CHAPTER 9 COST ESTIMATE

CHAPTER 9 COST ESTIMATE

9.1 General

The costs derived in this chapter are based on mean prices from April to June, 1986, Kyat 1 = ¥24, $1 = Kyats 7.5 without allowances for future inflation. The cost estimations developed for this study are based on the present construction conditions in Burma.

9.2 Cost Element

In developing the unit cost, each item has been broken down into components such as labour, materials, equipment, overhead, profit, etc.

In addition, each element has been divided into local and foreign expenditures.

The local currency component includes cost of:

- Domestic materials and supplies, of which the country is a net exporter
- Wages of local personnel
- Overhead and profit of local corporations.

The foreign currency component includes cost of:

- Imported equipment, materials and supplies
- Domestic materials of which the country is a net importer
- Wages of expatriates
- Overhead and profit of foreign firms.

(1) Working Conditions

Calculated workable days/months are based on the weather conditions shown in Appendix Table 9.2.1.

1) In rainy season (June to October) earth work is impossible.

2) From April to May, labour work is impossible from noon to 2 PM because of high temperature.

Hydrograph at Kyawzwa shown in Appendix Fig. 9.2.1 indicates that the water level in the dry season varies from E.L 18.3 m to 19.5 m, and in rainy season it can be about 12 meters higher with flooding from July through October.

Therefore, substructure work in the river would be impossible in the rainy season.

(2) Tax and Duty

For budgeting purposes, the cost of Burmese tax or duty on imported equipment or materials should be included. However, the economic evaluation requires these taxes and duties to be disregarded. These taxes and duties are shown in Appendix Tables 9.2.2 and 9.2.3.

(3) Transportation Charges

Transportation charges from Yokohama to Rangoon and inland transportation charges are shown in Appendix Tables 9.2.4 and 9.2.5.

(4) Cost of Materials

The unit costs of the major construction materials are shown in Appendix Tables 9.2.6 and 9.2.7. The costs of imported materials are based on the FOB Yokohama price including transportation charges from Yokohama to the bridge site; charges for local materials are based on the market price in Kyawzwa.

(5) Labour Cost

Unit labour costs are shown in Appendix Tables 9.2.8 and 9.2.9. These costs are based on actual rates prevailing in Burma.

The estimated labour rates do not include social benefits, travel costs, sick leave, etc.

Income tax is shown Appendix Table 9.2.3.

(6) Cost of Machinery and Equipment

The investigation of the inventory of construction machines and equipment possesed by the Construction Corporation indicates that some of them which are suited for the bridge construction work seemes to be available for this project.

However, the essential part of the machinery and equipment required for this project is obliged to be imported. The local periopheral techniques to maintain and supply the machinery and equipment seems to be not yet up to the mark, and spare parts would also be required to be imported.

Classifyig the required machinery and equipment into one that can be locally provided with and another that shall be imported (referring to Appendix Tables 8.4.4.1 - 5), the cost estimate was carried out.

The costs of major machinery and equipment are shown in Appendix Table 9.2.10.

The operating costs are based upon the government official prices in Burma.

(7) Land Acquisition and Compensation Costs

The bridge site belongs to the government, and no land acquisition costs are required to be estimated. Neither houses nor any other private property on the bridge site will interfere with bridge construction. Therefore, no land acquisition or compensation cost is estimated.

9.3 Unit Cost

The construction costs are devided as shown below:-

- Direct Construction Cost
  - Structure Cost
  - Machine Charge
  - General Site Office Expense
  - Site Preperatory Work Cost

- Indirect Construction Cost
  - General Home Office Expense
  - Engineering Fee
  - Contingency

The unit cost of each work item in the structure cost, which are most directly proportional to the quantities of structure, are estimated. The results are shown in Appendix Table 9.3.1 to 9.3.3.

9.4 Construction Cost

For both the road bridge and the rail-cum-road bridge, the construction costs are estimated for the items mentioned in Section 9.3. The summary of the costs is shown in Table 9.4.1. These costs are broken down as follows:-

- Direct Construction Cost

  The summary of the direct costs are shown in Table 9.4.2 and 9.4.3. Each element of the structure costs are shown in Table 9.4.4 to 9.4.5, and the break down of the cost elements are shown in Appendix Tables 9.4.1 to 9.4.9.

- Indirect Construction Costs

  The indirect costs, i.e. 10% of the direct cost for general home office expense, are estimated by referring to other studies in Burma.

- Engineering Fee

  Detailed engineering service fee and supervising fee are included.

- Contingencies

  10% is allocated for construction cost and engineering fee to cover phisical contingencies.

Table 9.4.1 PROJECT COST

Unit: Million Kyats

	ITEM	F.C	L.C	FC+LC	T & D	TOTAL
1.	Road Bridge					
1.1	Construction Cost					
	Direct Cost	332.1	85.5	417.6	43.7	461.3
	Indirect Cost	33.2	8.6	41.8	4.4	46.2
	Sub-total	365.3	94.1	459.4	48.1	507.5
1.2	Engineering Fee	42.0	4.2	46.2	0	46.2
1.3	Contingencies	40.7	9.8	50.5	4.8	55.3
1.5	Project Cost	448.0	108.1	556.1	52.9	609.0
2.	Rail-cum-Road Bridge					
2.1	Construction Cost					
	Direct Cost	461.8	79.2	541.0	44.3	585.3
	Indirect Cost	46.2	7.9	54.1	4.4	58.5
	Sub-total	508.0	87.1	595.1	48.7	643.8
2.2	Engineering Fee	42.0	4.2	46.2	0	46.2
2.3	Contingencies	55.0	9.1	64.1	4.9	69.0
2.4	Project Cost	605.0	100.4	705.4	53.6	759.0

Table 9.4.2 DIRECT CONSTRUCTION COST (1)

Road Bridge (PC Box)

Unit: Million Kyats

	ITEM	F.C	L.C	FC+LC	T & D	TOTAL
1.	Superstructure					
	Structure	63.4	17.8	81.2	10.9	92.1
	Machine $(1)^1$	7.0	2.0	9.0	1.4	10.4
	Machine $(2)^1$	24.0	2.3	26.3	3.3	29.6
	Barge Work	4.7	1.3	6.0	0.5	6.5
	Site Expense	28.4	1.9	30.3	2.0	32.3
	Sub-total	127.5	25.3	152.8	18.1	170.9
2.	Substructure					
	Structure	50.7	31.0	81.7	6.9	88.6
	Machine $(1)^2$	7.0	2.0	9.0	1.4	10.4
	Machine $(2)^2$	56.9	2.8	59.7	7.9	67.6
	Barge Work	26.4	7.2	33.6	3.0	36.6
	Site Expense	34.4	2.3	36.7	2.4	39.1
	Sub-total	175.4	45.3	220.7	21.6	242.3
3.	Preparatory Work	29.2	14.9	44.1	4.0	48.1
4.	Total	332.1	85.5	417.6	43.7	461.3

Note: $(1)^1$ substructure machines for superstructure
$(2)^1$ substructure machines

$(1)^2$ General work
$(2)^2$ RCD work

Table 9.4.3 DIRECT CONSTRUCTION COST (2)

Rail-cum-Road Bridge (Steel Truss)

Unit: Million Kyats

	ITEM	F.C	L.C	FC+LC	T & D	TOTAL
1.	Superstructure					
	Structure	199.3	15.5	214.8	12.1	226.9
	Machine (1)[1]	1.4	0.4	1.8	0.3	2.1
	Machine (2)[1]	23.6	1.7	25.3	3.2	28.5
	Barge Work	0	0	0	0	0
	Site Expense	27.4	1.8	29.2	2.0	31.2
	Sub-total	251.7	19.4	271.1	17.6	288.7
2.	Substructure					
	Structure	46.1	29.4	75.5	6.3	81.8
	Machine (1)[2]	12.3	3.4	15.7	2.5	18.2
	Machine (2)[2]	56.4	2.7	59.1	7.9	67.0
	Barge Work	31.0	7.5	38.5	3.5	42.0
	Site Expense	35.1	1.9	37.0	2.5	39.5
	Sub-total	180.9	44.9	225.8	22.7	248.5
3.	Preparatory Work	29.2	14.9	44.1	4.0	48.1
4.	Total	461.8	79.2	541.0	44.3	585.3

Notes: (1)[1] substructure machines for superstructure
(2)[1] substructure machines

(1)[2] General work
(2)[2] RCD work

Table 9.4.4 COST OF SUPERSTRUCTURE (1)

Superstructure

Unit: Million Kyats

	ITEM	F.C	L.C	FC+LC	T & D	TOTAL
1.	Road Bridge					
	PC Girder	46.9	14.5	61.4	8.3	69.7
	Accessories	9.1	1.2	10.3	1.4	11.7
	Temp. Work	7.4	2.1	9.5	1.2	10.7
	Total	63.4	17.8	81.2	10.9	92.1
2.	Rail-cum-Road Bridge					
	Truss	149.6	3.6	153.2	6.1	159.3
	Slab	4.9	6.1	11.0	0.7	11.7
	Painting	12.1	0.6	12.7	0.4	13.1
	Accessories	19.5	0.4	19.9	3.0	22.9
	Temp. Work	13.2	4.8	18.0	1.9	19.9
	Total	199.3	15.5	214.8	12.1	226.9

Table 9.4.5 COST OF SUBSTRUCTURE (2)

Substructure

Unit: Million Kyats

	ITEM	F.C	L.C	FC+LC	T & D	TOTAL
1.	Road Bridge					
	RCD Pile	37.8	17.1	54.9	5.2	60.1
	Footing	9.2	8.8	18.0	1.2	19.2
	Pier	3.7	5.1	8.8	0.5	9.3
	Total	50.7	31.0	81.7	6.9	88.6
2.	Rail-cum-Road Bridge					
	RCD Pile	33.8	15.1	48.9	4.7	53.6
	Footing	7.8	7.3	15.1	1.0	16.1
	Pier	4.5	7.0	11.5	0.6	12.1
	Total	46.1	29.4	75.5	6.3	81.8

9.5 Maintenance Cost

Data of past maintenance costs for steel railway bridges, i.e. Ava Bridge and Sittang Bridge, obtained from Burma Railway Corporation are shown in Appendix Table 9.5.1 and Table 9.5.2. The budget of these maintenance costs are limited and the maintenance was occasionally carried out for serious damages.

Date of the maintenance cost of PC bridge are not available in Burma. The environment of the proposed bridge site is quite free from industrial exhausts and sea water.

For the estimates of maintenance costs, following assumptions are adopted:-

- Steel truss members shall be painted 4 times in 50 years.
- The track rails and the sleepers shall be exchanged once in 50 and 10 years, respectively.
- The roadway pavement shall be exchanged once in 10 years.
- The other portion shall be free from maintenance.
- To estimate maintenance cost, present cost values shall be used, and no escalation shall be included.

The results of estimation are shown in Table 9.5.1.

Table 9.5.1 MAINTENANCE COST (KYATS IN THOUSAND)

1. Maintenance Cost of Each Work Item

ITEM	FC	LC	FC + LC	T & D	Duration (years)
Painting	2,175	5,040	7,215	1,664	12.5
Train Rail	878	115	993	90	50
Sleeper	42	382	424	4	10
Pavement	295	507	802	45	10

2. Maintenance Cost of Road Bridge a Year

ITEM	FC	LC	FC + LC	T & D	TOTAL
Pavement	30	51	81	5	86

3. Maintenance Cost of Rail-cum-Road Bridge a Year

ITEM	FC	LC	FC + LC	T & D	TOTAL
Painting	174	403	577	133	710
Train Rail	18	2	20	2	22
Sleeper	4	38	42	0	42
Pavement	30	51	81	5	86
Total	226	494	720	140	860

CHAPTER 10 ECONOMIC EVALUATION

CHAPTER 10 ECONOMIC EVALUATION

10.1 General

Economic evaluation was conducted in two phases. The first was for the comparison of bridge types by taking into consideration the project cost and benefits of diverted traffic, induced traffic and savings in ferry boat operation. Transportation costs for ferry boats, road vehicles and trains were studied and economic benefits estimated to compare advantages with the project to conditions without it. Project costs were approximated for each alternative bridge type and economic analysis conducted to estimate benefit-cost ratio and internal economic return. The result of economic analysis is tentative and used as one factor in the comparative selection of bridge type in Chapter 7.

The first phase of the study recommended, through the interim report, August 1986 with which Government of Burma concurred, to study the following two representative bridges:

- PC box girder bridge - road bridge
- Steel single deck truss bridge - rail-cum-road bridge (railway on oneside)

The economic evaluation in the second phase was to determine the economic return of the above 2 bridges by taking into account the development benefits accruable from the bridge construction and the refined cost with the preliminary designing. While a regional development plan in association with the bridge project is in process of drafting by Ministry of Finance and Planning, the development forecast of this study was determined after time to time discussions in the course of study. The estimate of economy in DIA was found within the agreeable range by Burmese side, from which the development benefit was estimated as described in Chapter 3.

The result indicates that values in economic analysis, in terms of B/C ratio, internal rate of return (IRR) and net present value, are not high for both types of the project. However, the study emphasizes the bridge project priority from the viewpoint of national trunk transport

network development and regional economic development as discussed in other Chapters.

10.2 Economic Cost of Transportation

10.2.1 Cost of the River Crossing by Ferry

Cost data of boats are difficult to obtain. Economic cost of the ferry boats was estimated by excluding duties and taxes from the financial cost of the boat by referring to the cost analysis of road vehicles as stated in Appendix Table 10.2.2.2. The cost of high-speed diesel fuel was assessed by referring to a feasibility study in late 1985. K 7.58 per Impg of diesel and K 8.31 per Impg of gasoline are used in the economic cost analysis. Unskilled labour cost was assessed at 2/3 of market rate, by taking into account the prevailing conditions of employment in the economy.

Foreign currency was not shadow priced. Using the current foreign exchange rate in the economic study is a common practice in Burma for feasibility studies of projects, and this approach is accepted by other funding organizations including ADB and World Bank.

Vessels are classified into five or six kinds. Information gathered during the traffic survey at jetty points in December 1985 and January 1986, is presented in Appendix Tables 10.2.1.1 through 10.2.1.4.

Generally Z-craft vessels are made of steel and are repaired and overhauled periodically. Different types of passengers boats are also in use. Most are covered by wood and require frequent painting and repairs, which are done along the open river bank. Engine maintenance and repair works are done in Mandalay/Rangoon. In Monywa and some other crossing points, small manual boats of capacity with 8 - 15 persons are used. Passenger boats in the DIA are classified into five groups as shown in Table 10.2.1.

Records of accountings and relevant data were hard to find in the Direct Influence Area. All were assessed and classified after interviews with boat crews and jetty staff.

Table 10.2.1 FERRY BOATS

Group	H.P	Capacity Rd Vehicles/Persons		Life (Years)	Cost, ('000)	Crossing
Z-craft H.I.C	250x2	8	100	40	7,000	Prome
" "	245x2	5	100	40	4,000	Patanago
" "	120x2	5	70	40	4,000	Myede
Z-craft I.W.T.C	215x2	7	100	40	6,000	Prome
Z-craft Coop	120x1	3	70	20	2,000	Prome, Monywa
" "	140x2	7	120	40	4,000	Nyaung U, Magwe
Passenger Boat						
Passenger Boat	120,110	-	150	15	400	Chauk, Prome, Myede, Nyaung U Monywa.
Passenger Boat	120,90	-	200-90	15	200	Yenanchaung, Myede, Magwe.
Passenger Boat	30	-	100-30	10	40	Yenanchaung, Patanago, Chauk.
Speed Small Boat	15	-	15	10	25	Nyaung U.
Small Boat	Manual	-	8	5	8	Monywa.

From traffic surveys, December 1985 - January 1986.
See details in Appendix Tables 10.2.1.1 - 10.2.1.4.

The economic cost of river crossing by ferry was studied for such items as initial procurement cost, annual maintenance, annual wages and fuel. The initial cost was annualized and a total average annual cost and average cost per trip estimated.

The resultant economic costs of ferry boat operation are summarized in the following Table 10.2.2. Passenger boat operation per trip costs 1/5 of that of the Z-craft operation in the Direct Influence Area. If small manual passenger boats in Monywa are excluded, the average cost per trip of powered passenger boats is 39 k, still less than 1/3 of the cost of a Z-craft.

Table 10.2.2 THE ECONOMIC COSTS OF Z-CRAFT AND PASSENGER BOAT OPERATIONS

	Trip per Day	Capacity per day	Cost per day	Cost per trip
Total of Z-craft Operations	92	349 veh. 9,590 persons	K 14,059	K 153
Total of Passenger boat Operations	603	18,228 pers	K 15,789	K 26

From Appendix Tables 10.2.1.1 - 10.2.1.4.

10.2.2 Vehicle Operating Cost

Burma has a number of useful different vehicles; some are assembled in Burma and others imported. Their life is quite long and some date to pre-World War II. Most of the components of these latter vehicles have been replaced. The long period of use is characteristic of Burma and is considered in the economic calculation.

Vehicle types are classified into small vehicles, pickup buses, buses and trucks. Typically vehicles are assembled in H.I.C plant in Burma and sold to government agencies. They are, then, sold to the private sector after years of use. Vehicles import is strictly controled under the foreign exchange policies. But used pickup import in particular has increased since 1981/82. No information is available for the percent shares of these two patterns of assembling and import in the registration figures of vehicles.

In the cost analysis, the assembling-use pattern is taken into consideration for all vehicles, except pickup buses. The used pickups, although quite new, are imported for use as passenger buses. Most small buses belong to this category, although there are some MAZDA T 2000 pickups assembled in the country. The imported pickup is used for the cost analysis of this vehicle type.

Economic costing method applied to ferry boats in the previous sub-section 10.2.1 is also used for the analysis of vehicle operating cost. Economic cost analysis used in previous studies of Burma and in Thailand of late 1985 were referred to when necessitated.

Representative vehicle types used for the economic cost analysis are shown in Table 10.2.3.

Table 10.2.3 REPRESENTATIVE VEHICLES

	Jeep (x 2,000)	Pickup (14 seats)	Bus B M (26 seats)	Truck T E (6.5 tons)
Annual mileage (ml.)	20,000	40,000	30,000	30,000
Years in use (yr.)	15	15	30	30
Fuel	gasoline	gasoline	diesel	diesel
Fuel consumption (ml./g)	20	15	10	10
Assembled/imported	assembled	imported	assembled	assembled
Government price (Kyat)	130,000	140,000	320,000	230,000

See also Appendix Table 10.2.2.1.

Cost is divided into market price (mostly determined by Government), duties and taxes, and net price where, in some cases, the net price is reassessed to represent the economic cost (see 10.2.1 of this chapter). Divided costs are shown in Appendix Table 10.2.2.2. Customs and sales tax portion, which are excluded from the economic cost determinations, are quoted from the customs table of Customs Department. Selected items are shown in Appendix Table 10.2.2.3. Selected economic costs are compared with studies in Burma by GITEC in 1982 and in Thailand in 1985 by CEC, PCI, etc. as presented in Appendix Table 10.2.2.5. The economic costs are reasonable compared with these data.

The costs, calculated for vehicle operating cost per mile and per hour, are compiled in Appendix Table 10.2.2.4. They are summarized in Table 10.2.4.

10.2.3 Train Operation Cost

Operation cost is estimated by assuming the following service between Kyangin and Prome passing through the project bridge:

- Two round trips of mixed train per day.
- A train is composed of 8 passenger coaches, two wagons (60 seats per coach and 30 ton-capacity per wagon)

Table 10.2.4 VEHICLE OPERATING COST

(In Kyat)

	Jeep	Pick-up	Bus	Truck
Financial				
A. Running cost per mile				
Depreciation	0.43	0.23	0.36	0.26
Tire wear	0.12	0.13	0.34	0.38
Fuel	0.19	0.24	0.26	0.26
Maintenance/Repair	0.40	0.31	1.16	1.17
Total	1.14	0.91	2.12	2.07
B. Time cost, Kyat per hour				
Wage	-	5.25	6.25	10.00
Insurance	0.36	0.41	0.60	0.61
Interest	2.71	2.92	6.67	4.79
Overhead	-	4.29	6.76	7.70
Total	3.07	12.87	20.28	23.10
C. Total vehicle operating cost per mile (V = 25 ml./H)	1.26	1.42	2.39	2.99
Economic				
A. Running Cost				
Depreciation	0.28	0.07	0.20	0.14
Tire wear	0.07	0.08	0.21	0.24
Fuel	0.44	0.58	0.80	0.80
Maintenance/Repair	0.28	0.22	0.82	0.82
Total	1.07	0.95	2.03	2.00
B. Time cost per hour				
Wage	-	4.84	5.84	9.59
Insurance	0.31	0.34	0.51	0.51
Interest	1.75	0.88	3.75	3.21
Overhead	-	3.03	5.05	6.66
Total	2.06	9.09	15.15	19.97
C. Total vehicle operating cost (V = 25 m /H) per mile	1.15	1.31	2.64	2.80

- An average speed of 20 mph.

The costs are determined as in Appendix Tables 10.2.3.1 and 10.2.3.2 with a summery as follows:

	Kyat/train-mile
Depreciation	22.73
Maintenance	2.39
Crew	0.28
Fuel	10.01
Overhead	7.08
Total	42.48

(per seat-mile 0.044 Kyat
per capacity-ton mile 0.236 Kyat)

The above cost does not include permanent way, station costs, etc., because they are included in the cost of railway extension from Kyangin and from Prome, which are assumed to be completed by the Burmese government before the completion of the bridge project. In this economic analysis they are handled as the "sunk cost."

10.2.4 Time Values

Despite numerous discussions of time values in the economic evaluation of project, no agreement has been reached yet for methodology and magnitude of values. Particularly in Burma, a problem arises from agriculture sector, the predominant economic sector, which uses labour intensively at specific periods of the year, releasing workers for the off season. In this situation, it is hard to determine the range of time value reflecting the busy season and off season.

Time values of passenger were determined by using per capita GDP, per worker GDP and trip purpose composition. GDP data are shown below.

1985/86	
Population in ('000)	37,115
Active labour force in ('000)	15,130
Provisional, in current prices	
GDP (Kyat mil.)	57,732.6

Output (Kyat mil)		101,912.9
per capita GDP	(Kyat)	1,556
per worker GDP	(Kyat)	3,816
Output per worker	(Kyat)	6,736

Source: Reports 1986/87.

Trip purpose are taken from Table 5.2.4 and supposed as follows

To work, during work	23%	46.0%
To home	23%	
To school and home		1.8%
To shop and others		52.2%
	Total	100.0%

Accordingly, passengers were divided into two groups using the above percentages and time value was calculated. (work hours per year are assumed at 1800 hours)

1/ Associated with works (1985/86)
passengers 0.46 : (6736/300x6) = K 3.74/H

2/ Other purposes (1985/86)
passengers 0.54 : (1556/300x6) = K 0.86/H

3/ In average (1985/86)
3.74 x 0.46 + 0.86 x 0.54 = K 2.18 per hour/person.

The per capita value is assumed to increase by 2.54% p.a. until 1993/94 in accordance with the growth of GDP and population forecast (see Chapter 2).

GDP	1993/94	82,462 million Kyats
Population	1993/94	43,274 thousand
per capital GDP in Kyat		1,906
Output per worker in Kyat		8,250

1) Time cost associated with work (1993/94) K 4.58/H
2) Other purposes (1993/94) K 1.05/H
3) In average
(4.58 x 0.46) + (1.05 x 0.54) = K 2.67 per hour/person

10.3 Economic Benefits

10.3.1 Benefit Derived from the Diverted Traffic

As shown in Appendix Tables 5.4.4.2 and 5.4.4.3, the diverted traffic volume crossing the bridge was estimated for each zone pair. Transport savings are estimated for diverted traffic by finding a balance between the cost with the project and the cost without the project. The cost with the project is calculated for the fastest route through the bridge, and without the project for fastest route via ferry boat crossing.

The input data and conditions necessary for the estimate of cost savings are same as those for diversion traffic estimate, shown in Fig. 5.4.3 and Appendix Table 5.4.4.1. The results of the estimate are presented in Table 10.3.1 along with the benefits of induced traffic.

10.3.2 Benefit Derived from the Induced Traffic

In 5.4.5 of Chapter 5, induced traffic is estimated based on the expectation that additional traffic will be encouraged by reduced travel time by the bridge. Benefit accruing to the induced traffic volume are measured at half of the same volume of diverted traffic. The estimated total induced benefits are 23.2% of the total diverted benefits. They are shown in Table 10.3.1.

10.3.3 Benefit Derived from the Ferry Operation

The volume of river-crossing traffic falls as part of it diverts to the project bridge in 1993/94 and afterward. However, river crossing service will not be closed since traffic that has not been diverted will need to use it. The traffic that remains on the ferry service will continue to increase, and the river-crossing service will require additional ferry boats if the demand becomes great enough.

If the above situation is compared to the case "without the bridge", benefits can be measured as postponed capital investment

Table 10.3.1 TRANSPORT COST SAVINGS IN 1993/94

(In Kyat/Day)

			Savings in Running Cost	Savings in Time Cost	Total
I Road Bridge	Diverted	Passengers	3,241.9	8,339.4	11,581.3
		Cargoes	15,386.6	3,200.2	18,586.8
		Passengers on Vehicles	1,612.1	1,143.5	2,755.6
		Cargoes on Vehicles	4,638.9	2,144.3	6,783.2
		Total	24,879.5	14,827.4	39,706.9
			67.7%	37.3%	100.0%
	Induced	Passengers	2,043.3	5,652.1	7,695.4
		Passengers on Vehicles	857.6	676.3	1,533.9
		Total	2,900.9	6,328.4	9,229.3
			31.4%	68.6%	100.0%
	Total	Passengers	5,285.2	13,991.5	19,276.7
		Cargoes	15,386.6	3,200.2	18,586.8
		Passengers on Vehicles	2,469.7	1,819.8	4,289.5
		Cargoes on Vehicles	4,638.9	2,144.3	6,783.2
		Total	27,780.4	21,155.8	48,936.2
			56.8%	43.2%	100.0%
II Rail-cum-Road Bridge	Diverted	Passengers	3,602.6	9,873.7	13,476.3
		Cargoes	17,703.8	3,406.7	21,110.5
		Passengers on Vehicles	1,612.1	1,143.5	2,755.6
		Cargoes on Vehicles	4,627.9	2,144.3	6,772.2
		Total	27,546.4	16,568.2	44,114.6
			62.5%	37.5%	100.0%
	Induced	Passengers	2,266.5	6,269.3	8,535.8
		Passengers on Vehicles	951.2	750.2	1,701.4
		Total	3,217.7	7,019.5	10,237.2
			31.4%	68.6%	100.0%
	Total	Passengers	5,869.1	16,143.0	22,012.1
		Cargoes	17,703.8	3,406.7	21,110.5
		Passengers on Vehicles	2,563.3	1,893.7	4,457.0
		Cargoes on Vehicles	4,627.9	2,144.3	6,772.2
		Total	30,764.1	23,587.7	54,351.8
			56.6%	43.4%	100.0%

(savings in interest because of postponed purchase of ferry boats) and associated savings in running costs of boats. These savings are approximately 7% of the benefits of diversion and induced traffic.

Savings in ferry boat operation cost are estimated by the following procedures.

1) In the total of 8 crossings, capacity, users, service ratio (users/capacity ratio) are determined as in Appendix Table 10.3.3.1, where users are assumed to increase 5.0% per annum upto 2000 and 4.5% per annum afterwards.

2) When the service ratio increases more than 1.20, new boats equivalent to 2/3 of the basic capacity are to be purchased. The purchase is assumed both for the cases "without project" and "with project". Appendix Table 10.3.3.1 shows the case without the project and Appendix Table 10.3.3.2 with the project.

   Since the difference between the volume for the road bridge and that for the rail-cum-road is not substantially large, the case with the rail-cum-road bridge is taken for the estimate, being shown in Appendix Table 10.3.3.2.

3) Economic costs of new ferry boats, maintenance, wages and fuel are estimated by using the cost analysis of Appendix Tables 10.2.1.1 through 10.2.1.4. The additional costs "without the project" and "with the project" are shown in Appendix Table 10.3.3.3. The balances between "without" and "with" are considered as savings (benefits) in ferry cost.

10.4 Economic Cost of Alternative Bridge Types

Alternative bridge types were studied in Chapter 7 and their economic costs, including approach sections of one mile on both sides, are tentatively summarized in Table 10.4.1.

Table 10.4.1 ALTERNATIVE BRIDGE TYPES, ECONOMIC COST[1] (1)

(In 1985/86 prices)

	Road Bridge				Rail-cum-road Bridge			
	1. Steel Truss		2. PC Box Girder		3. Steel Truss Rail on one-side		4. Staging St. Br. Rail on one-side[2]	
	yen Bill	K mill.	yen Bill	K mill.	yen Bill	K mill.	yen Bill	K mill.
I BRIDGE COST								
1 Super Structure	5.5	227	4.0	167	6.8	283	5.5	227
2 Sub-structure	5.8	242	5.8	241	6.1	254	6.2	258
3 Sub-total	11.3	469	9.8	408	12.9	537	11.7 (+ 4.0)	485 (+ 167)
4 Prep. Works	1.1	46	1.1	46	1.1	46	1.1	46
5 Overheads	1.2	52	1.1	46	1.4	58	1.3 (0.4)	53 (+ 17)
6 Engineering	1.0	42	1.0	42	1.0	42	1.0	42
7 Total	14.6	609	13.0	542	16.4	683	15.1 (+ 4.4)	626 (+ 184)
8 Contingencies, etc.	1.5	61	1.3	54	1.6	68	1.5 (+ 0.4)	63 (+ 18)
9 Total	16.1	670	14.3	596	18.0	751	16.5 (+ 4.9)	689 (+ 202)
							21.4	891
II APPROACH SECTION COST								
Total	0.3	12	0.3	12	0.5	22	0.3 (0.2)	12 (+10)
III G. Total	16.4	682	14.6	608	18.5	773	16.8 (+5.1)	701 (+212)
						1st & 2nd	21.9	913

1 Customs duty and tax are not included.
2 Figures in ( ) are the cost in the 2nd stage.
3 Kyat 1 = Yen 24.-

Table 10.4.1 ALTERNATIVE BRIDGE TYPES, ECONOMIC COST[1] (2)

	Rail-cum-road Bridge							
	5. Steel Double Deck		6. Steel, Road/ Railway		7. PC Box Girder Rail on one side		8. Steel & PC Rail Rail on one side	
	yen Bill	K mill.	yen Bill	K mill.	yen Bill	K mill.	yen Bill	K mill.
I BRIDGE COST								
1 Super Structure	6.6	273	6.1	252	5.1	213	6.4	266
2 Sub-structure	6.1	254	6.1	254	7.7	321	6.7	279
3 Sub-total	12.7	527	12.2	506	12.8	534	13.1	545
4 Prep. Works	1.1	46	1.1	46	1.1	46	1.1	46
5 Overheads	1.3	57	1.3	55	1.4	58	1.4	59
6 Engineering	1.0	42	1.0	42	1.0	42	1.0	42
7 Total	16.1	672	15.6	649	16.3	680	16.6	692
8 Contingencies, etc.	1.6	67	1.6	65	1.7	68	1.7	69
9 Total	17.7	739	17.2	714	18.0	748	18.3	761
II APPROACH SECTION COST								
Total	0.8	34	0.5	22	0.5	22	0.5	22
III G. Total	18.5	773	17.7	736	18.5	770	18.8	783

10.5 Economic Benefit Cost Analysis

10.5.1 Comparison of Bridge Types

Benefit cost ratio and internal economic return are calculated for bridge types under consideration according to the following assumptions.

- Detailed engineering study, 1987/88
- Construction period, 1988/89 - 1992/93
- Open for public, 1993/94
- Periodic maintenance, every ten years
- Benefits in transport cost savings of diverted traffic, induced traffic and of ferry operation.
  They increase at 5% annually for 1985/86 - 2000/01 and 4.5% annually for 2000/01 - 2022/23
- Development benefit is added when the selected two types are assessed.
- The cost of 1-mile-approach sections on both sides is not included. The cost of the bridge from abutment to abutment is used in the analysis.
- Residual value in 2022/23, 50% of the initial cost.
- Benefit streams from 1993 to 2023 (30 years) are shown in Appendix Table 10.5.1.
- Approach roads and railways are assumed to be constructed before the bridge completion.

The results indicate that economic return is in the range of 3.4 - 4.4% for all bridge types. The following points are noted.

Road bridge ····· Type 2 has a higher IRR than Type 1. The type 2 is recommended.

Rail-cum-road bridge ····· Although no substantial differences in IRR are found among the alternatives, the followings are noted, referring to Table 10.4.1.

Type 4 shows the lowest IRR because of cost burden of its second stage.

Types 6 and 8 present approximately the same return as the other types of 3, 5 and 7. These two types are ranked second by viewpoints of engineering as stated in Chapter 7.

Types 3, 5 and 7 are identified to have priority. Differences in IRR are marginal. They were submitted to discussions in the interim report meeting as stated in the following subsection, 10.5.2.1.

10.5.2 Selected Bridge Types

10.5.2.1 Interim Discussion

The first phase of this study recommended one PC box girder road bridge and three rail-cum-road bridges. They were presented in the interim report of August 1986. After discussions with the Construction Corporation, BOA, the followings are determined to study further in the second phase:

- Road Bridge ..... PC box girder type
- Rail-cum-Road Bridge ..... Steel single deck truss type

10.5.2.2 Refinement of Studies on the above bridges

The costs of the above two types in terms of economic cost are summarized as in Table 10.5.2. The maintenance cost assumed to incur every 10 years are also shown in Table 10.5.2.

Project expenditure is determined by studying the implementation programme. Fuel cost used in the construction work and cost of unskilled labourers were assessed and adjusted in the economic cost by referring to the data in Appendix Tables 10.5.2 - 10.5.3.

Economic benefits related to the diverted traffic were studied as in 10.3 of this chapter, which is closely associated with traffic forecast in Chapter 5. They are composed of savings in transport cost generated from traffic diversion, induced traffic and in the ferry boat river crossing operation.

Benefits were forecasted to increase 5% per annum upto 2000 and 4.5% per annum afterward, at the same ratio of increase in GRP. Estimated benefits in 1993, 2000 and 2010 are shown in Table 10.5.1.

Table 10.5.1 ECONOMIC BENEFITS IN 1993, 2000 AND 2010

Road Bridge

(Kyat '000/year)

	Diverted	Induced	Ferry	Total	Development	G. Total
1993	14,493	3,369	0	17,862	2,047	19,909
2000	20,393	4,741	2,320	27,454	16,376	43,830
2010	31,670	7,362	2,320	41,352	25,431	66,783

Rail-cum-road Bridge

	Diverted	Induced	Ferry	Total	Development	G.Total
1993	16,101	3,737	0	19,838	2,353	22,191
2000	22,656	5,258	2,320	30,234	18,829	49,063
2010	35,184	8,166	2,320	45,670	29,241	74,911

See Appendix Table 10.5.4.

Development of the economy in DIA was studied in Chapter 3 through which development benefit attributable to the bridge is taken into the benefit streams as shown in Appendix Table 10.5.4. The above Table 10.5.1 shows the figures in the selected years.

Assumptions for the economic analysis are described in 10.5.1 of this Chapter. Economic rate of return, benefit cost ratio and present value are calculated firstly by using the traffic related benefit (diverted, induced and ferry cost savings).

Table 10.5.2 PROJECT COST SUMMARY

(In 1985/86 prices)

	Foreign		Local		Total		Taxes		Fin·Total	
	Y. Bill	K. Mill	Y. Bill	K. Mill	Y. Bill	K. Mill	Y. Bill	K. Mill	Y. Bill	K. Mill
1. Road bridge										
Construction	8.77	365.3	2.26	94.1	11.03	459.4	1.15	48.1	12.18	507.5
Engineering	1.01	42.0	0.10	4.2	1.11	46.2	0	0	1.11	46.2
Contingencies	0.98	40.7	0.23	9.8	1.21	50.5	0.12	4.8	1.33	55.3
Total	10.76	448.0	2.59	108.1	13.35	556.1	1.27	52.9	14.62	609.0
		(Adjusted for economic analysis				560.8)[1]				
2. Rail/Road Bridge										
Construction	12.19	508.0	2.09	87.1	14.28	595.1	1.17	48.7	15.45	643.8
Engineering	1.01	42.0	0.10	4.2	1.11	46.2	0	0	1.11	46.2
Contingencies	1.32	55.0	0.22	9.1	1.54	64.1	0.12	4.9	1.66	69.0
Total	14.52	605.0	2.41	100.4	16.93	705.4	1.29	53.6	18.22	759.0
		(Adjusted for economic analysis				708.5)[1]				
3. Maintenance (every 10 years)[2]										
Road bridge	0.01	0.3	0.01	0.5	0.02	0.8	0.001	0.1	0.02	0.9
Rail/road bridge	0.06	2.3	0.12	4.9	0.18	7.2	0.01	0.7	0.19	7.9

Source: From Chapter 9.

1. Adjustment for economic analysis are done by referring Appendix Tables 10.5.2 and 10.5.3.
2. A ten year cycle is assumed for maintenance work. Adjustment for the economic costing is not shown because the adjusted amount is negligible.

They are shown below:

	Road Bridge	Rail-cum-Road Bridge
IRR	4.6%	4.2%
B/C ratio (i = 10%)	0.41	0.38
PW (i = 10%)	K -252 mill	K -333 mill
B/C ratio (i = 4%)	1.15	1.05
PW (i = 4%)	K 65 mill	K 28 mill

Development benefit attributable to the bridge is added to the traffic related benefits, which resulted in the followings. The cost benefit streams are shown in Appendix Table 10.5.5.

	Road Bridge	Rail-cum-Road Bridge
IRR	6.8%	6.4%
B/C ratio (i = 10%)	0.61	0.57
PW (i = 10%)	K -164 mill	K -232 mill
B/C ratio (i = 4%)	1.75	1.63
PW (i = 4%)	K 323 mill	K 348 mill

Sensitivity test is conducted by changing some factors of cost and benefit. The result is shown in Table 10.5.3.

Table 10.5.3 ECONOMIC ANALYSIS

	Road Bridge		Rail/Road Bridge	
	B/C i=10%	IRR -	B/C i=10%	IRR -
A. Bridge project	0.61	6.8	0.57	6.4%
B. Sensitivity				
1. Cost + 20% of A	0.51	5.9%	0.47	5.5%
2. Cost + 10% of A	0.55	6.5%	0.52	5.9%
3. Ben. + 20% of A	0.73	7.9%	0.68	7.5%
4. Cost -10% of A	0.68	7.2%	0.63	7.0%

CHAPTER 11 IMPLEMENTATION PLAN

CHAPTER 11 IMPLEMENTATION PLAN

11.1 Implementation Program for Irrawaddy River Bridge

11.1.1 General

The implementation schedule was studied using the condition that starting of site construction of Irrawaddy River Bridge was defined in the dry season, February 1989, which would be an effective way in taking into consideration of mobilization period. Prior to the commencement of the construction it is necessary to carry out such pre-construction works as soils investigation, detailed engineering design, financial arrangement, etc.

11.1.2 Project Cost

Based on the studies of the preliminary engineering, construction cost, construction procedure, etc., the implementation cost for the Irrawaddy River Bridge Project is summerized in Table 11.1.1.

Table 11.1.1 IMPLEMENTATION COST OF IRRAWADDY RIVER BRIDGE[1]

(Unit: Million Kyats)

Classified Cost	Foreign Currency Portion	Local Currency Portion	Total
Road Bridge			
Construction Cost	401.8	103.4	505.2 (558.1)[2]
Engineering Cost	46.2	4.7	50.9
Total	448.0	108.1	556.1 (609.0)
Rail-cum-Road Bridge			
Construction Cost	558.8	95.7	654.5 (708.1)[2]
Engineering Cost	46.2	4.7	50.9
Total	605.0	100.4	705.4 (759.0)

Notes: 1. Net cost with contingency allowances.
2. Figure in bracket is the cost including tax and duty.

11.1.3 Implementation Schedule

The overall project implementation schedule that was prepared based on the above-mentioned consideration is shown in Fig. 11.1.1. The requirement of each major activity is as described below:

(1) Detailed Engineering Design

The detailed engineering design will require about 12 months for its completion. Due consideration should be given to the commencement of the work because some activity of the work will have a seasonal restriction, for example, soils investigation and survey, the data of which are required at the initial stage of the design work can be conducted only in the dry season.

(2) Tender Process

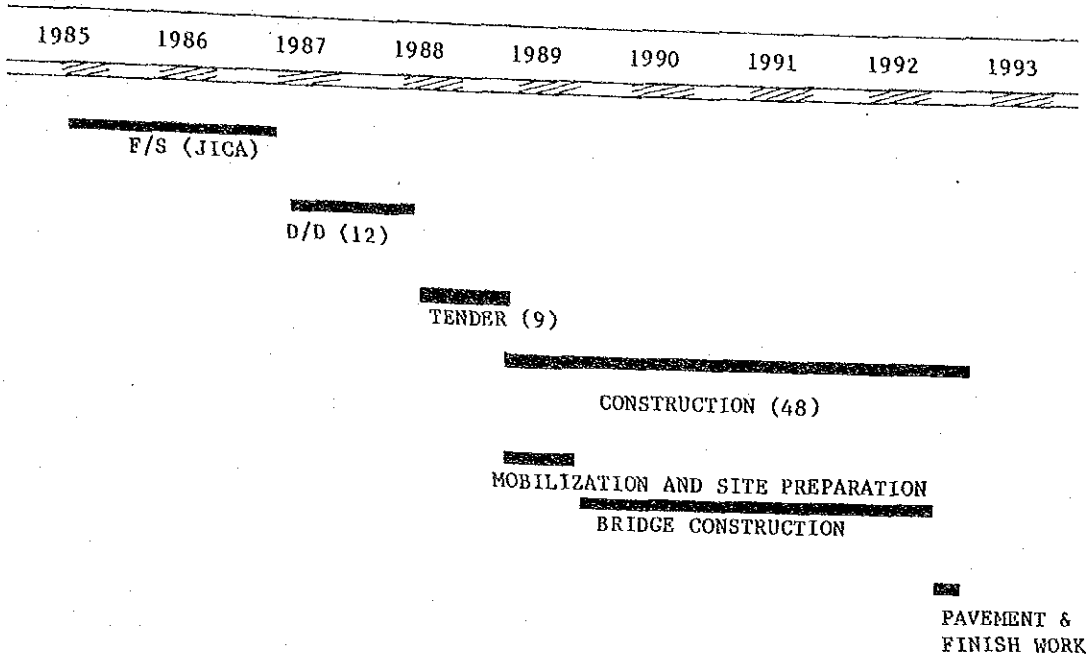
After completion of the detailed engineering design and financial arrangement, several months will be required for the tender process. The prequalification of contractors may also be required before the tender call.

(3) Construction

The initial and final stages of construction should be in the dry season in accordance with the characteristics,of the works and that foundation work should also be conducted in the low water season. Therefore the construction period was estimated at 48 months.

The disbursement schedule of the project was prepared to meet the above-mentioned requirements and is presented in Table 11.1.2.

Fig. 11.1.1 OVERALL IMPLEMENTATION SCHEDULE OF IRRAWADDY RIVER BRIDGE CONSTRUCTION



LEGEND: F/S : Feasibility Study
D/D : Detailed Engineering Design
▨ : Rainy Season

Table 11.1.2 DISBURSEMENT SCHEDULE OF IRRAWADDY RIVER BRIDGE PROJECT COST$_2$

(Unit: Million Kyats)

Cost Item	1987	1988	1989	1990	1991	1992	Total
Road Bridge							
Construction Cost	-	128.9 (143.2)	75.6 (84.0)	115.2 (128.0)	78.6 (84.1)	106.9 (118.8)	505.2 (558.1)
Engineering Cost	8.6	12.7	6.2	8.7	6.3	8.4	50.9
Total	8.6 (8.6)	141.6 (155.9)	81.8 (90.2)	123.9 (136.7)	84.9 (90.4)	115.3 (127.2)	556.1 (609.0)
Rail-cum-Road Bridge							
Construction Cost	-	134.6 (145.6)	153.9 (166.5)	164.4 (177.9)	96.5 (104.4)	105.1 (113.7)	654.5 (708.1)
Engineering Cost	8.6	12.7	6.2	8.7	6.3	8.4	50.9
Total	8.6 (8.6)	147.3 (158.3)	160.1 (172.7)	173.3 (186.6)	102.8 (110.7)	113.5 (122.1)	705.4 (759.0)

Notes: 1. Figure includes contingency allowances and those in bracket include tax and duty.
2. Above cost does not include inflation in prices.

CHAPTER 12 CONCLUSION AND RECOMMENDATIONS

CHAPTER 12 CONCLUSION AND RECOMMENDATIONS

12.1 General

The transportation sector including railway, road and waterway, accounted for 3.4% of the GDP in the fiscal year 1985 and an estimated 3.5% of GDP in the fiscal year 2010. Road and rail transport accounted for about 60% and 30% of all passenger transport services and 25% and 40% of goods transported while waterway transport so far has not represented more than 10% of passenger service and 35% of goods transported in the fiscal year 1985.

Land transport thus has dominated movement of passengers and goods. The proposed project will help establish an optimal transport network between the east and west sides of the Irrawaddy River and will, thus, encourage development of national economy.

12.2 Economic Analysis

Among the suitable alternatives considered, selection must take into account many factors, including the technical and economic evaluation. The study shows the costs and economic return as follows:

	Road Bridge PC box girder		Rail-cum-Road Bridge Steel single-deck truss	
	Y Bill	K Mill	Y Bill	K Mill
Total net cost (in 1985/86 prices)	13.35	556.1	16.93	705.4
Present worth (B-C) (with a discount rate 10%)	K -164 Million		K -232 Million	
B/C ratio (i = 10%)	0.61		0.57	
IRR	6.8%		6.4%	

The return is estimated at approximately 6% for both types including the development benefit of the bridge. It does not meet conventional economic return requirements even though neither alternative presents serious technical problems.

12.3 Conclusion and Recommendations

The proposed bridge can serve as a key east-west linkage for the formation of a national transport network and increase efficiency of the movement of passengers and cargos crossing the Irrawaddy River. With this linkage, the network can have the first and direct land transport approach to the Bay of Bengal and Bassein Port.

Traffic forecast was conducted by studying existing river crossing movement in the direct influence area.

Estimating the benefit of diverted traffic, induced traffic and savings in the ferry operation cost, the economic analysis for both bridge types yields an IRR of approximately 4%.

In addition to the above economic analysis, the development benefit was also calculated. In this calculation, a tentative regional development plan has been assumed by extracting plans and projects from the on-going 5th Four Year Plan and by findings of the area's development potential, since no regional development plan has been worked out for the influenced area of the project by the Government of Burma.

As a result of the analysis based on the above forecast, IRR increases to approximately 6%. It is considered that the estimated IRR is not high enough to present economic viability of this project.

Under the circumstances, it is an urgent necessity to formulate an integrated plan of development covering economic sectors of manufacturing, agriculture and others as well as various infrastructures. When the development plan is consolidated, the estimated benefits and IRR in this study can increase by the growth prospect.

Under the condition that the development plan, which aims to utilize abundant resources in the area, is consolidated and implemented by the Government of Burma, the construction of bridge is recommendable. The suitable type of its structure is:-

- PC box girder type for a road bridge, or
- Steel single-deck truss type for a rail-cum-road bridge with railway on one-side.

APPENDICES

- Scope of Work
- The Summary of Discussion
- Memorandum

SCOPE OF WORK

FOR

THE FEASIBILITY STUDY ON

IRRAWADDY RIVER BRIDGE CONSTRUCTION PROJECT

IN

THE SOCIALIST REPUBLIC OF THE UNION OF BURMA

AGREED UPON BETWEEN

CONSTRUCTION CORPORATION

AND

THE JAPAN INTERNATIONAL COOPERATION AGENCY

U Khin Maung Maung
Managing Director,
Construction Corporation.

Mr. Yutaka Iida
Leader of the Preliminary
Study Team,
The Japan International
Cooperation Agency.

I. INTRODUCTION

In response to the request of the Government of the Socialist Republic of the Union of Burma (hereinafter referred to as " BURMA "), the Government of Japan has decided to implement the Feasibility Study on Irrawaddy River Bridge Construction Project (hereinafter referred to as "the Study"), in accordance with the relevant laws and regulations in force in Japan.

The Japan International Cooperation Agency (hereinafter referred to as "JICA"), the official agency responsible for the implementation of technical cooperation programmes of the Government of Japan, will undertake the Study in close cooperation with the authorities of BURMA.

The present document sets forth the Scope of Work for the Study.

II. OBJECTIVE OF THE STUDY

The objective of the Study is to carry out the feasibility study for the construction of Irrawaddy River Bridge, which would be constructed as RAILWAY-CUM-ROAD BRIDGE or ROAD BRIDGE near MYAWADDY in order to stimulate the social and economic activities of the area lying on the Western Bank of the Irrawaddy River.

III. SCOPE OF THE STUDY

1. Subject of the Study

The Study will mainly deal with the superstructure and the substructure of the bridge and its approaches.

2. Items of the Study

In order to achieve the objective, the Study would divide into two (2) phases.

2-1 Phase I

Phase I study will cover following activities;

(1) Socio-Economic and Traffic Study

(a) Socio-economic data collection and analysis
(b) Traffic data collection and analysis

(c) Elaboration of future regional framework
(d) Forecast of future traffic demand

(2) Engineering Studies
(a) Topographic map and aerial photograph collection
(b) Engineering data collection and analysis
b-1 soil and geological data
b-2 hydrological and hydrographic data
b-3 materials data
b-4 meteorological data
b-5 seismic data
b-6 construction machinary, equipment and ship
b-7 construction materials
(c) Surveying
c-1 soil and geological surveying including drilling and testing
c-2 hydrograghic surveying
(d) Review of design criteria applied to the existing long span bridges
(e) Examination on the design criteria
e-1 geometric design
e-2 structural design
e-3 navigation clearance
(f) Elaboration of alteranative plans
f-1 type of bridge
f-2 staged construction
(g) Rough design for each alternative plans

(3) Evaluation for Each Alternative Plans
(a) Rough cost estimates for each alternative plans
(b) Rough estimates of benefites
(c) Rough economic evaluation
(d) Selection of optimum plan

2-2 Phase II

Phase II study will cover following activities;

(1) Engineering Studies
(a) Surveying

a-1 center line surveying
a-2 supplement surveying on soil, geological, hydrographic and others, if necessary

(b) Engineering work
b-1 preliminary design
b-2 quantity estimation

(c) Examination on the construction programme
c-1 construction method
c-2 construction schedule

(d) Cost estimates
d-1 land acquisition cost
d-2 temporary works cost
d-3 construction cost
d-4 maintenance cost

(2) Economic Evaluation
(a) Estimates of benefit
(b) Estimates of NPV, IRR and B/C
(c) Sensitivity analysis

IV. STUDY SCHEDULE

The Study will be conducted in accordance with the attached tentative study schedule.

V. REPORTS

JICA will prepare and submit the following Reports in English to the Government of BURMA.

1. Inception Report
30 copies.
At the starting date of the Study in BURMA.

2. Progress Report
30 copies.
Within four and half (4.5) months after the starting date of the Study in BURMA.

3. Interim Report
30 copies.

Within four (4) months after the presentation of Progress Report.

4. Draft Final Report
   30 copies.
   Within five and half (5.5) months after presentation on Interim Report.
   The Government of BURMA will provide JICA with its comments within one(1) month of receipt of Draft Final Report.
5. Final Report
   30 copies.
   Within one (1) month after receipt of Burmese Government's comments on the Draft Final Report.

VI. UNDERTAKING OF JICA

For the implementation of the Study, the JICA shall take the following measures;

1. To dispatch, at its own expense, study teams to BURMA.
2. To pursue technology transfer to the Burmese counterpart personnel in the course of the Study.

VII. UNDERTAKING OF THE GOVERNMENT OF BURMA

1. To facilitate smooth conduct of the Study, the Government of Burma in accordance with the laws and regulations in force in the Socialist Republic of the Union of Burma, shall take necessary measures;
   (1) To provide security for the safety of the Japanese study team.
   (2) To permit the members of the Japanese study team to enter, leave and sojourn in BURMA for the duration of their assignment therein, and exempt them from alien registration requirements and consular fees.
   (3) To exempt the members of the Japanese study team from taxes, duties, fees and other charges on equipment, machinery and other materials brought into BURMA for the conduct of the Study.
   (4) To exempt the members of the Japanese study team from income tax and charges of any kind imposed on or in connection with any emoluments or allowances paid to the members of the Japanese study team for their services in connection with the implementation of the Study.

(5) To provide the necessary facilities to the Japanese study team for the remittance as well as utilization of fund introduced into BURMA from Japan in connection with the implementation of the Study.

(6) To provide the medical services as needed and its expenses will be chargeable on the members of the Japanese study team.

(7) To secure permission to take all data and document related to the Study out of BURMA to Japan by the study team.

(8) To secure permission for the entry into private properties and any area necessary for the conduct of the Study, if necessary.

2. The Government of BURMA shall bear claims, if any arises against the members of the Japanese study team resulting from, occuring in the course of, or otherwise connected with the discharge of their duties in the implementation of the Study, except when such claims arise from gross negligence or wilful misconduct on the part of the members of the Japanese study team.

3. Construction Corporation (hereinafter referred to as "CC") shall, through Ministry of Construction (hereinafter referred to as "MOC") , act as counterpart agency to the Japanese study team and also as coordinating body in relation with other governmental and non-governmental organizations concerned for the smooth implementation of the Study.

4. CC shall, through MOC, at its own expense, provide the Japanese study team with the followings, in cooperation with other organizations concerned.

(a) Available data and information related to the Study.

(b) Counterparts personnel.

(c) Suitable office space with available equipment in Rangoon and near the site.

(d) Credentials or identification cards.

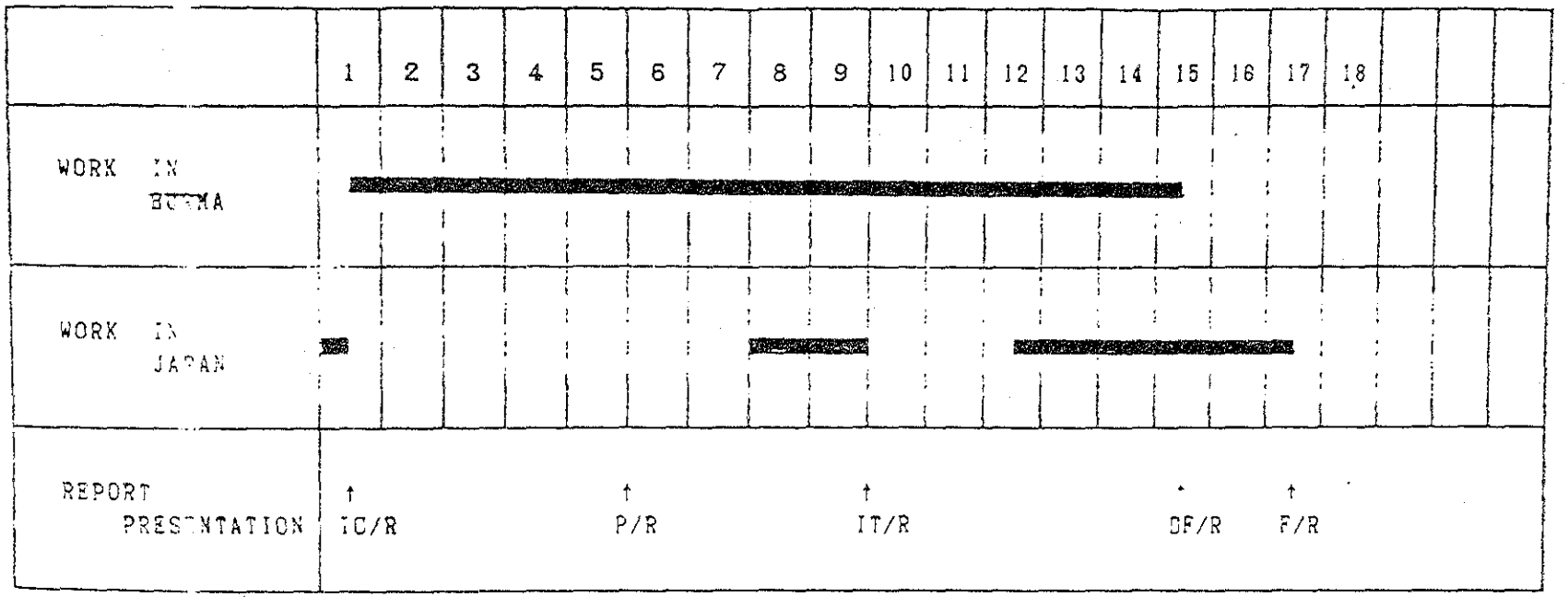
(e) Chauffeured vehicles.

VIII. MUTUAL CONSULTATION

JICA and CC shall consult with each other in respect of any matter that is not agreed upon in this document and may arise from or in connection with the Study.

ANNEX

TENTATIVE STUDY SCHEDULE



NOTE
IC/R : Inception Report
P/R : Progress Report
IT/R : Interim Report
DF/R : Draft Final Report
F/R : Final Report

The Summary of Discussion
between
The Construction Corporation
and
The Japanese Preliminary Study Team
for
The Feasibility Study
on
Irrawaddy River Bridge Construction Project
in
The Socialist Republic of the Union of Burma

1. The Japanese Preliminary Study Team (hereinafter referred to as "the Team") organized by the Japan International Cooperation Agency (hereinafter referred to as "JICA"), headed by Mr. Yutaka Iida, visited the Socialist Republic of the Union of Burma (hereinafter referred to as "Burma") from July 22 to August 1, 1985, in order to work out the Scope of Work for the feasibility study on Irrawaddy River Bridge Construction Project (hereinafter referred to as "the Study").

During its stay in Burma, the Team conducted a field survey and had series of discussions with Burmese authorities concerned with regard to the necessary measure to be taken by both sides for the successful implementation of the Study.

2. The contents of Scope of Work was mutually agreed upon by both sides. However, the Construction Corporation explained that effects of Scope of Work will be coming into force after getting the approval from its higher authorities concerned.

The Team understood the situation on the Burmese side and requested them to take necessary measures as soon as possible.

3. On July 24, 1985, the first day of discussion at Construction Corporation, U Khin Maung Maung, Managing Director, Construction Corporation, explained the need for implementation of the IRRAWADDY RIVER BRIDGE CONSTRUCTION PROJECT, for promotion of land communication between east bank and west bank of the Irrawaddy River in the middle part of Burma, in developing the social and economic activities to be in line with the State Long Term Plan. The Team Leader then presented questionnaire necessary for the Preliminary Study. The Burmese authorities concerned agreed to try their best to provide the Team with data relating to the questionnaire. A visit to the site during the period between July 26 and July 29, 1985 was organised. Discussion continued on July 30, 1985, after returning from the survey of the Bridge Site, relating to the provision of data for the questionnaire, required by the Team.

Through series of discussions the Managing Director, Construction Corporation, brought to the notice of the Team to delete the words "or ROAD BRIDGE" in paragraph II Objective of the Study, because the Higher Authorities on Burmese Side are interested in having the RAILWAY-CUM-ROAD BRIDGE. The Managing Director explained that the collection

of socio- economic, traffic and other data required for the Study had already been partly in hand and all necessary assistance and cooperation would be furnished for the Origin and Destination Survey and other necessary works and that the Engineering Study and Surveying period may also be reduced as far as practicable, so that the Study period could be reduced from initially proposed period of 16.5 months to 12 months.

The Japanese Side stated that the Study will have to cover feasibilities for both a rail-cum-road bridge and a road bridge as mentioned in the letter dated May 31, 1985 from the Minister of Foreign Affairs of Japan, addressed to the Deputy Prime Minister, Burma. The Japanese Side continued to explained that to minimize the study schedule which is initially 16.5 months would damage the quality of the report, and it is a matter of technicality but not of negotiation. The Japanese Side expressed their earnest desire to accept the proposed period of feasibility study. The Japanese Side also proposed to delete the phrase, "which would be constructed as RAILWAY-CUM-ROAD BRIDGE or ROAD BRIDGE" in paragraph II and to add the sentence "The study will cover feasibility of both a rail-cum-road bridge and a road bridge." at the end of this paragraph as a counter proposal to above mentioned Burmese proposal.

The Team expressed the view that the proposals put forward by the Burmese Side should be recorded in the Summary of Discussion.

4. In the course of discussions both sides agreed to record the following.

(1) The Study will cover feasibilities of both RAILWAY-CUM-ROAD BRIDGE and ROAD BRIDGE.

(2) The Study will be carried out taking into consideration the extention programme of railways on both sides of the Irrawaddy River, construction and investment programme of the access railways/roads and the other development plans in the influence area, which have been or will be planned by the Burmese Government.

(3) As for the location of the bridge the Study will examine the area near Myawaddy within the extent designated by the Burmese Government. (See Appendix A)

(4) The Study will make examination of the approaches to the Bridge with respect to the area within approximately one (1) mile from each end of the Bridge.

The examination on the access railways/ roads to the Bridge from the existing railways/roads is to be carried out by the Burmese side.

(5) Construction Corporation will set up the Burmese Steering Committee for smooth implementation of the Study.

The Burmese Steering Committee will consist of the following agencies;

(a) Construction Corporation, Ministry of Construction

(b) Burma Railways Corporation, Ministry of Transport and Communications

(c) National Planning, Ministry of Planning and Finance

(6) The Construction Corporation will provide the Team with following equipments and machinery for the Study.

(a) Soil sample machinery

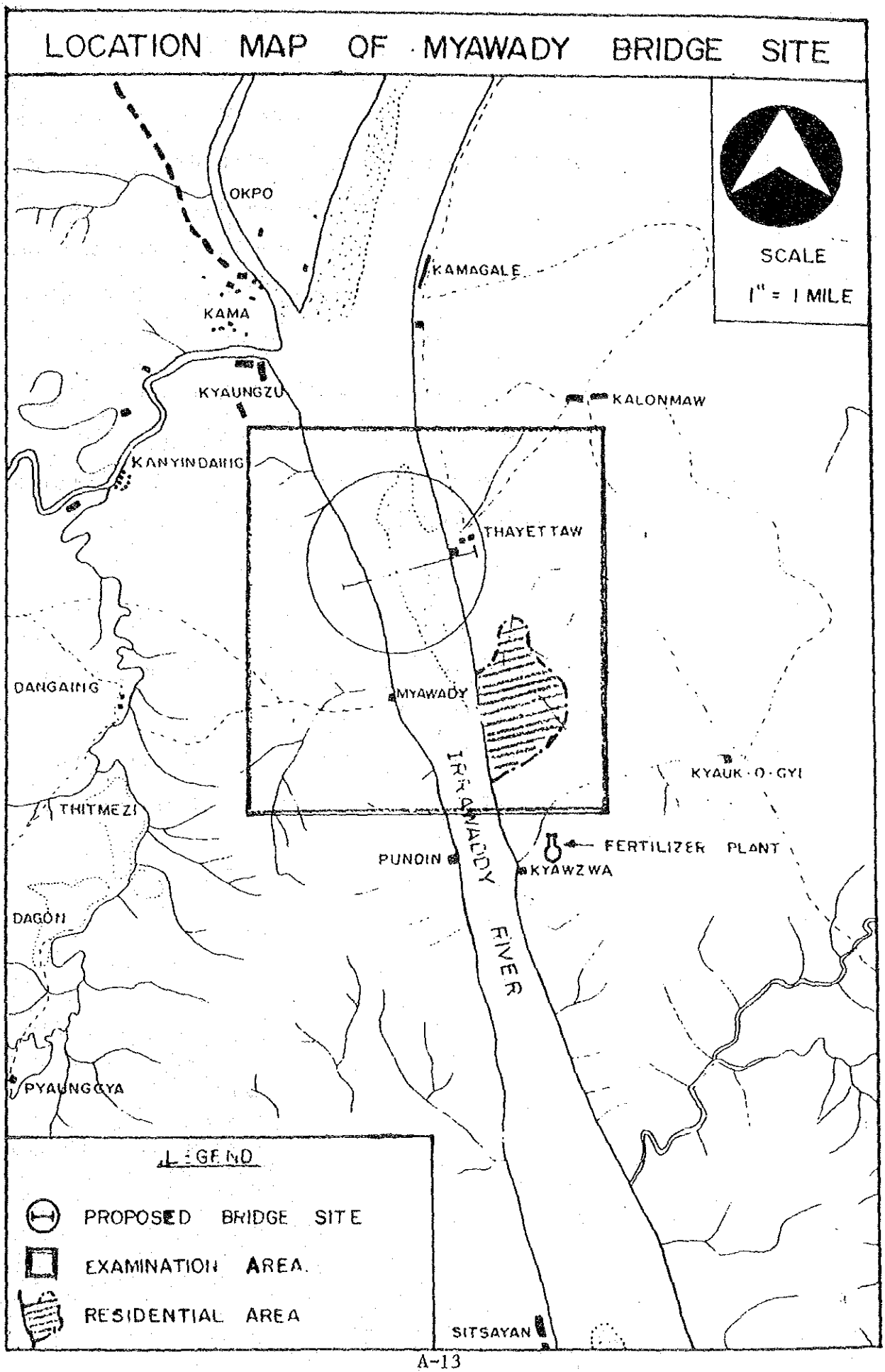
(b) Soil testing equipment

(c) Desks, chairs and telephone

July 31, 1985

U Khin Maung Maung
Managing Director,
Construction Corporation.

Mr. Yutaka Iida
Leader,
Japanese Preliminary
Study Team,
The Japan International
Cooperation Agency.


LOCATION MAP OF MYAWADY BRIDGE SITE
SCALE
1" = 1 MILE
OKPO
KAMA
KAMAGALE
KYAUNGZU
KALONMAW
KANYINDAING
THAYETTAW
MYAWADY
DANGAING
THITMEZI
KYAUK-O-GYI
FERTILIZER PLANT
PUNOIN
KYAWZWA
IRRAWADDY RIVER
DAGON
PYAUNGGYA
SITSAYAN
LEGEND
PROPOSED BRIDGE SITE
EXAMINATION AREA.
RESIDENTIAL AREA

Memorandum

With respect to Chapter II and Chapter IV of the Scope of Work for the Feasibility Study on Irrawaddy River Bridge Construction Project, the Managing Director, Construction Corporation, explained to the Japanese Preliminary Study Team to delete the phrase "or Road Bridge" in Chapter II, "Objective of the Study", and further requested that the Study Schedule period proposed to be 16.5 months should be reduced to 12 months.

As for the first proposal from the Managing Director, the Japanese Preliminary Study Team explained that it is one of the presuppositions for the Japanese side to proceed to the Feasibility Study on the Project that the Study will cover feasibilities of both a rail-cum-road bridge and a road bridge.

With regard to the second proposal, the Japanese Team explained that it is not possible to reduce the period from technical point of view, and stated that there might be some changes in the schedule in the course of implementation of the Study, but that it is impossible to foresee any changes in the schedule at present.

July 31, 1985.

U Khin Maung Maung
Managing Director,
Construction Corporation.

Mr. Yutaka Iida
Leader of the Preliminary
Study Team,
JICA.