavations for backfilling will be produced during the excavation works.

The temporary yards and facilities should be demolished when the construction is completed.

Figures 7.1.2 and 7.1.3 show the location of the temporary roads and yard at the Njeru side and Jinja side respectively.

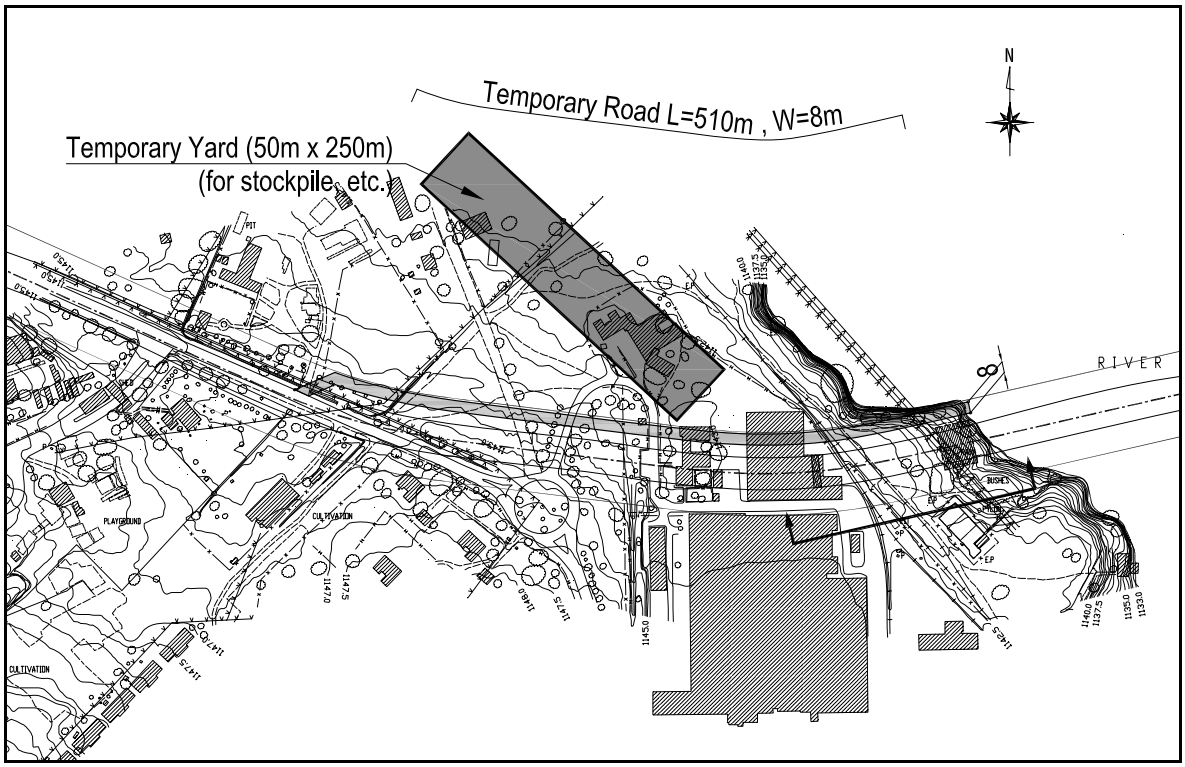


Figure 7.1.2 Location of Temporary Road and Yard at the Njeru side

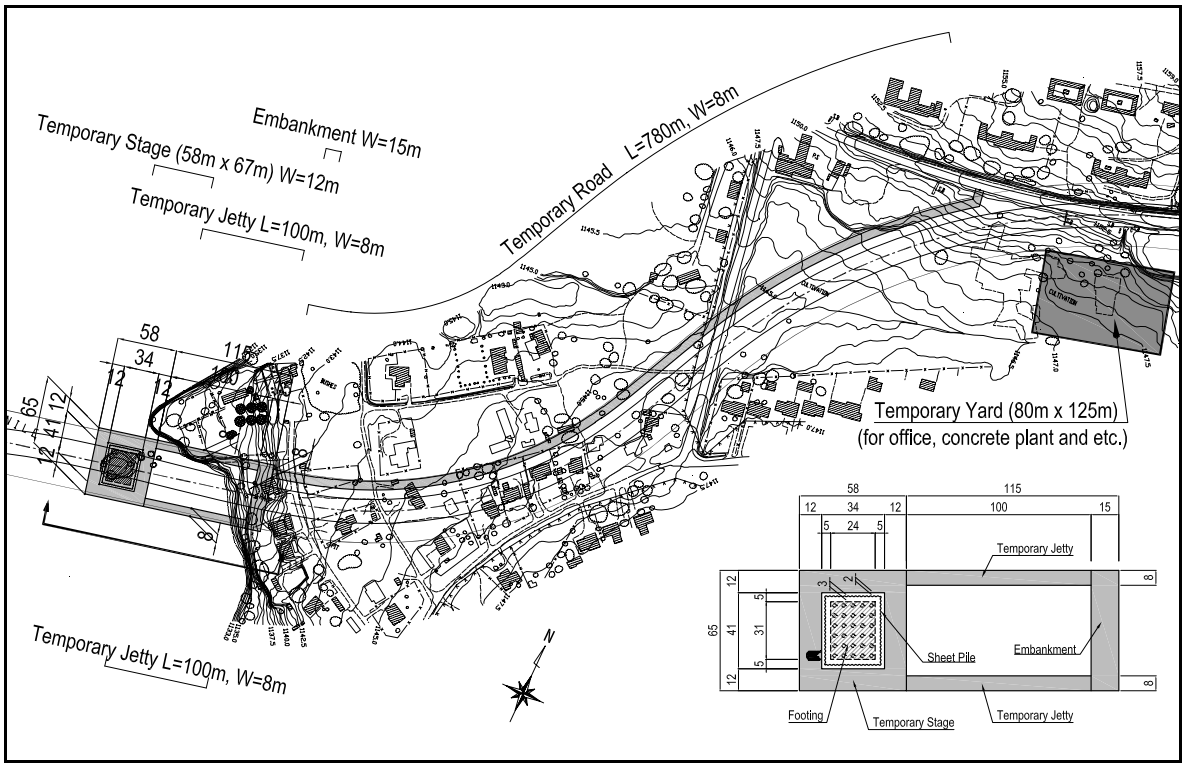


Figure 7.1.3 Location of Temporary Road and Yard at the Jinja side

(3) Mobilization of Resources

Materials

The major materials for the cable stay bridge are shown in Table 7.1.1. Some materials including aggregates and sand are locally available while the other materials will have to be mainly imported from Kenya and other foreign countries.

In Uganda, cement is locally available, but the domestic cement is the pozzolan cement which slowly sets at low heat, and less strength. For this reason Portland cement type II would have to be imported from Kenya to provide the required strength of the bridge structures.

Although some steel materials might be available in Kenyan markets, all of the steel products are assumed to be imported from overseas countries because the capacity of Kenyan steel market is so small that it will not be able to meet requirements for this project.

Table 7.1.1 Procurement Plan for Main Materials

Material	Country to be Procured	Remarks
Gasoline	Local	From a market in Uganda
Diesel	Local	From a market in Uganda
Natural Gravel	Local	Domestic product
Graded Crashed Stone	Local	Domestic product
Coarse Aggregate	Local	Domestic product
River Sand	Local	Domestic product
Asphalt Prime Coat	Kenya	From a market in Kenya
Bitumen	Kenya	From a market in Kenya
Portland Cement	Kenya	Products in Kenya
Plywood	Kenya	Products in Kenya
H-Shaped Steel	South Africa	Products in South Africa
Reinforcement Bar	South Africa	Products in South Africa
Steel Pipe Casing	South Africa	Products in South Africa
Sheet Pile	South Africa	Products in South Africa
PC Cable	Japan	Products in Japan
Stay Cable	Japan	Products in Japan
PC Anchor	Japan	Products in Japan
Cable Damper	Japan	Products in Japan
Rubber Bearing	Japan	Products in Japan
Expansion Joint	Japan	Products in Japan
Scaffoldings	Kenya	From a market in Kenya

Source: JICA Study Team

Equipment

Equipment for earth work is available from local contractors in Kampala although large crawler crane, concrete plant and some specific equipment such as "All Casing Pile Machine" should be imported temporarily. These temporary imported machines will be demobilized and re-exported back to the place of origin to ensure import tax exemptions.

Table 7.1.2 shows the main equipment to be mobilized for this project.

Table 7.1.2 Mobilization Plan for Main Equipment

Equipment	Specification	Country to be Procured
Bulldozer 15 ton	136 PS	Local
Bulldozer 32 ton with ripper	314 PS	Japan
Excavator 1.1m3 (0.8)	169 PS	Local
Tractor Shovel 1.8-1.9m3	152 PS	Local
Wheel Loader 1.5-1.7m3	110 PS	Local
Motor Grader blade 3.4 m	137 PS	Local
Dump Truck 10 ton	334 PS	Local
Road Roller Macadam 12 ton	76 PS	Local
Pneumatic Tire Roller 8-20 ton	97 PS	Local
Vibrating Roller 7-8.5 ton	105 PS	Local
Crawler Crane 50-55 ton	179 PS	Kenya
Crawler Crane 100 ton	277 PS	South Africa
Truck crane 25 ton	220 PS	Local
Tower Crane 90t.m B=24m	45 kW	Japan
Elevator 2 ton	30 kW	Japan
Vibration Hummer	60 kW	Japan
Vibration Hummer for Rock Pile	120 kW	Japan
All Casing Pile Machine D=2000 mm	392 PS	Japan
Concrete Plant 60m3/hr	91kW	South Africa
Asphalt Plant 30 ton/hr	120 kW	South Africa
Agitator Truck 4.4-4.5m3	290 PS	South Africa
Concrete Pump (boom) 90-110m3	271 PS	South Africa
Asphalt Finisher 2.4-4.5 m	53 PS	South Africa
Air Compressor 5m3	53 PS	South Africa
Power Generator 10 kVA	18 PS	South Africa
Power Generator 45 kVA	57 PS	South Africa
Power Generator 200 kVA	265 PS	South Africa

Source: JICA Study Team

Engineers

Foreign experts, technicians and Ugandan engineers will be hired for the supervising of works for the bridge and road construction work as listed in Table 7.1.3.

Table 7.1.3 Mobilization Plan for Engineers

Title	Experience	Country to be Procured
Team Leader	22 years or more	Foreign Expertise
Deputy Team Leader/ Structure Engineer	18 years or more	Foreign Expertise
Bridge Superstructure Engineer	13 years or more	Foreign Expertise
Bridge Substructure Engineer	13 years or more	Foreign Expertise
Highway Engineer	13 years or more	Foreign Expertise
Drainage Engineer	8 years or more	Foreign Expertise
Topographical Survey Engineer	8 years or more	Foreign Expertise
Soil Material Engineer	8 years or more	Foreign Expertise
Electric /Mechanical Engineer	8 years or more	Foreign Expertise
Cost Estimator	13 years or more	Foreign Expertise
Document Specialist	13 years or more	Foreign Expertise
Environmental Specialist	13 years or more	Foreign Expertise
Traffic Survey Specialist	8 years or more	Foreign Expertise
Deputy Team Leader/ Structure Engineer	18 years or more	Local Engineer
Bridge Superstructure Engineer	13 years or more	Local Engineer
Bridge Substructure Engineer	13 years or more	Local Engineer
Highway Engineer	13 years or more	Local Engineer
Soil Material Engineer	8 years or more	Local Engineer
Electric Engineer	8 years or more	Local Engineer
Topographical Survey Engineer	8 years or more	Local Engineer
Cost Estimator	8 years or more	Local Engineer
Quantity Engineer	5 years or more	Local Engineer
System Engineer	5 years or more	Local Engineer
Resettlement Engineer	5 years or more	Local Engineer
Environment Engineer	5 years or more	Local Engineer
CAD Operator	5 years or more	From the third country

Source: JICA Study Team

7.1.3 Construction Works for the Bridge

(1) Foundation Works

1) Direct Foundation

Direct foundation method will be applied for the semi-underground beam and Pier 1 of the Njeru side as stated in Chapter 6. Excavation for the semi-underground beam and Pier 1 will be done by the “open cut method” although cofferdam will be necessary for the excavation of Pier 1.

Applicable method for the excavation of the foundation for the Njeru side is shown in the Figure 7.1.4.

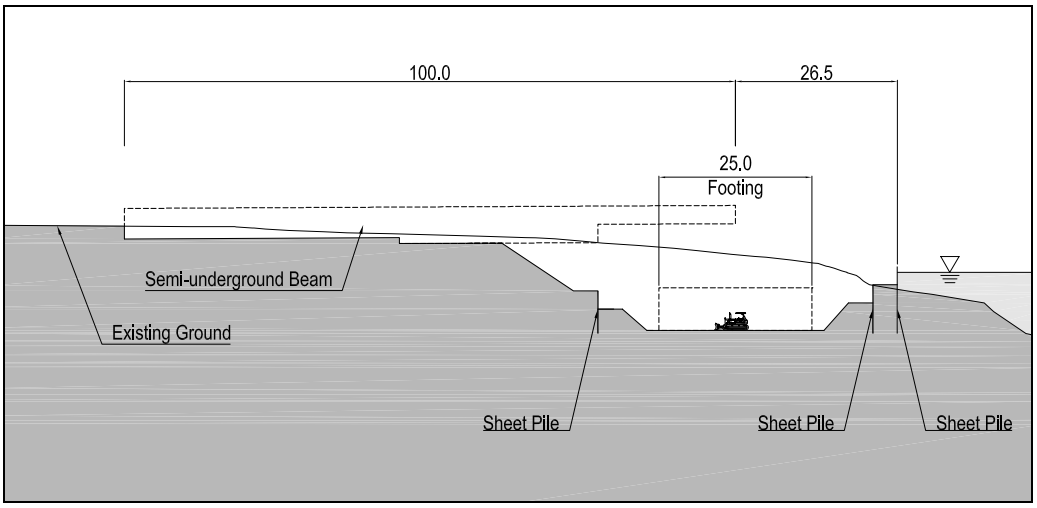


Figure 7.1.4 Methodof Construction for the Foundation Works at the Njeru side

2) Pile Foundation

Pile foundation method will be adopted for Pier 2 of the Jinja side as stated in Chapter 6. Excavation for the piles will be done by the "All Casing Method", while the open cut method will be applied to the direct foundation of Abutment 2.

Method to excavate the foundation for the Jinja side is shown in the Figure 7.1.5.

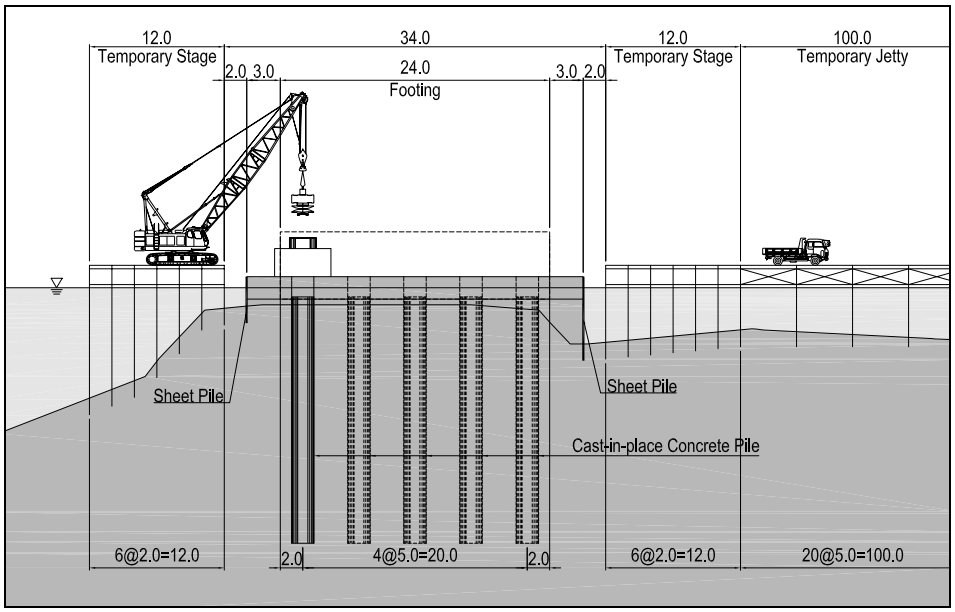


Figure 7.1.5 Method for Construction of the Foundations at the Jinja side

(2) Substructure Works

1) Footing

After the aggregate bed has been compacted, concrete placing for the footing concrete will follow in several lifts. Regarding mass concrete footings for Pier 1 and Pier 2, the height of one lift should be less than 1.5 m in order to comply with the capacities of the concrete plants.

2) Column

The height of one lift for concreting will be around 2 m for both piers considering productivity.

(3) Superstructure Works

1) Pylon

The pylon will be constructed with "whole scaffolding method" as shown in Figure 7.1.6 because of the difficulty in installing jumping form for "inverted Y type" pylon because of differential shape which is changing from bottom to top. The height of one lift will be around 2.5 m (30 lifts) in order to comply with the timing of erection of girders.

Figure 7.1.6 Construction of Inverted Y-type Pylon with Whole Scaffoldings

2) PC Girder

PC girder erection is estimated at 13 days for each segment in calculating the construction period. One segment of PC the girder will either be 3 m (for cable stay anchor) or 4 m (without cable stay anchor) long in the longitudinal direction. Therefore, the total period of girder erection is estimated at 13 days x 38 segments = 494 working days (20 months), excluding the period required for the preparation of Wagen (Travelling form for the cantilever PC girder).

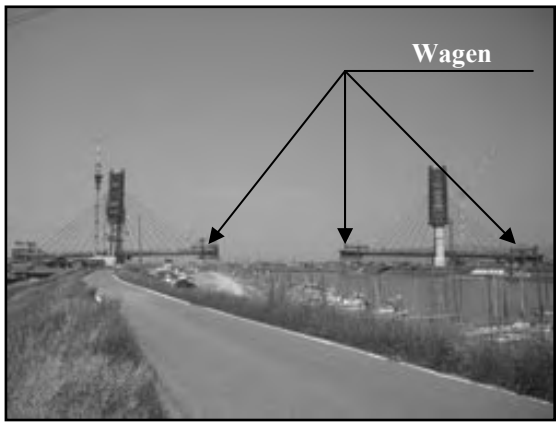


Figure 7.1.7 Construction of PC Girder with Wagens

3) Stay Cable Tensioning

Stay cable specifications:

- JIS G3536-1999 SWPR7BL or BS5896-1980, D=15.2mm 7-wire strand with Epoxy Coating Thickness of 0.400-0.900mm.

Epoxy coated type will be adopted for high durability and low maintenance cost future maintenance of the facility. The cross section of a stay cable is shown in Figure 7.1.8. This 7-wire strand is tensioned either one by one or in groups depending on the tensioning method.

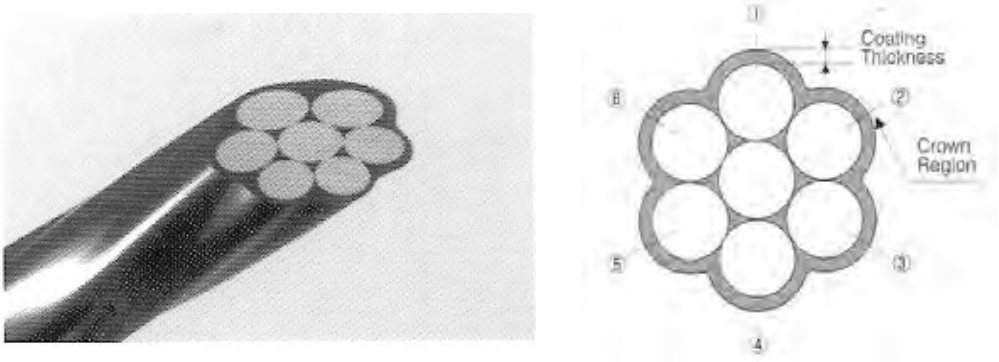


Figure 7.1.8 Cross Section of Stay Cable

7.1.4 Construction Works for the Road

(1) Subgrade Improvement

After clearing and grabbing works, the subgrade for the new approach roads should be improved to eliminate unsuitable "black cotton soil" by replacing with about 1 m thick, approved soil materials from the stockpile.

(2) Subbase and Base Course

1) Location of Quarries

Some quarries are producing subbase and base course materials near the project site. Location of the Quarries with sufficient capacity provided with crusher machine is shown in Figure 7.1.9.

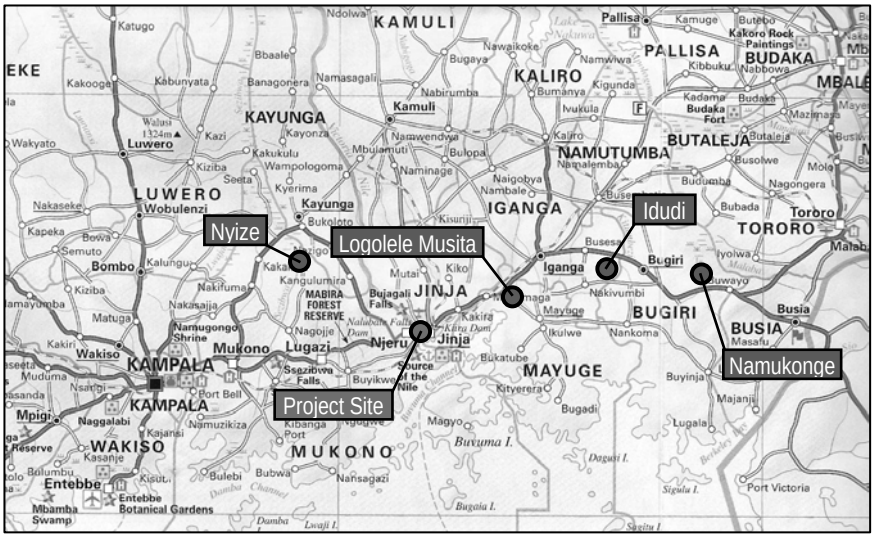


Figure 7.1.9 Location of Quarries near the Project Site

2) Construction of Subbase and base course

Subbase should be made of 200 mm graded crushed stone, excluding the shoulder, which can be constructed by 175 mm Natural Gravel as stated in Chapter 6 "6.1 Road Design". These layers should be compacted by Vibrating Roller (7 - 8.5 ton).

Base course also should be made of graded crushed stone 150 mm thick (for the walkway) and 175 mm thick (for the carriageway and shoulder), to be compacted by Road Roller Macadam 12 ton capacity and Pneumatic Tire Roller (8 - 20 ton) capacity.

3) Dense Bitumen Macadam Binder Course

As stated in Chapter 6 "6.1 Road Design", the dense bitumen macadam binder course is required for some sections of the carriageway and shoulder to strengthen the pavement.

(3) Surface Course

1) Wearing course

The thickness of the wearing course varies from 30 mm to 70 mm depending on the location. For bridge pavement, 70 mm of wearing course was applied and compacted by Road Roller Macadam 12 ton capacity and Pneumatic Tire Roller (8 - 20 ton) capacity, while 30 mm of wearing course will be applied and compacted by Hand Guide Roller (0.8 - 1.1 ton) capacity for the walkway.

2) Double or Single Surface Treatment

Some section of the shoulders and walkways, which will be provided low-cost pavement, commonly called double or single surface treatment. Double surface treatment will be applied to the shoulder, while single surface treatment will be applied to the walkway.

7.1.5 Finishing Works

(1) Electrical Facilities

For the last six months of the construction period, all the necessary electrical facilities will be installed, to include:

- Road lightings with poles
- Panel, pull box, cable and conduit for the lightings
- Power receiving system
- Obstacle lights and lightening protection system

(2) Miscellaneous

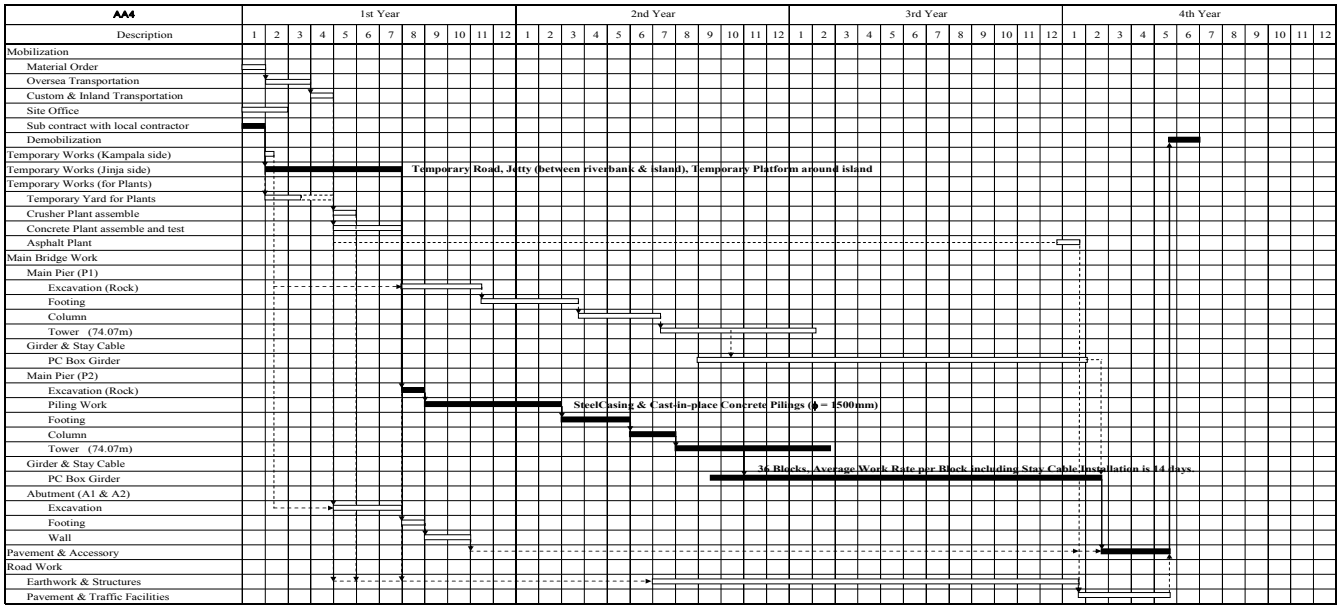
Following the foregoing works, miscellaneous works must be completed before the completion of the Project.

- Road Sign and Road Marking
- Kilometre Post
- Fencing, if necessary
- Landscaping and Planting

7.1.6 Construction Schedule

The construction period will be 3.5 years (42 months) including mobilization and demobilization as shown in Table 7.1.4.

Table 7.1.4 Construction Schedule of the Project



7.2 Cost Estimation

7.2.1 Estimated Costs

(1) Compensation Cost

Following costs are estimated at the Preconstruction Stage.

- Land Acquisition
- Resettlement of Houses and Industrial Structures
- Relocation of Utilities
- Protection of Utilities

(2) Construction Cost

Construction cost was estimated based on BQ (Bill of Quantities) method as shown in Table 7.2.1 considering consistency with the "Technical Specifications" to be prepared during the preparation of the Detailed Designs. Certain indirect costs, including contractor's administration cost, to be properly distributed and added for each of the "Pay Item", were also calculated as part of the individual items for the preparation of the Feasibility Study.

(3) Engineering Cost

Following costs were estimated for the Engineering Studies:

- Detailed Design Cost
- Tender Assistance Cost
- Construction Supervision Cost.

(4) Operation and Maintenance Costs

Operation and maintenance costs were estimated in "Chapter 8: Maintenance, Operation and Implementation Plans".

Table 7.2.1 Bill of Quantities for Project

	PRICED BILL OF QUANTITIES (Engineer's Estimate)					
ITEM NO.	DESCRIPTION	UNIT	Quantities			QUANTITY
			Approach Road (JINJA side)	Main Bridge	Approach Road (Njeru side)	
0.00	SECTION 0 - COMPENSATION					
0.01	Land Acquisition	LS				1.00
0.02	Resettlement of Houses and Industrial Structures	LS				1.00
0.03	Resettlement of Utilities	LS				1.00
0.04	Protection of Utilities	LS				1.00
1.00	SECTION 1 - GENERAL					
1.01	Mobilization, Contractor's Office and Facilities	LS				1.00
1.02	Mobilization, Contractor's Furniture and Services	LS				1.00
1.03	Mobilization, Engineer's Office and Facilities	LS				1.00
1.04	Mobilization, Engineer's Furniture and Services	LS				1.00
1.05	Mobilization, Quality Control Facilities and Equipment	LS				1.00
1.06	Supplementary Obligations, Traffic Control	LS				1.00
1.07	Supplementary Obligations, Site Survey	LS				1.00
1.08	Supplementary Obligations, Environmental Monitoring & Protection	LS				1.00
1.09	Supplementary Obligations, Insurances, Health and Safety	LS				1.00
1.10	Mobilization, Contractor's personnel	LS				1.00
1.11	Mobilization, Equipment and Materials from overseas	LS				1.00
1.12	Mobilization, Equipment and Materials Land Transportation Cost	LS				1.00
1.13	Mobilization, Equipment Depreciation Cost	LS				1.00
2.00	SECTION 2 - EARTH WORK					
2.01	Cleaning and Grubbing	sq.m.	10,780.00	0.00	11,500.00	22,280.00
2.02	Structure Excavation, Type 1: Soil	cu.m.	0.00	26,308.74	0.00	26,308.74
2.03	Structure Excavation, Type 2: Weathered Rock by Ripper	cu.m.	0.00	15,023.54	0.00	15,023.54
2.04	Structure Excavation, Type 3: Medium Rock by Giant Breaker	cu.m.	0.00	2,503.92	0.00	2,503.92
2.05	Structure Excavation, Type 4: with Cofferdam	cu.m.	0.00	858.00	0.00	858.00
2.06	Embankment & Compaction	cu.m.	42,240.00	0.00	9,520.00	51,760.00
2.07	Aggregate Bedding	cu.m.	0.00	1,723.00	0.00	1,723.00
2.08	Granular Backfill	cu.m.	0.00	0.00	0.00	0.00
2.09	Backfill A (W2 > 4 m)	cu.m.	0.00	0.00	0.00	0.00
2.10	Backfill B1 (1 < W2 < 4m, W1> 4 m)	cu.m.	0.00	24,880.60	0.00	24,880.60
2.11	Backfill B2 (W2 < 1m, W1> 4 m)	cu.m.	0.00	0.00	0.00	0.00
2.12	Backfill C (W2 < 1m, 1 < W1< 4 m)	cu.m.	0.00	0.00	0.00	0.00
2.13	Backfill D (W1 < 1 m)	cu.m.	0.00	0.00	0.00	0.00
2.14	Wet Masonry	sq.m.	3,313.00	2,968.00	301.00	6,582.00
2.15	Sodding	sq.m.	7,790.00	0.00	2,520.00	10,310.00
2.16	U-Shape Side Ditch	l.m.	887.00	0.00	1,312.00	2,199.00
2.17	Pipe Drain	l.m.	37.00	0.00	131.00	168.00
2.18	Catch Basin	nos.	2.00	0.00	5.00	7.00
2.19	Slope Cutting for Road	cu.m.	2,010.00	0.00	5,700.00	7,710.00
3.00	SECTION 3 - SUBBASE AND BASE COURSE					
3.01	Subgrade Preparation	sq.m.	20,380.00	0.00	19,950.00	40,330.00
3.02	Natural Gravel Sub-base (Shoulder)	cu.m.	470.00	0.00	0.00	470.00
3.03	Crashed Stone Sub-base (Carriageway & Shoulder)	cu.m.	3,210.00	0.00	3,410.00	6,620.00
3.04	Graded Crashed Stone Base (Walkway)	cu.m.	130.00	0.00	440.00	570.00
3.05	Graded Crashed Stone Base (Carriageway & Shoulder)	cu.m.	3,360.00	0.00	2,980.00	6,340.00
3.06	Dense Bitumen Macadam Binder Course (Carriageway & Shoulder)	cu.m.	2,540.00	0.00	2,560.00	5,100.00
3.07	Subgrade Improvement (Replacement Method)	cu.m.	19,560.00	0.00	17,020.00	36,580.00
4.00	SECTION 4 - SURFACE COURSES					
4.01	Wearing Course t=30mm (Walkway)	sq.m.	0.00	2,370.00	0.00	2,370.00
4.02	Wearing Course t=60mm (Carriageway & Shoulder)	sq.m.	16,890.00	0.00	17,020.00	33,910.00
4.03	Wearing Course t=70mm (Carriageway & Shoulder)	sq.m.	0.00	8,400.00	0.00	8,400.00
4.04	Double Surface Treatment (Shoulder)	sq.m.	2,680.00	0.00	0.00	2,680.00
4.05	Single Surface Treatment (Walkway)	sq.m.	810.00	0.00	2,930.00	3,740.00
4.06	Portland Cement Concrete Pavement, 25cm	sq.m.	0.00	0.00	0.00	0.00

Source: JICA Study Team

Table 7.2.1 Bill of Quantities for Project (cont'd)

ITEM NO.	DESCRIPTION	UNIT	PRICED BILL OF QUANTITIES (Engineer's Estimate)			
			Quantities			QUANTITY
			Approach Road (JINJA side)	Main Bridge	Approach Road (Njeru side)	
5.00	SECTION 5 - STRUCTURES					
5.01	Concrete Class A -1 (Pylon for Cable Stay) 40N/mm	cu.m.	0.00	4,145.80	0.00	4,145.80
5.02	Concrete Class A -2 (PC Segment cast-in-place) 40N/mm	cu.m.	0.00	7,155.90	0.00	7,155.90
5.03	Concrete Class B -1 (Concrete Pile) 30N/mm	cu.m.	0.00	2,072.40	0.00	2,072.40
5.04	Concrete Class C -1 (Pier for Main Bridge) 24N/mm	cu.m.	0.00	2,411.50	0.00	2,411.50
5.05	Concrete Class C -2 (Abutment for Main Bridge) 24N/mm	cu.m.	0.00	770.20	0.00	770.20
5.06	Concrete Class C -3 (Footing for Main Bridge) 24N/mm	cu.m.	0.00	10,210.00	0.00	10,210.00
5.07	Concrete Class C -4 (Other Small Structures) 24N/mm	cu.m.	0.00	465.90	0.00	465.90
5.08	Concrete Class D -1 (RC Counter Weight) 21N/mm	cu.m.	0.00	7,696.00	0.00	7,696.00
5.09	Concrete Class F -1 (Lean Concrete) 18N/mm	cu.m.	0.00	189.00	0.00	189.00
5.10	Bridge Approach Slab t=30cm	sq.m.	0.00	256.00	0.00	256.00
5.11	Reinforcement Bar size: 14mm or under (SD345)	ton	0.00	0.00	0.00	0.00
5.12	Reinforcement Bar size: 16 - 25mm (SD345)	ton	0.00	0.00	0.00	0.00
5.13	Reinforcement Bar size: 28 - 32mm (SD345)	ton	0.00	5,536.40	0.00	5,536.40
5.14	Reinforcement Bar size: 35mm or over (SD345)	ton	0.00	0.00	0.00	0.00
5.15	PC Cable 12T15.2B (SWPR7BL)	ton	0.00	247.90	0.00	247.90
5.16	PC Cable 1S28.6(SWPR19)	ton	0.00	82.10	0.00	82.10
5.17	Stay Cable SWPR7BL coated	ton	0.00	695.00	0.00	695.00
5.18	Concrete Curb for Sidewalk	l.m.	1,900.00	1,050.00	6,147.00	9,097.00
6.00	SECTION 6 - BRIDGE CONSTRUCTION					
6.01	Type 1 Rubber Bearing Shoe (15.500 kN)	nos.	0.00	0.00	0.00	0.00
6.02	Type 3 Rubber Bearing Shoe (12.500 kN)	nos.	0.00	16.00	0.00	16.00
6.03	Tie-rod Stopper	nos.	0.00	0.00	0.00	0.00
6.04	Expansion Joint for Main Bridge	l.m.	0.00	44.60	0.00	44.60
6.05	Bridge Guardrail	l.m.	0.00	1,050.00	0.00	1,050.00
6.06	Bridge Handrail	l.m.	0.00	1,050.00	0.00	1,050.00
6.07	Drain Pipe PVC, 150mm Dia.	l.m.	0.00	105.00	0.00	105.00
6.08	Drain Pipe PVC, 50mm Dia.	l.m.	0.00	0.00	0.00	0.00
6.09	Bridge Deck Waterproofing	sq.m.	0.00	11,707.50	0.00	11,707.50
6.10	Steel Door Type-1 (for Pylon)	each	0.00	4.00	0.00	4.00
6.11	Steel Door Type-2 (for PC Girder)	each	0.00	4.00	0.00	4.00
6.12	Flag Pole Setting	each	0.00	4.00	0.00	4.00
6.13	Bronze Bridge Name Plaque	each	0.00	4.00	0.00	4.00
7.00	SECTION 7 - FOUNDATION WORK					
7.01	Cast-in-Place Concrete Pile, 2.00m Dia.	l.m.	0.00	660.00	0.00	660.00
7.02	Stone Rip Rap	sq.m.	0.00	690.00	0.00	690.00
7.03	Gabion Mat with Geotexitile Sheet	sq.m.	0.00	600.00	0.00	600.00
8.00	SECTION 8 - TEMPORARY ROAD AND STAGES					
8.01	Temporary Road Construction	sq.m.	6,240.00	0.00	4,080.00	10,320.00
8.02	Temporary Yard Construction	sq.m.	10,000.00	0.00	12,500.00	22,500.00
8.03	Temporary Jetty on the River	sq.m.	1,080.00	0.00	0.00	1,080.00
8.04	Temporary Stage on the River	sq.m.	2,604.00	0.00	0.00	2,604.00
8.05	Cofferdam by Sheet Pile L=11m	l.m.	0.00	0.00	136.00	136.00
8.06	Cofferdam by Sheet Pile L=7m	l.m.	0.00	0.00	192.00	192.00
8.07	Cofferdam by Sheet Pile by Rock Piling L=8m	l.m.	138.00	0.00	0.00	138.00
8.08	Embankment Road to the Island	m	20.00	0.00	0.00	20.00
9.00	SECTION 9 - TESTING AND QUALITY CONTROL					
9.01	Testing of Materials specified by the Engineer	LS				1.00
9.02	Quality Control of Materials & Workmanship	LS				1.00
10.00	SECTION 10 - MISCELLANEOUS					
10.01	Road Marking	l.m.	4,394.00	2,100.00	4,175.00	10,669.00
10.02	Toll Gate	LS				0.00
10.03	Road Sign	each	5.00	0.00	5.00	10.00
10.04	Kilometer Post	each	2.00	0.00	2.00	4.00
10.05	Fencing	l.m.	100.00	0.00	0.00	100.00
10.06	Landscaping & Planting	LS	0.50	0.20	0.30	1.00

Source: JICA Study Team

Table 7.2.1 Bill of Quantities for Project (cont'd)

ITEM NO.	DESCRIPTION	UNIT	PRICED BILL OF QUANTITIES (Engineer's Estimate)			
			Quantities			QUANTITY
			Approach Road (JINJA side)	Main Bridge	Approach Road (Njeru side)	
11.00	SECTION 11 - ELECTRICAL ROAD FACILITIES					
11.01	Road Lighting with Pole	each	72.00	55.00	0.00	127.00
11.02	Panel DB	each	7.00	6.00	0.00	13.00
11.03	Cable X-LPE/PVC Non-armor	l.m.	2,088.00	1,050.00	0.00	3,138.00
11.04	PVC Conduit, 50 mm Dia.	l.m.	2,088.00	1,050.00	0.00	3,138.00
11.05	Pull Box under each Pole	each	72.00	55.00	0.00	127.00
11.06	Power Receiving System	set	1.00	0.00	0.00	1.00
11.07	Power Connection work	LS	1.00	0.00	0.00	1.00
11.08	Pylon Top: Light &Lightning Protection	LS	0.00	2.00	0.00	2.00
12.00	SECTION 12 - DAY WORKS					
12.01	Maintenance for the Temporary Road (First 15 months)	day	450.00	0.00	1,020.00	1,470.00
12.02	Maintenance of Drainage and Pit (During footing work)	day	240.00	0.00	150.00	390.00

Source: JICA Study Team

7.2.2 Conditions of Cost Estimate

(1) Term of Cost Estimation

The unit prices of resources (materials, equipment and labours) adopted for this cost estimation are based on market prices as of June, 2009.

(2) Exchange Rate

The exchange rate adopted for this cost estimate is the prevailing rate of exchange on 16th March, 2009, as shown hereunder:

1 US Dollar (US$) = 2,039.60 Uganda shilling (Ushs).

(3) Taxes and Duties

1) Import Duty

The import duty rates are listed in the "COMMON EXTERNAL TARRIF, 2007 Edition, of the EAST AFRICAN COMMUNITY". Temporary imported goods, such as vehicles and construction plant can be temporarily imported to Uganda duty free provided that the same will be re-exported to the country of the origin after project completion. In this case, the vehicle also can be sold in Uganda if the buyer assumes the import duty for the sales cost.

2) COMESA Duty

The rates of COMESA duty, which is applied to the products imported from COMESA countries including Kenya, are shown in the same document described in above.

3) VAT

According to the "Value Added Tax Act, Cap.349, Section 19, Exempt Supplies, p.54", It is stated that:

- *The supply of specialized vehicles, plant and machinery, feasibility studies, engineering designs and consultancy services and civil works related to hydro-electric power, roads and bridges' construction and public water works.*

Therefore, almost all materials and equipment for the Project are assumed as VAT exempted except for the cost of fuels, which the Contractor will procure at market prices.

7.2.3 Result of Cost Estimation

(1) Construction Cost without Tax and Contingencies

Construction Cost without Tax and Contingencies (Summation of BQ Section 1 to Section 12 of Table 7.2.1 including Contractor's Overhead) was estimated at Ushs 166,487 million (equivalent to US$ 81.6 million) as shown in Table 7.2.2. Of the estimated total cost, the foreign currency portion is 80.85 %, while the local currency portion is 19.15 %.

Table 7.2.2 Estimated Construction Cost without Tax and Contingencies

SUMMARY				
BILL NO.	DESCRIPTION	FOREIGN CURRENCY COMPONENT (USD)	LOCAL CURRENCY COMPONENT (UGX)	COMBINED EQUIVALENT TOTAL COST (UGX)
1	SECTION 1 - GENERAL	35,339,812	5,217,361,248	77,296,441,007
2	SECTION 2 - EARTH WORK	100,926	3,233,957,651	3,439,805,565
3	SECTION 3 - SUBBASE AND BASE COURSE	673,948	3,116,097,174	4,490,681,514
4	SECTION 4 - SURFACE COURSES	411,456	434,800,186	1,274,005,905
5	SECTION 5 - STRUCTURES	18,148,978	7,293,870,222	44,310,525,309
6	SECTION 6 - BRIDGE CONSTRUCTION	1,911,221	44,227,513	3,942,353,609
7	SECTION 7 - FOUNDATION WORK	1,124,013	251,325,372	2,543,862,116
8	SECTION 8 - TEMPORARY ROAD AND STAGES	3,874,496	1,475,984,671	9,378,407,127
9	SECTION 9 - TESTING AND QUALITY CONTROL	0	84,000,000	84,000,000
10	SECTION 10 - MISCELLANEOUS	5,949	83,795,864	95,929,921
11	SECTION 11 - ELECTRICAL ROAD FACILITIES	406,712	125,686,280	955,217,055
12	SECTION 12 - DAY WORKS	70,200	8,614,663,391	8,757,843,311
	SUM (BILL NO.1 - 12)	62,067,711	29,975,769,572	156,569,072,440
13	Contractor's Overhead 6.3346 % of the above	3,931,747	1,898,847,679	9,918,037,936
	NET CONSTRUCTION COST (BILL NO.1 - 13)	65,999,457	31,874,617,250	166,487,110,375
	Proportion (%) in terms of Ushs	80.85	19.15	100.00

Source: JICA Study Team

(2) Elements of the Construction Cost

Cost element ratio (proportion of labour cost, material cost and equipment cost) of the estimated construction cost is shown in the following table.

Table 7.2.3 Cost Elements of the Construction Cost without Tax and Contingencies

SUMMARY			COST ELEMENT (UGX)		
BILL NO.	DESCRIPTION	COMBINED EQUIVALENT TOTAL COST (Ushs)	A Labour	B Materials	C Equipment
	NET CONSTRUCTION COST (BILL NO.1 - 13)	166,487,110,375	27,119,402,984	84,820,580,522	54,547,126,869
	Proportion (%)	100.00	16.29	50.95	32.76

Source: JICA Study Team

(3) Total Project Cost

The total project cost comprising of compensation cost, engineering cost and construction cost including tax and contingencies were estimated at Ushs 236,052 million (equivalent to US$ 115.7 million) as shown in Table 7.2.4 and 7.2.5. A contingency of 10% was allocated for the Engineering cost and the Construction cost.

Table 7.2.4 Total Project Cost with Tax and Contingencies

SUMMARY				
BILL NO.	DESCRIPTION	FOREIGN CURRENCY COMPONENT (US$)	LOCAL CURRENCY COMPONENT (Ushs)	COMBINED EQUIVALENT TOTAL COST (Ushs)
(0)	(SECTION 0 - COMPENSATION)	0	20,621,677,750	20,621,677,750
1	SECTION 1 - GENERAL	35,341,959	5,305,240,871	77,388,699,593
2	SECTION 2 - EARTH WORK	100,926	3,359,954,451	3,565,802,365
3	SECTION 3 - SUBBASE AND BASE COURSE	673,948	3,188,850,735	4,563,435,076
4	SECTION 4 - SURFACE COURSES	411,456	443,177,206	1,282,382,925
5	SECTION 5 - STRUCTURES	18,148,978	7,391,165,011	44,407,820,099
6	SECTION 6 - BRIDGE CONSTRUCTION	1,911,221	45,131,346	3,943,257,442
7	SECTION 7 - FOUNDATION WORK	1,124,013	285,898,511	2,578,435,255
8	SECTION 8 - TEMPORARY ROAD AND STAGES	3,874,496	1,559,671,529	9,462,093,985
9	SECTION 9 - TESTING AND QUALITY CONTROL	0	84,000,000	84,000,000
10	SECTION 10 - MISCELLANEOUS	5,949	84,073,448	96,207,505
11	SECTION 11 - ELECTRICAL ROAD FACILITIES	406,712	129,149,774	958,680,548
12	SECTION 12 - DAY WORKS	70,200	9,072,599,035	9,215,778,955
	SUM (BILL NO.1 - 12)	62,069,858	30,948,911,919	157,546,593,749
13	Contractor's Overhead 6.3308 % of the above	3,929,514	1,959,311,389	9,973,947,912
	NET CONSTRUCTION COST (BILL NO.1 - 13)	65,999,372	32,908,223,308	167,520,541,661
14	TAX (Import Tax and Comesa Tax)	1,936,041	0	3,948,750,056
	CONSTRUCTION COST without Contingency (BILL NO.1 - 14)	67,935,413	32,908,223,308	171,469,291,716
15	Contingency (10 % of the above)	6,793,541	3,290,822,331	17,146,929,172
	CONSTRUCTION COST with Contingency	74,728,954	36,199,045,639	188,616,220,888
16	CONSULTANT SUPERVISION COST with Contingency	8,287,455	1,514,260,000	18,417,353,218
	TOTAL PROJECT COST (BILL NO.0 - 16)	83,016,409	58,334,983,389	227,655,251,856
17	DETAILED DESIGN and TENDER ASSIST. COST with Contingency	3,461,469	1,336,969,986	8,396,982,158
	TOTAL PROJECT COST (BILL NO.0 - 17)	86,477,878	59,671,953,375	236,052,234,014

Source: JICA Study Team

To summarize the above table, the total project costs, based on US$ and Ushs, are given in Table 7.2.5.

Table 7.2.5 Total Project Cost with Components

No	Item	Cost	
		US$ thousand	Ushs Mil.
1	**Construction Cost**		
2	Bridge	70,387	143,561
3	Approach Road	11,747	23,959
4	Subtotal (2 + 3)	82,134	167,520
5	Tax(Import Tax)	1,936	3,949
6	Subtotal (4 + 5)	84,070	171,470
7	Contingency (10% x 6)	8,407	17,147
8	**Total** (6 + 7)	**92,477**	**188,616**
9	**Engineering Service**		
10	Detailed Design	3,405	6,946
11	Tender Assistance	712	1,451
12	Supervision	9,030	18,417
13	Total (10 + 11 + 12)	13,147	26,814
14	Total for Construction (8 + 13)	**105,624**	**215,430**
15	**Land Acquisition & Compensation**		
16	Total	10,111	20,622
17	**Grand Total** (14 + 16)	**115,735**	**236,052**

(4) Construction Progress Accomplishment

Construction progress accomplishment at the end of each year was estimated at 32% for the first year, 62% for the second year and 90% for the third year, as shown in Figure 7.2.1.

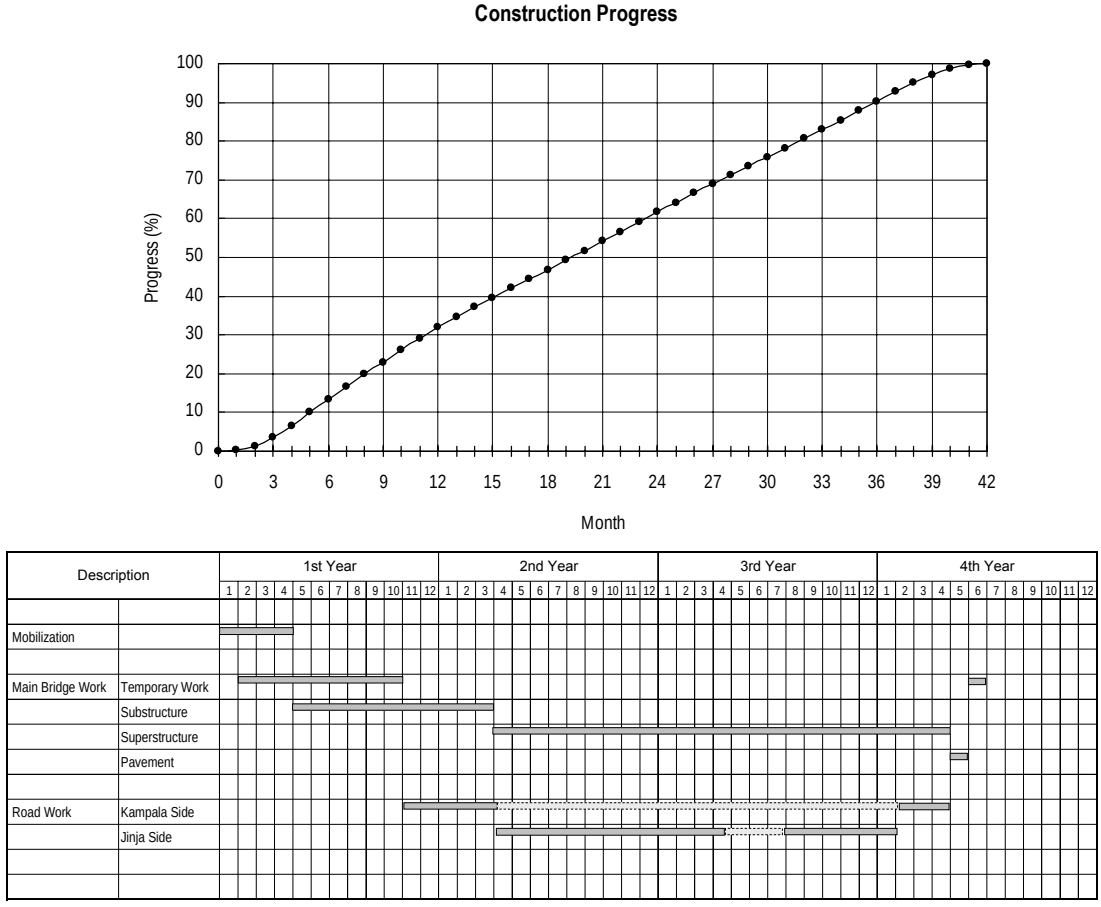


Figure 7.2.1 Construction Progress of the Project

CHAPTER 8

MAINTENANCE, OPERATION AND IMPLEMENTATION PLANS

8. MAINTENANCE, OPERATION AND IMPLEMENTATION PLANS

8.1 Inspection and Maintenance

8.1.1 General

Bridges are key elements of the road network. The New Nile Bridge should be maintained in sound conditions to sustain smooth and safe traffic flows as a critical segment of the Northern Corridor. In general, bridges are being administered by Bridge Management System which consists of such major activities as "Preparation of Inventory Data", "Inspection", and "Rating and Prioritization based on inspection results for actual Maintenance (Repair) works", and also documentation of all the records of the activities.

Figure 8.1.1 shows the procedure of the maintenance system from Inspection to Repair/Maintenance Operation. Maintenance operation includes Repair Works, Routine and Periodic Maintenance Works.

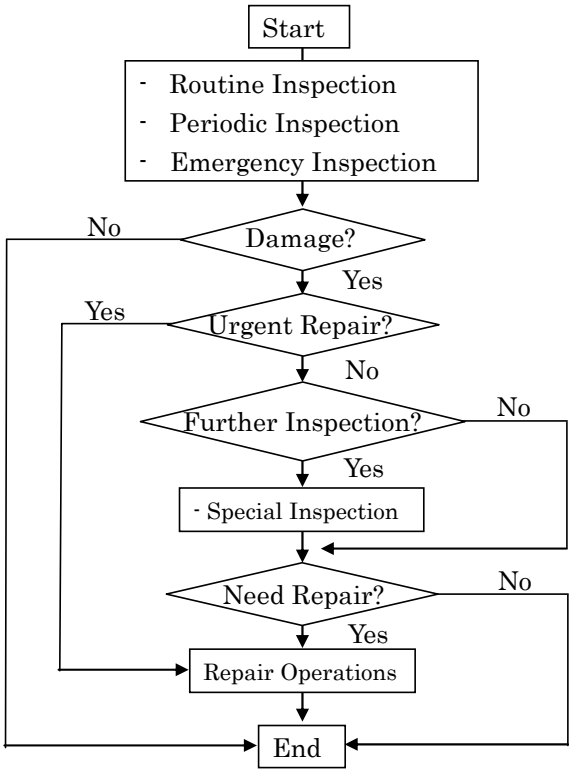


Figure 8.1.1 Procedure from Inspections to Maintenance (Repairs)

Daily Inspection may be conducted by UNRA itself, while heavier inspections such as Periodic or Emergency Inspection will be carried out by out-sourced experts by contract with UNRA. In order to operate the New Nile Bridge properly after opening, an additional section for Jinja Station of UNRA will have to be organized for the proposed maintenance of the bridge. Also, the costs of inspection and maintenance were estimated, based on certain assumptions.

8.1.2 Inspection

(1) Bridge Inspection

Classification of inspections for the New Nile Bridge is shown in Table 8.1.1. Inspection works are categorized into 3 types such as Routine, Periodic and Non-periodic inspections.

Table 8.1.1 Classification of Inspection Works

Inspection Type			Major objects	Purpose	Methods
Routine	Daily	Once or twice	Road surface	Road safety	Visual inspection from vehicle-on board
		Morning & evening	Doors / hatches of girder & pylon	Security	Visual and touch inspection on foot
	Every 3 months		Cable surface	Damage	Visual inspection
			Cable anchor	Water leakage	Visual inspection inside girder & pylon
Periodic	Every 1 year		All components	Damage and Safety	Visual inspection by min. equipment (crack scale, hand tape, etc.)
	Every 3 years		All components	Damage and Safety	Visual inspection by equipment
Non-periodic	Emergency (at the time of accident/disaster)		All damaged components	Damage and Safety	Visual inspection by equipment
	Special (as required)		Defective portions Discovered by above inspections	•to grasp detailed behavior of defects/ actions needed •to monitor progress of damage •to investigate cause of damage	•Visual inspection •Inspection using equipment •Testing (by equipment)

Source: JICA Study Team

Each inspection type is classified into more details, such as Routine inspection ranging from Daily to 3-month interval inspections, Periodic inspection will range from 1 year to 3years. Non-periodic inspection will be conducted in emergency cases including special inspections.

Commonly, daily visual inspection is conducted from the vehicle-on-board to secure road safety. However, as a PC Cable-stayed bridge is adopted for the New Nile Bridge, checking of the entrance facilities towards the girder and pylon is recommended to confirm whether or not doors or hatches are locked. All stay cables will be anchored inside the girder and pylon, and the tendon anchorages are very significant structural elements of the cable-stayed bridge. So, these doors and hatches should be checked not only visually but also by feel inspection every morning and evening.

Also, the 3-month interval inspection is recommended for the checking of the surface of the stay-cables whether or not there is water leakage of the tendon anchorages inside the girder.

Table 8.1.2 shows the proposed plan for inspection and relevant responsible organizations, to assume the daily inspection to be undertaken by Jinja Station, but the 3-month interval

inspection work will be conducted jointly by UNRA headquarters and Jinja Station. Other inspection activities will be done by above two UNRA organizations together with hired consultants.

Table 8.1.2 Proposed Plan for Inspection Works and Responsible Organizations

Inspection Type		UNRA		Consultant (hired)	Remarks
		Station	Headquarter		
Routine	Daily	✓	—	—	In-house
	Every 3 months	✓	✓	—	
Periodic	Every 1 year	✓	✓	✓	Out -sourcing
	Every 3 Years	✓	✓	✓	
Non-periodic	Emergency	✓	✓	✓	
	Special	✓	✓	✓	

Source: JICA Study Team

(2) Road Inspection

An objective of inspection is to find damages to the road facilities and take the necessary actions to sustain smooth and safety of traffic flows at all times. Inspection is often categorized into 3 three kinds:

(i) Routine inspection
(ii) Periodic inspection
(iii) Emergency inspection

Main features of these types of inspections are described in Table 8.1.3.

1) Routine inspection

Routine inspection is undertaken visually from road patrol on the shoulder or left-most lane. Accordingly, inspections are confined to those which can be observed from the moving vehicle. They include the following:

- Pavement condition, water-logging (drainage), condition of embankment/cut slope, appurtenant facilities (guard rail, lighting facilities, traffic information devices, etc.)

2) Periodic inspection

The items to be inspected will firstly be determined, for which the methods and locations for inspection are planned. The items commonly inspected include the following:

- Cut and embankment slopes: signs of slope erosion, conditions of slope protection works (retaining wall, etc.), drainage facilities
- Culverts: physical conditions of the culvert and water flow facilities

3) Emergency inspection

Emergency inspection is mainly conducted after the occurrence of natural disasters such as torrential rain or earthquake and accidents (road structure/facilities hit by vehicle). The main purpose of the emergency inspection is to check the soundness of roads. Accordingly, the inspection focuses on the following items:

- Soundness of the embankment and cut slopes
- Soundness of the pavement
- Soundness of appurtenant structures

Table 8.1.3 Items of Road Inspection

Inspection Type		Major objects	Purpose	Methods
Routine	Daily	Road surface, Slope condition	Road safety	Visual inspection from vehicle
Periodic	Every 1 year	Structures other than bridge: culvert retaining wall etc.	Soundness of structure	Visual inspection on foot with min. equipments (crack scale, hand tape etc.)
Emergency	At the time in the event of occurrence of accident/disaster	Damaged components	Magnitude of damage	Visual inspection with the use of Equipments

8.1.3 Maintenance

(1) Bridge Maintenance

Cleaning the carriage way of the bridge such as removing trash or debris on road surface and cleaning the drainage are conducted as Routine maintenance. A steel bridge or steel elements like guardrail of the concrete bridge will have to be repainted periodically. However, periodic maintenance works for the concrete bridge itself are not required but only repair works are required when necessary.

After completion of the New Nile Bridge, maintenance (repair) works will be planned and conducted based on rating and prioritization of inspection results.

Anticipated deterioration or damages to PC cable-stayed bridge are listed as follows:

- Wave, Rutting, Cracking and potholes of the pavement (Resurface ; every 20 years)
- Cracks of the slab, girder, pylon, pile-cap of the pier and abutment
- Damage to expansion joints (Replacement ; every 20 years)
- Damage to the bearing shoes of the girder (Replacement ; every 40 years)
- Deterioration or damage of polyethylene pipe surface of the stay cables
- Water-leakage of the Tendon anchorage
- Deterioration or damage of the stay cables (Replacement ; 75 years)

Maintenance works other than the routine maintenance will be carried out by out-sourcing (consultants and contractors) to be hired by UNRA.

(2) Road Maintenance

Usually, road maintenance works are categorized into the following three types.

(i) Routine maintenance
(ii) Periodic maintenance
(iii) Emergency maintenance

1) Routine Maintenance

Routine maintenance includes road cleaning: removal of trash, debris, soil, stone etc. including mowing of slopes and cleaning of drainage facilities. The frequency may vary from once a day to once a year, according to necessity. Localized repairs of pavement and shoulder damages, such as pothole patching, reshaping of side drains, repairing and cleaning of culverts and retaining wall are included. Also, repainting of road markings, repairing and replacing of road signs, lighting and guardrails should be undertaken.

2) Periodic Maintenance

Periodical maintenance includes the following features:

(i) Longer interval of implementation (once 5 years to 20 years),

(ii) Relatively large in scale requiring closure of lane(s), and

(iii) The interval of implementation is influenced by traffic volume, especially that for heavy vehicles.

Periodic maintenance includes full-width resurfacing or treatment of the existing pavement or roadway to maintain surface features and structural integrity for continued serviceability. Specific activities include after 20 years of operation, the removal of damaged surface course and laying of new surface course, and localised considerably damaged base course reconstruction.

3) Emergency Maintenance

Emergency maintenance mainly refers to the urgent repair of the road structure damaged by natural disasters or large-scale accidents. There are various forms of such damage and it is very difficult to anticipate what will happen. The followings are some examples of such damages:

(i) Failure of embankment/cut slope during/after heavy rain

(ii) Damage due to earthquake (Bridge/viaduct, cut/embankment slope, retaining wall, pavement, etc.)

To minimize traffic disturbance, repair works of damages are often implemented in two stages, i.e. urgent temporary repair to secure traffic flow, and full-scale repair including some strengthening to prevent recurrence in the future. The work items for maintenance are listed in Table 8.1.4.

Table 8.1.4 Maintenance Works of Road

Maintenance Type		Purpose	Maintenance Works
Routine	Every day	Road cleaning	Removal of trash, debris, soil, stone, etc.
	Every 3 months	Mowing on slopes	Mowing grass on slopes; frequency depend on weather condition
		Drainage facilities cleaning	Removal of trash and sediment in side ditch, culvert etc.
	After defects found	Repair of minor defects on pavement	Patching pothole, sealing crack etc.
		Soundness of appurtenant road facility/device	Repair/change parts of lighting, road sign, lane marking etc.
Periodic	Every 5 years	Repair of pavement	Overlay of pavement of damaged section
	Every 20 years	Rehabilitation of pavement	Removal of damaged surface course and laying new one
Emergency	At the time of accident/disaster	Repair of the damaged portions	Repair of pavement, structure, slope, etc.

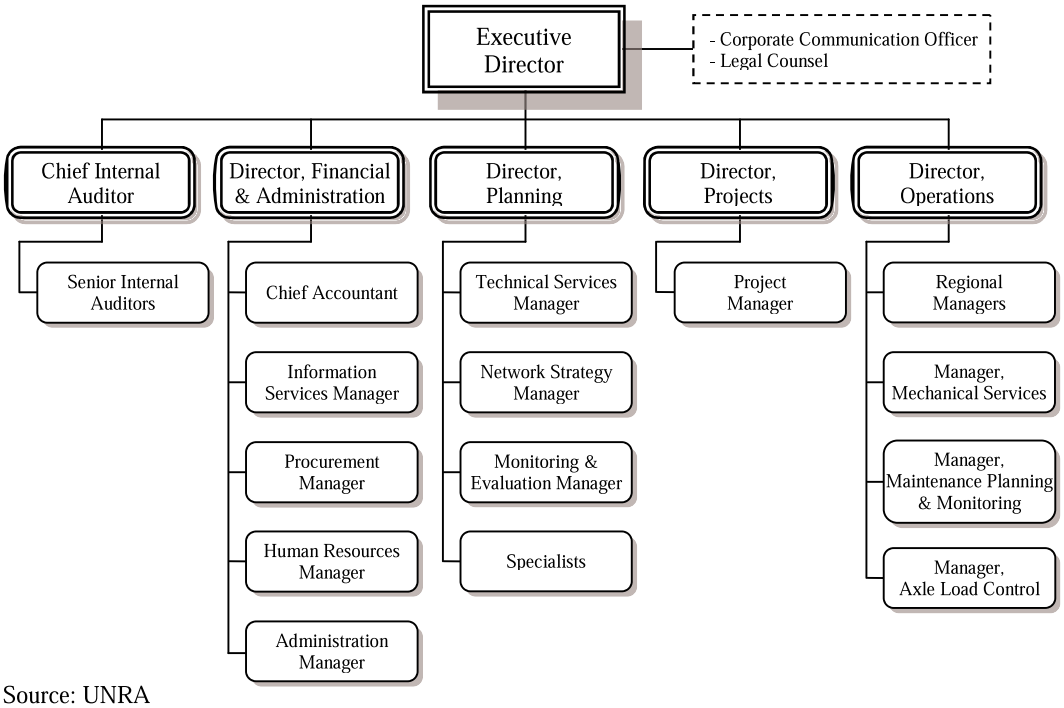
8.1.4 Organization

(1) Present organization

Figure 8.1.2 shows the present organization of UNRA headquarters. A Bridge Management Unit will be established in a few years through study and design aided by EU, WB and so on.

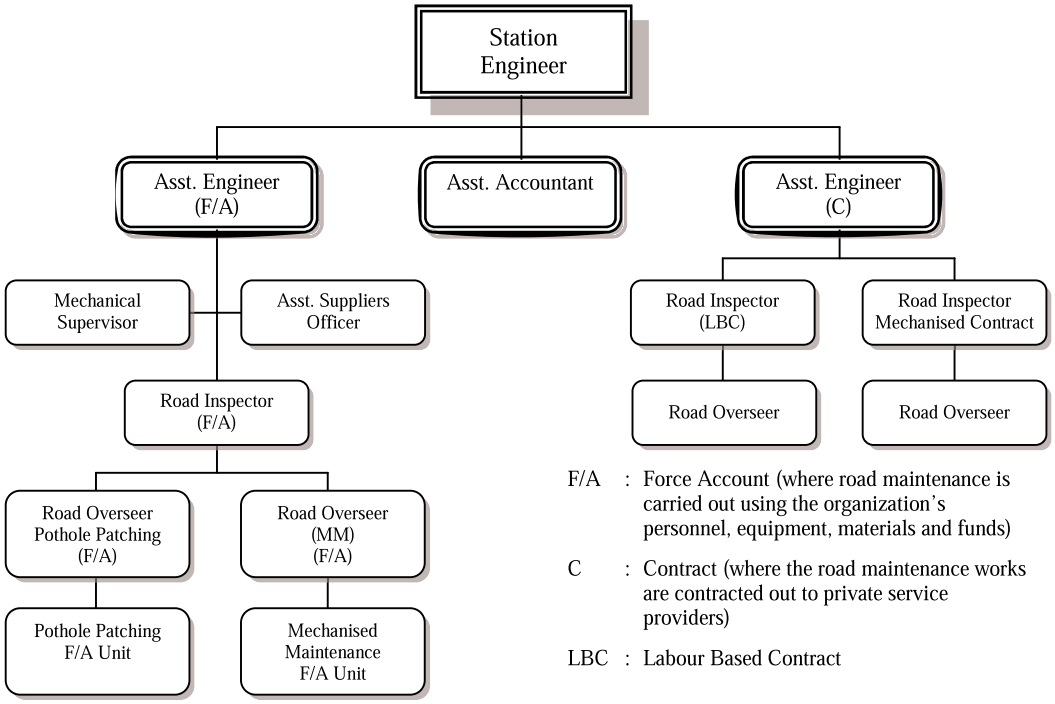
Therefore, further additional organizations of UNRA headquarters for bridge maintenance are considered unnecessary.

Figure 8.1.3 shows the present organization of Jinja Station, daily inspection & routine maintenance of the existing Nalubaale Dam Bridge conducted by the Asst. Engineer (F/A) and periodic & rehabilitation by Asst. Engineer (C).



Source: UNRA

Figure 8.1.2 The Present Organization for Operation Division of UNRA Headquarters



Source: Jinja Station

Figure 8.1.3 The Present Organization of Jinja Station

(2) Proposal for an additional position for Jinja Station

A position for inspection and supervision of repair works is proposed for Jinja Station. This will consist of 1 Bridge Engineer and 2 Technicians.

8.1.5 Cost of Inspection and Maintenance

After the New Nile Bridge is opened to service, costs of inspection and repair are estimated as shown in Table 8.1.5.

Table 8.1.5 Costs of Inspection and Maintenance Works of the Project

Maintenance Items	Maint. Interval (years)	Costs (Ushs Mil.)
Approach Road		
Routine Maintenance	Every year	9
Periodic Maintenance	5	515
Rehabilitation	20	2,061
Bridge		
Routine Inspection	Every year	145
Periodic Inspection	3	11
Pavement Resurface	20	669
Replacement Joints	20	315
Replacement Shoes	40	704
Replacement Stay Cable	75	5,068

Source: JICA Study Team

The total cost for the routine inspection and maintenance per year is estimated at Ushs 154 million. This cost is less than 10% of the budget of UNRA Jinja office for fiscal year 2008/09 (about Ushs 1,800 million.). However, maintenance cost after 20 years from completion date will exceed the current allocated budget.

8.2 Operation

Highway operation includes traffic management and toll operation. The purpose of highway operation is to maintain smooth and safe traffic flows at any time. It is especially important because the Project road will constitute part of the most important road in Uganda. Highway operation concept is illustrated in Figure 8.2.1 below.

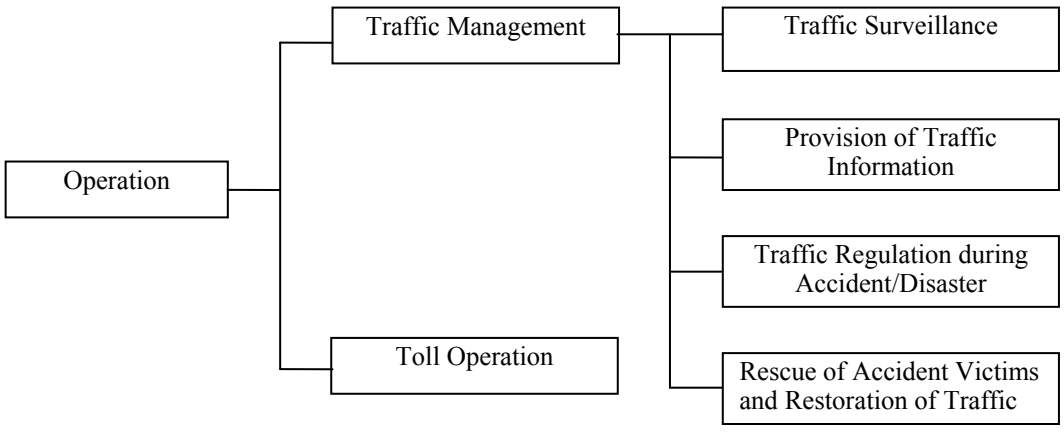


Figure 8.2.1 Concept of Highway Operation

8.2.1 Traffic management

(1) Traffic Management of the Project Road

The terminology "traffic management" often covers a wide range of concept that includes up to nation-wide activities. However, in this subsection it is confined only to the traffic management of the Project road, and thus, the relevant activities will include:

a) Traffic surveillance

b) Provision of road and traffic information

c) Traffic regulation during emergency and accident

d) Rescue of accident victims and restoration of traffic

1) Traffic Surveillance

Although in Kampala, traffic management concept is still rudimentary, so that the minimum requirements for traffic management should be implemented for the Project road. For this purpose automatic vehicle detector devices for speed and vehicle type detection with two induction loop coils should be installed at certain interval for each lane, should it be found to be found affordable to maintain, for the New Bridge site.

The data from the traffic detectors will be the basic information for traffic management, and to be recorded daily, weekly, monthly and annually. This traffic volume information is useful for the investigation and timing of maintenance works, and especially for the proposed toll operation, traffic volume data is fundamentally necessary for the review of traffic volume for the collection of toll revenue of users.

The information will also be used in the event of hazard such as occurrence of serious accident or lanes/road closure due to disaster or maintenance works.

2) Traffic regulation during accident/disaster

When accident/disaster occurs, an emergency measures to regulate traffic should be taken with the cooperation of the police.

3) Rescue of accident victims and restoration of traffic

In the event that accident occurs and the injured users are found, ambulance service is required. Records of accident and the accident site should be recorded including the photograph of the site, damaged vehicles which should be towed, and the site should be cleaned for which emergency repair work will be needed, for the restoration of traffic flow..

(2) The traffic condition to be considered at the Project roads

Traffic condition peculiar to the Project road which would require special attentions and measures are as follows:

a) To restrict motorized vehicles on the existing Nalubaale Dam road, however, passage should be kept for the maintenance of vehicles of the Dam and other facilities including emergency vehicles.

b) To restrict overloaded vehicles, because the bridge members will be damaged.
Cooperation with UNRA weigh bridge stations will be required.

c) To enforce speed limit for vehicles using the New Bridge and road, because the geometric condition is good at the bridge road and thus, many over-speeding vehicles are

expected. However, it will be dangerous at the roundabout intersections near the bridge where they have to stop to give way for the vehicles already in the circle.

(3) Organization

The traffic management works should be undertaken by governmental organizations, not by private sectors by out-sourcing. Because, the rules in Uganda to transfer the authority of traffic control to the private sector is still not clear, and the necessary know-how and experience should be accumulated by governmental organizations first.

To undertake the traffic management activities an assistant engineer specialized in traffic engineering should be attached to the Station Engineer at UNRA Jinja office. After several years of operation and with accumulated experience and technique, the traffic monitoring section should be attached to the Planning Director of UNRA Headquarters.

A traffic management room equipped with computers to store traffic data, and to issue periodic traffic volume report will be needed at the UNRA Jinja office.

8.2.2 Toll Operation

Currently, the budget for the road sector is growing resiliently. However, the requirement for road maintenance seems to have no end even in the future. With respect to the New Nile Bridge, a large amount of maintenance costs will emerge at every 20-year interval from the completion of the project and it will continue periodically.

These facts imply that a special fund to meet the periodic maintenance works is required. To ensure such funds or to reduce the burden of periodic maintenance costs of the government, introduction of a toll system is conceived as one of the options. In this section, the toll operation and its problems and issues are discussed.

(1) Rationale

1) To keep necessary fund for maintenance expenditures

Government budgets for road maintenance seem to be insufficient to maintain all the roads in Uganda. The New Nile Bridge will need a considerable maintenance costs in the future, at every 20 years interval from its completion. To fund those costs by governmental sources is uncertain. However, smooth and safe traffic flow should be maintained at all times on the New Nile Bridge, because it forms a part of the most important international trunk road connecting Uganda and other landlocked countries with Mombasa Port in Kenya.

In this context, satisfactory maintenance works need to be undertaken and regulated for the New Nile Bridge. Therefore, funding such expenditures by toll revenue is the main objective to introduce toll system for the New Nile Bridge.

2) Government intent to commercialize the road sector

The establishment of the Road Fund is part of the reforms aimed at commercializing the road sector. Commercialization entails bringing roads into market place, putting them on a fee-for-service basis and managing them like a business.[1]

[1] "Principles of a Road Fund", Road Fund Secretariat, Road Sector Development Program-Coordination Unit, MFPED

The project road will provide better service in terms of traffic capacity, geometric and pavement conditions and shortened travel time, which deserved to be tolled in light of the fee-for-service basis.

(2) Toll Rate

To determine the toll rate, two approaches, are envisioned: "Within Willingness to Pay" and "Within Users Benefit", were examined as follows:

1) Within Willingness To Pay (WTP)

a) Result of WTP survey

Willingness to pay survey was conducted by the Study Team as part of the traffic surveys in December 2008. The survey results are summarized in Table 8.2.1 in terms of the waiting time and willingness to pay for each vehicle type.

Table 8.2.1 Willingness to Pay and Waiting Time by Vehicle Type

Unit: Ushs

Type	Waiting Time			
	15 (Min)	30 (Min)	45 (Min)	60 (Min)
Motorcycle	275.4	370.7	520.9	791.1
Sedan	527.4	625.3	733.7	893.2
Station wagon	474.7	562.7	648.2	851.9
Bus	289.4	418.2	533.9	744.9
Truck	360.5	494.4	607.3	768.8
Average	344.4	454.7	586.2	783.2

Source: Traffic Survey by JICA Study Team

Based on the above table, observations were made as follows:

- Every type of vehicles indicated the reasonable relationship between waiting time and willingness to pay;
- Even motorcycles responded to willingness to pay showing Ushs 275.4 in waiting time of 15 minutes;
- Sedan responded to the highest level of willingness to pay in any waiting time.
- Bus and truck drivers/owners showed somewhat lower level of willingness to pay than that of sedan and station wagon.

b) Estimation of toll rate

To estimate the difference in travel time between the existing Nalubaale Dam Bridge and the New Nile Bridge, assumptions were set as shown in Figure 8.2.2.

- Nalubaale Dam Bridge with section of 2.18 km long: as the travel speed is restricted at 20km/h at present the speed will further lower in 2015. Based on the result of traffic assignment to the road network, a travel time on the project section is estimated at 8.2 minutes in 2015 (2.18km / 16.0km/h x 60 = 8.2 min).
- The New Nile Bridge section (2.35 km long): with design speed of 80km/h, will have a travel speed to be derived from the traffic assignment results of 44.6 km/h. Hence, the travel time will be 3.2 min (2.35 / 44.6 x 60 = 3.2min.).
- The difference in travel time is 5 minutes (8.2 min. – 3.2 min.).

The results of the WTP survey were extrapolated to obtain the value of WTP at a waiting time of 5 minutes as shown in Figure 8.2.3. According to Figure 8.2.3 the value derived from the reduction in travel time is slightly higher than Ushs 450 for sedan.

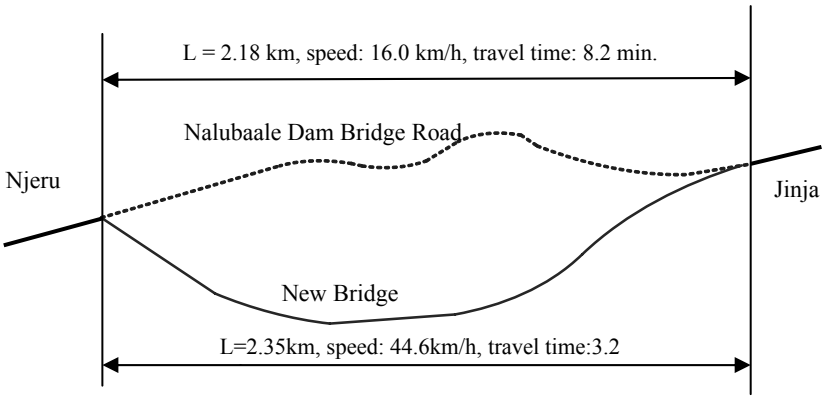


Figure 8.2.2 Schematic Drawing of Travel Time Comparison

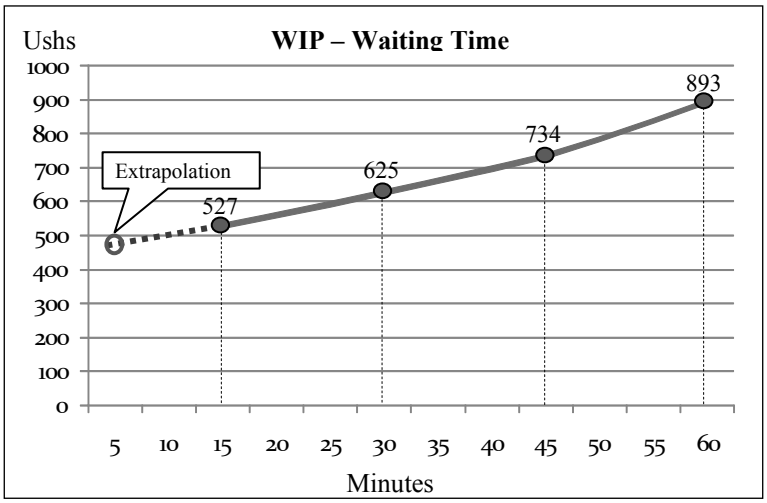


Figure 8.2.3 Extrapolation of WTP

2) Within users benefit

Another criterion is that the toll rate should be less than the user benefit, which is derived from using the toll facility by paying toll. Users' benefits are calculated in term of savings in VOC (Distance Related and Time Related Vehicle Operating Costs) and TTC (Travel Time Cost).

a) Saving in Distance Related VOC

The new bridge will be a little longer by around 170 m than the existing bridge. On the contrary, since the surface condition and road capacity of the new bridge will be better than the existing one, the disadvantage of longer distance might be offset by improved travel speed in term of VOC. Hence, VOC saving is assumed to be null.

b) Saving in Time Related VOC and TTC

The travel speed on the existing bridge in 2015 is estimated at 16km/h, while that of new bridge is estimated at 44.6km/h. Therefore, there is a 5-minute savings in time. Time related cost savings for sedan is estimated at US$2.015/h (US$1.640 + US$0.375), such that the 5 minutes saving will result to a savings which is cost of US$2.015 x 5 / 60 = US$ 0.17, equal to Ushs 340.

c) Benefits

By adding both VOC and TTC savings, the user benefit of Ushs 340 is obtained. Based on these two calculations, the appropriate toll rate for sedan is conceived at Ushs 300.

Based on the comparison between "willingness to pay (Ushs 450 per sedan)" and "user's benefit (Ushs 300 per sedan)" principles, the lower value of Ushs 300 per sedan was adopted for the toll rate.

(3) Vehicle Classification and Tolling Alternatives

1) Classification of vehicle type for tolling

All vehicle types are classified into several categories for tolling. Table 8.2.2 shows the proposed vehicle classifications and respective toll rates. For Class 2 and 3, which are two times higher in toll rate than sedan, is proposed. For Class 4, 3.3 times higher toll rate is proposed. Although heavier trucks responded to lower cost for WTP during the traffic survey, a higher toll rate seems to be reasonable considering their heavy load thus subjecting the pavement and bridge structure to damages. Also, such higher rates for large vehicles are commonly observed for toll roads in other countries.

In any Class, motorcycle (M/C) is not included, as it will be treated as toll free.

Table 8.2.2 Proposed Vehicle Classification and Toll Rates

Class	Class 1	Class 2	Class 3	Class 4
Vehicle Type	Sedan, Wagon, Mini-bus	Bus and Light and Medium Truck	Heavy Truck	Semi and Trailer Truck
Toll Rate (Ushs)	300	600	600	1000

Source: JICA Study Team

2) Tolling Alternatives

Alternatives for tolling policies were described as shown in Table 8.2.3.

Table 8.2.3 Tolling Alternatives

Alternative	Toll Imposition
Alternative 1	All Classes
Alternative 2	All Classes but Class 1 for near-by dwellers
Alternative 3	Class 3 and Class 4 Only

Source: JICA Study Team

(4) Estimation of Future Toll Revenue by Tolling Alternative

1) Estimation of future revenue by tolling alternative

Using future traffic volume shown in Table 8.2.4 and toll rates shown in Table 8.2.2, future toll revenues for 30 years after the opening year in 2016 are estimated. Table 8.2.5 and Figure 8.2.3 show the results for toll revenue.

Table 8.2.4 Future Average Daily Traffic

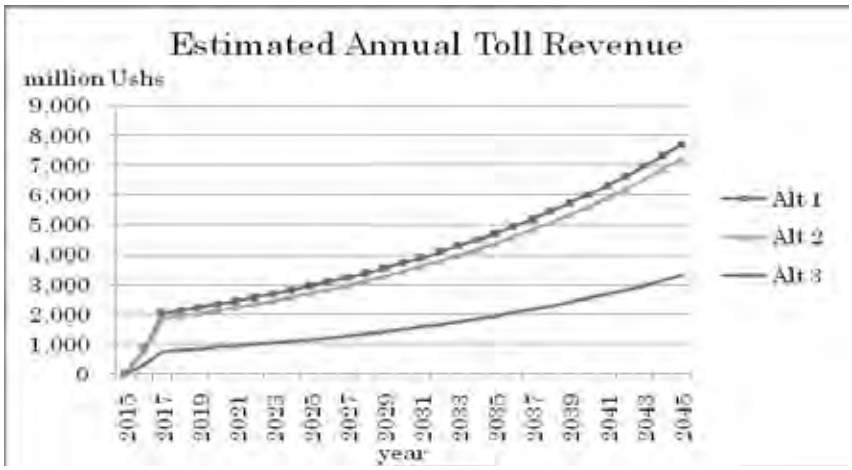
Year	Sedan, SW	Mini Bus	Bus	Truck	Trailer	Total
2015	5858	3826	236	2596	1754	14,270
2025	8578	4934	358	4870	2848	21,588
Growth rate 2015-2025	3.9%	2.6%	4.3%	6.5%	5.0%	-

Source: JICA Study Team

Table 8.2.5 Estimation of Future Annual Toll Revenue for 30 years

Estimation of Future Toll Revenue (Ushs Million)							
year	Alternative Toll			year	Alternative Tolls		
	1	2	3		1	2	3
2016	809	736	297	2031	3,885	3,596	1,564
2017	2,032	1,850	751	2032	4,075	3,775	1,648
2018	2,126	1,938	792	2033	4,274	3,964	1,738
2019	2,224	2,031	834	2034	4,483	4,163	1,832
2020	2,328	2,128	879	2035	4,704	4,372	1,931
2021	2,437	2,230	926	2036	4,936	4,593	2,036
2022	2,552	2,337	975	2037	5,180	4,826	2,146
2023	2,672	2,450	1,028	2038	5,438	5,071	2,263
2024	2,798	2,569	1,083	2039	5,709	5,329	2,386
2025	2,931	2,694	1,141	2040	5,995	5,602	2,516
2026	3,071	2,826	1,203	2041	6,295	5,889	2,653
2027	3,218	2,965	1,267	2042	6,612	6,192	2,798
2028	3,372	3,111	1,336	2043	6,947	6,511	2,950
2029	3,535	3,264	1,408	2044	7,299	6,848	3,112
2030	3,706	3,426	1,484	2045	7,670	7,204	3,282
-	-	-	-	Total	123,312	114,490	50,255

Source: JICA Study Team



Source: JICA Study Team

Figure 8.2.4 Estimation of Future Annual Toll Revenue

Assumption used:

- 80% of calculated toll fees are considered as actual revenues.
- 20% of Class 1 traffic are exempted under Alternative 2 Scheme
- Average growth rate of traffic volume from 2015 to 2025 were interpolated to obtain values for intermediate years.
- The same growth rates mentioned above were used to extrapolate values beyond 2025.

2) Expenditures to be covered by the toll revenue

What cost items could the toll revenue cover? The extent of possible cost coverage was examined by comparing the alternative toll revenues and the coverage of the following costs:

a) Construction cost of the New Nile Bridge with approach road,

b) Maintenance cost of the New Nile Bridge and approach road

c) Construction costs of the approach roads were added to b) above.

a) Initial construction costs of the New Nile Bridge

Project cost to construct the New Nile Bridge is estimated at Ushs236 billion. Whereas, the cumulative toll revenue for 30 years for Alternative 1 will amount to Ushs 123 billion which is only half the project costs. The net revenue will be much less when the interest of construction cost and maintenance costs are included.

b) Maintenance cost of the New Nile Bridge and approach roads

Maintenance items and the costs for the New Nile Bridge including the approach roads are summarized in Table 8.2.6. The required costs for the first 30 years were summed up. In the summing process, replacement of joints will be required only once every 30 years. The same replacement will be needed for the further future. However, replacements of the shoes and Stay Cable will not be required, this will take place at 40 and 75 years after its completion respectively.

The maintenance costs required during 30 years of bridge operation is estimated at Ushs 10,357 million. This amount, which is the lowest cost coverage alternative, will be covered by the toll revenue collected even for the lowest tolling alternative (Alt-3).

Table 8.2.6 Maintenance Items and Costs

No.	Item		Interval (year)	Bridge	Approach Road	Total
1	Routine Inspection/Maintenance		1	145	9	154
2	Periodic Inspection		3	11		11
3	Periodic Maintenance		5		515	515
4	Resurface/Rehabilitation		20	669	2,061	2,730
5	Replacement of Expansion Joint		20	315	-	315
6	Replacement of Shoes		40	704	-	704
7	Replacement of Stay Cable		75	5,068	-	5,068
8	Total	During 100 years	Ushs Mil.	26,257	18,930	45,187
			US$ 1000	13,128	9,465	22,593
		During 30 years	Ushs Mil.	5,451	4,906	10,357

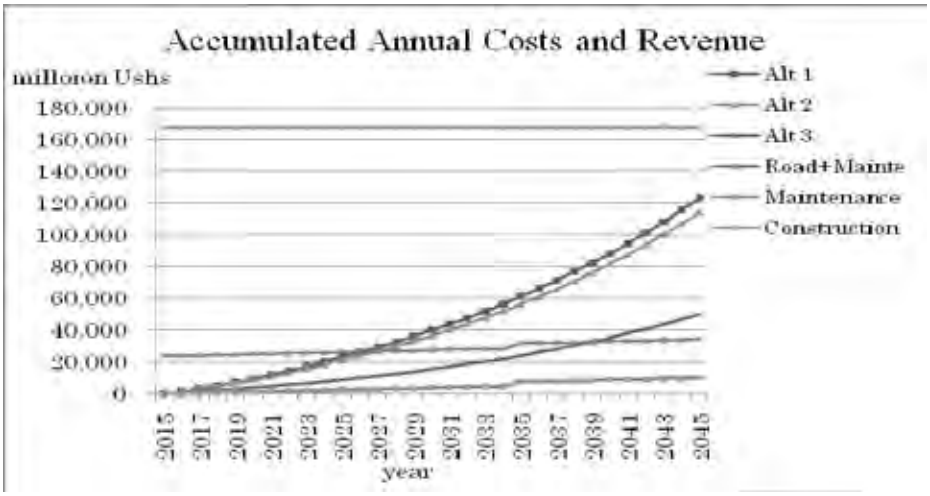
Source: JICA Study Team

c) Maintenance costs for b) plus construction costs of the approach roads

Assessment were made to determine whether or not the toll revenue can cover the total costs of the approach road construction, estimated at Ushs 51,428 million, and the maintenance costs.

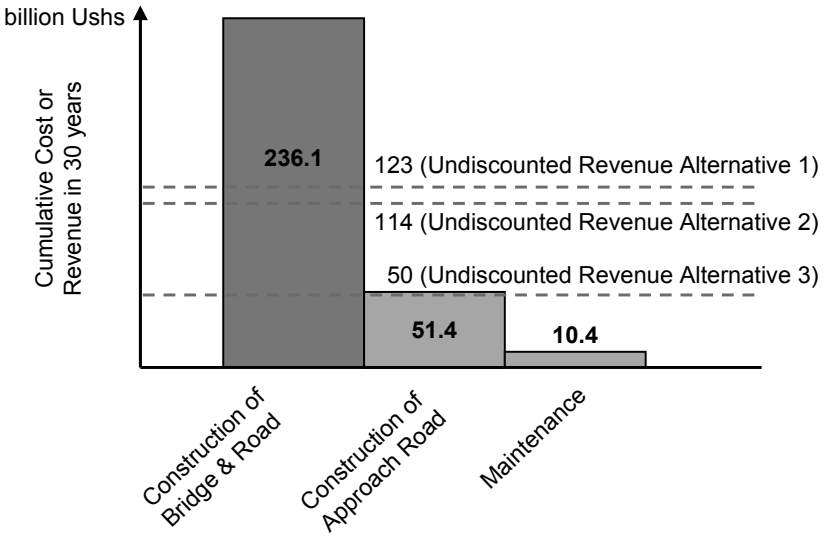
The total costs of these items are estimated at Ushs 61,789million, which is lower than the 30 years accumulation of toll revenues for either Alternative 1 or 2, but slightly higher than Alternative 3.

These costs and revenues are cumulative for 30 years as shown in Figures 8.2.5 and 8.2.6.



Source: JICA Study Team

Figure 8.2.5 Accumulated Costs and Revenues



Source: JICA Study Team

Figure 8.2.6 Cost Coverage by Cumulative Toll Revenue in 30 years

(5) Technical Issues Regarding Collection of Tolls

1) Installation of toll booths at the approach road

a) Necessary number of toll booths

To collect toll with certainty, toll booths should be installed at the traffic lane. A toll booth with a capacity of one third of normal lane, ie. 650 vehicle/hour should be considered. Future vehicular traffic volume in year 2025 is estimated at 21,588 units, with peak hourly volume of 1,575 units, assuming of peak hour ratio of 7.3%.

The necessary number of toll booths will be: 1,575 / 650 = 2.4. Then, 3 booths will be sufficient in terms of capacity. However, considering the necessity to separate directional flow and to shorten waiting time 2 booths for each direction will be reasonable. This number will be used for all tolling alternatives. For Alternative 3, 2 booths per direction will be required as minimum taking precaution for lane blockage due to vehicle breakdown.

Also, additional toll free lane should be installed for M/C and toll exempted vehicles in accordance with Alternative 2 and 3 Schemes. Figure 8.2.7 shows the Main line toll plaza and Figure 8.2.8 shows the details of the toll booth.

2) Management of toll exempted vehicles

In Alternative 2, the vehicles of near-by dwellers are proposed to be toll-exempted. The issuance of pass or sticker is proposed. However, this will lead to complicated issues, as discussed hereafter.

Operation of toll-exemption for Alternative 3 will be less problematic. Because toll-exempted vehicles - other than truck and trailer - can be easily recognized, and they will be led to toll free lanes.

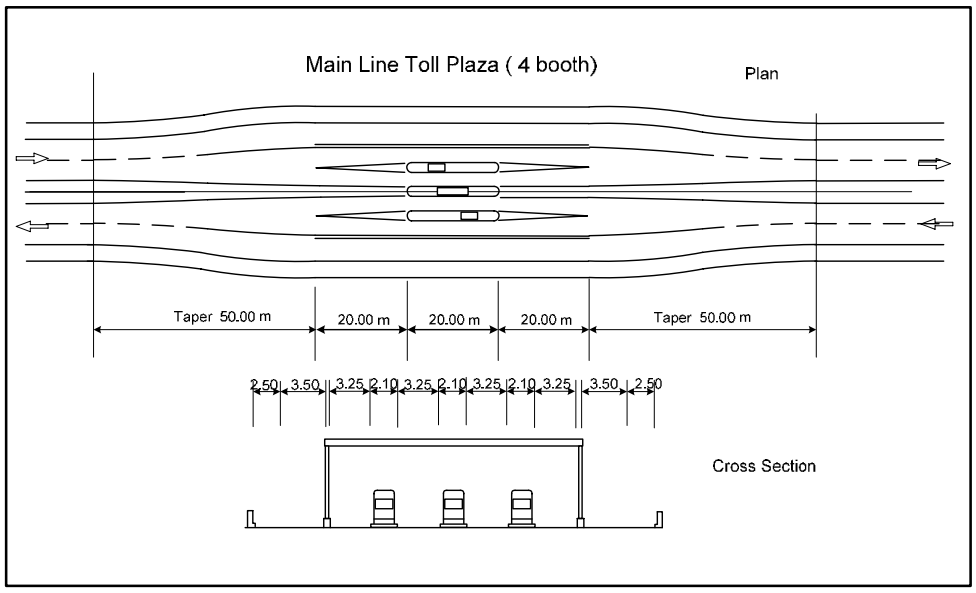


Figure 8.2.7 Main Line Toll Plaza

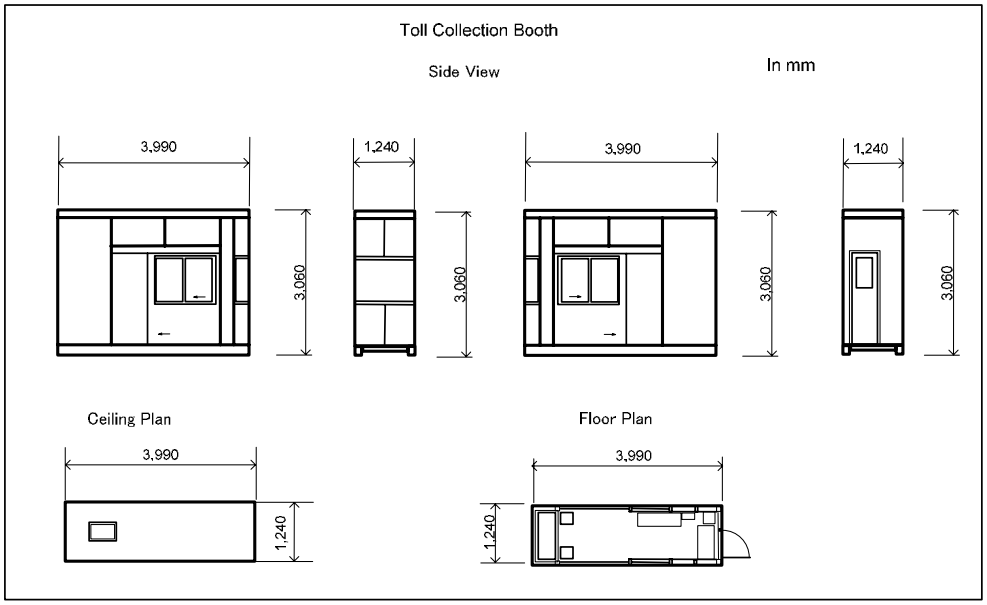


Figure 8.2.8 Details of Toll Booth

3) Installation of automatic traffic counter and difficulty of toll collection for Alternative 2 Scheme

Number of vehicle volumes and vehicle types which will pass through the toll booths should be recorded precisely. This record should be stored by the toll collection entity and to be transmitted to the managing entity such as UNRA or URA (Uganda revenue Authority).

The problems will arise for the management of toll-exempted vehicles for Alternative 2. If toll-exempted vehicles will pass through additional toll free lane, some of the non-toll-exempted vehicles will pass through that lane intentionally or unintentionally. Therefore, even the toll-exempted vehicle will have to pass through the lanes with toll booths, and then they should be mark for exemption for record purposes of traffic volume. The marking should be done by the vehicle owners (not by toll collectors) by magnet marking for free pass sticker which the owner will be provided.

By doing this, the system seems to barely work. However, in reality arise more problems may further arise which could be hardly solved. As such, it is not recommendable to apply this operation for Alternative 2.

4) Lease, Operate and Transfer (LOT)

Lease-Operate-Transfer is one of the already established privatization schemes. In this scheme, a private company will lease the facilities including bridge, approach road and toll booths, and operate them including the maintenance and toll collection for a long period, usually 25 to 30 years. After the expiration of the concession period, the facilities will be turned over to the government.

Usually, the facilities are leased based on appropriate lease fee. The approach road construction cost could be included in the lease fee. However, precise assessment of revenues and costs will be needed to operate this scheme transparently.

Besides the above, a legal background should be clarified whether or not the private company can collect tolls and appropriate them for his expenditures and profit.

5) Out-sourcing

UNRA makes contract with a private company for maintenance including inspection and toll collection for a period of probably one year. The collected toll revenues will go to UNRA directly, but not to the private company unlike LOT scheme. Hence, UNRA will save the revenue in its account for the foreseeable maintenance expenditure in the future.

Some necessary knowledge of road maintenance can be obtained by recruiting retired officials of MOWT, and it will also contribute as a relief measure against unemployment.

This scheme, however, will have to be examined whether or not to comply with the current legal framework.

6) UNRA

UNRA collects the toll and saves the revenue in its account for the foreseeable maintenance expenditure in the future.

UNRA will inspect the facilities but maintenance works will be contracted to contractors as required. For this operation, UNRA station office should be reinforced by the necessary number of engineers.

Table 8.2.7 compares the merits and demerits of the operation schemes, and Figure 8.2.9 illustrates the respective Operation Schemes.

Table 8.2.7 Merit and Demerit of Operation Scheme

Organization	Merit	Demerit
LOT	- Work burden of UNRA will be minimized. - Construction costs of approach roads can be included in the lease fee for the initial contract.	- Precise assessment of costs and revenue will be needed to keep transparency of the contract. - Legal background has to be clarified for the private company to collect toll and use it.
Out-sourcing	- Retired officials can be recruited, so that their experience can be utilized. - Damages to the facilities are expected to be repaired immediately based on annual contract.	- Annual budget of maintenance contract must be secured by UNRA for successful operation.
UNRA	- Technology to maintain cable stayed bridge will be obtained by UNRA, and number of experienced engineers will be developed.	- UNRA organization must be reinforced at the local office level. - Legal background has to be clarified for UNRA to save toll revenue and appropriate it for their future expenditures.

Source: JICA Study Team

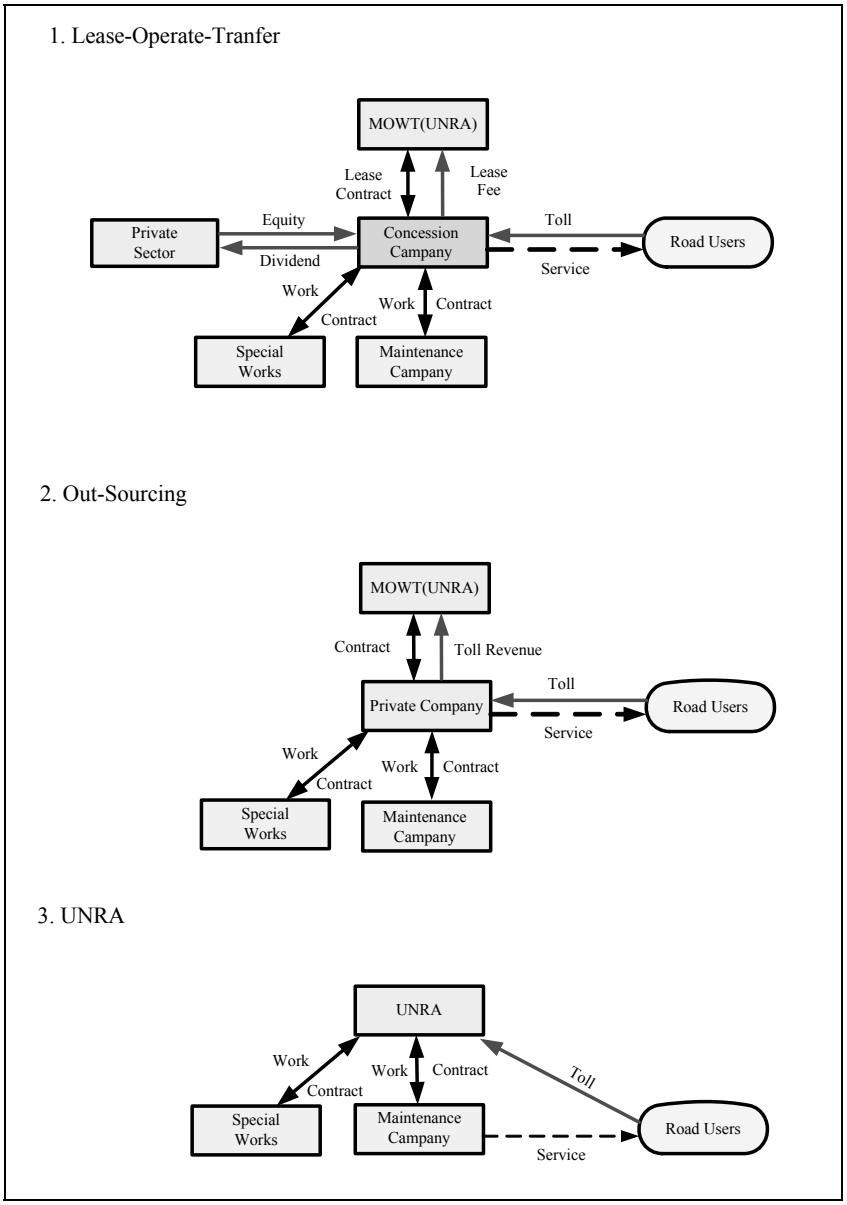


Figure 8.2.9 Operation Scheme

7) Legal aspects of toll operation

In the countries where toll roads exist, the toll roads are regulated by the Minister responsible for roads. Further, laws/acts define the section of toll roads, a level of toll rate and other related matters. The Road Fund Act in Uganda legalizes the collection of bridge and road tolls but it does not define who should collect tolls and appropriate them exclusively for costs of the subject toll facility. In Uganda, legislation for toll road administration does not been completely defined. In such a situation toll operation might become the cause of controversy.

(6) Problems and Issues on Tolling System

Because of incomplete legislation for toll road administration, it is necessary to enact new legislations to define unsolved issues on the toll system in Uganda.

1) Existence of alternative route

Existence of alternative route is one of the tributary issues of legal or social matters. There is a directive in almost all the laws/acts of countries where toll road system exists and that t a toll free alternative route parallel to the toll road should exist, in order to authorize toll operation.

In the case of the New Nile Bridge, the existing Nalubaale Dam Bridge is assumed, as the planning policy, to be used only by non-motorized traffic after completion of the New Nile Bridge, which was agreed by the Steering Committee of the Project Study. In such a situation, an alternative route to cross the River Nile exists very far detouring via Lira. This route could hardly be the alternative route for imposing the toll on the New Nile Bridge users. It is, therefore, not desirable from the alternative viewpoint to introduce a toll system for the New Nile Bridge.

2) International traffic in EAC countries

To let freight trucks stop and pay at the toll gate might be in conflict with the principles of Treaty of EAC and COMESA to promote the movement of traffic within the Community.

In the Treaty for the Establishment of the East Africa Community (EAC), it is called upon for the Partner State to: improve and expand the existing transport and communication links; and establish new ones to facilitate and promote the movement of traffic within the Community.

Whether or not the tolling is introduced to a section of the Northern Corridor depends much on the policy choice to be made by relevant high level officials. However, it is obvious that the installation of tolling system for the New Nile Bridge is not compatible with the treaty principle.

(7) Outlook of the toll operation

There are many uncertainties, incomplete legislative background and inconsistency with the international treaty regarding tolling issues, and which makes it difficult to conclude the issue soonest. Those problems and issues, which are listed in Table 8.2.8, will contribute to the delay in commencing the project implementation.

Moreover, there are other uncertainties on the surrounding situation as follows:

1) Economic development

The higher economic development of the country will lead to an increase in traffic volume. Hence, fuel levy will increase to provide sufficient fund for Roads and to allocate sufficient budgets to places where they are needed. Another scenario is also conceived, i.e., if national

income level would arise, the double charging of fuel levy and toll may not be serious matters for most of the road users.

2) Other mode of transports

Another surrounding situation will be a development of other mode of transports. If the pipeline is developed, heavy lorry trucks will be replaced. And if RVR will be rehabilitated using standard gauge, a huge quantity of cargo will be transported by rail. This will affect the required frequency of periodic maintenance. If damage of the pavement will not be so serious, the pavement and rehabilitation interval will become longer than 20 years. It will alleviate the burden of budget for future maintenance works.

As a consequence, introduction of the tolling system for the project will need more discussions and preparation of legislative actions and consensus of users on principles of tolling, such as the necessity of alternative route when a toll system is introduced.

Table 8.2.8 Problems and Issues on Introduction of Tolling System to the Project Bridge and Road

Toll Option	Road Administrator	Financing Aspect	Legal Aspect	Social Aspect
Toll Free Option	• Road Maintenance Plan should be authorized to secure future maintenance fund.	• GOU is responsible to prepare funds for the maintenance required by the Road Maintenance Plan.	• Legal as well as institutional frameworks should be established to assure the fund required by the Road Maintenance Plan.	• Toll free is socially agreeable and economically encouraging transport and industrial activities.
Tolling Option	• Additional operation facilities are required (installation of 3 toll booths, administrative office will cost about Ushs 3 billion). • Method of operation should be determined, i.e. Force Account, Subcontracting, Leasing, Special Purpose Company. • Method to determine a level of toll should be established, for instance, based on beneficiaries-to-pay, cost recovery, willingness-to-pay principles. • A decision should made of who should pay the toll in order to mitigate complaints from frequent bridge users for their daily lives (Only heavy trucks should pay?) • Toll collection measures need to be formulated, if some vehicles are exempted from paying toll. • Preventive measures against irregularities of toll collection should be taken including additional devices and facility requirements. • Argument and preparation about the tolling will cause the delay in the new bridge construction, and eventually bring about another cost of rehabilitation and long traffic queue at the existing Nalbaale Dam Bridge.	• GOU is responsible to prepare funds which cannot be covered by the toll revenue. • Demarcation between public and private sectors should be clarified for financing the initial investment costs. • It is necessary to examine whether or not a shadow toll should be introduced in order to assure the operational profit and to attract private sector eventually.	• It is necessary to establish an entity that is authorized to collect toll and appropriate the toll revenue to the relevant bridge and road maintenance. • Legal as well as institutional frameworks should be prepared to enable the GOU to introduce PFI schemes such as BOT, Leasing, PPP and SPC. • Justification is required to collect toll besides Road User Charges of Road Fund. • Consent by the Parliament may be required to infringe the vested right of crossing the River freely. • Law enforcement is required to prevent illegal toll collection and cheating toll. • Compatibility with EAC and COMESA treaties are required.	• A sentiment of double charging, i.e. toll and fuel levy, is raised. • A sentiment of infringement of vested right to cross the River freely will arise. • Complaints from frequent users such as shoppers, pupils/students, commuters will be voiced. • Complaints of no alternative choice other than the toll bridge will be raised. • Inconvenience to stop, pay and re-start at toll booth will take place. • Tolling will discourage community activities to cross the River. • Additional barrier of toll booth will obstruct regional and international traffics.

8.3 Implementation and Disbursement Plans

8.3.1 Implementation Plan

Because a large amount of initial investment is required, the New Nile Bridge Project will have to rely much for the financial support from either international or bilateral donor agencies. Japanese ODA Loan or co-financing by both Japan and an international/bilateral agency might be one of the most conceivable entities to finance this project.

The implementation plan will be based primarily on pre-construction and construction of the Project. The construction period was already analyzed in Chapter 7 as 3.5 years, which could hardly be reduced compared to experiences of similar projects worldwide.

The difference in loan application procedure between Japan and other international/bilateral lending agencies is that these agencies might require project cost data at the level of Detailed Design whereas Japanese ODA Loan will be able to determine the loan amount at the Feasibility Study level. Hence, application for loan financed by one of the other international/bilateral agency will need a Detailed Design before loan application could be pursued, which is usually undertaken by the borrowing country.

Japanese ODA loan can afford to lend funds for both Detailed Design and Construction of the Project (including construction supervision services), though loan agreements will be made separately for the respective stages.

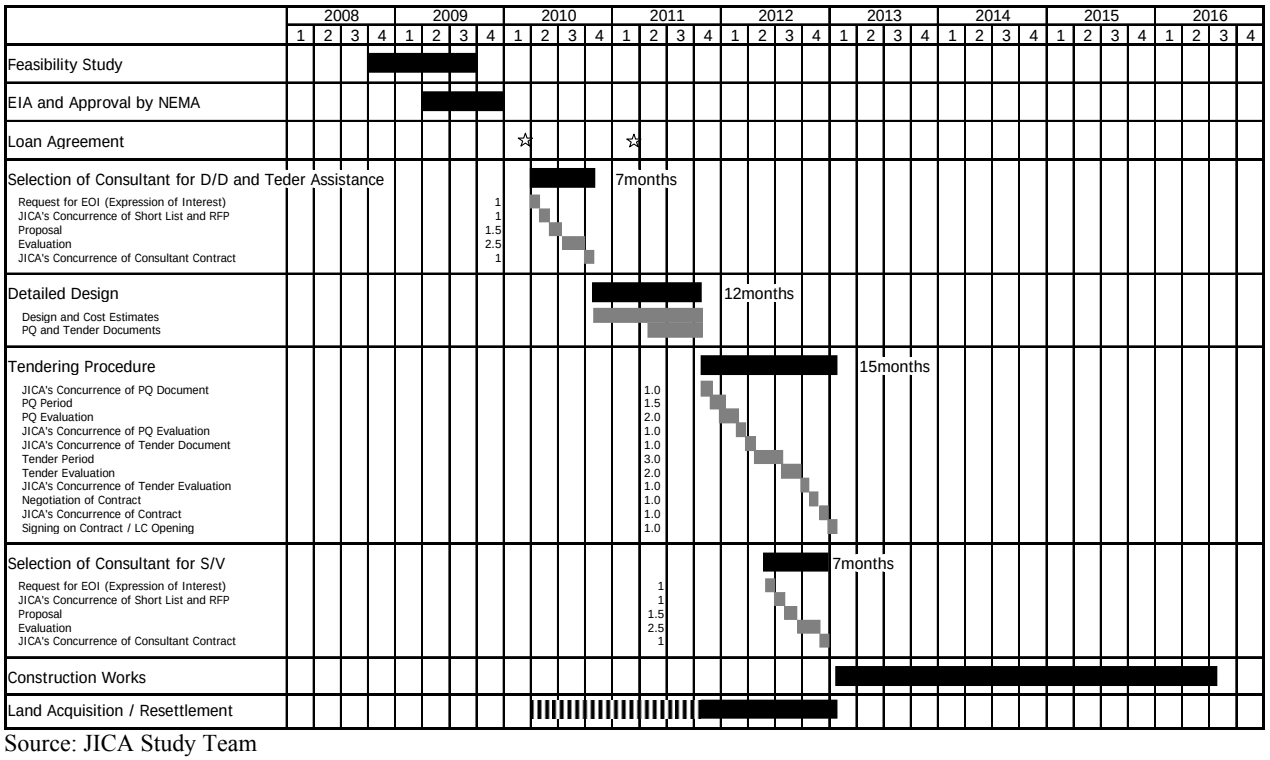
Assuming that International Competitive Bidding (ICB) will be adopted for both the Detailed Design and Construction, a time required for procurements is more or less the same when compared the financing scheme of GOU (Detailed Design) plus one international/bilateral agency (for the Construction) and that of Japan (Detailed Design and Construction with separate bidding). Therefore, reference was made to experiences of Japanese ODA scheme for similar type of projects in the world. Milestones of the implementation plan as a consequence is formulated as follows:

- E/N and L/A for DD consultant procurement will be concluded at the end of March 2010 after 4 months of EIA approval.
- 7 months for selection of DD consultant
- L/A for SV consultant and contractor procurement will be concluded at the end of March 2011
- A period of 1 year (12 months) is allocated for DD work including topography, geological survey and preparation of tender documents
- 15 months is allocated for the selection of contractor
- The construction of the New Nile Bridge will commence in the beginning of February 2013
- The construction of the New Nile Bridge will be completed by the end of July 2016

To summarize, the total implementation schedule will begin with a Loan Agreement for the DD in March 2010 and the construction will be finished by July 2016 as detailed in Table 8.3.1.

In addition, considering that the detailed design for the New Nile Bridge and the approach road can be undertaken within the ROW determined by the Feasibility Study, UNRA will be able to proceed with the land acquisition and compensation for affected facilities immediately after the Study.

Table 8.3.1 Implementation Plan for Project



Source: JICA Study Team

8.3.2 Disbursement Plan

The forecast of disbursement for the engineering service and construction is estimated as shown in Table 8.3.2.

Table 8.3.2 Disbursement Plan of Project Costs

Work		Amount	2010	2011	2012	2013	2014	2015	2016
Engineering Cost									
1	Detailed Design	3,095	1,238	1,857					
2	Tender Assist.	647	259	388					
3	Supervision (including Contingency)	9,405				1,881	2,633	2,633	2,258
4	Subtotal	13,147	1,497	2,245		1,881	2,633	2,633	2,258
Construction Cost (including Contingency & Tax)		92,477				18,495	25,894	25,894	22,194
Land Acquisition. & Compensation		10,111		1,011	9,100				
Total	US$x1,000	115,735	1,497	3,256	9,100	20,376	28,527	28,527	24,452
	Ushs Mil.	236,052	3,053	6,641	18,560	41,559	58,184	58,184	49,871

Source: JICA Study Team

CHAPTER 9

ECONOMIC AND FINANCIAL EVALUATION

9. ECONOMIC AND FINANCIAL EVALUATION

9.1 Economic Evaluation

9.1.1 General

The primary objective of the economic analysis is to examine the effects of the project investment. Although there are many proposed projects for the public sector which must be pursued for the improvement of the people's life, the government budget is limited. The economic analysis was done to evaluate whether or not the project investment will be beneficial for the national economy by analyzing the required expenditure of the national economy resources.

(1) Basic Assumption

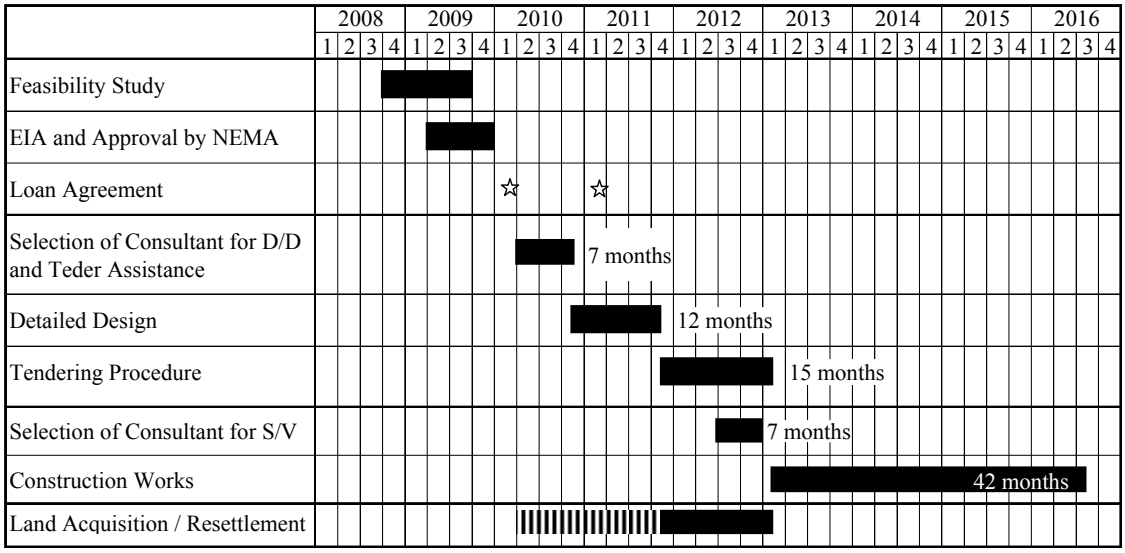
1) "With project" and "Without Project"

"With Project" covers the situation where the proposed bridge is implemented, and "Without Project" covers the situation where no investment takes place. The quantified economic benefits, which would be realized from the implementation of the project, are defined as savings in Vehicle Operating Costs (vehicle operating costs and vehicle time costs) and Travel Time Cost derived from the difference between "With Project" and "Without Project".

2) Implementation Schedule

According to the implementation plan, it is assumed that the engineering design work of the project bridge will start in the 4th quarter of 2010 to be completed by the 3rd quarter of 2016. The construction is expected to commence in 2011 and completed by 2016 for 42 months. Therefore, the actual opening of the bridge to traffic is expected by the 3rd quarter of 2016 as shown in Table 9.1.1.

Table 9.1.1 Implementation Schedule of the New Nile Bridge



Source: JICA Study Team

3) Evaluation Period for Economic Evaluation

The period of the economic evaluation for the project is assumed at 25 years after the completion of the bridge by the 3rd quarter of 2016.

4) Prices

Base year prices is June 2009 and exchange rates are set as follows:

US$ 1.0 = Yen 98.27 = Ushs 2039.6 (latest exchange rates according to bank of Uganda on 16th March, 2009)

(2) Traffic Demand Forecast

Based on the traffic survey conducted by the study team, the traffic demand to cross the River Nile was forecasted as shown in Table 9.1.2, and which also shows the summary of the estimated daily traffic volume, 'vehicle-km' and 'vehicle-hour' under different network conditions of 'with' and 'without' project. In addition, the growth rate of demand forecast after year 2026 is assumed to be the same rate as the growth rate between year 2015 and year 2025 for purposes of economic project evaluation.

Table 9.1.2 Forecast Average Daily Traffic Volume, Vehicle-Km and Vehicle-Hour

Type of Vehicle	ADT Forecast (Vehicle/day)		Vehicle-Km/day				Vehicle-Hour/day			
			'With' case		'Without' case		'With' case		'Without' case	
			44.6km/h	41.4km/h	16.0km/h	11.4km/h	44.6km/h	41.4km/h	16.0km/h	11.0km/h
	2015	2025	2015	2025	2015	2025	2015	2025	2015	2025
Motorcycle	3,684	6,356	8,648	14,880	8,188	14,088	194	360	510	1,228
Sedan, SW	5,858	8,577	13,776	20,158	13,007	19,047	309	487	812	1,664
Mini Bus	3,826	4,934	8,943	11,549	8,421	10,875	201	279	527	953
Large Bus	236	359	555	842	524	794	13	21	33	70
Truck	2,596	4,870	6,101	11,449	5,752	10,795	137	277	360	945
Trailer	1,754	2,848	4,065	5,874	3,840	6,276	91	143	240	548
Total	17,954	27,944	42,088	64,752	39,732	61,875	945	1,567	2,482	5,408

Source: JICA Study Team

Note: Project length is 2.35 km, while the relevant existing road/bridge length is 2.18 km.

9.1.2 Economic Project Benefit

(1) Estimation of the Benefit

The future traffic demand was forecasted under differing road network conditions of "With" and "Without" project cases. "With" case scenario, assumes that all motorized vehicles would use the New Nile Bridge, while 'Without" case scenario assumes that all the motorized vehicles would use the existing Nalubaale Dam Bridge.

Savings are derived from the comparison between costs ("With" case scenario) of road users who would have passed over the project bridge and costs ("Without" case scenario) of those who have crossed the river by the existing Bridge. Those savings are composed of:

- Vehicle Operating Cost (Both Distance and Time related costs);
- Travel Time Cost (Savings in passenger travel time that for users of Motorcycle, Sedan, Mini Bus and Large Bus);
- Waiting time by traffic queues brought about by the over-capacity of traffic demand; and
- Initial Investment, Operation and Maintenance Costs.

(2) Vehicle Operating Cost

Vehicle operating costs were estimated as summarized in Table 9.1.3 (at economic prices) and breakdown of the cost components are described hereafter.

Table 9.1.4 shows the representative vehicle by vehicle type.

Table 9.1.3 Vehicle Operating Cost by Vehicle Type (at Economic Prices)

		Motorcycle	Sedan	Mini Bus	Large Bus	Truck	Trailer
Time Related VOC(US$/yr)	Crew cost	-	-	1,647	8,943	19,357	19,357
	Maintenance Cost	13.3	107.9	161.8	313.8	313.8	313.8
	Insurance Cost	328	496	613	580	357	357
	Depreciation Cost	128	722	1,299	2,438	2,244	3,456
	Sub-Total	469	2,809	3,721	12,275	22,272	23,483
	Overhead Cost	-	-	372	1228	2227	2348
	Total	469	2,809	4,093	13,503	24,499	25,831
US$ / Hour		0.063	0.375	0.547	1.803	3.272	3.450
Distance Related VOC(US$/yr)	Fuel Cost	269.7	4,247.2	4,853.9	12,973.1	11,892.0	12,973.1
	lubricant Cost	19.0	42.8	76.0	582.7	662.3	722.5
	Tire Cost	25.7	207.3	173.3	582.8	884.1	2,818.1
	Maintenance Cost	21.8	136.2	263.0	774.1	591.4	910.5
	Depreciation Cost	237	1,341	2,413	4,529	4,168	6,417
	Sub-Total	573.1	5,974.8	7,778.9	19,441.3	18,197.9	23,841.7
	Overhead Cost	-	-	777.9	1,944.1	1,819.8	2,384.2
	Total	573.1	5,974.8	8,556.7	21,385.4	20,017.7	26,225.9
US$ / 000km,		*34.4*	*159.3*	*213.9*	*356.4*	*364.0*	*437.1*

Source: JICA Study Team

Table 9.1.4 Representative Vehicle by Vehicle Type

Vehicle Type	Motorcycle	Sedan	Mini Bus	Large Bus	Truck	Trailer
Typical Model	Honda 125	Corolla 1500	Toyota Hi-ace (15pax)	Toyota Coaster	Hino (8ton)	Benz 2024

Source: JICA Study Team

Regarding the distance related VOC, the fuel cost and lubricant cost is affected by gas mileage and the travel speed for each vehicle type. The demand forecast (refer to Table 9.1.2) of vehicle-km 'with' project case is larger than the 'without' project case, because the project length is longer by 170 m than the existing route. Despite of this, the positive benefit in vehicle-km could emerge, because the travel speed is improved by the project and vehicle could travel at less cost than 'without' project case. Table 9.1.5 shows the distance related VOC which is converted by gas mileage by speed of each vehicle type in the future.

Table 9.1.5 Distance Related VOC* by Vehicle Type (at Economic Prices)

(unit: US$/000km)

	Motorcycle	Sedan	Mini Bus	Large Bus	Truck	Trailer
'Without' Project case						
Year 2015	46.9	209.7	332.5	489.5	499.9	590.2
Year 2025	56.2	246.8	413.0	594.0	620.3	725.9
'With' Project case						
Year 2015	35.3	163.1	228.5	362.3	364.7	438.0
Year 2025	35.8	165.4	234.4	368.0	368.3	442.0

Source: JICA Study Team
Note: VOC at the speed shown in Table 9.1.2*

Table 9.1.6 shows the conversion factors of fuel and lubricant costs..

Table 9.1.6 Conversion Factors of Fuel and Lubricant Costs at Estimated Travel Speeds

	Motorcycle	Sedan	Mini Bus	Large Bus	Truck	Trailer
'Without' Project case						
Year 2015	1.66	1.42	1.84	1.51	1.51	1.51
Year 2025	2.16	1.73	2.42	1.92	1.95	1.95
'With' Project case						
Year 2015	1.05	1.03	1.10	1.02	1.00	1.00
Year 2025	1.08	1.05	1.15	1.04	1.02	1.02

Source: JICA Study Team
Note: The above factors indicate the fuel and lubricant consumption at the speed shown in Table 9.1.2 and the factor 1.00 is the base indicator that is achieved at the most economical driving speed of the vehicle.

VOC components consist of 'Vehicle and Depreciation Cost', 'Fuel and Lubricant Cost', Tier Cost' and 'Maintenance and Insurance Cost' and their current market prices (as of March 2009) of representative vehicles were derived from the interview survey of several car dealers in Kampala. For the economic prices, VAT and import duty should be deducted from the obtained current market price. The economic costs of the representative vehicles and their depreciation costs are estimated as shown in Table 9.1.7.

Table 9.1.7 Vehicle and Depreciation Costs by Vehicle Type

Items	Motorcycle	Sedan	Mini Bus	Large Bus	Truck	Trailer
Economic Vehicle Cost (US$)	2,431	18,343	28,870	77,412	71,250	109,700
Residual Value (US$)	243	1,834	2,887	7,741	7,125	10,970
Vehicle Life (Year)	6	8	7	10	10	10
Depreciation Rate (% /year)	15.0%	11.3%	12.9%	9.0%	9.0%	9.0%
Depreciation Amount (US$/year)	365	2,064	3,712	6,967	6,413	9,873
Average Running (Km/year)	16,667	37,500	40,000	60,000	55,000	60,000
Depreciation Cost (US$/km)	0.022	0.055	0.093	0.116	0.117	0.165

Source: JICA Study Team based on interview with Car Dealers in Kampala

Based on recent fuel prices, economic prices of fuel by type of vehicle were estimated as shown in Table 9.1.8. The fuel consumption rate (liter per 1,000 km) and a distance interval between lubricant changes was derived from setting data of HDM4 in 'Procedural Guide to Economic Road Feasibility', March 2006, by Road Agency Formation Unit (RAFU).

Table 9.1.8 Fuel and Lubricant Cost by Vehicle Type

Items	Motorcycle	Sedan	Mini Bus	Large Bus	Truck	Trailer
Fuel Type Used (US$)	Petrol	Petrol	Petrol	Diesel	Diesel	Diesel
Fuel Costs (US$/L)	0.8090	0.8090	0.8090	0.7207	0.7207	0.7207
Fuel Consumption Rate (L/km)	0.02	0.14	0.15	0.3	0.3	0.3
Lubricant Costs (US$/Time)	5.70	11.40	14.25	77.69	120.42	120.42
Distance between Lubricant Changes (km)	5000	10000	7500	8000	10000	10000

Source: JICA Study Team based on interview with Car Dealers in Kampala and HDM4 in UNRA

The current market prices of tires were derived from interview survey of car dealers in Kampala. VAT and import duty should be deducted from the current market prices should be be taken out for converting to the economic price as shown in Table 9.1.9.

Table 9.1.9 Tire Cost by Vehicle Type

Items	Motorcycle	Sedan	Mini Bus	Large Bus	Truck	Trailer
Tire Cost (US$/Unit)	30.78	221.16	173.28	485.64	803.70	2,348.40
Running Kilometres (km)	20,000	40,000	40,000	50,000	50,000	50,000
Tire Cost per 000 Kilometre (US$)	1.54	5.53	4.33	9.71	16.07	46.97

Source: Car Dealers in Kampala

The maintenance costs comprised of mechanical parts and labor costs. The parts and labor cost were derived from interview survey of car dealers in Kampala. The insurance cost also was derived from car dealers in Kampala. The current market prices of maintenance and insurance costs by vehicle type were converted into economic prices based on Table 9.1.10.

Table 9.1.10 Maintenance and Insurance Costs by Vehicle Type

Items	Motorcycle	Sedan	Mini Bus	Large Bus	Truck	Trailer
Maintenance Cost- Spare Parts (US$/year)	21.8	136.2	263.0	774.1	591.4	910.5
Maintenance Cost- Labour (US$/year)	13.3	107.9	161.8	313.8	313.8	313.8
Insurance Cost (US$/year)	328	496	613	580	357	357

Source: Car Dealer in Kampala

(3) Waiting Time due to Traffic Queues

The traffic capacity of the existing Nalubaale Dam Bridge is estimated at 1,230 pcu/hour or 17,079 pcu/day as indicated in Table 4.3.22, Chapter 4 Traffic Demand Forecast. Assuming that future traffic will fluctuate by the hour based on the current traffic survey in Jinja, the traffic generated by saturation over the hourly capacity will have to wait for the following hour. Over-saturated traffic every hour becomes a backlog and a traffic queue will appear and remain till the cumulative hourly capacity can manage to pass the cumulative hourly backlog traffic through the existing Dam Bridge.

Thus, the backlog of waiting vehicles every hour is accumulated to estimate the total waiting vehicle-hours that will occur when the project bridge with 4-lane dual carriage way is not constructed. Hence, the increase in vehicle-hours by traffic queue is incorporated into the additional Travel Time Cost as discussed in subsequent section of this report.

(4) Travel Time Cost

Passenger's travel time costs were evaluated only for 4 types of vehicles, i.e. Motorcycle, Sedan, Mini Bus and Large Bus. Table 9.1.11 shows the summary of Travel Time Cost of passengers at 2009 price. In addition, the future value of 'Travel Time Cost' was assumed in par with the same growth rate for GDP per capita as assessed in the preceding Section 4.2.2.

Table 9.1.11 Travel Time Cost by Vehicle Type of Passenger

Items	Motorcycle	Sedan	Mini Bus	Large Bus
No. of Average PAX/ Vehicle *1	1.46	2.51	13.03	46.36
Time Value (US$)/PAX /Month *2	119.4	119.4	119.4	119.4
Aggregated Time Value (US$)/Month/Vehicle	174.4	299.1	1,555.3	5,534.4
Aggregated Time Value (US$) /Hour/Vehicle	0.96	1.64	8.55	30.41

Source: JICA Study Team
*Note[*1]: Based on Traffic Survey in Jinja; [*2]: Estimates from Uganda National Household Survey 2005/2006 and Consumer Price Index (CPI) source: Bank of Uganda*

(5) O&M Costs of the Existing Bridge

In the case of 'without' project, the existing bridge should continue to operate but with higher operation and maintenance costs. Accordingly, increased in operation and maintenance costs of the existing bridge would be considered as one of the benefit items to be generated from the "with" and "without" case comparison. Table 9.1.12 shows the summary of operation and maintenance costs derived from UNRA for the existing bridge.

Table 9.1.12 Future O&M Costs of Existing Bridge ('Without' case)

Items	US$000/year	Remarks
Daily Maintenance	14	Annual
Routine Maintenance	23	Annual
Repair and Rehabilitation (2015/16)	3,560	
Repair and Rehabilitation (2021/22 or Later)	4,634	Every 6 years

Source: UNRA

9.1.3 Economic Project Cost

(1) Estimation of Economic Project Cost

Based on the preliminary engineering design, the project costs in terms of financial prices were estimated as shown in Chapter 7. For the economic analysis, financial costs were converted to economic costs by deducting the tax portion and applying a standard conversion factor to the portion of non-trade goods.

The conversion factor was applied in the following manner:

For purposes of the economic analysis, all the costs were classified into trade goods, non-trade goods and transfer items. It was assumed that trade goods are equivalent to the foreign currency potion, and aggregation of non-trade goods represent the local currency portion.

Transfer item means the portion of the tax. In this study the following conversion factors were applied;

- Import duties were deducted from market prices of fuels (gasoline and diesel)and import duty and VAT are deducted from the lubricants;
- For tax, conversion factor of 0.00 was applied and
- For land acquisition and compensation, a standard conversion factor was applied.

Standard Conversion Factor (SCF):

The standard conversion factor is an index, which converts domestic prices to border prices by adjusting the distortion of prices in the domestic market. SCFwas estimated based on the following equation:

$$SCF = \frac{M + X}{(M + T_m) + (X - T_x - S_x)}$$

Where:

M : Total value of import (CIF)
X : Total value of export (FOB)
Tm : Total value of import duty
Tx : Total value of export duty
Sx : Total value of export subsidy

Based on statistical data regarding foreign trade and governmental revenues in Uganda, SCF is estimated at 0.90 as shown in Table 9.1.13.

Table 9.1.13 Calculation of Standard Conversion Factor

Financial Year	2001/02	2002/03	2003/04	2004/05	2005/06
Export (US$ Mil.)	474.0	507.9	647.2	786.3	889.8
Import (US$ Mil)	1,004.3	1,128.7	1,319.5	1,623.9	1,991.4
Tax on Imports (Ushs Bil.)					
Duties - non-oil products	93.0	133.1	116.4	146.5	171.5
Excise taxes					
Petroleum products	218.9	232.1	269.8	309.9	362.6
Other imports	24.6	39.0	50.4	49.3	57.6
Total import taxes (Ushs Bil.)	336.5	404.2	436.6	505.7	591.7
Exchange rate (US$ 1.0)	1,754.6	1,882.9	1,934.9	1,737.7	1,825.2
Total import taxes (US$ Mil.)	191.8	214.7	225.6	291.0	324.2
SCF	0.89	0.88	0.90	0.89	0.90

Source: Uganda Bureau of Statistics

It was assumed that the portion for price contingency was excluded as an economic project costs. The total economic project costs which cover 'Land Acquisition and Compensation Costs', 'Engineering Costs' and 'Construction Costs' in economic prices are estimated at US$101.0 Million as shown in Table 9.1.14.

Table 9.1.14 Estimated Project Cost

(Unit: US$ million)

Cost Items		Local	Foreign	Financial Cost	Economic Cost
(1)	Land Acquisition & Compensation Cost	10.1	0.0	10.1	9.1
	Land Acquisition	10.1	0.0	10.1	9.1
	Tax	0.0	0.0	0.0	0.0
(2)	Engineering Cost	1.4	11.7	13.1	11.8
	Detailed Design	0.6	3.1	3.7	3.7
	Construction Supervision	0.7	7.5	8.2	8.1
	Tax	0.0	0.0	0.0	0.0
	Contingency	0.1	1.1	1.2	0.0
(3)	Construction Cost	17.7	74.7	92.5	80.1
	Temporary work	5.2	3.9	9.2	8.4
	Road Construction	3.1	2.4	5.5	5.1
	Bridge Construction	4.3	28.3	32.6	32.1
	River Protection Works	0.1	0.0	0.1	0.1
	Other Works	0.0	0.3	0.4	0.4
	Common Temporary Works	0.7	20.3	21.0	20.9
	Site Expense	1.9	6.7	8.6	8.4
	Overhead	1.0	3.9	4.9	4.8
	Tax	0.0	1.9	1.9	0.0
	Contingency	1.6	6.8	8.4	0.0
Total Project Cost		29.3	86.5	115.7	101.0

Source: JICA Study Team

(2) Operation and Maintenance Costs of the Project

The operation and maintenance costs for the proposed bridge in terms of financial prices are provided in the cost estimates in Chapter 8 "Maintenance, Operation and Implementation Plans". Table 9.1.15 shows the routine and periodic maintenance costs for the bridge.

Table 9.1.15 Routine and Periodic Maintenance Cost

(Unit: US$000)

Items	Financial Cost	Economic Cost	Maintenance Term (year)	Remarks (Frequency during 25 years)
Approach Road				
Routine Maintenance	4	4	1	Routine (every year)
Periodic Maintenance	253	247	5	Periodic (5 times)
Rehabilitation	1,010	989	20	Periodic (1 times)
Bridge				
Routine Inspection	71	68	1	Routine (every year)
Periodic Inspection	5	5	3	Periodic (8 times)
Resurface	328	326	20	Periodic (1 times)
Replacement Joints	771	771	20	Periodic (1 times)
Replacement Shoes	690	627	40	Not applicable
Replacement Stay Cable	2,485	2,259	75	Not applicable

Source: JICA Study Team

9.1.4 Cost Benefit Analysis

For the Economic Analysis of the project, costs and benefits of the project were determined as shown in Table 9.1.16. The economic evaluation results are summarized in Table 9.1.17. All three indicators of the economic evaluation substantiated the economic viability of the project investment, with an. EIRR of 17.1 %, B/C Ratio and 1.86 and ample positive NPV.

Table 9.1.16 Cost Benefit Items of the Project for Economic Analysis

	For Supplier		For User		Net Cash Flow for the Cases
	Cash-Out	Cash-In	Cash-Out	Cash-In	
Case: [Without] Project					
	O&M of the Existing Bridge		VOC Travel Time Cost		-O&M (Existing) -VOC -Travel Time Cost
Case: [With] Project					
	Investment (New) & O&M (New)	*(Revenue from the Bridge, if tall is applied)*	*(Payment for the Bridge, if toll is applied)* VOC Travel Time Cost		-Investment (New) -O&M (New) -VOC -Travel Time Cost
[With-Without] Project					
					Cash-In items -O&M (Existing) -Saving in VOCs -Saving in Travel Time Costs **Cash-Out items** -Investment (New) -O&M (New)

Source: JICA Study Team

Table 9.1.17 Estimated Net Cash Flow for Economic Evaluation of Project

Unit: US$000 (Economic Price)

		Cash-out			Cash-in						
		New Bridge		Total	User's Cost Saving				Existing Bridge O&M	Total	Net Cash Flow
		Inv.	O&M		VOC (D)[1]	VOC (T)[2]	TTC	Total			
	2010	1,472	0	1,472	0	0	0	0	0	0	-1,472
	2011	3,118	0	3,118	0	0	0	0	0	0	-3,118
	2012	8,190	0	8,190	0	0	0	0	0	0	-8,190
	2013	17,641	0	17,641	0	0	0	0	0	0	-17,641
	2014	24,698	0	24,698	0	0	0	0	0	0	-24,698
	2015	24,698	0	24,698	0	0	0	0	0	0	-24,698
1	2016	21,169	30	21,199	600	564	1,500	2,663	3,384	6,047	-15,152
2	2017		72	72	1,517	1,559	4,063	7,140	37	7,177	7,105
3	2018		77	77	1,599	1,811	4,631	8,041	37	8,078	8,002
4	2019		72	72	1,686	2,100	5,267	9,053	37	9,090	9,018
5	2020		319	319	1,777	2,717	6,700	11,194	37	11,231	10,912
6	2021		77	77	1,874	3,382	8,220	13,476	37	13,513	13,436
7	2022		72	72	1,977	4,062	9,675	15,713	4,356	20,069	19,997
8	2023		72	72	2,085	4,806	11,242	18,133	37	18,170	18,098
9	2024		77	77	2,199	5,733	13,191	21,123	37	21,160	21,083
10	2025		319	319	5,833	8,370	18,868	33,071	37	33,108	32,789
11	2026		72	72	5,984	9,469	21,145	36,598	37	36,635	36,563
12	2027		77	77	6,139	10,632	23,529	40,300	37	40,337	40,260
13	2028		72	72	6,299	11,947	26,132	44,377	4,356	48,733	48,661
14	2029		72	72	6,463	13,337	28,861	48,662	37	48,699	48,627
15	2030		324	324	6,632	14,883	31,796	53,310	37	53,347	53,023
16	2031		72	72	6,805	16,520	34,880	58,206	37	58,243	58,171
17	2032		72	72	6,983	18,515	38,572	64,070	37	64,107	64,035
18	2033		77	77	7,166	20,622	42,440	70,228	37	70,265	70,188
19	2034		72	72	7,354	23,190	46,981	77,525	4,356	81,881	81,809
20	2035		2,158	2,158	7,548	25,892	51,731	85,171	37	85,208	83,050
21	2036		77	77	7,747	28,996	57,012	93,754	37	93,791	93,714
22	2037		72	72	7,951	32,262	62,540	102,753	37	102,790	102,718
23	2038		72	72	8,161	36,047	68,791	112,999	37	113,037	112,965
24	2039		77	77	8,377	40,029	75,335	123,742	37	123,779	123,702
25	2040		319	319	8,599	44,227	82,198	135,025	4,356	139,381	139,062
	Total	100,985	4,869	105,855	129,356	381,671	775,301	1,286,327	21,549	1,307,877	1,202,022
	NPV	56,943	524	57,467	12,829	28,625	61,668	103,122	3,535	106,658	49,191
	B/C	Discount Rate		12%							1.86
	EIRR										17.1%

Notes: VOC (D)[1] means Distance related vehicle operating cost
VOC (D)[2] means Time related vehicle operating cost
Source: JICA Study Team

9.1.5 Sensitivity Analysis

A sensitivity analysis against the base case was undertaken to validate the project viability under the following worse case scenarios:

- Increase in construction cost by 10 %
- Increase in construction cost by 20 %
- Decrease in traffic demand by 10 %
- Decrease in traffic demand by 20 %
- Increase in construction cost by 10 % & Decrease in traffic demand by 10 %
- Increase in construction cost by 10 % & Decrease in traffic demand by 20 %
- Increase in construction cost by 20 % & Decrease in traffic demand by 10 %
- Increase in construction cost by 20 % & Decrease in traffic demand by 20 %

The results of the sensitivity analysis for the above 8 cases are shown in Table 9.1.18. The results show that the project maintained its economic feasibility i.e. EIRR=13.7% even if the cost was increased by 20 % and traffic demand was decreased by 20 %.

Table 9.1.18 Summary of Economic Evaluation Indicators based on Assumptions

			Project Cost		
			Base Case	10% Increase	20% Increase
Traffic Demand	Base Case	EIRR	17.1%	16.3%	15.5%
		NPV	49,191	43,444	37,698
		B/C	1.86	1.69	1.55
	10% Decrease	EIRR	16.2%	15.4%	14.7%
		NPV	38,879	33,132	27,385
		B/C	1.68	1.52	1.40
	20% Decrease	EIRR	15.3%	14.5%	13.7%
		NPV	28,567	22,820	17,073
		B/C	1.50	1.36	1.25

Note: NPV Unit in US$1000
Source: JICA Study Team

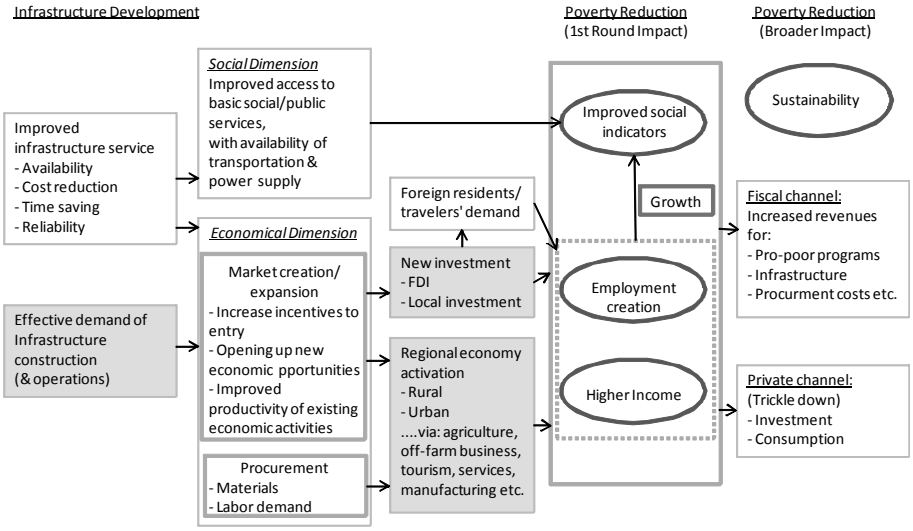
9.1.6 Economic Impact on Regional Development and Poverty Alleviation

In addition to the foregoing quantified benefits, there were various impacts to the region that will be brought about by the construction of the proposed bridge. For the evaluation of these unquantifiable benefits, the relevant indicative statements comprise of the following:

(1) General impacts of large-scale transport projects

- Improving connectivity and economic distance to markets, information, education and health service – road network and accessibility in rural areas, are the key factors to regional income development and resource mobilization capability for the improvement of the living conditions of the poor.
- Creating effective demand, off-farm jobs and income opportunities, for construction of large-scale infrastructure projects. The employment of local farmers for unskilled works will contribute to job opportunities and income generation in the surrounding rural areas, particularly during off-farm seasons.
- Reducing transaction costs and facilitating trade flows.

- Lowering the costs of inputs used in the production of almost all goods and services. Opening up new opportunities for entrepreneurs, or making existing business more profitable.
- Improving environmental conditions, which link to improved livelihoods, better health and reduced vulnerability of the poor



Source: Linking Economic Growth and Poverty Reduction —Large-Scale Infrastructure in the Context of Vietnam's CPRGS— November 2003 GRIPS Development Forum

Figure 9.1.1 Linkages among Large-Scale Infrastructure, Growth, and Poverty Reduction

(2) General Impact of the Bridge Project

1) Study on Honshu-Shikoku Bridges of Japan pointed out the following impacts:

- Improvement of basic traffic condition; saving of travel time, accessibility without limitation and punctuality.
- Increase in traffic volume (passenger and cargo)
- Improvement of livelihood; better access to medical service, more options for commuting and leisure.
- Enhancement of production in farming and fishery, increase in tourist and logistics by increase in traffic volume and enhanced market.
- Increased potential for investment; increased number of firms by 1.3 times and increased number of retail super markets by 3.2 times
- Increase in production by 1 % of GRDP, increased employment by 120,000 workers, annual time and cost savings by vehicle US$ 2.3 billion

Source; URL of Honshu-Shikoku Bridge Expressway Company Limited (HSBE)

2) The result of Impact Study on Infrastructure Project by Infrastructure Development Institute (IDI) and Ministry of Land, Infrastructure and Transport of Japan in March 2002, which studied the impact of the construction of Meghna Bridge and Meghna-Gumti Bridge in Bangladesh, showed the benefits of the bridge project as follows:

- Even the people at the bridge site area, located at Dhaka-Chitagong Highway that connects the capital of Bangladesh and the major port in Bangladesh, enjoyed an increase in income, including farmers, fishermen and other industries. While some of the transport sector experienced an increase in income, other sectors suffered a

decrease in income; however, study analysis also showed a reduction in expenses for those whose income had decreased and consequently the overall net income did not changed.

- More than 60 % of the project related inhabitants responded they were provided with better medical treatment access after the project, although only 1 % answered "good" before the project. The percentage of doctors also answered they could get medicinal supplies without any problem an increased from 5 % before the project to 70 % after the project.
- Decrease in quantity of poverty by 8 %, from 59.9 % to 51.9 %.

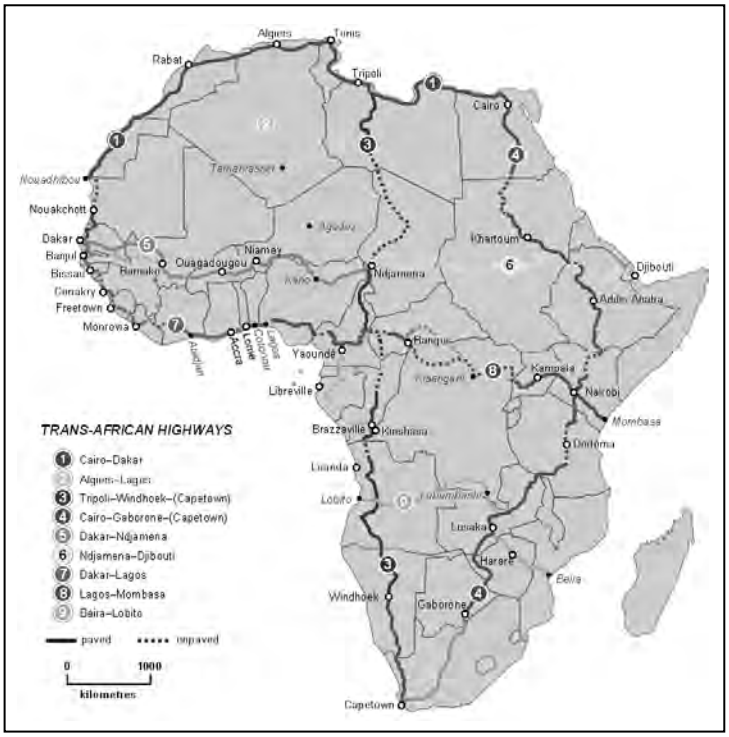
(3) Impacts to African Highway Concept

The Trans-African Highway network comprises transcontinental road projects in Africa being developed by the United Nations Economic Commission for Africa (UNECA), the African Development Bank (AfDB), and the African Union in conjunction with regional international communities. The aim is to promote trade and alleviate poverty in Africa through highway infrastructure development and the management of road-based trade corridors. The nine highways in the network totals 56,683 km.

Trans-African Highway 8 (TAH 8), i.e. Lagos-Mombasa Highway, is 6,259 km long, which is contiguous with the TAH 7, a 10,269 km long in total road of the east-west corridor across the centre of the African Continent, via the Nile Bridge in Uganda.

Eastern half of the Lagos-Mombasa Highway is already completed from Kenya to Uganda, locally known as the Trans-African Highway (the only place the name is commonly use). Its western extremity in Nigeria, Cameroon and Central Africa Republic is mostly completed but a long missing link across DR Congo currently prevents any practical use through the mid section.

Trans-African Highway Network is shown in Figure 9.1.2.



Source: African Development Bank

Figure 9.1.2 Trans-African Highway Network

1) Unquantifiable Benefit of the Proposed Bridge

The Nile Bridge Crossing will improve traffic circulation and flow. Motorized vehicles will use the New Nile Bridge, while pedestrians and motorcycle would continue to use the Nalubaale Dam Bridge thereby decreasing traffic flow in VOC, (Travel Time Cost) and quantity of Vehicle/CO2 emissions. In addition the movement of cross border traffic (through Trans-African Highway 8) would become more pronounced to further improvement along sections of the road. Similarly, because of reductions in VOC brought about by an improved Nile Crossing, the price of goods imported from elsewhere would be reduced, as well as the cost of passenger transport. Improvements to feeder roads would spread this effect would extend into areas some distance away from the Nile Crossing.

a) Improve Accessibility

Upgrading the Northern Corridor would greatly contribute to the development of districts and towns along the Corridor. For instance, in Jinja the bottleneck of the Nalubaale Dam Bridge will be eliminated and will provide improved access to Jinja District and Mukono District, particularly for heavy vehicles in conjunction with improvement of connecting capacity and travel speed.

b) Impacts on Tourism

The proximity of the Source of the Nile at Lake Victoria and availability of tourism accommodations will engender a high potential for attracting tourism, both domestic and international. Jinja and Mukono are keen to develop the area. The new Nile Crossing road would enhance tourism and associated activities such as accommodation development, river recreation and handicrafts.

c) Impacts on Rehabilitation for the Existing Bridge

Additionally, under normal situation the rehabilitation work should be done by "Without" case, for which one of the two lanes traffic through the existing bridge will have to be blocked off. Accordingly the bottleneck of the traffic would surface during the rehabilitation period. Uganda National Roads Authority (UNRA) estimated the rehabilitation to take about 8 months. The influence of the rehabilitation work on the existing bridge could have been taken into account as one of the benefits to the project.

9.2 Financial Analysis

9.2.1 General

The purpose of the financial analysis is to examine the financial viability of the investment for the "Construction of the New Nile Bridge Project" from the viewpoint of the implementation body. The analysis was conducted based on the revenue, in accordance with the toll policy considered in Chapter 8.

As the first step in this study, the Financial Internal Rate of Return (FIRR) was calculated in order to evaluate the return on total investment. In this case, the FIRR indicated a project viability regardless of the need for fund raising conditions.

(1) Implementation Schedule

The implementation schedule in the financial evaluation is the same as the assumption made for the economic analysis.

(2) Project Life

The project life is assumed at 30 years, after the completion of the bridge construction as well as when the operation would be started.

(3) Price

Price in the financial evaluation is the same as the assumption made for the economic analysis.

9.2.2 Financial Project Revenue

As discussed in "Chapter 8: Maintenance, Operation and Implementation Plans", the base case for the project is to impose toll rates on the different classes of vehicle as shown in Table 9.2.1. In addition, the effective toll collection rate is assumed at 80%. Table 9.2.2 shows the revenue derived from the case where all the vehicles, except for motorcycles are subject to pay the toll by class.

Table 9.2.1 Toll Rates Assumption

		Base Toll Rates		Assumption of Actual Collection Rate
		Ushs	US$	
Class 1	Sedan Wagon Mini-Bus	300	0.15	80%
Class 2	Large-Bus	600	0.29	
Class 3	Truck	600	0.29	
Class 4	Trailer	1,000	0.49	

Source: JICA Study Team

Table 9.2.2 Estimated Toll Revenue by Vehicle Class

(Unit: US$1,000 /year)

	Class1	Class2	Class3	Class4	Total
2020	491	220	111	320	1,141
2025	580	297	152	408	1,437
2030	686	403	208	520	1,817
2035	813	547	285	662	2,306
2040	963	742	390	844	2,939
2045	1,142	1,009	534	1,075	3,760

Source: JICA Study Team

9.2.3 Financial Project Cost

(1) Initial Investment Cost

Aforesaid Table 9.2.3 shows the initial investment cost of the proposed bridge.

Table 9.2.3 Initial Investment Cost

(Unit: US$ million)

	Cost Items	Local	Foreign	Financial Cost
(1)	Land Acquisition & Compensation Cost	10.1	0.0	10.1
	Land Acquisition	10.1	0.0	10.1
	Tax	0.0	0.0	0.0
(2)	Engineering Cost	1.4	11.7	13.1
	Detailed Design	0.6	3.1	3.7
	Construction Supervision	0.7	7.5	8.2
	Tax	0.0	0.0	0.0
	Contingency	0.1	1.1	1.2
(3)	Construction Cost	17.7	74.7	92.5
	Temporary work	5.2	3.9	9.2
	Road Construction	3.1	2.4	5.5
	Bridge Construction	4.3	28.3	32.6
	River Protection Works	0.1	0.0	0.1
	Other Works	0.0	0.3	0.4
	Common Temporary Works	0.7	20.3	21.0
	Site Expense	1.9	6.7	8.6
	Overhead	1.0	3.9	4.9
	Tax	0.0	1.9	1.9
	Contingency	1.6	6.8	8.4
	Total Project Cost	29.3	86.5	115.7

Source: JICA Study Team

(2) Maintenance Cost

Table 9.2.4 shows the summary of routine and periodic maintenance costs for the proposed bridge as previously estimated in Chapter 8.

Table 9.2.4 Estimated Routine and Periodic Maintenance Costs

(Unit: US$1,000)

Items	Financial Cost	Maintenance Term (year)	Remarks
Approach Road			
Routine Maintenance	4	1	Routine (every year)
Periodic Maintenance	253	5	Periodic (5 times)
Rehabilitation	1,010	20	Periodic (1 times)
Bridge			
Routine Inspection	71	1	Routine (every year)
Periodic Inspection	5	3	Periodic (8 times)
Resurface	328	20	Periodic (1 times)
Replacement Joints	771	20	Periodic (1 times)
Replacement Shoes	690	40	Not applicable
Replacement Stay Cable	2,485	75	Not applicable

Source: JICA Study Team

9.2.4 Cash Flow Analysis

(1) Estimated FIRR (ROI)

Based on the estimated revenues and project costs, the FIRR is found not viable unless the toll rates are raised to a level 12 times the base rate. The detailed cash flows of the cost and revenue are shown in Table 9.2.5.

Table 9.2.5 Cash-flow for Estimating Financial IRR (ROI)

Unit:US$1000

		Year	Revenue	Bridge Cost				Net Cash Flow
			Base Toll	Investment	Periodic M.	Routine M.	Total	
1		2010		1,497			1,497	-1,497
2		2011		3,257			3,257	-3,257
3		2012		9,100			9,100	-9,100
4		2013		20,369			20,369	-20,369
5		2014		28,517			28,517	-28,517
6		2015		28,517			28,517	-28,517
7	1	2016	397	24,443	0	32	24,474	-24,078
8	2	2017	996		0	76	76	920
9	3	2018	1,042		5	76	81	961
10	4	2019	1,090		0	76	76	1,015
11	5	2020	1,141		253	76	328	813
12	6	2021	1,195		5	76	81	1,114
13	7	2022	1,251		0	76	76	1,175
14	8	2023	1,310		0	76	76	1,234
15	9	2024	1,372		5	76	81	1,291
16	10	2025	1,437		253	76	328	1,109
17	11	2026	1,506		0	76	76	1,430
18	12	2027	1,578		5	76	81	1,497
19	13	2028	1,653		0	76	76	1,578
20	14	2029	1,733		0	76	76	1,657
21	15	2030	1,817		258	76	334	1,483
22	16	2031	1,905		0	76	76	1,829
23	17	2032	1,998		0	76	76	1,922
24	18	2033	2,095		5	76	81	2,014
25	19	2034	2,198		0	76	76	2,123
26	20	2035	2,306		2,109	76	2,185	121
27	21	2036	2,420		5	76	81	2,339
28	22	2037	2,540		0	76	76	2,464
29	23	2038	2,666		0	76	76	2,591
30	24	2039	2,799		5	76	81	2,718
31	25	2040	2,939		253	76	328	2,611
32	26	2041	3,087		0	76	76	3,011
33	27	2042	3,242		5	76	81	3,161
34	28	2043	3,406		0	76	76	3,330
35	29	2044	3,578		0	76	76	3,503
36	30	2045	3,760		258	76	334	3,427
Total			60,457	115,699		2,224	121,349	-60,892
NPV			10,863			NPV	65,595	-60,091
						B/C		0.17
						FIRR		Unsolved

Source: JICA Study Team
Note: A discount rate 12% is applied to PV/NPV and B/C

In summary, the financial evaluation, NPV, ROI and FIRR are shown in Table 9.2.6. As mentioned above, the FIRR will become feasible only if the toll rates are raised to a level of 12 times the base rate as shown in Table 9.2.6.

Table 9.2.6 Summary of Cash Flow Analysis

	Base Toll	Base Toll x 12
NPV(US$1,000)	-60,091	450
ROI	0.17	1.99
FIRR	Unsolved	12.7%

Source: JICA Study Team

(2) Loan Repayment and Cash Flow Analysis

The loan repayment plan was prepared to evaluate possible cash flows that would reflect the fund procurement method and repayment conditions. The purpose of this analysis is to estimate the cost of subsidy the government of Uganda would have to provide compensate annual deficit of the project, should the required investment cost be funded by a loan and the maintenance cost by an annual government budget.

Basic assumptions made for the analysis were:

- Toll collection was NOT considered;
- Interest during the construction is assumed to be covered by a subsidy;
- The government will provide the subsidy required to compensate annual deficit for the operation body;
- Hence, a scheme of short-term borrowings required to cover the annual deficit is NOT assumed in the cash flow;
- A repayment method of the loan is assumed to be an equal repayment of the principal; and
- Loan conditions of JICA are assumed preferable as compared with those of AfDB based on Table 9.2.7, and therefore they were applied for the analysis of loan repayment schedule.

Table 9.2.7 Assumptions of Loan Conditions

Conditions	Fund Sources	
	JICA	AfDB
Repayment Period	40 Years	40 Years
Grace Period	10 Years	10 Years
Interest Rate	0.01%	1.0% (11th to 20th years) 3.0% (21st to 40th years)

Source: JICA Home Page
Note: AfDB conditions are based on the Loan Agreement of "Bujagali Interconnecton Project"

- Loan/equity ratios were assumed at 90/10 or 100/0. The former case is more realistic based on the practice of international donor agencies and the 10% equity nearly corresponds to the required cost for 'Land Acquisition' including compensation cost plus the'Tax portion' as shown in Table 9.2.3.
- A price escalation of 6.7% was assumed per annum, based on the recent trend of Consumer Price Index (CPI) as shown in Table 9.2.8, which was applied from the beginning of project implementation (2010) up to the end of the loan repayment term in 2056.

Table 9.2.8 Increase in Consumer Price Index from 2002/03 to 2007/08

	2002/03	2003/04	2004/05	2005/06	2006/07	2007/08	Average
CPI	5.7%	5.0%	8.0%	6.6%	7.5%	7.3%	6.7%

Source: Bank of Uganda

The government will have to provide the subsidy for the cost of loan repayment and interest payment. Further, the government should also bear the operation and maintenance costs annually and periodically from their budget.

Based on the various conditions for loan/equity ratio, the analysis showed that the government have to shoulder annual deficits as shown in Tables 9.2.9 and 9.2.10, and summarized in Table9.2.11.

Table 9.2.9 Cash Flow (Loan/Equity=90/10)

Unit: Mil. US$

	Year		Equity	Loan1	Annual Inflow	Initial Investment	Periodic Maintenance	Routine Maintenance	Loan Repayment	Loan Interest	Annual Outflow	Annual Balance
1		2010	0.2	1.4	1.6	1.60			0.000		1.60	0.000
2		2011	0.4	3.3	3.7	3.71			0.000	0.00014	3.71	-0.000
3		2012	1.1	9.9	11.0	11.05			0.000	0.00048	11.05	-0.000
4		2013	2.6	23.7	26.4	26.38			0.000	0.00147	26.39	-0.001
5		2014	3.9	35.5	39.4	39.41			0.000	0.00385	39.41	-0.004
6		2015	4.2	37.8	42.0	42.04			0.000	0.00739	42.05	-0.007
7	1	2016	3.8	34.6	38.4	38.44		0.00	0.000	0.01118	38.46	-0.015
8	2	2017			0.0			0.01	0.000	0.01464	0.02	-0.024
9	3	2018			0.0		0.01	0.01	0.000	0.01464	0.03	-0.034
10	4	2019			0.0			0.01	0.000	0.01464	0.02	-0.025
11	5	2020			0.0		0.51	0.01	0.000	0.01464	0.54	-0.540
12	6	2021			0.0		0.01	0.01	0.048	0.01464	0.09	-0.086
13	7	2022			0.0			0.01	0.159	0.01463	0.19	-0.186
14	8	2023			0.0			0.01	0.491	0.01462	0.52	-0.519
15	9	2024			0.0		0.01	0.01	1.282	0.01457	1.33	-1.325
16	10	2025			0.0		0.71	0.02	2.464	0.01444	3.21	-3.205
17	11	2026			0.0			0.02	3.726	0.01419	3.76	-3.756
18	12	2027			0.0		0.02	0.02	4.879	0.01382	4.93	-4.927
19	13	2028			0.0			0.02	4.879	0.01333	4.91	-4.911
20	14	2029			0.0			0.02	4.879	0.01284	4.91	-4.911
21	15	2030			0.0		1.00	0.02	4.879	0.01236	5.92	-5.916
22	16	2031			0.0			0.02	4.879	0.01187	4.91	-4.913
23	17	2032			0.0			0.02	4.879	0.01138	4.91	-4.914
24	18	2033			0.0		0.03	0.03	4.879	0.01089	4.94	-4.941
25	19	2034			0.0			0.03	4.879	0.01040	4.92	-4.917
26	20	2035			0.0		11.34	0.03	4.879	0.00992	16.26	-16.260
27	21	2036			0.0		0.03	0.03	4.879	0.00943	4.95	-4.950
28	22	2037			0.0			0.03	4.879	0.00894	4.92	-4.921
29	23	2038			0.0			0.04	4.879	0.00845	4.92	-4.923
30	24	2039			0.0		0.04	0.04	4.879	0.00797	4.96	-4.962
31	25	2040			0.0		1.88	0.04	4.879	0.00748	6.80	-6.803
32	26	2041			0.0			0.04	4.879	0.00699	4.93	-4.929
33	27	2042			0.0		0.05	0.05	4.879	0.00650	4.98	-4.977
34	28	2043			0.0			0.05	4.879	0.00601	4.93	-4.934
35	29	2044			0.0			0.05	4.879	0.00553	4.94	-4.936
36	30	2045			0.0		2.65	0.06	4.879	0.00504	7.59	-7.588
37	31	2046			0.0			0.06	4.879	0.00455	4.94	-4.943
38	32	2047			0.0			0.06	4.879	0.00406	4.95	-4.946
39	33	2048			0.0		0.07	0.07	4.879	0.00357	5.02	-5.017
40	34	2049			0.0			0.07	4.879	0.00309	4.95	-4.954
41	35	2050			0.0		3.58	0.08	4.879	0.00260	8.54	-8.542
42	36	2051			0.0		0.08	0.08	4.831	0.00211	5.00	-4.997
43	37	2052			0.0			0.09	4.720	0.00163	4.81	-4.809
44	38	2053			0.0			0.09	4.388	0.00116	4.48	-4.483
45	39	2054			0.0		0.10	0.10	3.597	0.00072	3.80	-3.796
46	40	2055			0.0		46.32	0.11	2.415	0.00036	48.84	-48.837
47	41	2056			0.0			0.11	1.153	0.00012	1.27	-1.266
		Total	16.3	146.4	162.6	162.63	68.44	1.671	146.367	0.74647	379.48	-216.849

Note: The future prices in the above table includes price escalation
Source: JICA Study Team

Table 9.2.10 Cash Flow (Loan/Equity=100/0)

Unit: Mil. US$

	Year		Equity	Loan1	Annual Inflow	Initial Investment	Periodic Maintenance	Routine Maintenance	Loan Repayment	Loan Interest	Annual Outflow	Annual Balance
1		2010	0.0	1.6	1.6	1.60			0.000		1.60	0.000
2		2011	0.0	3.7	3.7	3.71			0.000	0.00016	3.71	-0.000
3		2012	0.0	11.0	11.0	11.05			0.000	0.00053	11.05	-0.001
4		2013	0.0	26.4	26.4	26.38			0.000	0.00164	26.39	-0.002
5		2014	0.0	39.4	39.4	39.41			0.000	0.00427	39.41	-0.004
6		2015	0.0	42.0	42.0	42.04			0.000	0.00821	42.05	-0.008
7	1	2016	0.0	38.4	38.4	38.44		0.00	0.000	0.01242	38.46	-0.016
8	2	2017			0.0			0.01	0.000	0.01626	0.03	-0.025
9	3	2018			0.0		0.01	0.01	0.000	0.01626	0.04	-0.036
10	4	2019			0.0			0.01	0.000	0.01626	0.03	-0.027
11	5	2020			0.0		0.51	0.01	0.000	0.01626	0.54	-0.542
12	6	2021			0.0		0.01	0.01	0.053	0.01626	0.09	-0.093
13	7	2022			0.0			0.01	0.177	0.01626	0.21	-0.206
14	8	2023			0.0			0.01	0.545	0.01624	0.57	-0.575
15	9	2024			0.0		0.01	0.01	1.425	0.01619	1.47	-1.469
16	10	2025			0.0		0.71	0.02	2.738	0.01604	3.48	-3.480
17	11	2026			0.0			0.02	4.140	0.01577	4.17	-4.172
18	12	2027			0.0		0.02	0.02	5.421	0.01536	5.47	-5.471
19	13	2028			0.0			0.02	5.421	0.01481	5.45	-5.454
20	14	2029			0.0			0.02	5.421	0.01427	5.45	-5.455
21	15	2030			0.0		1.00	0.02	5.421	0.01373	6.46	-6.459
22	16	2031			0.0			0.02	5.421	0.01319	5.46	-5.457
23	17	2032			0.0			0.02	5.421	0.01264	5.46	-5.458
24	18	2033			0.0		0.03	0.03	5.421	0.01210	5.48	-5.484
25	19	2034			0.0			0.03	5.421	0.01156	5.46	-5.460
26	20	2035			0.0		11.34	0.03	5.421	0.01102	16.80	-16.803
27	21	2036			0.0		0.03	0.03	5.421	0.01048	5.49	-5.493
28	22	2037			0.0			0.03	5.421	0.00993	5.46	-5.464
29	23	2038			0.0			0.04	5.421	0.00939	5.47	-5.466
30	24	2039			0.0		0.04	0.04	5.421	0.00885	5.51	-5.505
31	25	2040			0.0		1.88	0.04	5.421	0.00831	7.35	-7.346
32	26	2041			0.0			0.04	5.421	0.00777	5.47	-5.472
33	27	2042			0.0		0.05	0.05	5.421	0.00722	5.52	-5.520
34	28	2043			0.0			0.05	5.421	0.00668	5.48	-5.476
35	29	2044			0.0			0.05	5.421	0.00614	5.48	-5.479
36	30	2045			0.0		2.65	0.06	5.421	0.00560	8.13	-8.131
37	31	2046			0.0			0.06	5.421	0.00506	5.49	-5.485
38	32	2047			0.0			0.06	5.421	0.00451	5.49	-5.489
39	33	2048			0.0		0.07	0.07	5.421	0.00397	5.56	-5.560
40	34	2049			0.0			0.07	5.421	0.00343	5.50	-5.496
41	35	2050			0.0		3.58	0.08	5.421	0.00289	9.08	-9.084
42	36	2051			0.0		0.08	0.08	5.368	0.00234	5.53	-5.534
43	37	2052			0.0			0.09	5.244	0.00181	5.33	-5.333
44	38	2053			0.0			0.09	4.876	0.00128	4.97	-4.970
45	39	2054			0.0		0.10	0.10	3.996	0.00080	4.20	-4.196
46	40	2055			0.0		46.32	0.11	2.683	0.00040	49.11	-49.105
47	41	2056			0.0			0.11	1.281	0.00013	1.39	-1.395
		Total	0.0	162.6	162.6	162.63	68.44	1.671	162.631	0.82942	395.78	-233.154

Note: The future prices in the above table include price escalation
Source: JICA Study Team

Table 9.2.11 Summary of Required Subsidy of Uganda Government

Unit: US$ million

Loan/Equity ratio	Max annual subsidy	Average annual subsidy	Max annual Loan Repayment	Average Annual Loan Repayment
90/10	48.837	4.614	4.879	3.114
	Year 2055	-	Year 2027-2050	-
100/0	49.105	4.961	5.421	3.460
	Year 2055	-	Year 2027-2050	-

Source: JICA Study Team

Based on the above cash flow analysis, the maximum annual subsidy of US$49.0 million is estimated to be required for 2055 when large periodic maintenance will be incurred but the averaged annual subsidy is estimated at US$4.6~5.0 million from 2010 to 2056. Within the annual flow of required subsidy, a maximum loan repayment estimated at US$4.8~5.4 million will continue from 2027 to 2050 but the averaged annual loan repayment is estimated at US$3.1~3.4 million from 2010 to 2056.

In comparison to the UNRA's budget for 2008/2009 at Ushs 949 billion (US$ 474 million), among which Ushs 775 billion (US$389 million) is allocated to National Road Construction (refer to Table 2.1.13), the average annual subsidy required for routine and periodic maintenance as well as loan repayments will account to about 1% of UNRA's total budget or 1.2% of UNRA's construction budget.

9.3 Overall Evaluation of Project

9.3.1 Economic Evaluation

Major quantifiable economic benefits derived from the proposed project were composed mainly of savings in vehicle operating cost and travel time cost. The project EIRR for the base case was estimated at 17.1 %. Sensitivity analysis, at reduced traffic demand of 20 % and increased project cost by 20 %, resulted to an EIRR of 13.7% which established the economic feasibility of the project.

In addition to these quantitative benefits, unquantifiable benefits also suggest the importance of improving the infrastructure network, especially for the trunk road including the Trans-African Highway 8 (TAH 8) connecting the capital cities in Central Africa.

From the Study results, it is concluded that high priority should be given to the implementation of the project for the promotion of economic and social development of the country and Central Africa.

9.3.2 Financial Evaluation

Despite the higher economic viability of the project, the analysis conducted for Financial IRR (ROI) shows that the project will be unable to attract the private sector to provide the project investment, unless significant financial input to the project is undertaken by the government.

If the government adopts s JICA as the financing source for funding the procurement, it has to provide an annual fund estimated at US$ 4.6 million on average for a 47-year period from 2010 to 2056 to cover cumulative annual deficits.

The required annual budget for maintenance and loan repayment for the project is estimated at 1.2% of UNRA's construction budget in 2008/2009. Although the construction budget includes funds from Donor countries, it appears that it would not pose difficulty for UNRA to increase its budget to pursue the implementation of the Project, based on the high economic feasibility of the Study.