8.4 Bridge Design Standard

8.4.1 Bridge Design Standard

Design Live Load

Japanese bridge design standard will be adopt for the project, with the following considerations:

a) "National Transport Study" recommends that the use of the "AASHTO code with HS 20-44 increased by 25%" (referred to as HS 25-44) for design live load and "allowable stress design method" be adopted instead of more sophisticated "Ultimate Limit State" method for easier use.

b) Japanese bridge design standard has been based on AASHTO code with some modification to meet Japanese requirements and adopts "allowable stress design method".

c) Thailand, giving important economic effect on Laos, adopts the HS 20-44 standards for the design of all bridges on national roads.

8.4.2 Proposed Bridge Design Standard

The following basic design criteria will be applied for the bridge design.

1) Design Standards:
The current Japanese Standard "Specifications for Highway Bridges" will be used.

2) Carriageway loadings:
The decks are designed to carry T-20 loadings, and L-20 loadings for the main girders, as in Japanese Standards.

3) Sidewalk loadings:
The sidewalk loadings is 350 kg/m^2.

4) Seismic loading:

Surface acceleration of 0.05G will be adopted for design.

5) Wind Speed:

The design basic wind speed is 40 m/sec.

6) Temperature

The design temperature range is +15°C

7) Collision load on parapet: 2 ton/m

8) Materials and allowable stress:

a) Concrete

	Bored Pile	Substructure & Deck Slab	Main Girder
Specified compressive strength (kg/cm^2)	δck=300	δck=240	δck=350
Young's modulus (kg/cm^2)	2.8×10^5	2.5×10^5	2.95×10^5
Unit weight (t/m^3)	2.5	2.5	2.5
Flexural extreme fiber stress (kg/cm^2)	70	80	125
Axial compressive stress (kg/cm^2)	65	65	85
Shear stress (kg/cm^2)	3.9	3.9	5.0

b) Prestressing bar

Prestressing strand will be used for longitudinal steel and prestressing bar for lateral steel.

c) Reinforcing bar

Reinforcing bar conforming to SD30 of JIS G3112 (Deformed steel bar) or equivalent will be used.

Allowable stress is shown below.

For ordinary members	:	1,800 (kg/cm^2)
For slab	:	1,400 (kg/cm^2)
For members in water or below ground-water level	:	1,600 (kg/cm^2)
Yield stress	:	σsy = 3,000 kg/cm^2

9) Backfill Material

Unit weight	:	r = 1.8 t/m^3
Internal friction angle	:	$\phi = 30^o$
Cohesion of soil	:	c = o

Earth pressure coefficient in passive earth pressure betwee concrete wall and soil:

In normal case	;	kah = 0.304	kav = 0.054
At the time of earthquakes	;	kah = 0.374	kav = 0

10) Stability

Stability against overturning:

In normal case	;	e<B/6
At the time of earthquakes	;	e<B/3

Stability agaisnt sliding

In normal case	;	F<1.5
At the time of earthquakes	;	F<1.2

Coefficient of friction between foundation ground and bottom of foundation ; u = 0.6

Stability for bearing:

In normal case	;	qa = 40 t/m^2
At the time of earthquakes	;	qa = 60t/m^2

11) Design flood level:

Design flood level is 168.00^{m} (100-years return period)

12) Applicable Standard:

"Specifications for highway Bridges" issued by Japan Road Association.

I. Common specifications
II. Concrete Bridge
III. Substructures

8.5 Preliminary Design for Road

8.5.1 Outline of the Construction Site

Construction site belongs to the Ban Tha Ngon, Ban Na and Ban Hai. These villages are in the administrative area of Xaythani District of Vientiane Municipality.

Area spreads on a flat and hilly terrain with elevation varying from 168 meters to 187 meters above sea level. Both left and right sides at the starting point are occupied with paddy and right sides at the starting point are occupied with paddy fields and a few houses are located on right hand side of the existing road. This area has an irrigation system development plan which will be implemented in the near future.

After passing the flat terrain, the route enters the out skirts of Ban Na residential area. The route crosses the existing feeder road which is separated from Route No.10 in front of Tha Ngon market and heads to reach the Tha Ngon firm through the fish pond. This feeder road crossing on the route, locates the highest point in the Project. Area where route is passing along is mainly categorized as bushy lands and a small few part is classified as residential areas (out skirts of villages) and paddy fields.

After the intersection with existing feeder road, route takes place close to the cooperative training school of the Ministry of Agriculture, after running along the bushy area between meteorological station and political school.

Center of right side abutment is located about 110 meters upstream of the pump station for irrigation project mentioned.

After crossing the Nam Ngum river, route runs through the wild-cultivated areas with straight alignment and skirts the forest to avoid disturbance to the local cemetery i the forest. There are only two houses close-by the route in Ban Hai side.

8.5.2 Right of Way

In accordance with Lao PDR's regulations, there is two standards for Right of Way. 30 meters of Right of Way is used for Provincial Roads and 40 meters for National Roads. Because this project is planned on the Provincial Road No.10, 30 meter Right of Way will be adopted to reduce the land acquisition cost.

8.5.3 Alignment

The new alignment consists three horizontal curves (two right hand curves and one left hand curve) and three vertical curves.

The route starts from the point which pass-over the military camp about 1.5 Km ahead of Ban Tha Ngon and the first curve shifts the alignment to right hand side with 900 meters of radius. The length of this first curve is 691 meters with 225 meters clothoide for both simple curve ends under parameter of 450. After passing the flat terrain which is mainly used as residential area where alignment changes with a left hand curve of 700 meters radius. Then the route crosses with the existing feeder road which is separated from Route No.10 in front of Tha Ngon market which this feeder road aims to reach the Tha Ngon Firm through the fish pond. Areas where route runs along after flat terrain are categorized mainly as bushy hills and a small part as residential areas (out skirts of villages). Vertical alignment form starting point to this feeder road crossing has a constant upward gentle

grade of 1.6% including vertical curve near the beginning of the route.

After the intersection with existing feeder road, route descends with a grade under 2.6%, and pass through the area between meteorological station and political school. The route between meteorological station and political school. The route then takes place next to the cooperative trading school of the Ministry of Agriculture and finally reaches to the bridge entrance on the right bank of river.

The road crosses the Nam Ngum river with same 1.6% gradual descent with a small skew angle of 85 degree.

After crossing the Nam Ngum river, route runs through the wild-cultivated areas with a straight alignment of 55- meters and skirts the forest with a 450 meter radius right hand curve to avoid disturbing the local cemetery in the forest. Ultimately, the route joints with existing Route No.10 in Ban Hai.

As above mentioned, route has only three horizontal curves and three vertical curves connected continuously from Ban Tha Ngon to Ban Hai.

From the starting point up tot he feeder road crossing, road formation is scheduled to be constructed with filling and about 1,200 meters of subsequent sections planned to be cut. On the other hand, almost all sections of Ban Hai side is designed with filling. Total earth work(cut and fill) is estimated to amount 147,000 qu.meters in this preliminary design work. Good accessibility from Ban Tha Ngon, Ban Na and also from Ban Hai to the new route is retained.

Comprehensive location and both horizontal and vertical alignment of the rout are shown in the Drawings.

8.5.4 Structure of Road

Road structure is mainly divided into two categories such as geometric structure and layer system(structure).

Main geometric structure is as described in the chapter of (Geometric) Design Standards. Therefore, only carriageway width is discussed in this chapter, including state construction method.

Existing road connected with the approach road has two(2) lanes of three meter carriageway (total 6-meters) and 1.5 meter shoulders on both sides. This means that roughly calculated traffic capacity is about 12,000 per day.

This traffic capacity is enough for estimated future traffic volume on the bridge.

The carriageway and shoulder widths in the Project, therefore, are to be at least same with the existing Route No.10 and no stage construction method is considered for the approach road, because so short duration as mentioned above.

Layer system(structure) of the road shall be durable for the planned life time of the pavement. Usually it would be 20 years including annual and periodic maintenance. Layer system for the project will follow the existing pavement structure employed in the actual Route No.10. Road structure of the layer, therefore, is separated into two types, i.e. filling section and cutting section and each typical section is constituted in the Drawings as a part of the Report.

8.5.5 Pavement

Pavement shall consist Subbase Course, Base Course and Surface Course. Subbase Course having a 20 cm thickness shall be constructed with lateratic soil and/or lateratic soil mixed with river gravel to the lateratic soil. Base course, on the other hand, is a mixture of river gravel with lateratic soil. It should have a thickness of 15 cm.

Road surface will be covered by DBST(Double Bituminous Surface Treatment) by using screened river gravel. This type of pavement, however, is considered as a "Low Cost Pavement" and therefore annual maintenance is indispensable. Periodic maintenance shall also be required every 5 years to keep serviceability of the road for a safe and comfortable drive.

8.6 Preliminary Design for Bridge

8.6.1 Outline of Construction Site

Water depth at the proposed bride site is 2.5 to 3 meters during dry season and 1o to 13 meters during rainy season. The river begins its rise with the heavy rains in July and reaches its peak flow in August/September. Pier foundation work will be below the low water level. and therefore pier construction have to be executed in the dry season.

Due to short period of dry season and rapid raise of the water level, construction difficulties and dangers are expected during coffering by sheet piles.

River bed consists of loose river deposit which might be scoured around piers.

Care should be given for consolidation settlement of backfill and stability of river banks as the ground on the left bank comprise soft ground of alluvial deposit.

Road of the proposed route on the right bank have to be used for girder fabrication and stock yard. However, the space (flat ground) around the abutment is very limited even for the areas of abutment construction. Proposed road (relatively deep cut section) also have to be used as an access road for pier construction work. Appropriate planning will be required for the efficient working.

8.6.2 Superstructure

The overall length is so defined that front face of the abutments will be located at the intersection of high water level with the extension of bank slope, this results with an overall bridge length of 230 meters and bridge is skewed about 5 degrees towards upstream.

Overall width of the bridge will be 11.0 meters, consisting 7.5 meters of carriageway, 2.5 m of sidewalk on one side, and 0.4 m and 0.6 m of parapet on each side. The 7.5 m of carriageway have two 3.00 meters traffic lanes and 0.75 m of reduced shoulder, which corresponds to the Class III of the Design Standard currently used in Lao PDR.

Bridge elements

Deck

The bridge deck consists of a pre-stressed concrete slab 200 mm thick, supported on pre-stressed concrete beam (called as T-girder). The slabs are precasted together with beams, and pre-stressing forces are transferred to the concrete in one direction of the slab after filling the gaps between slabs with concrete.

The slabs are analyzed as one way continuous slabs and T-Loading (including impact) form Japanese Bridge Standards are used for design. The deck slab is assumed not to act compositely with beams.

Girder

Nominal length of 46 meters of post-tensioned concrete beams will be casted on bridge site. The beams have 200 mm thick walls with 2.4 m height and 1.5 m of slab width. Japanese Bridge Design Standard of L-Loading is used for design.

Bridge Railing

Open-type metal rail with curb base will be constructed (see Figure 8.2). The rail is a 110 mm diameter cast iron pipe which it's top is 0.75 m above the top level of the concrete curb on the carriageway side and 1.1 meters on the sidewalk.

The total height of the parapet including the handrail will be 1.0 meter above the level of the carriageway (downstream die) and 1.2 meters above the level of the sidewalk (upstream side).

Sidewalk

Sidewalk consists of concrete pavement under which public utilities are embedded, such as water supply pipe, electrictly pipe etc..

Deck Drains

The deck is drained by means of storm water gullies made from standard cast iron units which are placed along the edge of the carriageway. The water drains directly out of pipes passing through the deck.

Bearings

All bearings will be laminated neoprene type, reinforced with steel plates.

Joints

Expansion joints will be of the Steel Comb Type Joint.

8.6.3 Substructure

Abutment

Abutments will be constructed of reverse T-type (see Figure 8.1). Wing walls shall be cantilever type and parallel to the axis of the road.

Right Bank Abutment

The Right Bank abutment will be more than 15 meters i height as bearing stratum (hard clay) is about 6meters below ground. From the economic point of view, a 11.5 meters high abutment will be constructed and the remaining portion of 3.5 meters below this abutment's foundation shall be replaced with lean concrete.

Approach Slab

200 mm thick, 8.0 meters long and 10.0 meters wide approach slab will be provided on the left bank abutment only. The leading edge of the slab rests on top of the abutment wall where it is retained by dowels casted into the top of the wall.

Piers

The reinforced concrete wall type piers have been selected for construction from "Design Recommendation for Type of Abutment and Piers" in Figure 8.1 The Figure are compared form both the technical and economic point of view. The pier consists of 1.8 meters thick foundation slab supported on 6 bored piles, 1.5 meters thick pier wall, and cantilever pier head. A total load of 1,220 tons will be imposed no the pier.

Pier Foundation

Bored in-situ concrete piles have been adopted for foundation. Reverse circulation drill method will be used for construction.

Lighting

Lighting will be provided edge of the side walk at abutments and next to the balcony for traffic safety, and community service.

Balcony/gallery

At each pier, side walk will be widened 2.0 meters, addition to the ordinary width as balcony/gallery. Lighting pole will be set up close to this balcony as mentioned above.

8.7 Preliminary Bill of Quantities for the Works

The following table shows the quantities of the work based on the preliminary design.

Description	Class	Unit	Quantity	Remarks
(1) Pile Foundation (Bored pile 30 No)				
Bored pile	1.5 m dia.		30	15 m length
Concrete	σ_{28}=300kg/cm^2	m^3	890	
Reinforcing Steel	D13-D25	kg	93,200	
Casing	1.6 m dia.	m	394	
(2) Sub-structure				
Excavation		m^3	10,600	
Concrete	σ_{28}=240kg/cm^2	"	1,790	
	σ_{28}=150kg/cm^2	"	490	
Formworks		m^2	2,190	
Reinforcing Steel	D13-D25	t	237	
(3) Super-structure, 30 nos. of girder				
Concrete	σ_{28}=350kg/cm^2	m^3	1,190	
	σ_{28}=240kg/cm^2	"	390	
Formworks		m^2	1,400	
Prestressing steel		kg	71,500	
Grouting		m	11,500	
Reinforcing Steel	D13-25	t	181	
(4) Approach Road, 3.56 km length				
Subgrade		"	33,585	
Base course		"	31,234	
Double bituminous surface treatment		"	26,868	

8.8 Preliminary Design Drawing

8.8.1 Preliminary Design of Approach Road

In accordance with aforementioned conditions and design standards, typical cross section of the approach road is specified in Drawings attached hereto as preliminary design are also presented in the "DRAWINGS".

8.8.2 Preliminary Design of Proposed Bridge

General view of the proposed bridge are presented in Figure 8.3 and 8.4, and other drawings are presented in the "DRAWINGS".

General arrangement and typical cross section of the bridge are presented in the "DRAWINGS".

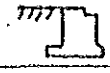
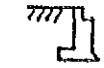
Table 8.1 Rivesed Design Standard for Road and Bridge

Design Class ADT Terrain		VI up to 50 F	 H	 M	V 50 to 300 F	 H	 M	IV 300 to 1000 F	 H	 M	III 1000 to 3000 F	 H	 M
Min. Design Speed	Kph	60	40	30	60	40	30	90	80	50	100	90	70
Max Gradient	%	6	8	10	6	8	10	5	6	8	4	5	7
Width of Surface	M	4 to 6			6.5 (3.5 m seald)	6.5	5.5	6.0	6.0	5.5	7.0	6.5	6.5
Width of one shoulder	M	nil			(1.5) nil	(1.5) nil	(1.0) nil	*2 2.0	1.5	1.0	2.5	2.5	2.5
Width of Roadway	M	*1 4 to 6			6.5	6.5	5.5	10	9.0	7.5	12	11.5	10
Minimum Radius	M	As table 3.4 for 10% max superelevation											
Non Passing Sight Distance	M	As table 3.5											
Width of Bridge L < 20	M	3.5 - 4.0			3.5 - 4.0			10.0 - 7.5			12 - 10		
between kerbs L>20		3.5 - 4.0			3.5 - 4.0			7.5 - 8.2			8.3 - 9.3		
Design Live Loading		HS 15-44			HS 20-44			HS 20-44			HS 20-44		
Axle Load Limit	M.ton				9			9			9		
Right of Way	M	25			35			40			50		
Surface & Type		Granular			Glanular full width or single lane single or double surface treatment with granular shoulders			Multiple layer bitouminous surface treatment bitouminous Macadam, Road Mixed or AC			Initial Multiple bitouminous surface treatment overlay with Road Mix or AC		

Table 8.2 Comparision of Design Standards

	Japanese Standard		Lao PDR Standard	
	National Road & Provincial Road	National Road	Provincial Road	Provincial Road
Average Daily Traffic(for Design)	500 - 4,000	> 20,000	300 - 1,000	1,000 - 3,000
Terrain	Flat	Hilly	Flat	Hilly
Design Class	Grade 3, Class 3	Grade 3, Class 1	IV	III
Design Speed(Km/hr)	60	80	80	90
WIDTH				
One Lane(m)	3.0	3.5	3.0	3.0
Shoulder(m)	L=0.75(0.50) R=0.5	L=1.25(0.75) R=0.5	1.5	2.5
Side Walk(m)	1.50(0.75)	1.50(0.75)		
Pedestrian and Bicycle Way(m)	2.00(1.50)	2.00(1.50)		
Roadway(m)	7.5	9.5	9.0	11.5
Bridge-way(m)	7.50(7.00)	9.50(8.50)	7.50-8.20	8.30-8.30
Minimum Radius(m)	200	400	250	
Maximum Gradient(%)	5%	4%	6%	5%
SIGHT DISTANCE				
Overtaking(m)	75	160		
Braking(m)	250	500		
Design Live Load	TL-20, TT-43	TL-20, TT-43	HS 20-44	HS 20-44
Axle Load Limit(kgf)	16,000 or 13,000	16,000 or 13,000	9,000	9,000

Abutment

Type	Height (m) 10	20	30	Sketch
Gravity Type Abutment	4			
Semi-Gravity Abutment	6			
Reversed T-type Abutment	6	12		
Counterforted Abutment				
Rigid Frame Abutment		15		
Cellular Abutment		12		
Spill-through Abutment		15		

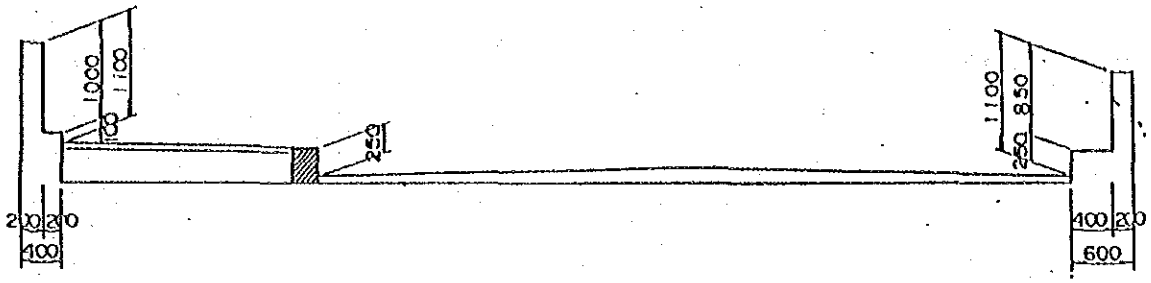
Pier

Type	Height (m) 10	20	30	Sketch
Twin Column Pier (R.C slab bridge	only)	15		
Rigid Frame Pier (one layer)	5	15		
Rigid Frame Pier (two layer)		15	25	
Wall Type Pier (including hollow	type)			
I-shaped Hollow Pier			25	

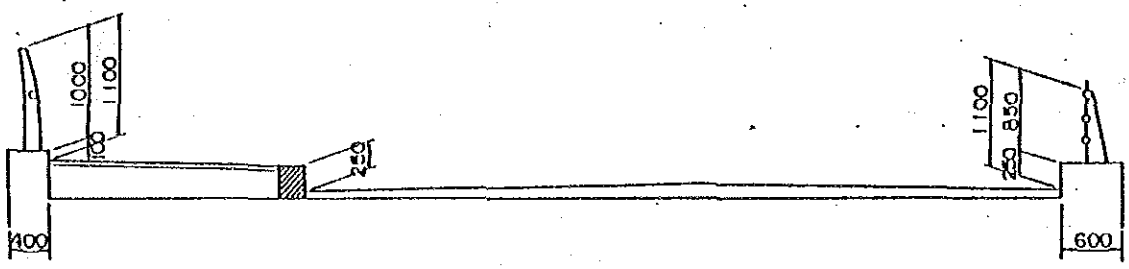
——————— Economically applicable

..... Applicable but not economical

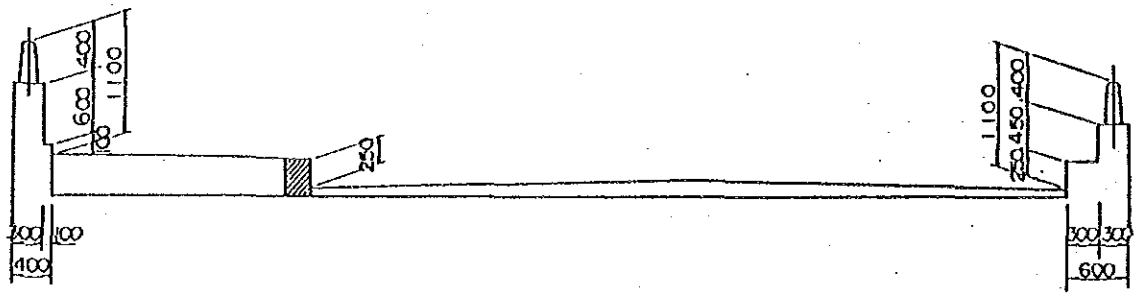
Figure 8.1 Design Recommendation for Type of Abutment and Piers



TYPE-1 (Concrete Parapet with Curb)



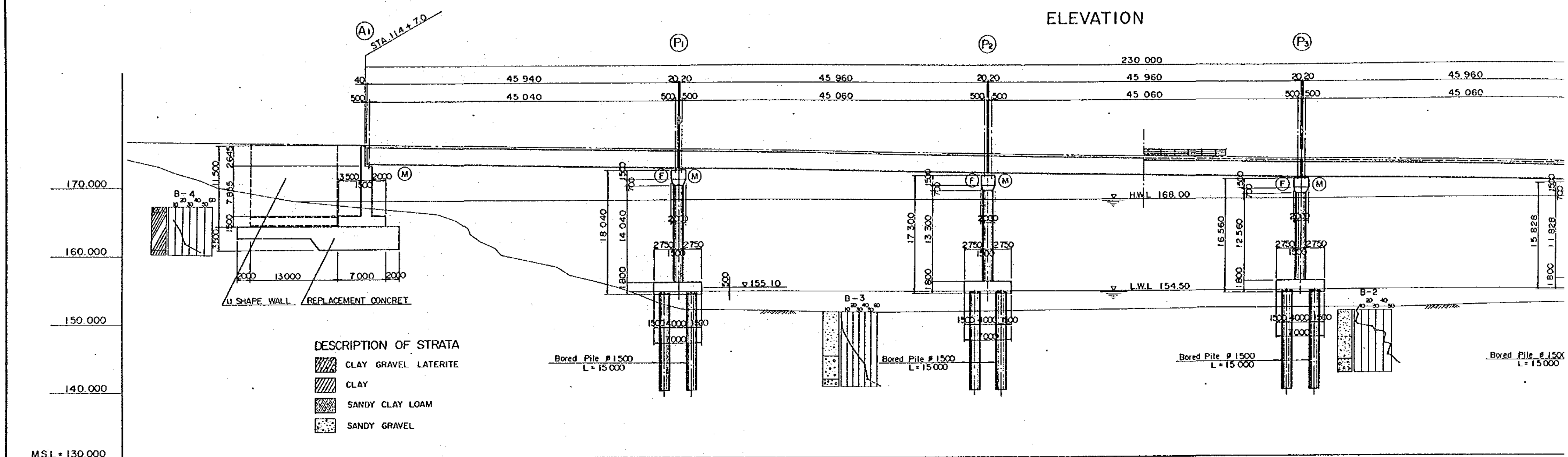
TYPE-2 (Open-Type Metal Rail with Curb Base)



TYPE-3 (Concrete Parapet with Metal Top Rail)

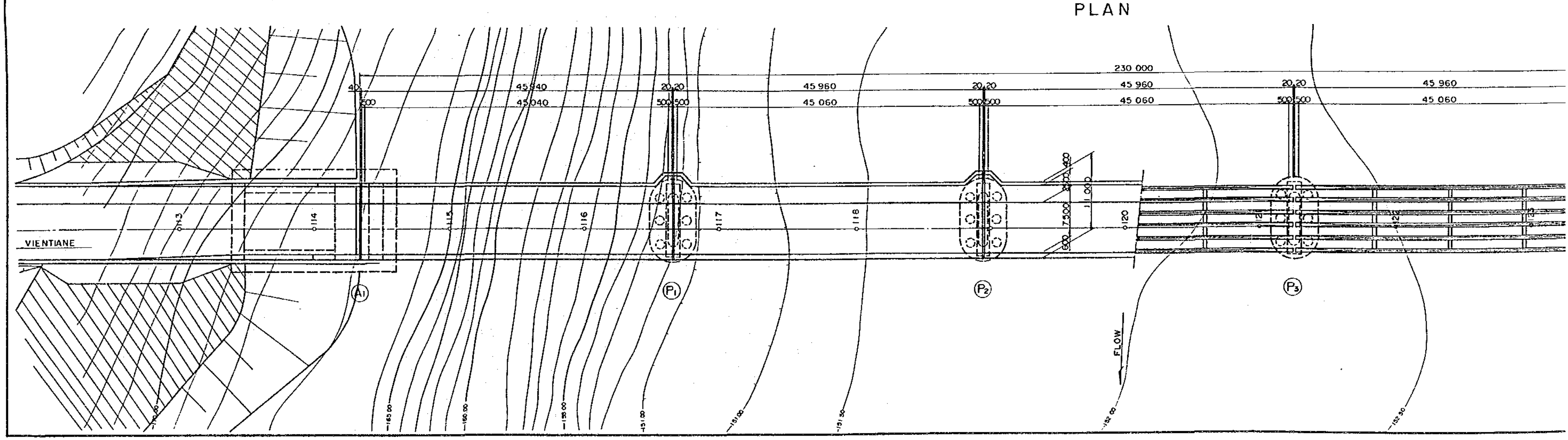
Figure 8.2 Bridge Railing Structures

ELEVATION



GRADIENT			175.725							i=1.600 % ℓ= 230.00					
ROAD LEVEL	176.157	175.837	175.725	175.517	175.197	174.989	174.877	174.557	174.253 / 174.237	173.917	173.597	173.517	173.277	172.957
GROUND LEVEL	171.92	167.77	167.00	165.20	157.30	152.50	151.40	157.30	151.80 / 151.80	152.20	152.40	152.20	152.70	152.70
CUMULATIVE DISTANCE	2260.0	2280.0	2287.0	2300.0	2320.0	2333.0	2340.0	2360.0	2379.0 / 2380.0	2400.0	2420.0	2425.0	2440.0	2460.0
STATION	113	114	114+7.0	115	116	116+13.0	117	118	118+19.0 / 119	120	121	121+5.0	122	123

PLAN



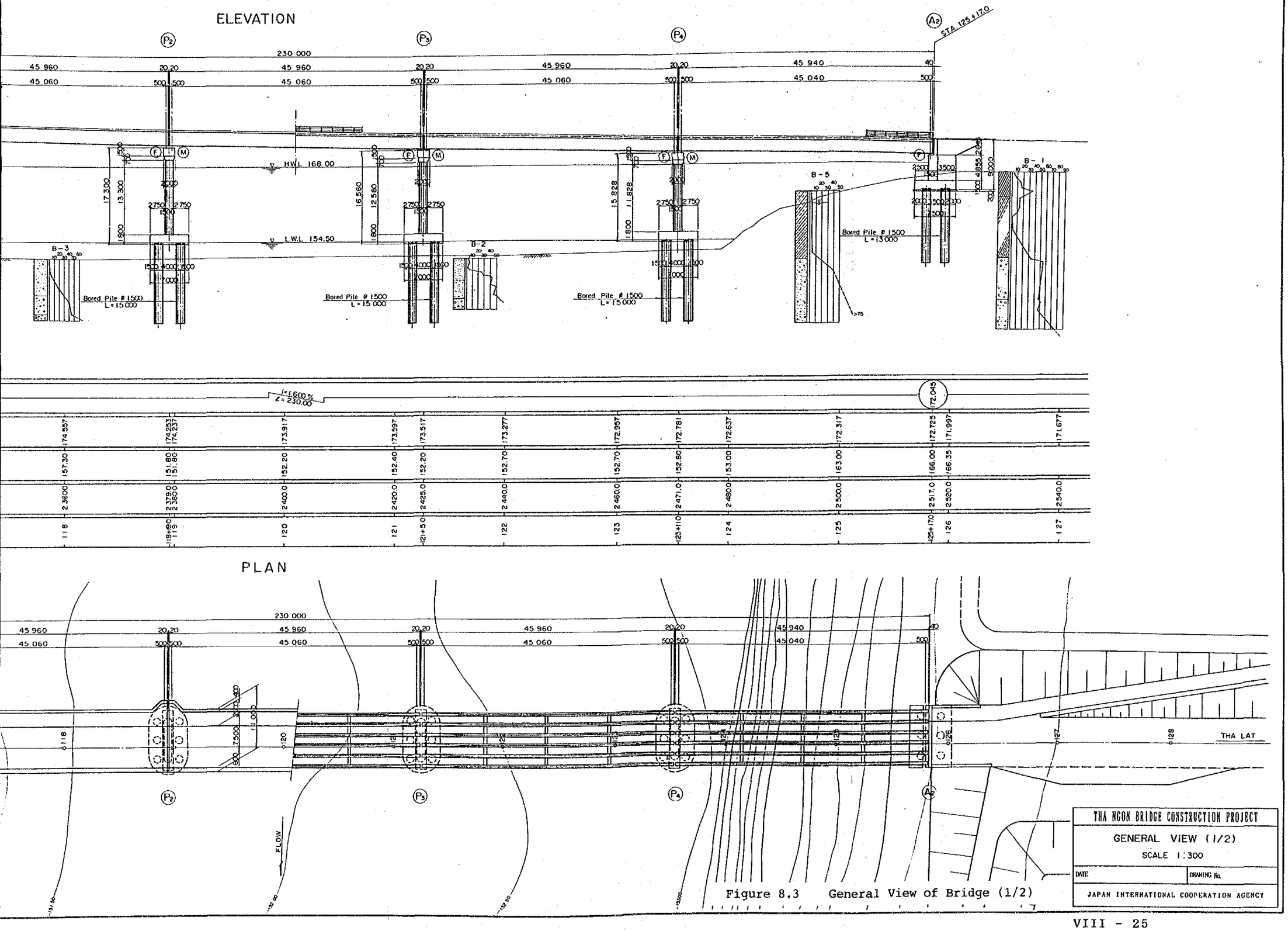
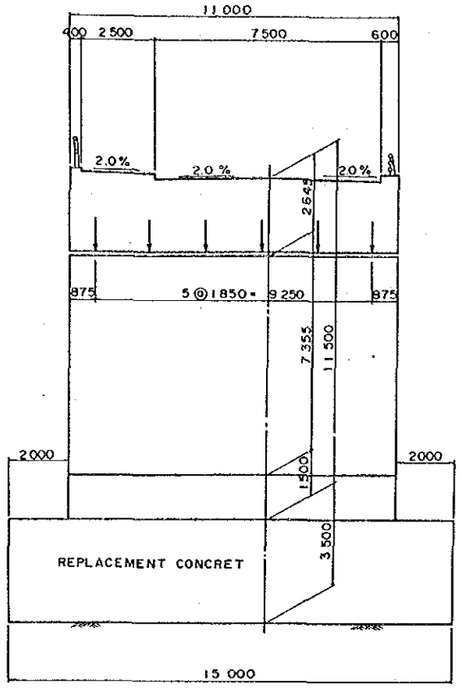
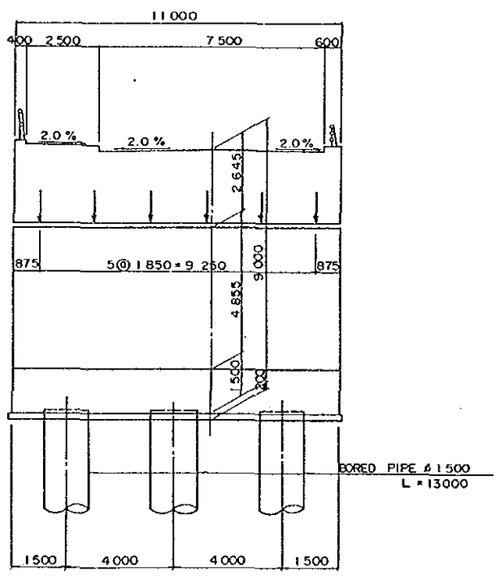


Figure 8.3 General View of Bridge (1/2)

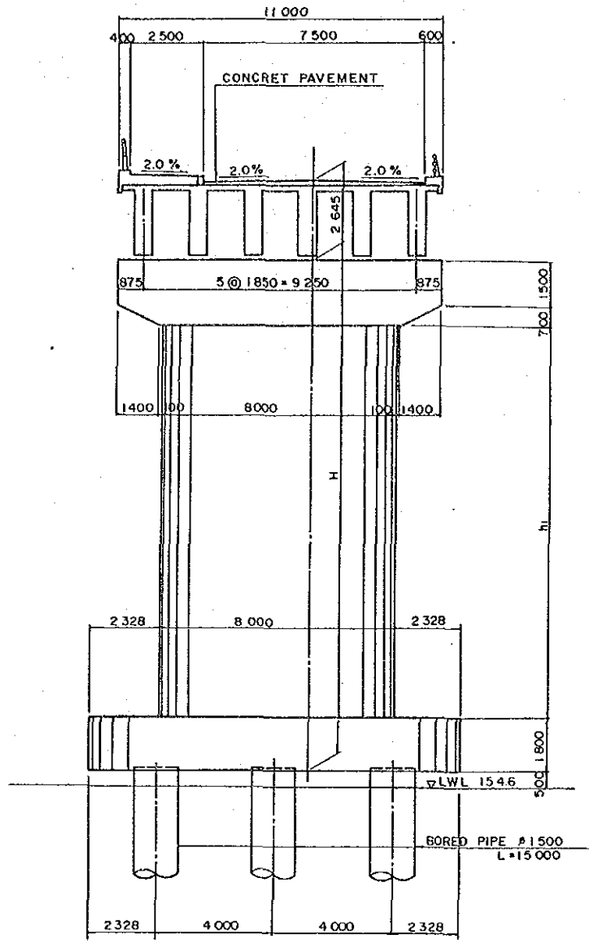
A1 ABUTMENT SCALE 1:100



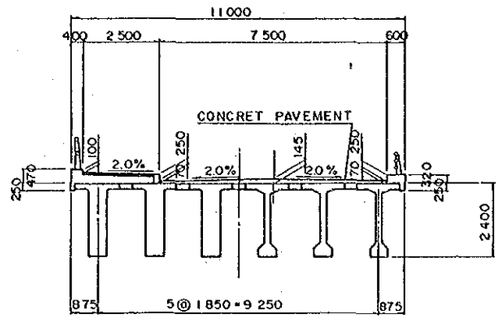
A2 ABUTMENT SCALE 1:100



PIERS SCALE 1:100



SECTION SCALE 1:100



DIMENSION OF PIERS

	H	h1
P1	18 040	14 040
P2	17 300	13 300
P3	16 560	12 560
P4	15 828	11 828

DESIGN STANDARD AND CRITERIA

DIMENSIONS	TYPE	5-SPAN PRESTRESSED CONCRETE T-GIRDER BRIDGE
	LENGTH	230 M
	SPAN	45 060 M
	WIDTH	OVERALL WIDTH: 11.0 M
		CARRIAGEWAY : 7.5 M
		SIDEWALK : 2.5 M
DESIGN ROAD	LIVE LOAD	DECKS: T-20(JAPANESE STANDARD)
		GIRDER: L-20(")
	SEISMIC ROAD	0.05 G
MAIN GIRDER	CONSTRUCTION	GIRDER ERECTION METHOD
	CONCRETE	σck = 350 kg/cm²
	PRESTRESSING STEEL	SWPR7A ; SWPR19
	REINFORCING BAR	SD 30 (JIS G 3112)
SUBSTRUCTURE	CONCRETE	σck = 240 kg/cm²
	REINFORCING BAR	SD 30 (JIS G 3112)
FOUNDATION	BORED PILE	Pa = 354 T/PILE
	SPREAD FOUNDATION	Qa = 40 T/M²

THA NGON BRIDGE CONSTRUCTION PROJECT	
GENERAL VIEW (2/2)	
SCALE 1:100, 1:50, 1:30	
DATE	DRAWING No.
JAPAN INTERNATIONAL COOPERATION AGENCY	

Figure 8.4 General View of Bridge (2/2)

CHAPTER IX

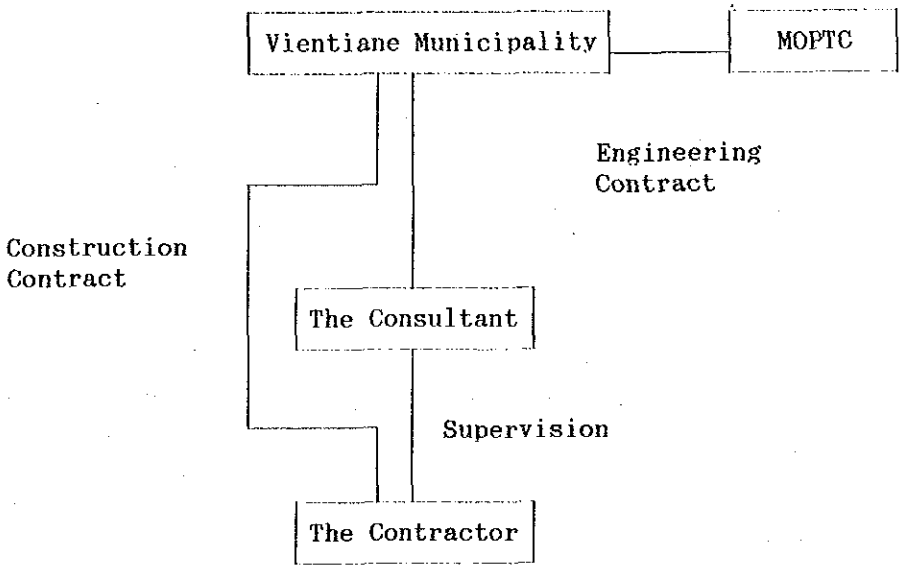
CONSTRUCTION PLAN AND COST ESTIMATE

CHAPTER IX CONSTRUCTION PLAN AND COST ESTIMATE

9.1 Implementing Agency

The Vientiane Municipality will be the agency to superintend the Project under the jurisdiction of the Government of Lao People's Democratic Republic.

The project implementing organization is proposed as follows:



It is proposed that MOPTC should support Vientiane Municipality with implementing the project for relating to the engineering arrangement as seen in Figure 9.1. Organization chart of DCTC of the Vientiane Municipality is shown in Figure 9.2.

9.2 Construction Plan

9.2.1 Maximum Use of Local Resources

The following should be given a particular consideration through the project implementation:

a) Maximum use of local construction material and equipment,

b) Creation of employment opportunity in the locality.

9.2.2 Special Consideration

1) Capacity of Local Contractor

The competent foreign contractors shall be involved in the construction works. Subletting of primary part of the bridge works to the local contractors will not be expected, as they have no qualified engineering personnel with part of experience for this type of bridge construction. As for approach road, a few local construction enterprises have a capacity to undertake the subletting work but their work output will be substantially limited.

2) Local Labour

There are no governing labour laws in Lao PDR. The foreign contractors shall recruit labour through the local firms and provide safety control measures spontaneously to prevent conflict with local labour.

3) Construction Material

The local construction material are very scarce. The available materials are limited to aggregates, bitumen and timber only. Almost all the major construction materials will be generally imported from foreign countries.

4) Construction Equipment

Most major construction equipment and facilities will be mobilized form abroad except for some earth moving machines which can be hired from local contractors.

5) Rainy Season

As all the pier construction work will be carried and in the river, the construction time will be limited especially in rainy season, during which there should be paid special care to safety control for the construction work.

6) Erection of Girder

The girder of proposed bridge weighing more than 100 ton will be erected by using a temporary erection steel girder, which requires high technical control of safety. Careful planning should be made prior to starting the work.

9.3 Work Plan

9.3.1 Preparatory Works

Temporary yard of some 18,000 m^2 will be opened on the Tha Ngon side to accommodate the site office, concrete plant, warehouse, workshop and other temporary facilities.

PC girder casting yard will be provided adjacent to the site of the right bank abutment, where two fabricating bases and stock yard for 20 girders will be prepared.

Water used for construction are to be taken from the river. Contractor's staff houses and liaison office will be arranged in the Vientiane city.

9.3.2 Sub-structure

1) Temporary Bridge and Platform

Six meter wide temporary bridge facility will be erected crossing Tha Ngon at around EL.161.00 for submergible works of in situ concrete piles and pier construction, and for transportation of construction material to left bank side. The facility comprises steel H-pile bent and H-beam with steel deck plate. H-pile will be driven by vibrating hammer. 4-platform for in situ concrete piles of steel H-pile bent and steel deck plate are separately constructed at around EL 155.70.

2) In Situ Concrete Pile

In situ concrete piles are constructed for the foundation of the piers and left bank abutment. The piles are designed of 1500 mm in diameter and 15 meter long. All the piles are constructed by the reverse circulation drill method which comprises power unit and crawler crane mounted on the separate pontoons, and rotary table on the platform as shown in the Figure 9.3.

Five day cycle are required for completion of one pile as described below.

a) Driving stand pipe by vibrating hammer
b) Drilling by reverse circulation drill
c) Measuring excavation depth and removing slime
d) Insert reinforcing cage
e) Placing concrete by tremie method

3) Footings and Piers

The footing of piers will be so constructed that the top of piles be submerged at the expected low water level(154.5m) to prevent the piles from deterioration due to the repeated dry and wet conditions.

9.3.3 Superstructure

Precast concrete girder required for this bridge construction is 30 numbers in total.

The girders will be fabricated at the casting yard on the approach road near the A1 abutment (right bank side) and stocked on the same approach road. (refer to Annex J)

The casting yards will be provided with two casting bases which enable the girder fabrication at the rate of 5 numbers per month. (12 days of construction time per one casting base).

A steel erection girder will be utilize for launching the girders. The erection girder consist of two box-typed girders with two gantry cranes on its.

The girders will be lifted by cranes and travelled to carry the girders in place.

9.3.4 Approach Road

1) Left Side Bank(Ban Hai Side)

Considerable amount of fill material f about 46,000 m^3 will be required for the road section on Ban Hai Side. Material from side borrow will not be enough for the work and most of all material have to be hauled from the

borrow pits near Hat Kiang. The rate of filling work should be limited to nearly 10 cm high per day to prevent possible ground failure because of the soft ground area. Pavement work also should commence about 6 months later of the completion of filling work in order to mitigate residual settlements. Selected material from borrow pit will be used for the subgrade.

2) Right Side Bank

Construction of access road to bridge site from the Ban Na Side is primarily required for starting the bridge works. For the erection of temporary bridge facility and girder casting yard, approximately 39,000 m^3 of material will be excavated along the same access road. These material will be disposed at low ground around the site.

9.3.5 Access to the Construction Site

Existing straight road originating in the front of Tha Ngon market directed to Tha Ngon firm will be used for preliminary access means to the site for preparation works. This existing road has 6 meters wide carriageway in general with one meter wide shoulder on both sides. The pavement of this road, however, is of single surface dressing treatment which, therefore causes the occurrence of many pot-holes on the stretch. To facilitate smooth transport, advanced maintenance care shall be required.

Farm road from route 10 near ferry on Ban Hai side going up to the north-east direction will be used as a haul road of small equipment. This road is of about 5 meters wide with lateratic pavement. This road has been used as an access road to Route 10 for inhabitants of Ban Hai area. Thus, routine maintenance shall be required during the construction work. This road shall also be kept as an access road to the approach road of the bridge.

9.4 Construction Materials and Equipment

9.4.1 Materials and Equipment Available in Lao PDR

Principal construction materials and equipment which may be available in Lao PDR are as follows:

1) Materials

Sand and gravel for concrete and surfacing, Timber, Fuel, and Bitumen

2) Equipment

Limited number of the bulldozer, motor-grader, tired roller, macadam roller, and dump truck may be hired out from the local contractors.

9.4.2 Materials and Equipment Mobilized from Foreign Countries

1) Materials

Materials which shall be imported from abroad will be;

Portland cement, Reinforcing steel, Prestressing steel, Steel H-pile and H-beam, Chemicals for grouting, Concrete admixture, Expansion joint, Rubber Shoe, Drain box, Steel pipe for stand pipe, and any other engineered materials.

2) Equipment

Following equipment will be obtained from abroad;

Crawler crane 50 ton, Truck crane 25 ton, Vibratory hammer 60 kw, Generator 200 kv, 100 kv, 60 kv, Truck mixer 4.5 m3, Hydraulic excavator 0.8 m3, Welding set 300A, Compressor 10.6 m3/sec and 3.7 m3/sec, Wheel loader 1.2 m3/sec, Concrete batch plant 30 m3/hr, Cement silo 30 tons, Grout pump, Erection girder 50t x 2, Railway 30 kg/m, Gantry crane 60t, Reverse circulation drill unit 55 kw, 12 ton, Drill pipe 200 m/m, Suction hose 200 m/m, Delivery hose 200 m/m, Drill bit 1500 m/m - 2,000 m/m, Clam shell bucket, Tremie pipe, Drop hammer 5 ton, Tensioning devices, Diesel hammer 2.5t, Hydraulic jack 75t, and Concrete bucket.

9.5 Implementation Schedule

9.5.1 Design and Tendering

As seen in Figure 9.4 and 9.5, the duration required for the designs and tender and contracting process will be about 12 months. The preliminary designs undertaken in this feasibility study will satisfy the level of engineering required as for the basic design.

9.5.2 Construction

The critical component of the construction schedule will be the in-situ concrete piles work for the bridge substructures and pre-load or surcharge operation for the fill work on the very soft foundation of the left bank. In the former case the temporary bridge facility will be erected crossing the river at the considerable lower elevation(EL. 158.00), and haul or transport works or any other works which base on the facility will be, in principle, interrupted for the period from July to October of the year(4 months), where the water level of the Nam Ngum may rise up to about EL. 158.00, while, the fill speed of the materials on the left bank will be set very moderately. In the latter case, the temporary bridge will be constructed at the higher elevation(EL. 166.00), which may allow another two more months(non-workable only for August and September) for the related works than in the former case, while the fill works on the left bank will be made in fairly faster speed. (refer to Annex K)

As a whole, although the duration of construction period required the former case will become 12 months longer than the latter case(total 36 months), it will ensure the reliable construction of the project from the various technical or constructional point of views.

Preparatory work for erection of temporary buildings, approach to the bridge site, and temporary bridge facility may be finished before such a peak flow as may occur in August.

After the first construction year(second year in implementation schedule), rainy season ends, in-situ concrete piles construction for the piers will be

forced to wait until around March in the sequence when the water level may decrease to the elevation of about 154.5 meter, and the work must finish before July when the river re-begins to rise with the rains. Two shift work would be required to meet the limited construction period. Higher construction technology will be required during the works.

9.6 Estimation of Project Cost

9.6.1 Basic Conditions

1) Base date of estimation

The project cost is estimated at the price level of August, 1990 and expressed in two components; Japanese Yen for foreign currency and US$ for local currency.

2) Structure of cost items

As there have not been established prevailing system or structure for the formulating of construction cost estimated for the engineering works in Lao PDR, the method authorized in Japan will be applied. The major cost items categorized of the project are as follows:

a) Actual construction cost
- Direct construction cost
- Bridge
- Approach road
- Temporary bridge
- Revetments

b) Indirect construction cost
- Preliminaries and general items
- Packing and transport cost
- Dispatch of expatriate technician
- Site on costs

3) Unit price analysis method

In order to undertake the cost estimate, the unit price analysis method

will be applied for each cost item. The method will be developed on a series of unit price analyses sheets, which, first, analyses the cost to lateral components such as foreign, local and taxes, and second, breaks it down to vertical components such as labour, materials and equipment expenditures. Those sheets will e appended hereto.

4) Currencies and conversion rate

The currency for the estimation for the local labour, materials, equipment and any other management related costs is expressed in US dollar, while that for the foreign tradable or imported cost elements are shown in Japanese Yen. As referred to below, the conversion rates of US dollars for Japanese Yen and Lao Kip, shall apply as follows: 1US$ = 153 Yen = 715 Kip

Exchange Rate of US Dollars for Laos Kip

Date	TTB	TTS	A/S
30 Dec 89	710	717	717
Jan 90	710	717	717
Feb 90	710	717	717
Mar 90	710	717	717
Apr 90	710	717	717
May 90	710	717	717
Jun 90	710	717	717
Jul 90	710	717	717
20 Aug 90	705	715	715

Tokyo Bank TTS Rate of US Dollars for Japanese Yen

Date	Rate	Date	Rate	Date	Rate	Date	Rate	Date	Rate	Date	Rate
Feb 1'90	145.45	Mar 1'90	150.80	Apr 1'90	-	May 1'90	160.10	Jun 1'90	153.30	Jul 1'90	-
2	145.95	2	151.20	2	161.15	2	159.55	2	-	2	153.15
3	-	3	-	3	160.15	3	-	3	-	3	152.70
4	-	4	-	4	160.30	4	-	4	153.50	4	151.40
5	146.55	5	151.25	5	159.15	5	-	5	153.25	5	151.75
6	145.85	6	149.80	6	157.75	6	-	6	153.50	6	151.95
7	146.20	7	151.40	7	-	7	158.95	7	153.45	7	-
8	146.55	8	151.30	8	-	8	159.10	8	153.60	8	-
9	146.15	9	152.30	9	157.80	9	158.35	9	-	9	152.45
10	-	10	-	10	159.15	10	157.55	10	-	10	151.55
11	-	11	-	11	158.70	11	156.15	11	154.70	11	149.45
12	-	12	153.00	12	159.40	12	-	12	155.40	12	149.85
13	145.50	13	153.80	13	159.45	13	-	13	155.65	13	148.55
14	145.20	14	153.80	14	-	14	153.90	14	155.05	14	-
15	145.60	15	152.45	15	-	15	152.80	15	155.55	15	-
16	145.80	16	153.40	16	160.15	16	153.40	16	-	16	149.35
17	-	17	-	17	160.75	17	153.30	17	-	17	149.00
18	-	18	-	18	161.15	18	153.95	18	154.90	18	148.40
19	145.30	19	153.60	19	159.50	19	-	19	154.70	19	148.95
20	145.65	20	153.80	20	158.10	20	-	20	154.95	20	149.20
21	146.45	21	-	21	-	21	154.40	21	155.35	21	-
22	146.45	22	156.20	22	-	22	154.10	22	155.90	22	-
23	147.05	23	156.10	23	158.15	23	152.50	23	-	23	149.30
24	-	24	-	24	159.10	24	152.20	24	-	24	149.20
25	-	25	-	25	159.90	25	151.45	25	156.55	25	150.10
26	148.70	26	156.65	26	159.80	26	-	26	156.15	26	150.75
27	149.40	27	158.20	27	160.30	27	-	27	155.20	27	151.55
28	149.80	28	159.55	28	-	28	150.40	28	154.55	28	-
		29	158.35	29	-	29	150.35	29	153.90	29	-
		30	159.00	30	-	30	152.00	30	-	30	150.15
		31	-			31	152.60			31	148.70
19days	2783.60	21days	3235.95	20days	3189.9	21days	3247.1	21days	3249.1	22days	3307.45
Aver.	(146.50)	Aver.	(154.09)	Aver.	(159.50)	Aver.	(154.62)	Aver.	(154.72)	Aver.	(150.34)

Total: 124days 19013.1
Average: Feb/Jul 153.33

Note: (1) TTS Rate means Telegraphic Transfer Selling Rate.
(2) Average Tokyo Bank TTS Rate of US$ for the period February 1'90 to July 31'90(6 months) be applied for the currency conversion rate of Japanese Yen for US$.

5) Contractors

Taking into the high construction expertise of the bridge required and the magnitude of the project sot, the contractors of the project shall be selected by international competitive tenders.

The following are supplementary conditions for the estimation of the project cost:

a) Materials prices

The costs local material are the market prices in Vientiane city available as of August of 1990, and expressed in US$.

While, the prices of imported or tradable materials are based on the market prices in Bangkok or Japan prices plus freight, insurances, local custom fees and duties, which will be expressed in Japanese Yen.

b) Labour rates

The minimum rate for local labour or staff available in Vientiane are shown below.

Actual rates established for each category of the labour are showing below. Those are adjusted to correspond to the Japanese classification of construction labour based on 8-hour working time from Monday through Saturday.

c) Equipment owing costs

The Standard established by the Japanese authority are used for estimating ownership cost, which consisting of depreciation, repairs and overhauling, and maintenance cost. Those for major equipment are shown in unit price analysis sheets attached hereto.

d) Land Acquisition and Compensation Cost

Land acquisition cost and compensation within right-of-way are estimated as follows:

i) Land acquisition cost

Paddy field	10.86	US$/$m^2$
Residential area	1.15	US$/$m^2$
Orchard	1.15	US$/$m^2$
Cultivated area/Farm	0.58	US$/$m^2$

ii) Compensation

Wooden house	10,000	US$/house

Wage for Local Labour

Category	Minimum Rate of Monthly Salary
Common labour	US$ 60 - 160
Skilled labour	80 - 210
Welder	90 - 250
Mason	90 - 210
Carpenter	120 - 250
Mechanic	120 - 290
Brick layer	90 - 210
Concrete worker	90 - 250
Steel bar and fixer	90 - 250
Painter	90 - 250
Lorry/Truck driver	90 - 250
Operator	100 - 340
Foreman	150 - 160
Guardsman	60 - 80

Note : (1) Workable conditions are : 25 days/month, 8 hrs/day
(2) The least figure for each category show the minimum rate which shall be applied to the foreign

Minimum Rate for Local staff Applied for
the Foreign Firms or International Agency Offices

Kind of Job	Minimum Rate of Monthly Salary
Secretariat	US$ 130
Interpreter	100
Secretary office	90
Receptionist	90
Typist	90
Technician	120
Driver	90
Cooker	90
Service man or women	90
Night guard	90
House maid	80
Cleaner	80
Gardener	80
Post man	80
Sunday guard and Sunday night guard	40

Labour Costs/Wage and Allowances

(US$)

Labour Category	Basic salary established (A)	Overtime allowances (0.21A)	Recruit cost and fringe benefit (0.14A)	Total (B)	Daily cost B- 25 days (rounded)
Foreman	340	71	48	459	18
Special worker	290	61	41	392	16
Plant mechanic	290	61	41	392	16
Formwork carpenter	250	53	35	338	14
Steel fixer	250	53	35	338	14
Scaffolding man	250	53	35	338	14
Welder	250	53	35	338	14
Electrician	250	53	35	338	14
Plant Operator	250	53	35	338	14
Heavy driver	250	53	35	338	14
Light driver	225	47	32	304	12
Concrete worker	210	44	29	283	11
Common worker	210	44	29	283	11
Helper	160	34	22	216	9
Unskilled worker	160	34	22	216	9
Light worker	160	34	22	216	9

Note: (1) The rate of overtime allowances for the basic salary established for the F/S is calculated as: A x 21 Hours Overtime/month x 2.0 (twice the normal hourly cost)/(8 normal working hours per day x 25 days/month)=0.21A

(2) Labour category is set forth to comply with and cover the classified labours by the Ministry of Construction of Japan

e) Local labour output

We uniformly assumed that three fold figure of the Japanese standard output rate of labour be used for the productivity estimation for each labour requirement.

9.6.2 Unit Costs

1) Equipment

The hire rates of the earth work equipment which may be available in Vientiane are shown below. However, taking into consideration of the market, the owing and operation unit cost of equipment which are imported in principle from Japan shown in each unit price analysis sheet will be applied.

Hire Rate of Equipment

Equipment			Construction Enterprise No.10 (US$/day)	Private Company (US$/Hr)
Bulldozer	9 ton	class	310	64.3
	12 ton	class	510	85.7
Backhoe	0.3 m^3	class	-	42.8
	0.6 m^3	class	-	57.1
	1.2 m^3	class	300	
Dozer shovel	0.8 m^3	class	-	71.4
Tired shovel	1.4 m^3	class	250	1$/7$m^3$ per loading
Motor grader	3.7 m	class	250	42.9
Dump truck	4 ton	class	-	17.1/day
	6 ton	class	-	21.4/day
	8 ton	class	-	25.7/day
Flatbed truck	2 ton	class	-	14.3/day
Tired roller	8-15 ton	class	190	42.9
Steel roller	10 ton	class	-	42.9
Water tanker	4000 L	class	120	21.4/day
Compressor	7 m^3		-	17.1

2) Material cost

Major construction materials available in Laos as of August 1990 are as follows.

Item	Unit	Price(US$)	Remarks
Fuel and oil			
Gasoline	l	0.46	ex. Tha Ngon
Diesel	l	0.37	ditto
Aggregate for concrete			
Gravel, 5-10mm	m^3	10.7	ex. Tha Ngon
10-20mm	m^3	10.7	ditto
Sand	m^3	5.3	ditto
Timber			
Class I	m^3	360.0	
Class II	m^3	290.0	
Class III	m^3	230.0	
Plywood			
12x900x1800	sheet	13.0	
9x900x1800	sheet	10.0	
Portland cement	t	183	

9.6.3 Construction Cost

Construction costs expressed in US$ are summarized as follows. They are estimated on condition that the construction period be 36 months as seen in Figure 9.4.

The conversion of the financial costs to the economic costs are summarized in the appended tables.

Description	Financial cost (100 US$)
Bridge	43,952
Approach road	13,337
Temporary bridge	8,260
Rivetment work	4,636
Total Direct construction cost	70,186
Preliminaries and general items	11,938
Packing and transport	14,771
Dispatch of expatriate technician	12,503
Site on cost	12,093
Overhead	8,269
Total of Indirect construction cost	59,574
Total of Construction Cost	129,758

9.7 Maintenance Programme

9.7.1 Maintenance Capability of Lao PDR/DCTC

1) Road

Road maintenance work in Vientiane Municipality have been taken by the DCTC and its subsidiary enterprises. The organization for maintenance work is shown in Figure 9.2.

In practice, maintenance works have been limited to small scale ones such as asphaltic repainting on road surface, repair of potholes, and grass cutting. Maintenance gangs of the municipality, therefore can do in routine with skills maintenance works on double or single bituminous treated surfaces. Actual maintenance work for road has been undertaken about 30 to 40 Km per annum on the paved roads. The Project for which pavement is planned with DBST will, therefore, be well maintained has been undertaken maintenance works on double.

2) Bridge

Pre-stressed concrete bridge shall in principle require the least maintenances among various types of bridges. The following are, however, will be essential for safety of traffic.

a) Remove dirt and debris from drainage pipe and drain pits.

b) Remove accumulated dirts and debris of the deck surface.

c) Remove dirts and debris of the bridge seats and bearing.

Regular inspection and cleaning shall be undertaken to prevent the accumulation of dirts and debris on the part of the structure, particularly just before rainy season.

9.7.2 Maintenance Cost

1) Road

Most of Road maintenance cost for the project road will be consumed mainly for surface course such as resealing, pot-hole maintenance and repaving through out the project life time. While, minor amount of the maintenance cost will be used for grass cutting, side ditch, shoulder, road marking, traffic sign and other relatively small items.

Based upon the maintenance requirement, we assume that an annual and periodic maintenance costs be estimated as follows.

Type of Maintenance Work	Cost
Routine maintenance cost, annually	4,400 US$
Periodic maintenance cost, every 7 years	73,500 US$

The unit price analysis for this cost are seen in the appended table.

Table 9.1. Summary of Project Capital Cost and Economic Converted Cost ; 3 years

	Financial Cost ('00US$)	Economic Cost ('00US$)	1st Year	2nd Year	3rd Year	4th Year
I CONSTRUCTION COST ('00YS$)	129,758	116,106		40,338	45,547	30,221
1. Direct Construction Cost ('00US$)	70,184	61,498				
Foreign portion ('0000Yen)	64,354	61,137				
Material	29,468	27,995				
Equipment	34,886	33,142				
Local Portion ('00US$)	28,123	21,539				
Labour	7,543	3,107				
Material	16,679	15,011				
Equipment	3,901	3,511				
2. Indirect Construction Cost ('00US$)	59,574	54,608				
Foreign portion ('0000Yen)	64,352	62,666				
Material	60,010	58,551				
Equipment	4,332	4,115				
Local Portion ('00US$)	17,520	13,649				
Labour	5,660	2,264				
Material	10,704	10,345				
Equipment	1,156	1,040				
II LAND ACQUISITON COST						
Local portion ('00US$)	952	857	857			
III ENGINEERING SERVICE COST ('00US$)	16,338	16,186	2,900	4,430	4,430	4,426
Foreign portion ('000Yen)	24,144	24,123				
Local portion ('00US$)	558	419				
Labour	166	66				
Material	392	353				
IV CONTINGENCY, 5% of (I) ('00US$)	6,479	5,805		2,017	2,277	1,511
Total	153,527	138,954	3,757	46,705	52,254	36,158

Note: (1) Foreign currency is expressed in Japanese Yen, while local currency is represented in US dollars.
(2) Average Tokyo Bank TTS rate February through July of 1990 of US dolars is adopted: 1US$ = 153Yen
(3) 5% of the foreign portion's material and equipment cost is eliminated as import tax.
(4) The economic cost of local labour is obtained by applying 0.4 to market cost.
(5) 0.9 of conversion factor is applied for the market cost of local material and equipment.
(6) The total figuer is expressed in US dollars for the convenience of calculation.

Table 9.2 Breakdown of Construction Cost and Economic Conversion Cost; Construction Period 3 years (1)

Description			Financial Cost						Economic Cost (100US$)
			Foreign Cost Component (10,000yen)		Local Cost Component (100US$)			Total (100US$)	
			Material	Equipment	Labour	Material	Equipment		
(Conversion Factor)			(0.95)	(0.95)	(0.4)	(0.9)	(0.9)		
I CONSTRUCTION COST									
1. Direct Construction Cost									
1.1 Bridge									
1.1.1 Superstructure									
1) Bridge deck slab	2,530	m²	178	15	926	994	7		
2) Main girder, fabrication	30	nr	9,934	106	1,743	3,817	35		
3) Main girder, scaffolding	30	nr	115	–	76	–	–		
4) Main girder, temporary setting	30	nr	–	–	61	2	–		
5) Manufacturing platform, main girder	123	m	62	12	33	260	3		
6) Adjustable work for platform	30	nr	–	–	22	1	–		
7) Setting and removing of p. crane	2	nr	300	50	140	1,003	12		
8) Railwork for portal crane		sum	–	–	34	1	–		
9) Rubber bearing work	30	nr	260	–	20	2	–		
10) Erection of main girder	30	nr	31	15	475	14	22		
11) Cross beam		sum	672	5	365	362	3		
12) Equipment ownership cost/PC girder	30	nr	–	8,842	–	–	–		
13) Equipment ownership cost/concreting		sum	–	754	–	–	–		
Total of Superstructure			11,552	9,799	3,895	6,456	86	24,392	20,703
1.1.2 Substructure									
1) Abutments									
(1) Concrete placing by truck crane	255	m³	7	21	22	415	5		
(2) Formwork	643	m²	–	18	75	11	6		
(3) Reinforcement work	34	t	195	–	55	3	–		
(4) Levelling concrete	13	m³	–	1	1	–	18		
(5) Scaffolding	734	m²	75	11	42	–	4		
(6) Pipe timbering	26	m²	–	–	2	–	–		
(7) Excavation	10,636	m³	–	275	–	–	151		
(8) Backfill	14,221	m³	–	429	17	4	242		
(9) Equipment ownership cost/concreting		sum	–	1,257	–	–	–		
(10) Equipment ownership cost/earthwork		sum	–	1,194	–	–	–		
Total of abutments			277	3,206	214	433	426	3,349	3,021

Table 9.3 Breakdown of Construction Cost and Economic Conversion Cost; Construction Period 3 years (2)

Description		Financial Cost						Economic Cost (100US$)
		Foreign Cost Component (10,000yen)		Local Cost Component (100US$)			Total (100US$)	
		Material	Equipment	Labour	Material	Equipment		
(Conversion Factor)		(0.95)	(0.95)	(0.4)	(0.9)	(0.9)		
2) Piers								
(1) Concrete placing by truxk crane	739 m³	19	61	65	1,202	14		
(2) Formwork	1,177 m²	–	33	138	19	11		
(3) Reinforcement work	163 t	925	–	263	13	–		
(4) Scaffolding	2,011 m²	344	29	115	–	10		
(5) Footing concrete, placing by truck crane	554 m³	14	46	49	902	11		
(6) Footing concrete, formwork	259 m²	–	7	30	4	2		
(7) Footing concrete, reinforcement work	21 t	117	–	33	2	–		
(8) Equipment, ownership cost/concrete	sum	–	723	–	–	–		
Total of piers		1,419	899	693	2,142	48	4,398	3,687
3) In situ concrete pile, reverse circulation drill								
(1) ISCP, L = 15m, submergible	24 nr	2,319	979	575	1,181	326		
(2) ISCP, L = 13m, on land	6 nr	131	164	128	327	28		
(3) Ownership cost, standpile	sum	–	1,400	–	–	–		
(4) Equipment, ownership cost/drill	sum	–	4,676	–	–	–		
(5) Equipment, ownership cost/concrete	sum	–	408	–	–	–		
Total ISCP		2,450	7,627	703	1,508	354	9,151	8,214
4) U-shape wall								
(1) Concrete placing by truck crane	1,285 m³	34	106	113	2,091	25		
(2) Formwork	782 m²	–	22	92	13	7		
(3) Reinforcemnt work	40 t	226	–	64	3	–		
Total of U-shape wall		260	128	269	2,107	32	2,662	2,274
Total of Substructure		4,406	11,860	1,879	6,190	860	19,560	17,196
Total of Bridge (1.1)		15,958	21,659	5,774	12,646	946	43,952	38,899

Table 9.4 Breakdown of Construction Cost and Economic Cost; Construction Period 3 years (3)

Description		Financial Cost						Economic Cost (100US$)
		Foreign Cost Component (10,000ven)		Local Cost Component (100US$)			Total (100US$)	
		Material	Equipment	Labour	Material	Equipment		
(Conversion Factor)		(0.95)	(0.95)	(0.4)	(0.9)	(0.9)		
1.2 Approach road								
1) Pavement work	26,868 m²	266	398	454	228	322		
2) Subgrade	33,585 m²	–	4,171	306	40	2,133		
3) Base course	31,234 m²	–	59	31	1,415	78		
4) Culvert, ϕ = 800, corrugated	8 nr	126	47	94	1,012	15		
5) Culvert, ϕ = 1,000, corrugated	2 nr	32	12	23	253	4		
6) Side ditch	6,000 m	11	30	237	799	10		
7) Road marking	9,000 m	25	–	1	–	–		
8) Guardrail	1,400 m	531	–	179	–	–		
9) Equipemnt ownership cost/earthwork	sum	–	3,017	–	–	–		
Total of Approach Road (1.2)		991	7,734	1,325	3,747	2,562	13,337	11,626
1.3 Temporary Bridge								
1) EL 166.00 Temporary bridge	sum	–	407	250	17	155		
2) El 155.70 platform	sum	2	64	42	11	6		
3) EL 160.00 Temporary landing pier	sum	2	65	42	10	9		
4) Equipment ownership cost/pile driver	sum	–	4,555	–	–	–		
5) Material ownership cost/El166 T/B	sum	5,322	–	–	–	–		
6) ditto/El 155.70 platform	sum	722	–	–	–	–		
7) ditto/El 160.00 T. landing pier	sum	669	–	–	–	–		
Total of Temporary Bridge (1.3)		6,717	5,091	334	38	170	8,260	7,653

Table 9.5 Breakdown of Construction Cost and Economic Cost; Construction Period 3 years (4)

Description		Financial Cost						Economic Cost (100US$)
		Foreign Cost Component (10,000yen)		Local Cost Component (100US$)			Total (100US$)	
		Material	Equipment	Labour	Material	Equipment		
(Conversion Factor)		(0.95)	(0.95)	(0.4)	(0.9)	(0.9)		
1.4 Rivetment work								
1) Excavation	9,372 m³	–	243	–	–	133		
2) Refill	5,271 m³	–	159	6	2	90		
3) Concrete block pitching	4,337 m²	5,802	–	104	246	–		
Total of Rivetment work (1.4)		5,802	402	110	248	223	4,636	4,320
Total of Direct Construciton Cost (1)		29,468 (27,995)	34,886 (33,142)	7,543 (3,017)	16,679 (15,011)	3,901 (3,511)	70,184	(61,498)

Table 9.6 Breakdown of Construction Cost and Economic Conversion Cost; Construction Period 3 years (5)

Description		Financial Cost						Economic Cost (100US$)
		Foreign Cost Component (10,000yen)		Local Cost Component (100US$)			Total (100US$)	
		Material	Equipment	Labour	Material	Equipment		
(Conversion Factor)		(0.95)	(0.95)	(0.4)	(0.9)	(0.9)		
2. Indirect Construction Cost								
2.1 Preliminaries and general items								
1) Temporary facilities								
(1) Temporary facilities	sum	6,988	843	1,543	1,376	766		
(2) Security	sum	1,371	–	278	545	–		
(3) Technical administrative	sum	667	–	980	–	–		
Total of preliminaries and general Items (2.1)		9,026	843	2,801	1,921	766	11,938	9,667
2.2 Packing and transport cost								
Total of Packing and Transport Cost (2.2)		11,713	–	–	7,115	–	14,771	14,771
2.3 Dispatch of expatriate technician								
1) Remuneration	sum	16,313	–	–	–	–		
2) Allowance	sum	2,318	–	–	–	–		
3) Traveling expenses	sum	499	–	–	–	–		
Total of despatch of Expatriate technician (2.3)		19,130	–	–	–	–	12,503	12,503

Table 9.7 Breakdown of Construction Cost and Economic Conversion Cost; Construction Period 3 years (6)

Description		Financial Cost						Economic Cost (100US$)
		Foreign Cost Component (10,000yen)		Local Cost Component (100US$)			Total (100US$)	
		Material	Equipment	Labour	Material	Equipment		
(Conversion Factor)		(0.95)	(0.95)	(0.4)	(0.9)	(0.9)		
2.4 Site oncosts								
1) Insurance	sum	1,144	–	–	–	–		
2) Remuneration of expatriate engineers	sum	12,397	–	–	–	–		
3) Remuneration of local staff	sum	–	–	1,483	–	–		
4) Welfare cost	sum	257	–	–	–	–		
5) Office equipment cost	sum	635	–	–	–	–		
6) Communication expenses	sum	163	–	–	–	–		
7) Traveling expenses expatriate staff	sum	260	–	–	–	–		
8) Communication and transport cost	sum	381	–	622	–	–		
9) Furniture of staff quarters	sum	44	–	–	–	–		
Total of site oncost (2.4)		15,281	–	2,105	–	–	12,093	10.330
2.5 Overhead cost 10% of sum of direct construciton cost and despatch cost of expatriate technician Total of overland cost (2.4)		4,860	3,489	754	1,668	390	8,269	7,338
Total of Indirect Costruciton Cost (2) Economic Converted Cost		60,010 (58,551)	4,332 (4,115)	5,660 (2,264)	10,704 (10,345)	1,156 (1,040)	59,574	54,608
Total of Construction Cost		89,478	39,218	13,203	27,383	5,057	129,758 ¥ 1,985,296	116,106

Table 9.8 Breakdown of Construction Cost and Economic Converted Cost; Construction Period 3 years (7)

Description	Financial Cost						Economic Cost (100US$)
	Foreign Cost Component (10,000yen)		Local Cost Component (100US$)			Total (100US$)	
	Material	Equipment	Labour	Material	Equipment		
(Conversion Factor)	(0.95)	(0.95)	(0.4)	(0.9)	(0.9)		
II. MAINTENANCE COST							
Note: No maintenance work will be substantially required for the bridge works. We assume both routine and periodical maintenance be regruired only for the pavement of the roadway.							
1. Routine Maintenance Cost							
Note: It is assumed 3% of the pavement surface course area (995m²) be repaired at the unit price 5.97US$/m² every year. (total : 5,970US$)							
Maintenance cost, routine			19	17	24	60	
(composition)			(31.5%)	(28.0%)	(40.5%)	(100.0%)	
Economic Converted cost (every year)			7	15	22		44
2. Periodic Maintenance Cost							
Note: 50% of the pavement surface course area (33,160m²) will be assumed to be reconstruct at the unit price 5.97US$/m² at every 7 years after completion. (total : 98,983US$)							
Maintenance cost, periodic			312	277	401	990	
(composition)			(31.5%)	(28%)	(40.5%)	(100%)	
Economic converted cost (every 7 years)			125	249	361		735

Table 9.9 Breakdown of Costs of Land Acquisition and Engineering Service and Economic Converted Costs; Construction Period 3 years

Description		Financial Cost						Economic Cost (100US$)
		Foreign Cost Component (10,000yen)		Local Cost Component (100US$)			Total (100US$)	
		Material	Equipment	Labour	Material	Equipment		
(Conversion Factor)		(0.95)	(0.95)	(0.4)	(0.9)	(0.9)		
III. Land Acquisition and Compensation Cost Note: Since it is difficult to obtain the clearcut figure of the productivity foregone for each farm and paddy field, the conversion rate 0.9 will be uniformly their economic cost is established by applying to the financial cost.								
1. Presidential are	1,500 m²	(@ 1.15US$)			17			
2. Paddy field	6,200 m²	(@ 0.86US$)			53			
3. Farm	42,000 m²	(@ 0.58US$)			24			
4. Orchard	12,000 m²	(@ 1.15US$)			138			
5. Residence	5 nr	(@10,000US$)			500			
Total of Land Acquisition Cost					952		952	(90.0%)
Economic converted cost					(857)			(857)
IV. Engineering Service Cost		4,430 (CF= 1.0)						
1. Detailed design		208 (CF= 0.9)		166	392	–		
2. Supervision		19,506 (CF= 1.0)						
Total of Engineering Service		24,144		166	392	–	16,338	(99.1%)
		(24,123)		(66)	(353)			(16,186)

Table 9.10 Summary of Unit Price Analysis (1)

	Unit	Amount	Foreign Component				Local Component					
			Material cost		Equipment cost		Labour cost		Material cost		Equipment cost	
			Unit Cost	Cost	Unit Cost	Cost	Unit Cost	Cost	Unit Cost	Cost	Unit Cost	Cost
Superstructure												
Bridge deck slab	sqm	2530	705	1,783,650	61	154,330	36.61	92623.30	39.27	99353.10	0.42	1062.60
Main girder, fabrication	nr	30	3,311,493	99,344,790	35,450	1,063,500	5808.36	174250.80	12722.99	381689.70	115.13	3453.90
Main girder, scaffolding	nr	30	38,250	1,147,500	0	0	253.80	7614.00	0.00	0.00	0.00	0.00
Main girder, temporary setting	nr	30	0	0	0	0	201.69	6050.70	6.04	181.20	0.00	0.00
Main girder, platform	m	123	5,049	621,027	945	116,235	27.04	3325.92	211.57	26023.11	2.22	273.06
Adjustable work for platform	nr	30	0	0	0	0	74.13	2223.90	2.22	66.60	0.00	0.00
Potal crane	nr	2	1,498,425	2,996,850	251,358	502,716	7021.81	14043.62	50171.78	100343.56	591.92	1183.84
Potal crane, rail	sum	1	0	0	0	0	3389.85	3389.85	101.25	101.25	0.00	0.00
Bearing	nr	30	86,612	2,598,360	0	0	65.99	1979.70	7.16	214.80	0.00	0.00
Main girder, election	nr	30	10,384	311,520	5,090	152,700	1582.12	47463.60	45.86	1375.80	73.56	206.80
Cross beam	sum	1	6,718,783	6,718,783	53,303	53,303	36481.07	36481.07	36198.69	36198.69	259.87	259.87
Sub total		1		15,522,480		2,042,784		389446.46		645547.81		8440.07
Substructure												
Abutment, concrete	cum	255	261	65,555	821	209,355	8.82	2249.10	162.66	41478.90	1.93	492.15
Abutment, formwork	sqm	643	0	0	279	179,481	11.73	7545.91	1.64	1055.01	0.94	604.70
Abutment, reinforcement	t	34	56,732	1,945,908	0	0	161.19	5528.82	8.06	276.46	0.00	0.00
Abutment, leveling concrete	cum	13	0	0	590	7,611	11.17	144.09	0.22	2.84	136.11	1755.82
Abutment, scaffolding	sqm	734	1,026	752,571	146	107,091	5.70	4180.95	0.00	0.00	0.49	359.42
Abutment, pipe timbering	cum	26	0	0	0	0	7.14	185.64	0.71	18.46	0.00	0.00
Abutment, excavation	cum	10636	0	0	259	2,754,724	0.00	0.00	0.00	0.00	1.42	15103.12
Abutment, backfill	cum	14221	0	0	302	4,294,742	0.12	1706.52	0.03	426.63	1.70	24175.70
Pier, concrete	cum	739	261	192,801	821	606,473	8.82	6515.33	162.66	120156.94	1.93	1425.69
Pier, formwork	sqm	1177	0	0	279	328,383	11.73	13806.21	1.64	1930.28	0.94	1106.38
Pier, reinforcement	t	163	56,732	9,247,316	0	0	161.19	26273.97	8.06	1313.78	0.00	0.00
Pier, scaffolding	sqm	2011	1,711	3,440,308	146	293,562	5.70	11460.99	0.00	0.00	0.49	985.24
Footing, concrete	cum	554	261	144,698	821	455,162	8.82	4889.81	162.66	90178.70	1.93	1069.99
Footing, formwork	sqm	259	0	0	279	72,317	11.73	3040.42	1.64	425.09	0.94	243.65
Footing, reinforcement	t	21	56,732	1,174,352	0	0	161.19	3336.63	8.06	166.84	0.00	0.00
U-shape wall, concrete	cum	1285	261	335,489	821	1,055,313	8.82	11337.23	162.66	209083.16	1.93	2480.82
U-shape wall, formwork	sqm	782	0	0	279	218,066	11.73	9168.17	1.64	1281.82	0.94	734.70
U-shape wall, rinforcement	t	40	56,732	2,257,934	0	0	161.19	6415.36	8.06	320.79	0.00	0.00
In situ concrete pile L=15m	nr	24	966,287	23,190,888	408,044	9,793,056	2396.18	57508.32	4919.24	118061.76	1360.40	23649.60
In situ concrete pile L=13m	nr	6	217,671	1,306,026	273,244	1,639,464	2140.05	12840.30	5452.74	32716.44	459.33	2755.98
Sub total				44,054,846		22,014,801		188133.77		618893.91		85942.97
Total of bridge				59,577,326		24,057,585		577580.23		1264441.12		94383.04

Table 9.11 Summary of Unit Price Analysis (2)

	Unit	Amount	Foreign Component				Local Component					
			Material cost		Equipment cost		Labour cost		Material cost		Equipment cost	
			Unit Cost	Cost	Unit Cost	Cost	Unit Cost	Cost	Unit Cost	Cost	Unit Cost	Cost
Approach road												
Approach road, pavement	sqm	26868	99	2,659,932	148	3,976,464	1.69	45406.92	0.85	22837.80	1.20	32241.60
Approach road, subgrade	sqm	33585	0	0	1,242	14,712,570	0.91	30562.35	0.12	4030.20	6.35	213264.75
Approach road, base course	sqm	31234	0	0	19	593,446	0.10	3123.40	4.53	141490.02	0.25	7808.50
Culvert, dia=800	nr	8	157,926	1,263,408	58,390	467,120	1174.98	9399.84	12647.74	101181.92	186.10	1488.80
Culvert, dia=1000	2	2	157,926	315,852	58,390	116,780	1174.98	2349.96	12647.74	25295.48	186.10	372.20
Side ditch	m	6000	18	108,000	50	300,000	3.95	23700.00	13.31	79860.00	0.16	960.00
Road marking	m	9000	28	252,000		363	0.01	90.00		0.63	0.00	0.00
Guardrail	m	1400	3,790	5,306,000	0	0	12.77	17878.00	0.00	0.00	0.00	0.00
Total of approach road				9,905,192		47,166,743		132510.47		374696.05		256135.85
Temporary bridge												
Temporary bridge	sum	1	0	0	4,066,600	4,066,600	24983.42	24983.42	1668.75	1668.75	15501.06	15501.06
platform	sum	1	24,462	24,462	640,433	640,433	4193.94	4193.94	1137.69	1137.69	565.14	565.14
Temporary landing pier	sum	1	19,070	19,070	650,917	650,917	4209.65	4209.65	1027.88	1027.88	877.31	877.31
Total of temporary bridge				43,532		5,357,950		33387.01		3834.32		16943.51
Rivetment Work												
Rivetment work, excavation	cum	9372	0	0	259	2,427,348	0.00	0.00		0.00	1.42	13308.24
Rivetment work, refill	cum	5271	0	0	302	1,591,842	0.12	632.52	0.00	158.13	1.70	8960.70
Rivetment work, concrete block	sqm	4337	13,379	58,024,723	0	0	2.36	10365.43	0.03	24590.79	0.00	0.00
Total of rivetment work				58,024,723		4,019,190		10997.95	5.67	24748.92		22268.94
Total				27,550,773		80,601,468		754475.66		1667720.41		389731.34

Table 9.12 Estimate of Equipment Owership Cost (1)

Description		Quantity	Owing days			Remarks
			Day	Owing cost	Cost	
Earthwork						
Back hoe	1.0m³	1	540	13,410	7,241,400	
Wheel loader	1.2m³	1	540	4,662	2,517,480	
Bulldozer	21 t	1	540	17,370	9,379,800	
Vibration roller	1.0 t	1	540	1,116	602,640	
Compactor	50~60kg	1	540	180	97,200	
Tamper	80kg	1	540	266	143,370	
Pick hammer	-	2	540	50	53,460	
Macadam roller	10~12 t	1	540	596	3,227,040	
Tyre roller	8~20 t	1	540	5,499	2,969,460	
Grader	3.1m	1	540	7,857	4,242,780	
Dump truck	11 t	2	540	5,616	6,065,280	
Dump truck	4 t	1	540	3,681	1,987,740	Abutment 4months 31%
Earthwork total					38,527,650	Approach road 9months 69%
Abutment Total					11,943,572	
					26,584,079	
Pavement work						
Distributor	-	1	180	2,421	435,780	
Chipspreader	-	1	180	535	96,228	
Road sweeper	-	1	180	12,150	2,187,000	
Line maker	-	2	180	239	97,038	
Truck	2 t	1	180	1,512	544,320	
Compressor	3.7m³			1,278	230,040	
Pavement total					3,590,406	
Approach road Total					30,174,485	
Temporary bridge						
Crawler crane	50 t	1	525	25,650	13,466,250	
Truck crane	25 t	1	525	21,240	11,151,000	
Diesel hummer	2.5 t	1	525	9,540	5,008,500	
Vibro hummer	40 t	1	525	9,270	4,866,750	
Trailer	32 t	1	525	10,350	5,433,750	
Unic truck	4 t	1	525	3,681	1,932,525	
Truck	10 t	1	525	5,301	3,783,025	
Generater	60KVA	1	525	1,728	907,200	
Total					45,549,000	

Table 9.13 Estimate of Equipment Owership Cost (2)

Description		Quantity	Owing days			Remarks
			Day	Owing cost	Cost	
PC girder						
Portal crane	60 t	2	450	12,690	11,421,000	
Girder hanging	60 t	2	450	21,060	18,954,000	
Metal fitting	60 t	2	450	191	171,720	
Lateral transfer	60 t	2	450	1,404	1,263,600	
Erection girder	–	100	450	493	22,194,000	
Bent	–	12	450	462	2,493,180	
Winch	5 t	2	450	12,600	11,340,000	
Hydraulic jack	75 t	8	450	1,080	3,888,000	
Hydraulic pump	75 t	4	450	881	1,585,980	
Carriage	60 t	2	450	1,710	1,539,000	
Roller	60 t	10	450	1,395	6,277,500	
Expansion pump	1T19.3	3	450	878	1,185,840	
Rail	–	14.7	450	170	1,125,212	
Cutter	–	1	–		292,500	
Bender	–	1	–		299,250	
Working table	–	1	–		89,100	
Gas cutter	–	1	–		34,650	
High speed cutter	–	1	–		37,238	
Electric saw	–	1	–		66,150	
Disk sander	PD-150A	1	450	191	12,465	
Pilot attachment	–	1	450	44	85,860	
Electric drill	–	1	450	313	19,845	
Grouting mixer	200	1	450	497	140,940	
Grouting pump	30	1	450	896	223,560	
Chain block	5.0 t	4	450	516	1,611,900	
Chain block	2.0 t	4	450	80	928,260	
Lever block	5.0 t	3	450	123	108,135	
Lever block	3.0 t	2	450	190	110,970	
Lever block	1.5 t	1	450	134	85,455	
Chill hall	3.0 t	1	450	215	60,345	
Chill hall	1.6 t	1	450	86	96,795	
Pulley	300	5	450	213	194,400	
Pulley	400	5	450		479,925	
Total					88,416,774	

Table 9.14 Estimate of Equipment Owership Cost (3)

Description		Quantity	Owing days			Remarks	
			Day	Owing cost	Cost		
Concrete work							
Concrete plant	30m3/hr	1	735	13,500	9,922,500		
Cement silo	30 t	1	735	1,341	985,635		
Bucket elevater	20t/hr	1	735	900	661,500		
Screw Converor	20t/hr	2	735	475	698,544		
Generater	200KVA	1	735	4,158	3,056,130		
Generater	100KVA	1	735	2,178	1,600,830		
Compressor	10.6m³	1	735	3,564	2,619,540		
Welder	300A	1	735	84	61,520		
Convertor	12A	2	735	163	239,463		
Vibrator	40	10	735	143	1,051,785		
Underwater pump	#4	3	735	137	301,644		
Underwater pump	#3	2	735	200	293,706		
Underwater pump	#2	4	735	284	836,136		
Washer	11kw	1	735	754	554,337		
Concrete bucket	0.6	1	735	336	246,740		
Concrete bucket	1.0	1	735	479	351,918		
Truck mixer	4.5m³	2	735	5,400	7,938,000		
Totel					31,419,927		
					7,540,782	Superstructure	24%
					12,567,971	Abutment	40%
					7,226,583	Pier	23%
					4,084,591	In situ concrete pile	13%
In situ concrete pile							
Crawler crane	50 t	1	210	25,650	5,386,500		
Truck crane	25 t	1	210	21,240	4,460,400		
Vibro hummer	40 t	1	210	9,270	1,946,700		
Trailer	32 t	1	210	10,350	2,173,500		
Unic truck	4 t	1	210	3,681	773,010		
Truck	10 t	1	210	5,301	1,113,210		
Generater	200KVA	1	210	1,728	362,880		
Boat	15 t	1	210	7,542	1,583,820		
Float	10 t	20	210	1,458	6,123,600		
Welder	150A	1	210	287	60,291		
Winch	5 t	3	210	12,600	7,938,000		
Reverse circulation	-	1	210	19,620	4,120,200		
Hummer grab	1500	1	210	27,180	5,707,800		
Hummer crown	-	1	210	4,968	1,043,280		
Underwater pump	-	1	210	1,477	310,149		
Tremie pipe	250	12	210	245	616,896		
Drill pipe	200	12	210	1,206	3,039,120		
Totel					46,759,356		

Table 9.15 Estimate of Material Owershop Cost (1)

Description	Size	Quantities	Weight	Month	Purchase		Rental		Maintance		Remarks
					Unit	Cost	Unit	Cost	Unit	Cost	
1. Temporary Bridge											EL=161.00
Pile	H350x350x13x19	1904	260.848	24			2,850	17,842,003	3,100	808,629	
Beam	H350x350x13x19	840	115.080	24			2,850	7,871,472	3,100	356,748	
Deck plate	1000x2000x200	1260	236.880	24			600	18,144,000	1,200	1,512,000	
Section steel	I300x90x10	602	26.367		83,000	2,188,461					
	I200x90x 8		17.998		79,000	1,421,842					
	L100x100x10		28.796		73,000	210,378					
	L100x100x10		1.621		350	567					
	FR12x350x310		1.226		150,000	183,900					
	FR16x147x310		1.373		150,000	205,950					
	FR 9x270x310		0.709		150,000	106,350					
	FR12x250x270		0.096		150,000	14,400					
Bolt	BN60, 70xM22		1.040		70,000	72,800					
	HIB(F10T)		1.347		180,000	242,460					
	HIB(F10T)		0.462		170,000	78,540					
	HIB(F10T)		0.412		160,000	65,920					
Sub total			694.245			6,682,568		43,857,475		2,677,377	Total 53,217,420

Table 9.16 Estimate of Material Owershop Cost (2)

Description	Size	Quantities	Weight	Month	Purchase		Rental		Maintance		Remarks
					Unit	Cost	Unit	Cost	Unit	Cost	
2. Platform											EL=155.70
Pile	H350x350x12x19	63	8.631				2,850	590,360	3,100	26,756	
Beam	H350x350x12x19	27	3.699				2,850	253,012	3,100	11,467	
Deck plate	1000x3000x200	48	10.208				600	691,200	1,200	57,600	
Section steel	I300x90x10	6	1.840		83,000	152,720					
	I200x90x 8		0.050		160,000	8,000					
	L100x100x10		0.083		160,000	13,280					
Sub total			24.511			174,000		1,534,572		95,823	
Platform 4hr			98.044			696,000		6,138,288		383,292	Total 7,217,580
3. Landing Pier											EL=160.00
Pile	H350x350x12x19	3045	41.717	24			2,850	2,853,443	3,100	129,323	
Beam	H350x350x12x19	91	12.467	24			2,850	852,743	3,100	38,648	
Deck plate	1000x2000x200	144	27.072	24			600	2,073,600	1,200	172,800	
Section steel	I300x90x10	84	3.201		83,000	265,683					
	I200x90x 8	42	1.273		79,000	100,567					
	L100x100x10	144	2.146		73,000	156,658					
Bolt	HIB(F10T)		0.200		170,000	34,000					
	HIB(F10T)		0.103		160,000	16,480					
Sub total			88.179			573,388		5,779,786		340,770	Total 6,693,944

Table 9.17 Estimate of Packing and Transport Cost

No.	Item	Quantity	unit	F/T	Packing	Shipping	Ship's cargo	Customs	On land	Total	
										¥	$
	Mobilization	1.00	sum	4457	¥ 38,674,800	¥ 31,199,000	¥ 47,255,121	$ 1671	$ 379,198	117,128,921	380,869.00
	Demobilization	1.00	sum	2916	$ 138,039	$ 133,413	$ 201,568	$ 1671	$ 243,771	0	718,462.00
	Sub-total									117,128,921	1,099,331.00
	Reduction										
	Rail	1.00	sum	500	$ 25,000	$ 22,876	$ 41,882		$ 55,000		- 144,758.00
	H-beam	1.00	sum	880	$ 44,000	$ 40,262	$ 61,992		$ 96,800		- 243,054.00
	Sub-total										- 387,812.00
	Total									117,128,921	711,519.00

Packing	(¥/FT)	Case (CA)	¥ 15,850/FT	Crate (CR)	¥ 14,250/FT	Skid/Bundle (S/B)	¥ 7,650/FT	Marking (M)	¥ 4,750/FT			
Shipping	(¥/FT)	General cargo	¥ 7,000/FT	Self-propelled vehicles	¥ 7,000/FT	Plants	¥ 7,000/FT					
Ship's cargo	(¥/FT)	Referred to Estimate Cost.										
Customs	($/FT)	Sum of Port charge, Customs and Storage charge	$ 1671									
On land	($/FT)	General cargo	$ 87/FT,	Self-propelled vehicles	$ 35/FT,	Plants	$ 80/FT,	Steel	$ 110/FT			

Table 9.18 Packing and Transport Cost (1)

No.	Item	Quantity	unit	F/T	Packing (¥)		Shipping (¥)	Ship's cargo (¥)	Customs ($)	On land ($)	Total	
											¥	$
1	Crawler crane 50t	2	nr	130	M	617,500	910,000	1,992,062		10,400.00	3,519,562	12,071.00
2	Truck crane 25t	2	nr	110	M	522,500	770,000	1,660,051		3,850.00	2,952,551	3,850.00
3	Back hoe	1	nr	54	M	256,500	378,000	691,688		4,320.00	1,326,188	4,320.00
4	Wheel loader	1	nr	44	M	209,000	308,000	309,439		3,520.00	826,439	3,520.00
5	Bulldozer 21t	1	nr	60	M	285,000	420,000	830,025		4,800.00	1,535,025	4,800.00
6	Vibration roller	1	nr	3	M	14,250	21,000	33,027		240.00	68,277	240.00
7	Vibrating compactor	1	nr	3	CR	42,750	21,000	33,027		261.00	96,777	261.00
8	Tamper	1	nr									
9	Pick hammer	2	nr									
10	Diesel hammer	1	nr	6	CR	85,500	42,000	66,055		480.00	193,555	480.00
11	Pile Hammer & head	2	nr	12	CR	171,000	84,000	132,109		960.00	387,109	960.00
12	Vibro pile driver	1	nr	8	CR	114,000	56,000	88,073		640.00	258,073	640.00
13	Boat FRP 15t	1	nr	200	S/B	1,530,000	1,400,000	1,652,400		16,000.00	4,582,400	16,000.00
14	Boom of crawler crane	1	sum	30	CR	427,500	210,000	330,270		2,610.00	967,773	2,610.00
15	Generater 175KVA	1	nr	8	CR	114,000	56,000	88,073		696.00	258,073	696.00
16	Generater 100KVA	1	nr	7	CR	99,750	49,000	77,064		609.00	225,814	609.00
17	Generater 60KVA	1	nr	4	CR	57,000	28,000	44,036		348.00	129,036	348.00

Packing	(¥/FT)	Case (CA)	¥ 15,850/FT	Crate (CR)	¥ 14,250/FT	Skid/Bundle (S/B)	¥ 7,650/FT	Marking (M)	¥ 4,750/FT	
Shipping	(¥/FT)	General cargo	¥ 7,000/FT	Self-propelled vehicles	¥ 7,000/FT	Plants	¥ 7,000/FT			
Ship's cargo	(¥/FT)	Referred to Estimate Cost.								
Customs	($/FT)	Sum of Port charge, Customs and Storage charge	$ 1671							
On land	($/FT)	General cargo	$ 87/FT,	Self-propelled vehicles	$ 35/FT,	Plants	$ 80/FT,	Steel	$ 110/FT	

Table 9.19 Packing and Transport Cost (2)

No.	Item	Quantity	unit	F/T	Packing (¥)	Shipping (¥)	Ship's cargo (¥)	Customs ($)	On land ($)	Total ¥	Total $
18	Compressor 3㎥	2	nr	6	CR 59,400	42,000	66,055		522.00	167,455	522.00
19	Compressor 10㎥	1	nr	8	CR 79,200	56,000	88,073		696.00	223,273	696.00
20	Welder 500A+150A	2	nr	2	CA 31,700	14,000	22,018		174.00	67,718	174.00
21	Converter	2	nr								
22	Vibrator	6	nr	5	CA 79,250	35,000	55,046		435.00	169,296	435.00
23	Underwater pump	9	nr								
24	High pressure washer	1	nr								
25	Concrete plant	1	nr	240	CA 2,760,000	1,680,000	2,642,188		20,880.00	7,082,188	20,880.00
26	Cement silo	1	nr	10	CA 158,500	70,000	110,091		870.00	338,591	870.00
27	Bucket elevator	1	nr	5	CA 79,250	35,000	55,046		435.00	169,296	435.00
28	Screw coeveyor	2	nr	5	CA 79,250	35,000	55,046		435.00	169,296	435.00
29	Concrete bucket	2	nr	2	CA 31,700	14,000	22,018		174.00	67,718	174.00
30	Dump truck 11t	2	nr	160	M 760,000	1,120,000	1,092,236		5,600.00	2,972,236	5,600.00
31	Truck mixer	2	nr	160	M 760,000	1,120,000	1,092,236		5,600.00	2,972,236	5,600.00
32	Truck 10t	1	nr	80	M 380,000	560,000	546,118		2,800.00	1,486,118	2,800.00
33	Truck crane 5t	1	nr	45	M 321,750	315,000	364,044		1,575.00	1,000,794	1,575.00
34	Trailer 32t	1	nr	140	M 665,000	980,000	996,031		4,900.00	2,641,031	4,900.00

Packing	(¥/FT)	Case (CA)	¥ 15,850/FT	Crate (CR)	¥ 14,250/FT	Skid/Bundle (S/B)	¥ 7,650/FT	Marking (M)	¥ 4,750/FT		
Shipping	(¥/FT)	General cargo	¥ 7,000/FT	Self-propelled vehicles	¥ 7,000/FT			Plants	¥ 7,000/FT		
Ship's cargo	(¥/FT)	Referred to Estimate Cost.									
Customs	($/FT)	Sum of Port charge, Customs and Storage charge			$ 1671						
On land	($/FT)	General cargo	$ 87/FT,	Self-propelled vehicles	$ 35/FT,			Plants	$ 80/FT,	Steel	$ 110/FT

Table 9.20 Packing and Transport Cost (3)

No.	Item	Quantity	unit	F/T	Packing (¥)	Shipping (¥)	Ship's cargo (¥)	Customs ($)	On land ($)	Total ¥	Total $
35	Truck 2t	2	nr	50	M 357,500	350,000	324,765		1,750.00	1,032,265	1,750.00
36	Van 2200cc	2	nr	16	M 114,400	112,000	594,612		1,435.00	821,012	1,435.00
37	Mini bus (15 persons)	1	nr	15	M 107,250	105,000					
38	Mini bus (29 persons)	1	nr	20	M 143,000	140,000					
39	Portal crane	2	nr								
40	Girder hanging	2	nr								
41	Metal fitting	2	set	180	CA 2,070,000	1,260,000	1,981,641		15,660.00	5,311,641	15,660.00
42	Lateral transfer	2	nr								
43	Election girder	1	nr								
44	Bent	3	nr								
45	Winch	5	nr								
46	Hydraulic jack	4	nr								
47	HYdraulic pump	4	nr	400	CA 4,600,000	2,800,000	4,403,646		34,800.00	11,803,646	34,800.00
48	Carriage	2	nr								
49	Roller	10	nr								

Packing	(¥/FT)	Case (CA)	¥ 15,850/FT	Crate (CR)	¥ 14,250/FT	Skid/Bundle (S/B)	¥ 7,650/FT	Marking (M)	¥ 4,750/FT	
Shipping	(¥/FT)	General cargo	¥ 7,000/FT	Self-propelled vehicles	¥ 7,000/FT	Plants	¥ 7,000/FT			
Ship's cargo	(¥/FT)	Referred to Estimate Cost.								
Customs	($/FT)	Sum of Port charge, Customs and Storage charge	$ 1671							
On land	($/FT)	General cargo	$ 87/FT,	Self-propelled vehicles	$ 35/FT,	Plants	$ 80/FT,	Steel	$ 110/FT	

Table 9.21 Packing and Transport Cost (4)

No.	Item	Quantity	unit	F/T	Packing (¥)	Shipping (¥)	Ship's cargo (¥)	Customs ($)	On land ($)	Total ¥	Total $
50	Chain blick 5t	4									
51	Chain blick 2t	4									
52	Lever block 1.5t	3									
53	Lever block 3t	2		2	CA 31,700	14,070	22,018		174.00	67,718	174.00
54	Lever block 5t	1									
55	Chill hall 1.6t	1									
56	Chill hall 1.6t	1									
57	Pulley (oak) φ300	5									
58	Pulley (shakkle) φ300	5		2	CA 31,700	14,070	22,018		174.00	67,718	174.00
59	Pulley (oak) φ400	5									
60	Pulley (shakkle) φ400	5									
61	Derformed reinforcing bar	78.5	ton								
62	PC wire 12T-12.4	36.9	ton	120	S/B 918,000	840,000	1,321,094		13,200.00	3,079,094	13,200.00
63	PC wire 1T-19.3	6.5	ton								

Packing (¥/FT) Case (CA) ¥ 15,850/FT Crate (CR) ¥ 14,250/FT Skid/Bundle (S/B) ¥ 7,650/FT Marking (M) ¥ 4,750/FT
Shipping (¥/FT) General cargo ¥ 7,000/FT Self-propelled vehicles ¥ 7,000/FT Plants ¥ 7,000/FT
Ship's cargo (¥/FT) Referred to Estimate Cost.
Customs ($/FT) Sum of Port charge, Customs and Storage charge $ 1671
On land ($/FT) General cargo $ 87/FT, Self-propelled vehicles $ 35/FT, Plants $ 80/FT, Steel $ 110/FT

Table 9.22 Packing and Transport Cost (5)

No.	Item	Quantity	unit	F/T	Packing (¥)	Shipping (¥)	Ship's cargo (¥)	Customs ($)	On land ($)	Total ¥	Total $
64	Sheath φ65										
65	Sheath φ35										
66	Fixing equipment	200	nr	80	CA 920,000	560,000	880,729		6,960.00	2,360,729	6,960.00
67	Fixing equipment	780	nr								
68	Rubber bareing	40	nr								
69	Anchor bolt	1	sum								
70	Equipment for tensioning	2	nr								
71	Equipment for main girder fabrication	1	sum		CA 2,875,000	1,750,000	2,752,279		21,750.00	7,377,279	21,750.00
72	Main girder formwork	1	sum								
73	Instruments	1	sum	56	CA 747,500	455,000	715,592		5,655.00	1,918,092	5,655.00
74	Consumption material	1	sum	230	CA 3,645,500	1,610,000	2,532,096		20,010.00	7,787,596	20,010.00
75	Rail	100	t	100	S/B 765,000	700,000	578,340		11,000.00	2,043,340	11,000.00
76	H-beam	880	t	880	S/B 6732,000	6,160,000	9,484,776		96,800.00	22,376,776	96,800.00
77	Steel box	500	t	500	S/B 3825,000	3,500,000	6,407,870		55,000.00	13,732,870	55,000.00

Packing	($/FT)	Case (CA)	$ 103.600/FT	Crate (CR)	$ 93.137/FT	Skid/Bundle (S/B)	$ 50.000/FT	Marking (M)	$ 31.046/FT			
Shipping	($/FT)	General cargo	$ 45.752/FT	Self-propelled vehicles	$ 45.752/FT			Plants	$ 45.752/FT			
Ship's cargo	($/FT)											
Customs	($/FT)	Sum of Port charge, Customs and Storage charge	$ 1671									
On land	($/FT)	General cargo	$ 87/FT,	Self-propelled vehicles	$ 35/FT,			Plants	$ 80/FT,	Steel	$ 110/FT	

Table 9.23 Packing and Transport Cost (6)

No.	Item	Quantity	unit	F/T	Packing		Shipping	Ship's cargo	Customs	On land	Total	
						($)	($)	($)	($)	($)	($)	($)
1	Crawler crane 50t	1	nr	130	M	4,036	5,948	13,020		10,400		35,075
2	Truck crane 25t	1	nr	110	M	3,415	5,033	10,850		3,850		23,148
3	Back hoe	1	nr	54	M	1,676	2,471	4,521		4,320		12,988
4	Wheel loater	1	nr	44	M	1,366	2,013	2,022		3,520		8,921
5	Bulldozer	1	nr	60	M	1,863	2,745	5,425		4,800		14,833
6	Vibration roller	1	nr	3	M	93	137	216		240		686
7	Diesel hammer	1	nr	6	CR	559	275	432		480		1,745
8	Pile hammer & head	2	nr	12	CR	1,118	549	863		960		3,490
9	vibro pile hammer	1	nr	8	CR	745	366	576		640		2,327
10	Boom of crawler crane	1		30	CR	2,794	1,373	2,159		2,610		8,936
11	Generator 175KVA	1	nr	8	CR	745	366	576		696		2,383
12	Generator 100KVA	1	nr	7	CR	652	320	504		609		2,085
13	Generator 60KVA	1	nr	4	CR	373	183	288		348		1,192
14	Compressor 3m³	2	nr	6	CR	388	275	432		522		1,617
15	Compressor 10m³	1	nr	8	CR	517	366	576		696		2,155
16	Concrete plant	1	nr	240	CA	18,039	10,980	17,269		20,880		67,169
17	Cement silo	1	nr	10	CA	1,036	458	720		870		3,084

Packing ($/FT) Case (CA) $ 103.600/FT Crate (CR) $ 93.137/FT Skid/Bundle ($/B) $ 50.000/FT Marking (M) $ 31.046/FT
Shipping ($/FT) General cargo $ 45.752/FT Self-propelled vehicles $ 45.752/FT Plants $ 45.752/FT
Ship's cargo ($/FT)
Customs ($/FT) Sum of Port charge, Customs and Storage charge $ 1671
On land ($/FT) General cargo $ 87/FT, Self-propelled vehicles $ 35/FT, Plants $ 80/FT, Steel $ 110/FT

Table 9.24 Packing and Transport Cost (7)

No.	Item	Quantity	unit	F/T	Packing ($)		Shipping ($)	Ship's cargo ($)	Customs ($)	On land ($)	Total ($)	Total $
18	Bucket elevater	1	nr	5	CA	518	229	360		435		1,542
19	Screw conveyor	2	nr	5	CA	518	229	360		435		1,542
20	Dump truck 11t	2	nr	160	B	4,967	7,320	7,139		5,600		25,026
21	Truck mixer 5m³	2	nr	160	B	4,967	7,320	7,139		5,600		25,026
22	Truck 10t	1	nr	80	B	2,484	3,660	3,690		2,800		12,513
23	Truck crane 5t	1	nr	45	B	2,103	2,058	2,379		1,575		8,115
24	Trailer 32t	1	nr	140	B	4,346	6,405	6,510		4,900		22,161
25	Diesel truck 2t	2	nr	50	B	2,337	2,288	2,123		1,750		8,498
26	Van 2000cc	2	nr	16	B	748	732	3,886		1,435		10,038
27	Mini bus (15 persons)	1	nr	15	B	701	686					
28	Mini bus (29 persons)	1	nr	20	B	935	915					
29	Rail	100	t	100	S/B	5,000	4,575	3,780		11,000		24,355
30	H-beam	880	t	880	S/B	44,000	40,262	61,992		96,800		243,054
31	Steel box	500	t	500	S/B	25,000	22,876	41,882		55,000		144,758

Table 9.25 Estimate of Engineering Survice Cost for Detail Design

DESCRIPTION	UNIT	QUANTITY	FOREIGN PORTION (¥)		LOCAL PORTION (US$)		REMARKS
			UNIT PRICE	AMOUNT	UNIT PRICE	AMOUNT	
Direct personnel expenses							
Project manager	sum	1.00		2,395,000			
Bridge engineer	sum	1.00		6,015,000			
Highway engineer	sum	1.00		1,560,000			
Geologist	sum	1.00		1,203,000			
Surveyor	sum	1.00		936,000			
Specification and tender document	sum	1.00		2,005,000			
Cost estimate	sum	1.00		936,000			
Sub-total				15,050,000			
Direct expenses							
Traveling expenses	sum	1.00		4,557,000			
Investigation expenses	sum	1.00		3,621,000			
Sub-total				8,178,000			
Overhead cost	sum	1.00		15,050,000			L.C× 100%
Technical administrative expense	sum	1.00		6,020,000			(L.C+O.C)X20%
Total				44,298,000			

Table 9.26 Engineering Survice Cost for Detail Design (1)

DESCRIPTION	UNIT	QUANTITY	FOREIGN PORTION (¥)		LOCAL PORTION (US$)		TOTAL (US$)	REMARKS
			UNIT PRICE	AMOUNT	UNIT PRICE	AMOUNT		
Direct personnel expense								
Position	Grade	Unit Price	Man-Month	Amount				
Project manager	2	958	2.5	2,395				
Bridge engineer (A)	3	802	2.5	2,005				
Bridge engineer (B)	3	802	2.5	2,005				
Bridge engineer (C)	3	802	2.5	2,005				
Highway engineer	4	624	2.5	1,560				
Geologist	3	802	1.5	1,203				
Surveyor	4	624	1.5	936				
Specification and tender document	3	802	2.5	2,005				
Cost estimate	4	624	1.5	936				
TOTAL			19.5	15,050				

Table 9.27 Engineering Survice Cost for Detail Design (2)

DESCRIPTION	UNIT	QUANTITY	FOREIGN PORTION (¥)		LOCAL PORTION (US$)		TOTAL (US$)	REMARKS
			UNIT PRICE	AMOUNT	UNIT PRICE	AMOUNT		
Travelling expenses								
Position	Grade	day	Travel cost		Allowance		Hotel charges	Amount
Project manager	2	30+ 0.9 × 15= 43.5	258,100 × 1 = 258,100		4,500 × 43.5= 195,750		13,500× 44= 594,000	1,047,850
Bridge engineer (A)	3	30+ 0.9 × 15= 43.5	258,100 × 1 = 258,100		3,800 × 43.5= 165,300		11,600× 44= 510,000	933,800
Highway engineer	4	30+ 0.9 × 15= 43.5	258,100 × 1 = 258,100		3,800 × 43.5= 165,300		11,600× 44= 510,000	933,800
Geologist	3	30	258,100 × 1 = 258,100		3,800 × 30 = 114,000		11,600× 29= 336,400	708,500
Surveyor	4	30+ 0.9 × 15= 43.5	258,100 × 1 = 258,100		3,800 × 43.5= 165,300		11,600× 44= 510,000	933,800
TOTAL				1,290,500		805,650	2,461,600	4,557,750

Table 9.28 Engineering Survice Cost for Detail Design (3)

DESCRIPTION	UNIT	QUANTITY	FOREIGN PORTION (¥)		LOCAL PORTION (US$)		TOTAL (US$)	REMARKS
			UNIT PRICE	AMOUNT	UNIT PRICE	AMOUNT		
Investigation expenses								
① Local labour cost								
② Vehicle rental (A)	day	41.0	3,500	143,500				
(B)	day	41.0	3,500	143,500				
Sub total				287,000				
③ Transport cost		-		-				
④ Matenals and equipment		-		-				
⑤ Consumption goods		-		-				
⑥ Printing and filing for B/Q	sum	1.0	99,100	99,100				
Inking for tender drawing	nr	60.0	11,000	660,000				A1 size
Reducing for tender drawings	nr	60.0	130	7,800				A3 size
Printing and filing for tender document (report)	nr	5.0	6,100	30,500				A4 200× 25+ 1100
(drawwings)	nr	5.0	19,500	97,500				A3 120× 110+ 6300
Sub total				894,900				
⑦ Miscellaneous	sum	1.0		2;440,000				Ref. estimate sheet
Total				3,621,000				

Table 9.29 Engineering Survice cost for Detail Design (4)

Item	Printing				Filing			
	Unit	Unit Price	Quantity	Amount	Unit	Unit Price	Quantity	Amount
Design Report	nr	8	500	4,000	nr	5	125	625
Superstructure D/R	nr	8	500	4,000	nr	5	200	1,000
Superstructure B/Q	nr	8	25	200	nr	5	125	625
Substructure D/R	nr	8	400	3,200	nr	5	170	850
Substructure B/Q	nr	8	250	2,000	nr	5	125	625
Accessories D/R	nr	8	150	1,200	nr	5	95	475
Approach road D/R	nr	8	200	1,600	nr	5	110	550
Drawings	nr	45	1,200	54,000	nr	5	800	4,000
Tender Document	nr	8	2,000	16,000	nr	5	350	1,750
Preliminary evaluation report	nr	8	100	800	nr	5	80	400
Evaluation Report	nr	8	100	800	nr	5	80	400
Total				87,800				11,300
	99,100							

Table 9.30 Engineering Survice Cost for Detail Design (5)

	6	7	8	9	10	11	Man-Month Domestic	Site	Total
Project Manager							1.0	1.5	2.5
Bridge Engineer (A)							1.0	1.5	2.5
Bridge Engineer (B)							2.5		2.5
Bridge Engineer (C)							2.5		2.5
Highway Enginner							1.0	1.5	2.5
Geologist							0.5	1.0	1.5
Surveyor								1.5	1.5
Spec. Writer							2.5		2.5
Cost Estimater							1.5		1.5
Total man-month for detail design							12.5	7.0	19.5

: Domestic

: Site

Table 9.31 Estimate of Engineering Survice Cost for Supervision ;Construction Period 3 years

DESCRIPTION	UNIT	QUANTITY	FOREIGN PORTION (¥)		LOCAL PORTION (US$)		REMARKS
			UNIT PRICE	AMOUNT	UNIT PRICE	AMOUNT	
Direct personnel expenses							
Project Manager	sum	1.00		3,353,000			
Resident Enneer	sum	1.00		30,476,000			
Highway Engineer	sum	1.00		21,840,000			
Bridge Engineer	sum	1.00		20,852,000			
Sub-total				76,521,000			
Direct expenses							
Traveling expenses	sum	1.00		11,410,000			
Investigation expenses	sum	1.00		2,082,000		54,937.90	
Sub-total				13,492,000			
Overhead cost	sum	1.00		76,521,000			L.C× 100%
Technical administrative expense	sum	1.00		30,608,000			(L.C+O.C)X20%
Total				197,142,000		54,937.90	

Table 9.32 Engineering Survice Cost for Supervision ;Construction Period 3 years (1)

DESCRIPTION	UNIT	QUANTITY	FOREIGN PORTION (¥)		LOCAL PORTION (US$)		TOTAL (US$)	REMARKS
			UNIT PRICE	AMOUNT	UNIT PRICE	AMOUNT		
Direct personnel expenses								
Position	Grade	Unit Price	Man-Month	Amount				
Project Manager	2	958	3.5	3,353				
Resident Engineer	3	802	38	30,476				
Highway Engineer	4	624	35	21,840				
Bridge Engineer	3	802	26	20,852				
Total			102.5	76,521				

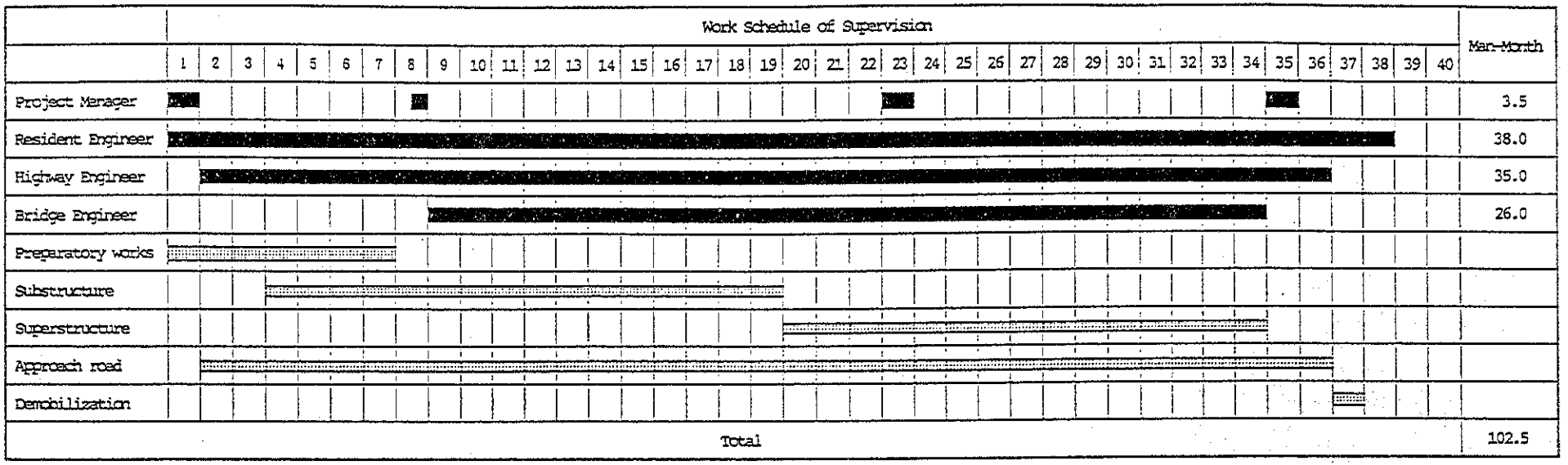
Table 9.33 Engineering Survice Cost for Supervision ;Construction Period 3 years (2)

DESCRIPTION	UNIT	QUANTITY	FOREIGN PORTION (¥)		LOCAL PORTION (US$)		TOTAL (US$)	REMARKS
			UNIT PRICE	AMOUNT	UNIT PRICE	AMOUNT		
Position Grade Position Grade	day day		Travel cost Travel cost		Allowance Allowance		Amount Amount	
Project Manager 2		30+ 15+ 30+ 30= 105	258,100 × 4 =	1,032,400	4,500 × 105 =	472,500	1,504,900	
Resident Engineer 3		30+ 30× 0.9 + 30× 0.8 × 36= 921	258,100 × 1 =	258,100	3,800 × 921 =	3,499,800	3,757,900	
Highway Engineer 4		30+ 30× 0.9 + 30× 0.8 × 33= 849	258,100 × 1 =	258,100	3,800 × 849 =	3,226,200	3,484,300	
Bridge Engineer 3		30+ 30× 0.9 + 30× 0.8 × 24= 633	258,100 × 1 =	258,100	3,800 × 633 =	2,405,400	2,663,500	
Total				1,806,700		9,603,900	11,410,600	

Table 9.34 Engineering Survice Cost for Supervision ;Construction Period 3 years (3)

DESCRIPTION	UNIT	QUANTITY	FOREIGN PORTION (¥)		LOCAL PORTION (US$)		TOTAL (US$)	REMARKS
			UNIT PRICE	AMOUNT	UNIT PRICE	AMOUNT		
Investigation expenses								
① Local labour cost								
Typist	M/M	38.0			117.00	4,446.00	4,446.00	
Civil Engineer	M/M	35.0			220.00	7,700.00	7,700.00	
Driver	M/M	38.0			117.00	4,446.00	4,446.00	
Sub total						16,592.00	16,592.00	
② Rental Vehicle								
Van	nr	1.0	1,224,165	1,224,165			8,001.08	
transportation	nr	1.0			857.00	857.00	857.00	
Feul	ℓ	13,300			0.233	3,098.90	3,098.90	0.233 $/ℓ
Office rental	M	38.0			850.00	32,300.00	32,300.00	850 $/M
Sub total				1,224,165		36,255.00	44,256.98	
③ Transport cost		—	—	—			—	
④ Material and equipment	nr	7,600	8	60,800			397.39	200nr/m× 38M for copy
⑤ Communication expense	nr	38.0			55.00	2,090.00	2,090.00	1nr/M× 38M, 55$/nr
⑥ Printing and filing	nr	266.0	3,000	798,000			5,215.69	7nr/M× 38M
Total				2,082.965		54,937.90	68,552.06	

Table 9.35 Engineering Service Cost for Supervision ; Construction Period 3 years (4)



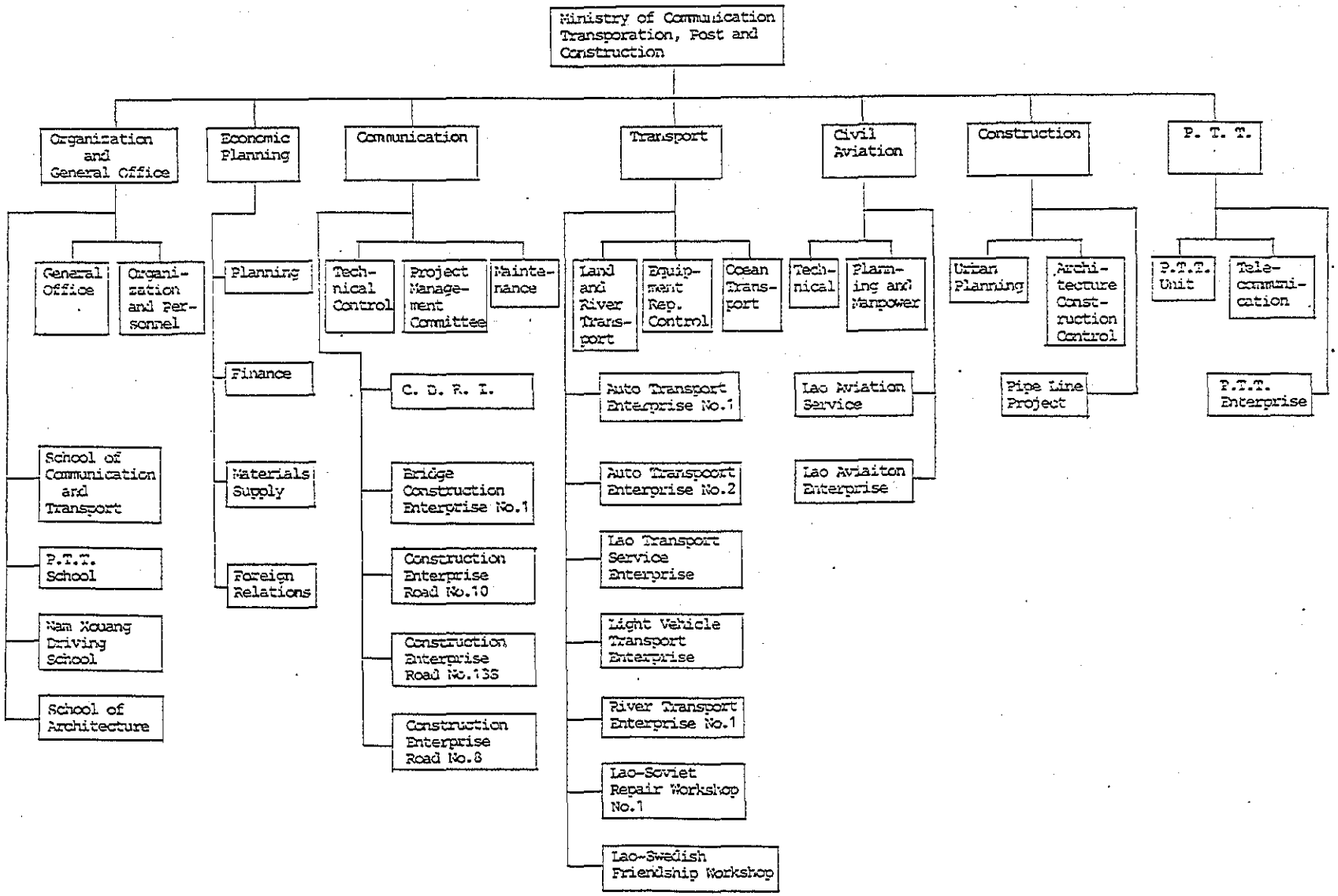


Figure 9.1 Organization Chart of MCTPC

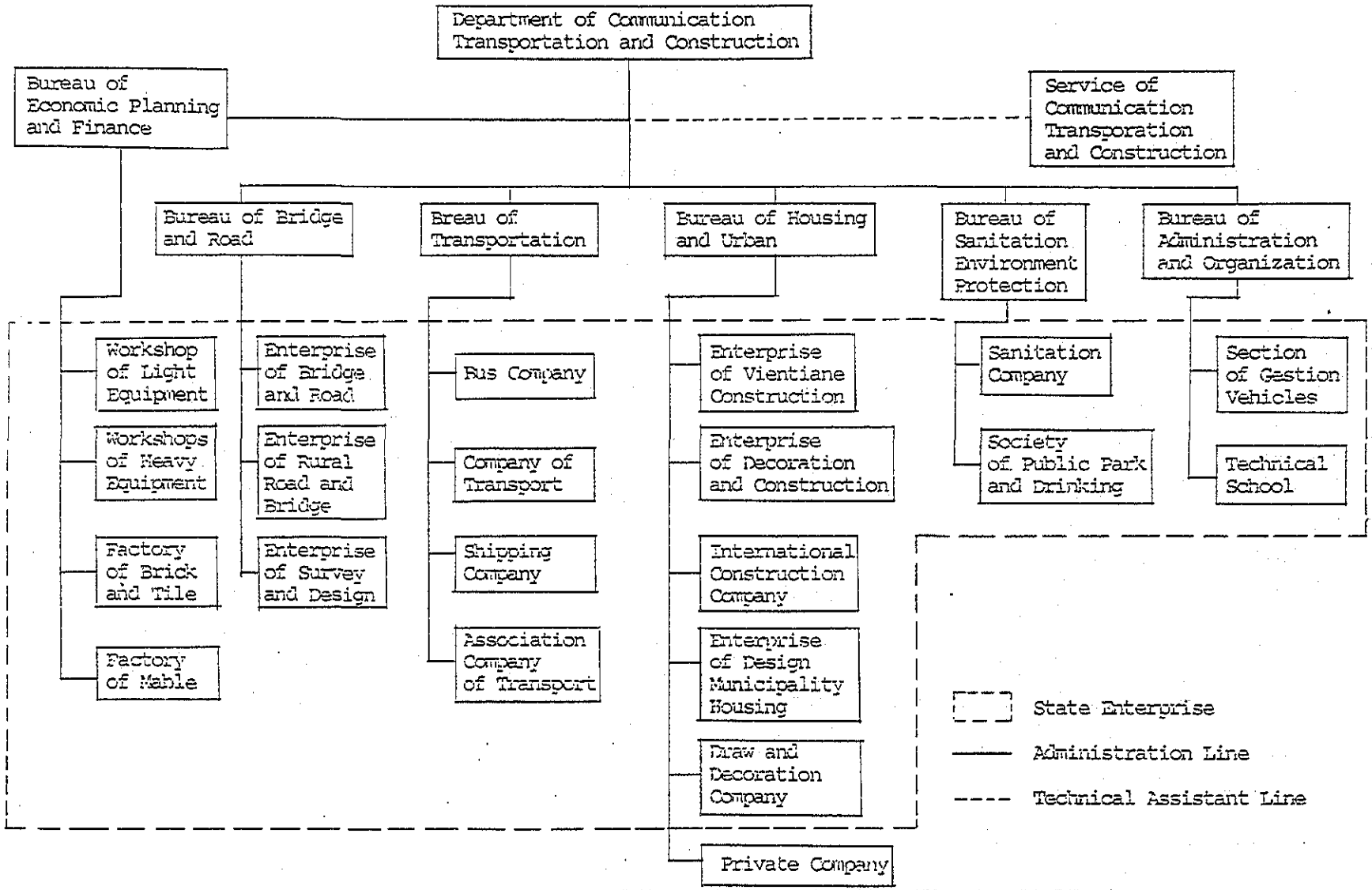
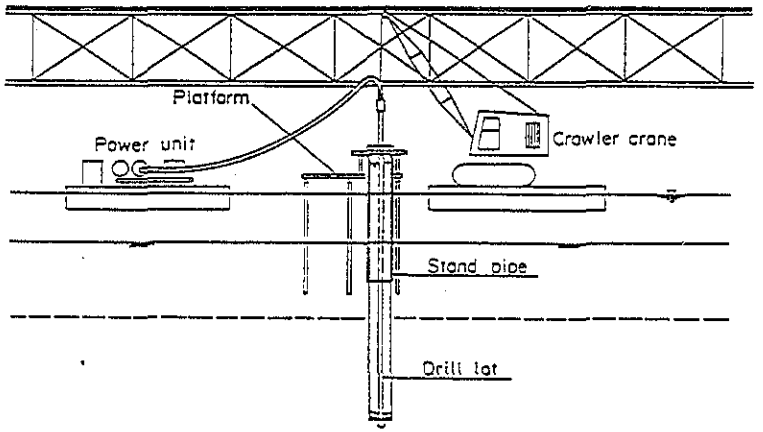
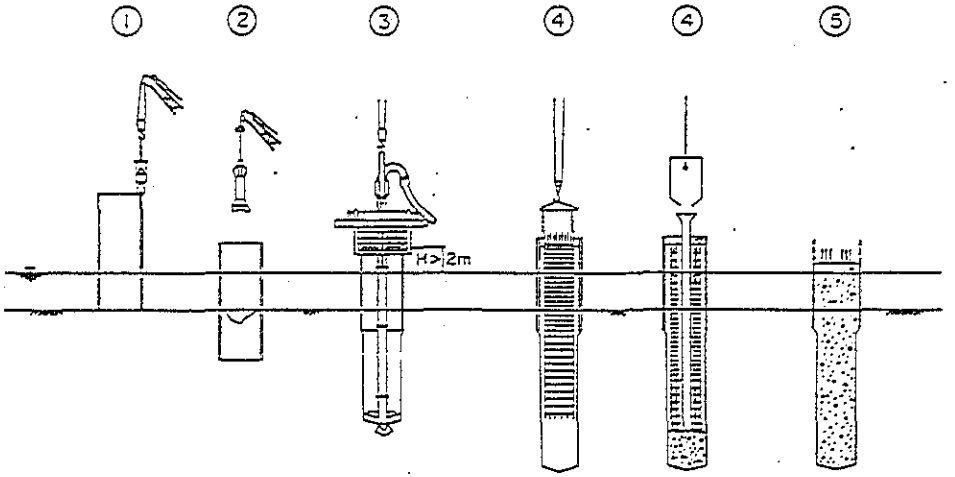


Figure 9.2 Organization Chart of DCTC in Vientiane Municipality





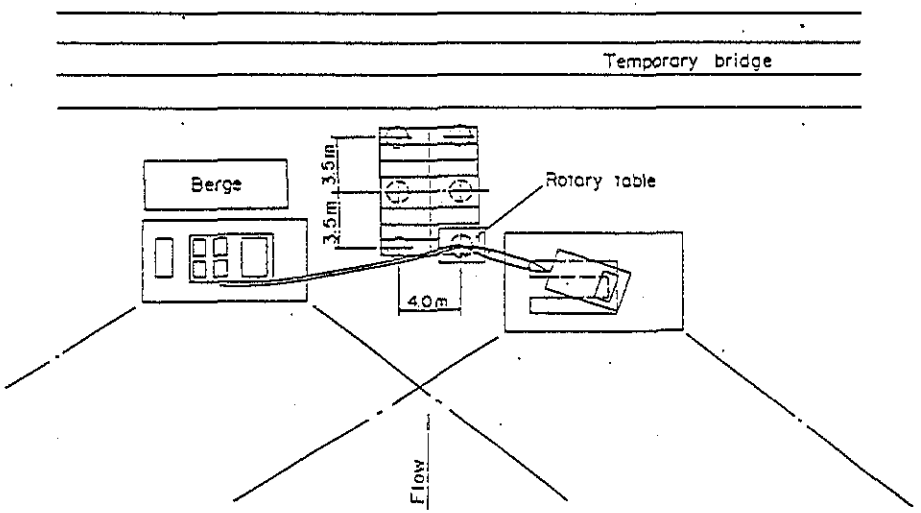


Figure 9.3 Construction of Bored Pile

Description	Year / Colendar Month / ACCUM. Month	1st Year												2nd Year												3rd Year												4th Year												5th year		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
													1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37			
1. Design and Tendering																																																					
Contract of Consultant	▽																																																				
Detailed Design	■	■	■	■	■	■																																													
Preparation of Tender Documents		■	■	■	■	■	■																																												
Advertising					▽																																															
Prequalification					■																																														
Approval of Prequalification						■																																													
Distribution of Tender Documents							▽																																												
Tendering							■	■	■																																											
Evaluation									■																																										
Negotiation										■	■																																								
2. Construction												▽	Contract																																									
Preparatory Work & Mobilization														Mobilization																																								
Temporary Bridge														Procurement	Access Road	Temporary Bridge																																					
Temporary Landing Pier																																																				
Platform																																																				
A1 Abutment																																																				
P1 Pier																																																			
P2 Pier																																																			
P3 Pier																																																			
P4 Pier																																																			
A2 Abutment																																																			
Fabrication of Girder																																																			
Erection of Gider																																																			
Deck slab																																																			
Rivetment Work (Right)																																																			
Rivetment Work (Left)																																																			
Roadway Work (Ridgt)														Earthwork																																						
Roadway Work (Left)														Clearing & Grubbing																																						
Demobilization																																																			

Figure 9.4 Implementing Time Schedule for Tha Ngon Bridge

CHAPTER X

ECONOMIC EVALUATION

CHAPTER X ECONOMIC EVALUATION

10 Economic Evaluation

10.1 Economic Evaluation

10.1.1 General

The Project is evaluated from the viewpoint of the national economy based on the following assumptions:

a) The project life is 20 years after completion of construction.
b) All prices are expressed at constant 1990 prices.
c) The exchange rates as of August 1990 are applied:
   US$ 1.00 = 715 Kip = 153 Yen.
d) The Project initiates in 1992 and the proposed bridge opens at the beginning of 1996.

The economic benefits can be classified into :

a) saving of economic costs without the Project; and
b) economic benefits derived from the Project.

The major economic benefits are saving of vehicle operation costs (VOC) and time cost. Those without the Project are calculated based on the forecasted traffic volume without the Project, while those with the Project are obtained from the forecasted traffic volume with the Project.

10.1.2 Computable Economic Benefits

1) Economic Costs Without Project

a) Time cost of Passengers Crossing Nam Ngum River at Tha Ngon

The vehicle have to spend some time to cross Nam Ngum River at Tha Ngon. Passengers motorcycles, passenger cars, and buses have to take a burden of time cost. The average opportunity cost is assumed at US$ 0.035 per hour referring to the National Transport Study of Lao PDR.

b) Economic Loss due to No Ferry Operation

It is assumed that the boat does not operate for 10 days per a year. All the vehicles except motorcycles have to take an alternative road. Hence, additional VOC and time costs are generated.

c) Extra VOC and Time Cost due to Diversion from Route 10 to Route 13

When the average waiting time for the ferry exceeds one hour, a part of traffic is expected to divert from Route 10 to Route 13. This diverted traffic has to take a burden of extra VOC and time costs.

d) Extra VOC and Time cost of Diverted Traffic from Route 13 to Route 10

The proposed bridge will result in diversion of a part traffic on Route 13 to Route 10. Without the Project, this diverted traffic from Route 13 to Route 10 will continue to run on Route 13 with extra VOC and time costs.

e) Ferry Operation and Maintenance Costs

Monthly economic operation cost is US$ 2,100 as estimated in Chapter IV. After 5 years from the start of operation, the ferry boat has to be docked. Its cost is assumed at 20% of the price of the boat. Also, it costs US$ 1,400 to maintain the landing slopes on the both side of the River annually.

f) Replacement of Ferry

Every ten years, the ferry boat has to be replaced by new one. The price of a new boat is estimated at US$ 400,000 based on the interview to a shipbuilding company.

2) Economic Benefit With Project

a) VOC Saving of Generated and Developed Traffic

With the Project, some traffic are generated and developed as discussed in Chapter V. In accordance with the concept of the consumer surplus, a half of VOC of the generated and developed traffic can be considered as economic benefits derived from the Project.

b) Salvage Value of the Ferry Boat

Upon the completion of the Project, the ferry will be used at a different site where economic benefits will be generated. The salvage value of the ferry is estimated at US$ 36,000.

c) Residual Value of the Proposed Bridge and Approach Roads

The residual value of the proposed bridge and approach roads at the end of the project life is assumed at the sum of 15% of the construction cost.

10.1.3 Economic Costs

Financial project costs are converted into economic costs based on the following conditions and assumptions:

a) Direct transfer payments such as taxes and subsidies are deleted.

b) 5% of the foreign portion costs are considered as import taxes and thus excluded.

c) To adjust the distortion of domestic market prices, costs of local materials, equipment, and labor are multiplied by a standard conversion factor of 0.9, referring to the appraisal of the Rural Credit Project by the IFAD in 1987.

d) A shadow wage rate for construction labor is assumed at 0.4, referring to past studies concerned.

10.1.4 Results of Economic Evaluation

Benefit and cost stream during the project life are shown in Table 10.1. The economic internal rate of return (EIRR) is calculated at 11.90%. Net present value(NPV) of the Project is about US$ 8.3 million with a discount rate of 8%. The B/C ratio is 1.62.

To study how EIRR and NPV changes by key factors, the following cases are analyzed:

Case 1-1 : The initial investment increases by 10% due to unexpected inflation.

Case 1-2 : The initial investment increases by 25% due to unexpected inflation.

Case 2 : The traffic volume grows at 90% of the estimated growth rate due to unexpected delay of economic development in the region.

Case 3 : The rapid construction (2 years) plan is applied.

Increase in construction cost by 10% reduces EIRR down to 11.17%. In case that actual traffic growth rate is 90% of the estimated one, EIRR further goes down to 9.35%. Thus, the Project is relatively sensitive to future traffic volume. In addition,the rapid construction plan (case 3) is inferior to the three-year construction plan also from the viewpoint of the national economy. As a result, it can be said that the Project is economically feasible.

Sensitivity Analysis

	EIRR	NPV(US$1,000)
Base Case	11.90%	8,345
Case 1-1	11.17%	7.164
Case 1-2	10.22%	5,392
Case 2	9.35%	2.494
Case 3	11.25%	6.602

10.2 Non-quantifiable Benefits

The Project is expected to yield the following impacts which are difficult to calculate as economic benefits but are the basis of future traffic forecast:

a) Increase in Agricultural Production

Reduction of transportation costs due to the Project leads to increase in the farmgate prices of agricultural products in the left side of Nam Ngum River. The price increase naturally encourages agricultural production. As the result, the Project will increases income of the farmers in the left side of the River.

b) Improvement of Tourism

At present, bus tours to Tha Lat Area take Route 13 for outgoing and Route 10 for return. Breakdown of the ferry at Tha Ngon damages the tours. The completion of the proposed bridge ensures the different route back to Vientiane without unexpected delay, which improves the bus tours. This may lead to increase in tourists. In addition, tourism development in the Tha Lat-Nam Ngum Reservoir Area may be promoted.

c) Promotion of Regional Development in the Left Side of Nam Ngum River

Lao Government has a policy that a region with easy access is given higher development priority. Concretely speaking, Ministry of Agriculture and Forestry and Vientiane Municipality have intentions to implement development project in the left side of Nam Ngum River after open the proposed bridge. Cost of these project will be reduced due to improvement of access to project sites.

d) Dispersion of Market Economy

The permanent connection between Vientiane and the influence area by the proposed bridge is expected to accelerate dispersion of market economic system.

10.3 Social Impacts

In addition to economic impacts, the Project will bring the following social impacts to the project area.

a) The proposed bridge connects the two sides of Nam Ngum River not only physically but also psychologically. The psychological distance to Vientiane from Tourakhom District will significantly reduce with the Project. Hence, the number of trips between Tourakhom District and Vientiane will significantly increase.

b) With the Project, waiting time for the ferry will be eliminated all day long. The permanent connection supports emergency of traffic, if required, like medical care.

c) With the Project, Ban Tha ngon shall change its character from terminal to a passing point from the viewpoint of transportation. Local restaurants and shops near the ferry crossing point shall be out of business and may move to the edge of the proposed bridge. Ban Tha Ngon as a whole is expected to continue to grow as a collecting point of agricultural products. Also, the through traffic will disappear from center of Ban Tha Ngon.

d) Improvement of accessibility to Vientiane and dispersion of market economy will result in improvement of living conditions in the left side of Nam Ngum River.

Table 10.1 Stream of Economic Cost and Benefit : Base Case

(in US$ 1,000)

	COST			BENEFIT										
				Normal Traffic			Diverted Traffic		Ferry Operation		Generated Traffic	Salvage Value		
Year	Construc -tion	Mainte -nance	Sum	Time Save	Loss by no Ferry	Diversion to Rt.13	VOC Save	Time Save	O/M Cost	New Ferry	VOC Save	Ferry	Bridge & Road	Sum
1992	375.7		375.7											0.0
1993	4,670.5		4,670.5											0.0
1994	5,225.4		5,225.4											0.0
1995	3,615.8		3,615.8											0.0
1996		4.4	4.4	5.4	80.5	0.0	28.4	1.1	26.3		6.6	36.0		184.3
1997		4.4	4.4	6.4	89.5	0.0	31.6	1.4	26.3	400.0	7.3			562.5
1998		4.4	4.4	16.7	99.5	0.0	35.2	1.6	26.3		8.2			187.5
1999		4.4	4.4	30.2	105.5	177.0	39.1	1.9	26.3		9.1			389.1
2000		4.4	4.4	22.0	120.4	66.9	43.6	2.3	26.3		10.2			291.7
2001		4.4	4.4	23.4	120.9	454.8	47.7	2.7	26.3		11.2			687.0
2002		77.9	77.9	24.9	121.3	881.7	52.3	3.2	106.3		12.3			1,202.0
2003		4.4	4.4	26.5	121.8	1,351.4	57.3	3.7	26.3		13.5			1,600.5
2004		4.4	4.4	28.3	122.3	1,867.9	62.8	4.4	26.3		14.9			2,126.9
2005		4.4	4.4	30.3	122.7	2,435.9	68.8	5.2	26.3		16.4			2,705.6
2006		4.4	4.4	32.5	123.2	3,060.4	75.4	6.1	26.3		18.0			3,341.9
2007		4.4	4.4	34.9	123.6	3,746.9	82.7	7.2	26.3	400.0	19.8			4,441.4
2008		4.4	4.4	37.5	124.1	4,501.5	90.6	8.4	26.3		21.7			4,810.1
2009		77.9	77.9	40.4	124.5	5,330.7	99.3	9.9	26.3		23.9			5,655.0
2010		4.4	4.4	43.6	125.0	6,242.0	108.9	11.7	26.3		26.3			6,583.8
2011		4.4	4.4	46.0	125.1	6,905.1	115.7	13.1	26.3		28.0			7,259.3
2012		4.4	4.4	48.5	125.3	7,610.9	122.9	14.7	106.3		29.8			8,058.4
2013		4.4	4.4	51.2	125.5	8,362.2	130.6	16.4	26.3		31.7			8,743.9
2014		4.4	4.4	54.1	125.7	9,161.9	138.8	18.4	26.3		33.7			9,558.9
2015		4.4	4.4	57.1	125.8	10,013.0	147.4	20.6	26.3		35.9		1,388.7	11,814.8
Sum	13,887.4	235.0	14,122.4	659.9	2,352.2	72,170.2	1,579.1	154.0	686.0	800.0	378.5	36.0	1,388.7	80,204.6

CHAPTER XI

CONCLUSION AND RECOMMENDATION

CHAPTER XI CONCLUSION AND RECOMMENDATION

11 Conclusion and Recommendation

11.1 Conclusion

The project will consist 230 meter length of bridge which has two lane three meter carriageway, crossing the Nam Ngum River, and about 3,000 meter of approach road, as mentioned detail in the Drawings.

Present manner to cross the Nam Ngum River is only the way by means of ferry boat. This is the main bottle neck on the Provincial Road No.10, which should be improved as soon as possible to solve the transport problems and also to assist the national development programs.

11.2 Recommendation

As the result of this Feasibility Study, it is found that the Project is feasible with EIRR of 11.6%(base case). It is clearly understood that the Project will rush the national Socio-economic development projects,and also give great assistance to the public activities.

The project needs only 15,000,000 US$ consisting of about 14,00,000 US$ of construction cost and 1,000,000 US$ of engineering fee. Besides total benefit is 83,000,000 US$.

Passengers and passing traffic through Tha Ngon are facing difficulties, because Ferry Boat at Tha Ngon stops its operation repeatedly, with mechanical reason.

Uncountable national economic losses are born from this machine trouble. Thus it is recommended that the project shall be started as soon as possible.

APPENDIX

APPENDIX

APPENDIX - 1	SCOPE OF WORK
APPENDIX - 2	MINUTES OF MEETING(S/W)
APPENDIX - 3	MINUTES OF MEETING(Inception Report)
APPENDIX - 4	MINUTES OF MEETING(Interim Report-I)
APPENDIX - 5	MINUTES OF MEETING(Interim Report-II)
APPENDIX - 6	MINUTES OF MEETING(Draft Final Report)

APPENDIX - 1

SCOPE OF WORK

SCOPE OF WORK
FOR
THE FEASIBILITY STUDY
ON
THA NGON BRIDGE CONSTRUCTION PROJECT
IN
THE LAO PEOPLE'S DEMOCRATIC REPUBLIC

AGREED UPON BETWEEN

VIENTIANE MUNICIPALITY

AND

JAPAN INTERNATIONAL COOPERATION AGENCY

DATED THE 13TH SEPTEMBER 1989

AT VIENTIANE

Mr. Khamla SAYAVONGSA
Deputy Director of
Department of Communication,
Transport, and
Construction,
Vientiane Municipality

Mr. Takaaki NAMBU
Leader of the Preliminary
Study Team,
Japan International
Cooperation Agency

In response to the request of the Government of Lao People Democratic Republic, (hereinafter referred to as "the Governmen of Lao PDR"), the Government of Japan decided to implement the Feasibility Study on Tha Ngon Bridge Construction Project (here after referred to as "the Study"), in accordance with the relevant laws and regulations in force in Japan.

Accordingly, the Japan International Cooperation Agency (hereinafter referred to as "JICA"), the official agency responsible for the implementation of the technical cooperation programs of the Government of Japan, will undertake the Study, in close cooperation with the authorities concerned of the the Government of Lao PDR.

The present document sets forth the scope of work with regard to the Study.

II. OBJECTIVE OF THE STUDY

The objective of the Study is to conduct feasibility study for the construction project of Tha Ngon Bridge including its approaches.

III. SCOPE OF THE STUDY

In order to achieve the objective mentioned above, the St shall cover the following items:

1.Data collection and analysis
 (1)Socio-economic data
 (2)Traffic and transport data
 (3)Soil and geological data
 (4)Hydrological data
 (5)Topographic data

(7)Others

2.Preliminary survey
(1)Traffic survey
(2)Topographic survey
(3)Soil and geological survey
(4)Hydrological survey
(5)Other necessary surveys

3.Traffic forecast
(1)Forecast of future economic activities
(2)Forecast of future traffic demand

4.Preliminary comparative study of alternatives
(routes, location, bridge type, etc.)

5.Detailed field survey
(1)Topographic survey
(2)Soil and geological survey

6.Preliminary design
(1)Design criteria
(2)Bridge design
(3)Approach roads design
(4)Quantity estimate

7.Planning and scheduling of construction

8.Cost estimate

9.Socio-economic evaluation
(1)Economic analysis
(2)Social impact analysis

10.Implementation program

11.Conclusions and recommendations

The Study shall be conducted according to the attached tentative schedule.

V. REPORTS

JICA shall prepare and submit the following reports in English to the Government of Lao PDR.

1. Inception Report
   thirty (30) copies at the commencement of the Study

2. Interim Report
   thirty (30) copies within six (6) months after the commencement of the Study.

3. Draft Final Report
   thirty (30) copies within eleven (11) months after the commencement of the Study. Vientiane Municipality will submit their comments within one month after receipt of the Draft Final Report

4. Final Report
   fifty (50) copies within two (2) months after the receipt of the said comments on the Draft Final Report.

VI. UNDERTAKINGS OF THE GOVERNMENT OF LAO PDR

1. To facilitate smooth conduct of the Study, the Government of Lao PDR shall take necessary measures :

(1) To secure the safety of the Japanese study team (hereinafter referred to as "the Team")

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(2)To permit the members of the Team to enter, leave and sojourn in Lao PDR for the duration of their assignment therein, and exempt them from alien registration requirements and consular fees

(3)To exempt the members of the Team from taxes, duties and any other charges on equipment, machinery and other materials brought into Lao PDR for the conduct of the Study

(4)To exempt the members of the Team from income tax and charges of any kind imposed on or in connection with any emoluments or allowance paid to the members of the Team for their services in connection with the implementation of the Study

(5)To provide necessary facilities to the Team for remittance as well as utilization of the funds introduced into Lao PDR from Japan in connection with the implementation of the Study

(6)To secure permission for entry into private properties or restricted areas for the conduct of the Study

(7)To secure permission to take all data and documents (including maps and photographs) related to the Study out of Lao PDR to Japan, and

(8)To provide medical services as needed. Its expenses will be chargeable on members of the Team.

2. The Government of Lao PDR shall bear claims, if any arises, against the members of the Team resulting from, occurring 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 willful misconduct on the part of the members of the Team.

3. Vientiane Municipality shall act as counterpart agency to the Team and also as coordination body in relation with other governmental and non-governmental organizations concerned for the smooth implementation of the Study.

4. Vientiane Municipality shall, at its own expense, provide the Team with the followings, in cooperation with other relevant organizations:

(1) available data and information related to the Study

(2) counterpart personnel

(3) suitable office space with necessary equipment in Vientiane

(4) credentials or identification cards

VII. UNDERTAKINGS OF JICA

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

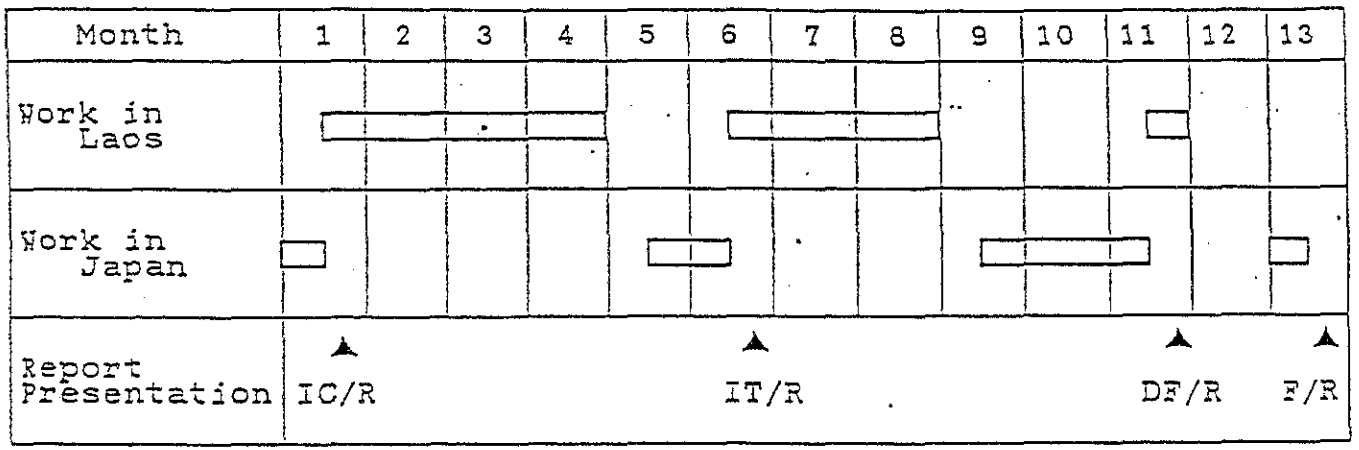
1. To dispatch, at its own expense, a study team to Lao PDR.
2. To pursue technology transfer to the Lao counterpart personnel in the course of the Study

VIII. CONSULTATION

JICA and Vientiane Municipality shall consult with each other in respect of any matter that may arise from or in connection with the Study.

ATTACHMENT

TENTATIVE SCHEDULE



IC/R : Inception Report

IT/R : Interim Report

DF/R : Draft Final Report

F/R : Final Report

APPENDIX - 2

MINUTES OF MEETING(S/W)

MINUTES OF MEETINGS
ON
THE FEASIBILITY STUDY
ON
THA NGON BRIDGE CONSTRUCTION PROJECT
IN
THE LAO PEOPLE'S DEMOCRATIC REPUBLIC

BETWEEN
VIENTIANE MUNICIPALITY
AND
PRELIMINARY STUDY TEAM

VIENTIANE, SEPTEMBER 13, 1989

Mr. Khamla SAYAVONGSA
Deputy Director of
Department of Communication,
Transport, and
Construction,
Vientiane Municipality

Mr. Takaaki NAMBU
Leader of the Preliminary
Study Team,
Japan International
Cooperation Agency

In response to the request of the Government of Lao People's Democratic Republic, the Preliminary Study Team of Japan International Cooperation Agency (JICA) visited Lao PDR from September 7 to 14, 1989, to agree on the Scope of Work for the Feasibility Study of Tha Ngon Bridge Construction Project (herein after referred to as "the Study").

The Preliminary Study Team headed by Mr. Takaaki NAMBU carried out the field reconnaissance survey on the Study area and had a series of discussion on the Scope of Work (S/W) with the officials of Lao side headed by Mr. Khamla SAYAVONGSA.

The final meeting was held on September 13, 1989 at the office of the Department of Communication, Transport, and Construction, Vientiane Municipality (hereinafter referred to as "the Department"). The list of attendants is shown in Appendix. Both Japanese and Lao sides agreed on the Scope of Work.

The main issues which were confirmed are as follows;

1. Bridge construction site

Lao side suggested that the location of the bridge could be close to the existing Ferry site.

Both sides agreed that alternative bridge locations (including Lao side's suggestion) would be considered in the course of the Study and be compared from various points of view.

2. Study schedule

Both sides agreed that JICA would inform, as soon as possible after the approval of finance, the time of the commencement of the Study, a list of the equipments to bring to Lao PDR, and the number of the members of the Study Team, so that the Department could prepare the office and take procedures necessary to the Study.

3. Counterpart personnel and topographic survey

Both sides agreed that the Department would provide the Japanese Study Team with about three couterpart personnel and that the Japanese Study Team would do the topographic survey at its own expense.

4. Office space

Both sides agreed that the Department would provide the Japanese Study Team with the same office that another JICA Study Team (theFeasibility Study on Improvement of Drainage System) was using at that time, or another equivalent office.

5. Vehicles

Japanese side requested Lao side to provide vehicles with driver for the Japanese Study Team. However, Lao side explained that because of its financial difficulties, the Department could not provide vehicles, and suggested that the Japanese Study Team should bring a 4WD vehicle from Japan, then the Department would provide a driver for that vehicle at its own expense.

Japanese side took note of it and agreed to convey the suggestion of Lao side to JICA headquarters.

6. Training in Japan

Lao side strongly requested Japanese side to accept two trainees in the training program in Japan as a part of technology transfer. Japanese side took note of it and agreed to convey the request to JICA headquarters.

APPENDIX - 3

MINUTES OF MEETING(Inception Report)

MINUTES OF MEETINGS
ON
THE FEASIBILITY STUDY
ON
THA NGON BRIDGE CONSTRUCTION PROJECT

BETWEEN
VIENTIANE MUNICIPALITY
AND
JICA FEASIBILITY STUDY TEAM

VIENTIANE, FEBRUARY 8, 1990

Mr. Khamla SAYAVONGSA
Deputy Director of
Department of Communication,
Transport and Construction
Vientiane Municipality

Mr. Kimio CHIBA
Team Leader of
The JICA Feasibility Study Team
Japan International
Cooperation Agency

In response to the request of the Government of Lao People's Democratic Republic, the Government of Japan decided to conduct a Feasibility Study on the Project for Tha Ngon Bridge Construction (hereinafter referred to as "the Project"), and entrusted the study to the Japan International Cooperation Agency (hereinafter referred to as "JICA"). JICA sent the Feasibility Study Team headed by Mr. Kimio CHIBA, to carry out the study from 4th of February 1990.

Following the introduction of all attendants to the meeting by Mr. Khamla SAYAVONGSA for Lao and Mr. CHIBA for JICA respectively, the meeting was opened by the chair of Mr. CHIBA, the Leader of Feasibility Study Team. (hereinafter the Attendants List is attached.)

The JICA Feasibility Study Team submitted the Inception Report and had a series of discussions for exchanging the views and opinions on the Project with the officials concerned of the Government of Lao People's Democratic Republic, at the office of the Department of Communication, Transport and Construction, Vientiane Municipality (hereinafter referred to as "the Department").

As the results of the above, the both sides have agreed and confirmed the following points:

1. JICA Team submitted the Inception Report for the Feasibility Study on the Tha Ngon Bridge Construction Project.
   Team Leader, Mr. CHIBA explained the process and aims of the study in detail. The Department understood and accepted the Inception Report.

2. The working schedule of the Feasibility Study Team also explained by Mr. CHIBA based upon the Inception Report. The Department agreed and accepted on this matter.

3. Feasibility Study Team submitted questionnaires and explained necessity of the data, information and other required assistance of the Department, for the implementation of the Feasibility Study.
The Department expressed to provide necessary data and information required by the Study Team and also confirmed the UNDERTAKINGS OF THE GOVERNMENT OF LAO PDR mentioned in the Scope of Works which had been signed on 13the September.

4. The Study Team also asked to issue the ID card to secure the member of the Study Team from any kind of objection/protest during the site investigation. The Department (DCTC) agreed and requested necessary personal data and material from member of the Study Team, such Passport Number, Full Name, Permanent Address, Date and Place of Birth etc.

ATTENDANTS LIST

A) THE GOVERNMENT OF LAO/VIENTIANE MUNICIPALITY

1. His excellency, Mr. Sisavath KEOBOUNPHANE
   Chairman, Vientiane Municipality

2. Mr. Sithone SIBOUNHEUNG
   Vice Minister of Administrative Committee
   Director, Dept. of Economic Planning and Finance
   Vientiane Municipality

3. Mr. Phila KHAMKOHOMKHAM
   Acting Director, Dept. of CTC,
   Vientiane Municipality

4. Mr. Khamla SAYAVONGSA
   Deputy Director, Dept. of CTC,
   Vientiane Municipality

5. Mr. Oudone VATHANAXAY
   Officer, Dept. of CTC, Vientiane Municipality

6. Mr. Phomma SIGNANONH
   Civil Engineer, chief of Division of Planning and Finance, Dept. of CTC, Vientiane Municipality

7. Mr. Himmakone MANOTHAM
   Vice Minister, Ministry of Communication, Transport, Post and Construction(MCTPC)

8. Mr. Boualay SOUKALOUN
   Director, Ministry of Communication, Transport, Post and Construction(MCTPC)

9. Mrs. Somsanouk VONGSACK
   Dept. No2, Ministry of Foreign Affairs

10. Dr. Bountheune MOULASY
    Acting Director, Department of Economic External Relation

ATTENDANTS LIST

B) JICA FEASIBILITY STUDY TEAM

1. Mr. Kimio CHIBA
   Bridge Planner, Team Leader of JICA Feasibility Study Team

2. Mr. Sadao HARA
   Road Engineer, Member of JICA Feasibility Study Team

3. Mr. Nobuhisa TAIRA
   Economist, Member of JICA FEasibility Study Team

C) ADVISORY COMMITTEE

1. Mr. Takaaki NAMBU
   Chairman of Advisory Committee

2. Mr. Mitsugu OKUDA
   Member of Advisory Committee

D) JAPAN INTERNATIONAL COOPERATION AGENCY(JICA)

1. Mr. Shin-ichi MORI
   Coordinator of JICA Study Team

E) EMBASSY OF JAPAN

1. Mr. Hirofumi TANIGUCHI
   Second Secretary

APPENDIX - 4

MINUTES OF MEETING(Interim Report-I)

MINUTES OF MEETING

1. Date : 27th of June 1990

2. Time : 09:10 am - 12:30 pm

3. Place : Conference room of DCTC

4. Attendants :

Lao Government/Vientiane Municipality

a. Mr. Phila KHAMKOHOMHPHANH
Acting Director, Dept. of CTC
Vientiane Municipality

b. Mr. Khamla SAYAVONGSA
Deputy Director, Dept. of CTC
Vientiane Municipality

c. Mr. Phomma SIGNANONH
Highway Engineer, Chief of Planning and Finance Division, Dept. of CTC, Vientiane Municipality

d. Mr. Khambay CHAREUN
Deputy Director, Dept. of Economy, Planning and Finance, Vientiane Municipality

e. Mr. Dapkeo DOUANGPRACHANH
Chief of Bridge and Road Division, Dept. of CTC, Vientiane Municipality

f. Mr. Math SOUNMALA
Project Management Committee,
Dept. of Communication, Ministry of Communication, Transport, Post and Construction

g. Mr. Hom ONE
Department of Communication,
Ministry of Communication, Transport, Post and Construction

JICA Feasibility Study Team

a. Mr. Kimio CHIBA
Team Leader of Feasibility Study Team

b. Mr. Sadao HARA
Road Engineer, Member of the Team

c. Mr. Nobuhisa TAIRA
Economist, Member of the Team

d. Mr. Nobuyuki SUZUKI
Bridge Engineer, Member of the Team

e. Mr. Kazutoshi YOSHITANI
Surveyor, Member of the Team

Advisory Committee

a. Mr. Mitsugu OKUDA
Acting Chairman of Advisory Committee

b. Mr. Hirohisa IMAGI
Member of Advisory Committee

Japan International Cooperation Agency

a. Mr. Shin-ichi MORI
Coordinator

Embassy of Japan

a. Mr. Hirofumi TANIGUCHI
Second Secretary

5. Itinerary

The meeting was chaired by Mr.Khamla, the Deputy Director of Department of Communication, Transport and Construction(DCTC) at the conference room of DCTC.

The DCTC, Mr.Khamla expressed his gratitude for Japanese Government and also stated welcome the Study Team and Advisory Committee to the Lao PDR.

Mr. CHIBA, the Team Leader introduced new member of the team (Mr. YOSHITANI as Surveyor), and informed about Mr. NISHINAKAMURA as Bridge Engineer coming on the 1st of July. He also expressed his appreciation for kind cooperation in last stage(February and March 1990) and also expressed pleasure to return to the Lao PDR for second stage of the works.

5.1 Interim Report (I)

The Study Team submitted twenty five(25) copies of Interim Report(I)(totally thirty(30) copies) to the DCTC and DCTC received those reports with highly appreciation.

5.2 Confirmation on the Minutes of Discussion

Team Leader, Mr. CHIBA explained again contents of the Interim Report(I) item by item to the DCTC and both parties confirmed the Minutes of Discussion concerning the Interim Report (I), signed on 21st of June between the DCTC and the Study Team.

5.3 Type of Bridge

The Study Team explained the types of bridge, firstly the span of bridge and considerable bridge type by span, as mentioned followings:

5.3.1 Considerable types of bridge by number of span

Types of bridge by number of span were explained as follows.

1) Three(3) span bridge
   a. Continuous prestressed concrete girder bridge
   b. Continuous steel box girder bridge
   c. Steel Langer girder bridge with steel girder for both side span

2) Four(4) span bridge
   a. Continuous prestressed concrete box girder bridge
   b. Continuous steel box girder bridge

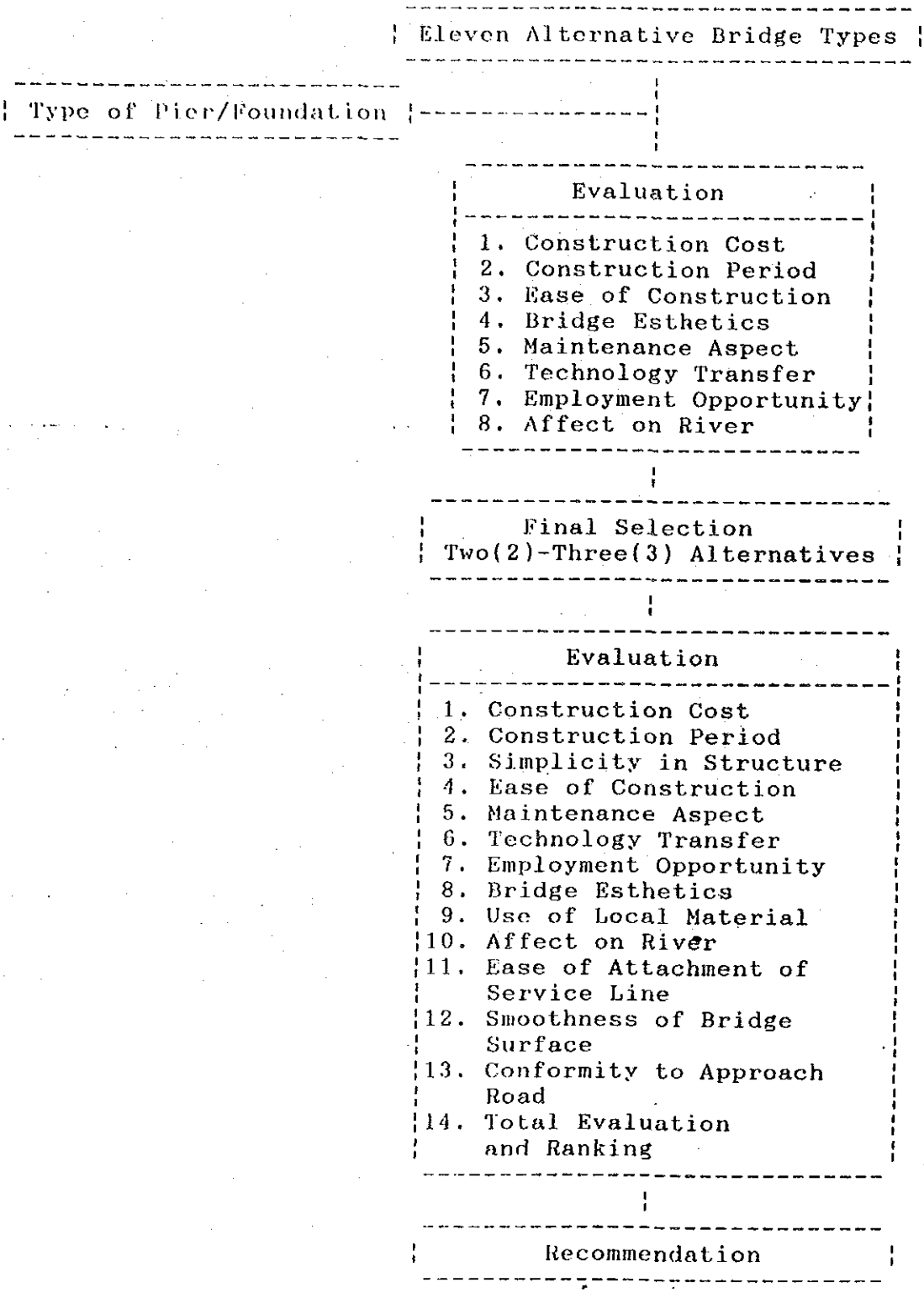
3) Five(5) span bridge
   a. Post-tensioning prestressed concrete simple girder bridge
   b. Continuous steel girder bridge

4) Six(6) span bridge
   a. Post-tensioning prestressed concrete simple girder bridge
   b. Two set of three(3) span continuous steel girder bridge

5) Seven(7) span bridge
   a. Connected continuous post-tensioning prestressed T-beam bridge
   b. Three(3) span continuous steel girder and four(4) span continuous steel girder bridge

Among the eleven considerable types of bridge mentioned above, the Study Team will select two(2) or three(3) types of bridge as final alternatives with work flow shown in next page.

WORK FLOW FOR SELECTION OF BRIDGE TYPE



5.3.2 Type of pier/foundation

Several possible alternatives for foundation are proposed as below.

a. Spread foundation on dense gravel with coffering by double sheet-piles
b. Multi-column foundation by reinforced concrete piles or prestressed concrete piles.
c. Multi-column foundation by reverse circulation drill method concrete piles
d. Reinforced concrete or prestressed concrete piles with coffering by single sheet-piles
e. Reverse circulation drill method concrete piles with coffering by single sheet-piles
f. Steel caisson method

Concerning the above six(6) alternatives for foundation, comparative study will be made. As same of bridge type by span, two(2) to three(3) final alternatives will be selected.

According to the site conditions of the Project, however, Multi-column foundation by reverse circulation drill method may be employed with number of pier two(2) to six(6), among the foundation methods indicated above.

During this stage II in Lao PDR, the Study Team will nominate several types and methods both for bridge type by span and foundation, through discussion with the DCTC. Those alternatives will be brought back to Japan and more deliberate comparison study will be made.

5.3.3 DCTC's Comment(Type, Span and Foundation of Bridge)

The DCTC agreed the Study Team's concept on the bridge types by span and also method of foundation which are considered by the Study Team. The DCTC will have internal meetings with authorities concerned and inform the Study Team of comments, if any.

5.4. Design Standard

Design standards for road and bridge which are being pondered to employ in the Project were explained to the DCTC.

5.4.1 Road design standard

The Study Team presented differences and similarities between Japanese standard and standard previously recommended by SMEC for route 10(see Table 1).

It was clearly expressed that Design standard shall be decided after completion of comparative study among the standards employed in Lao PDR. From view point of actual traffic volume and circumstances of the project site, however, the standard will newly be established with Grade 3, Class 3, Grade 3, Class 1 and Class IV mentioned in attached Table 1. Other figures for elements of horizontal and longitudinal alignment will be fixed based upon the Grade 3, Class 1 of Japanese Standard.

Following standard is tentatively considered.

Item	Value
Average Daily Traffic(for Design)	500 - 4,000
Terrain	Flat
Design Speed(Km/hr)	80
WIDTH	
One Lane(m)	3.0
Shoulder(m)	1.5
Side Walk(m) Pedestrian and Bicycle Way(m)	
Roadway(m)	9.0
Bridge-way(m)	7.50(7.00)
Minimum Radius(m)	400
Maximum Gradient(%)	4%
SIGHT DISTANCE	
Overtaking(m)	160
Braking(m)	500

5.4.2 Load for bridge

Considerable loads for bridge for the Tha Ngon Bridge are clarified to the DCTC, as follows.

a.	Dead load	b.	Live load
c.	Impact	d.	Prestress
e.	Creep of concrete	f.	Shrinkage
g.	Earth pressure	h.	Hydraulic Pressure
i.	Up-lift	j.	Wind load
k.	Thermal affect	l.	Braking load
m.	Erection load	n.	Collision load

No Earthquake, snow load, affect by movement of ground and support, wave pressure and centrifugal force are considered.

As same process of road design standard explanation, different and similar points of the design load were explained(see Table 1).

TT-43 load is being used only for bridges which is located near container terminal or where many container trailers are running. TL-20 load is being applied for most bridges on National road in Japan. Because the projected road is Provincial Road and only 20% of actual traffic volume is heavy vehicle, it is understandable that Design Load of TL-20 shall be employed for Tha Ngon Bridge.

Provisional Design Load is as follows.

Design Live Load	TL-20
Axle Load Limit(kgf)	16,000

Table 1 Comparison of Design Standard

	National Road & Provincial Road	National Road	Provincial Road	Provincial Road
Average Daily Traffic(for Design)	500 - 4,000	> 20,000	300 - 1,000	1,000 - 3,000
Terrain	Flat	Hilly	Hilly	Hilly
Design Class	Grade 3, Class 3	Grade 3, Class 1	IV	III
Design Speed(Km/hr)	60	80	80	80
WIDTH				
One Lane(m)	3.0	3.5	3.0	3.0
Shoulder(m)	L=0.75(0.50) R=0.5	L=1.25(0.75) R=0.5	1.5	2.5
Side Walk(m)	1.50(0.75)	1.50(0.75)		
Pedestrian and bicycle Way(m)	2.00(1.50)	2.00(1.50)		
Roadway(m)	7.5	9.5	9.0	11.5
Bridge-way(m)	7.50(7.00)	9.50(8.50)	7.50-8.20	8.30-9.30
Minimum Radius(m)	200	400		
Maximum Gradient(%)	5%	4%	6%	5%
SIGHT DISTANCE				
Overtaking(m)	75	160		
Braking(m)	250	500		
Design Live Load	TL-20, TT-43	TL-20, TT-43	HS 20-44	HS 20-44
Axle Load Limit(kgf)	16,000 or 13,000	16,000 or 13,000	9,000	9,000

5.4.3 Comment of DCTC for Design Standards

The DCTC fundamentally agreed upon the opinion of the Study Team. The DCTC will hold internal meetings with authorities concerned for this matter and inform the Study Team of comments, if any.

5.5 Request of the DCTC

The DCTC requested that after completion of the study, the Study Team would donate the Car and Photocopy Machine to the DCTC which were supplied by JICA. It was, therefore, replied that the Study Team would convey the request of DCTC to JICA.

5.6 Conclusion

The DCTC and the Study Team agreed on the contents of Interim Report(1) and results of this meeting. Two(2) copies of the Minutes of Meeting were made and signed by both parties in Vientiane on 27th June 1990.

Mr. Khamla SAYAVONGSA
Deputy Director of
Department of Communication,
Transport and Construction
Vientiane Municipality

Mr. Kimio CHIBA
Team Leader of
The Feasibility Study Team
Japan International
Cooperation Agency

APPENDIX - 5

MINUTES OF MEETING(Interim Report-II)

MINUTES OF MEETING

1. Project : Feasibility Study on Tha Ngon Bridge Construction Project

2. Date : September 8th, 1990

3. Place : Conference Room of DCTC

4. Attendants :

Lao PDR/Vientiane Municipality
Department of Communication, Transport and Construction

Mr. Phila KHAMKHOHOMPHANH
Acting Director, Department of CTC

Mr. Khamla SAYAVONGSA
Deputy Director, Department of CTC

Mr. Phomma SIGNANONH
Civil Engineer, Chief of Planning and Finance Division, Department of CTC

Mr. Home ONE
Department of Communication
Ministry of CTPC

The Study Team

Mr. CHIBA Kimio
Team Leader of the Study Team

Mr. HARA Sadao
Member of the Study Team

Mr. TAIRA Nobuhisa
Member of the Study Team

Mr. SUZUKI Nobuyuki
Member of the Study Team

Advisory Committee

Mr. NAMBU Taka-aki
Chairman of the Advisory Committee

JICA

Mr. MORI Shin-ichi

Embassy of Japan

Mr. TANIGUCHI Hirofumi
Second Secretary

5. Itinerary

Meeting was held on 7th and 8th of September 1990, chaired by Mr. Phila in the conference room of DCTC, Vientiane Municipality.

Mr. CHIBA, Team Leader of the Study Team, explained process of the study and results mentioned in the Interim Report(II) to the DCTC.

The Mission which consists of the Study Team, Advisory Committee and JICA confirmed the Minutes of Discussion signed on 4th of September 1990 between the Study Team and DCTC.

DCTC verified said Minutes of Discussion and made comments/requests on the following matters again to the Mission:

1) to make a comparison table between the selected route (same as the route proposed in the Interim Report(II)) and right-angled existing route(use as an alternative access road)

2) to repave/reseal the existing road between crossing in front of the public market and crossing with the proposed access road(close to the meteorology station)

3) to make the top of side wall round or sharp shape to prevent pedestrian from sitting on it

4) to make a comparison table among kinds of side wall such as concrete wall, pole and rail, etc.

5) to set up a fence or guard-rail between side walk and carriageway for safety of cyclists and pedestrians

6) to provide lighting on the bridge

7) to consider/check service line space on the bridge (electricity/telephone line, water-supply pipe)

6. Conclusion

The Mission replies that the Study Team takes note of the comments/requests made by DCTC. All the comments/ requests made by DCTC will be taken into consideration in the Draft Final Report.

Both parties understood each other and were satisfied with the results from this meeting and signed on 8th of September 1990 in Vientiane, Lao PDR.

Khamla SAYAVONGSA
Deputy Director,
Department of CTC
Vientiane Municipality

CHIBA, Kimio
Team Leader of
the JICA Study Team

APPENDIX - 6

MINUTES OF MEETING(Draft Final Report)

MINUTES OF MEETING

Date : 19th December 1990
Place : DCTC's Conference Room
Re. : Draft Final Report (DFR) of Feasibility Study on Tha Ngon Bridge Construction Project
Attendants :
Lao PDR side
DCTC
Mr. Xay PHAKAXOUN
Director of DCTC
Mr. Khamla SAYAVONGSA
Deputy Director
Mr. Phomma SINGNANONH
Civil Engineer

MCTPC
Mr. Bounthong PRASEUTSAK
Civil Engineer, Department of Communication

Japan side
Study Team
Mr. CHIBA Kimio, Team Leader
Mr. HARA Sadao
Dr. TAIRA Nobuhisa
Mr. SUZUKI Nobuyuki

Advisory Committee
Mr. NAMBU Taka-aki, Chairman of Committee
Mr. OKUDA Mitsugu
Mr. IMAGI Hirohisa

JICA
Mr. MORI Shin-ichi

A. General

The meeting was held on 17th and 18th of December at the conference room of Department of Communication, Transport and Construction(DCTC) of Vientiane Municipality, chaired by Mr. Xay.

The Study Team explained contents of the Draft Final Report to the DCTC and DFR was generally accepted by DCTC.

In those meetings, several discussions were made among the Study Team, Advisory Committee and DCTC concerning mainly construction cost and other new idea to use existing road as approach. Followings are details of the discussions.

B. Construction Cost

DCTC agreed upon the construction costs for the Project, mentioned in the DFR. DCTC asked whethere the expenses of staff of DCTC for the Project implementation are being included. The Team answered that it is to be discussed at the implementation stage. DCTC accepted the answer.

C. Other Idea to Use Existing Road as Approach

The Team explained that the right angled existing road would need more land acquisition and compensation costs than selected route in the DFR. DCTC requested to involve this explanation in the Main Report.

The Team replied that the idea of using the existing road could not be considered as an alternative route from the view point of the design standards agreed for this project, and thus this comparison study would be mentioned in ANNEX. DCTC agreed on this matter.

D. Separation of Carriageway and Side Walk

DCTC requested the Team to install fence/rail between carriageway and side walk for safety of pedestrians. The Team replied that separation by mound-up sidewalk is, at present, enough for safety of pedestrians. But, in future, it would be considered. Thus both parties agreed that the Team will calculate the weight and prepare necessary space for future instalation of fence/rail.

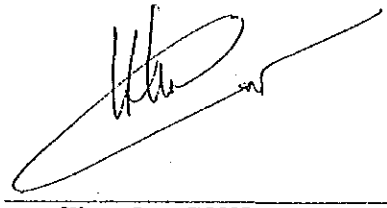
E. Comment(s) on DFR by DCTC

DCTC noted that comment(s) on details of the DFR shall be submitted to the JICA through the Embassy of Japan in Vientiane by January 15th 1991.

F. Conclusion

Finally, DCTC expressed its thanking to the JICA and the Team also expressed appreciation for the full cooperation made by DCTC for the Team through the Study.

On this day 19th December 1990, the Team and DCTC signed on and exchanged this Minutes of Meeting.



Khamla SAYAVONGSA
Deputy Director
Department of
Communication, Transport
and Construction
Vientiane Municipality
Lao P.D.R.

CHIBA Kimio
Team Leader
Feasibility Study on
Tha Ngon Bridge
Construction Project
Japan International
Cooperation Agency

REFERENCE

ບົດລາຍງານຂອງກອງປະຊຸມ

ວັນທີ : 19 ທັນວາ 1990

ສະຖານທີ : ຫ້ອງປະຊຸມຂອງ ພະແນກຄົມມະນາຄົມຂົນສົ່ງແລະກໍ່ສ້າງ ກຳແພງ.

ເລື່ອງ : ຮ່າງລະບຽບລາຍງານ ຂັ້ນສຸດທ້າຍ ຂອງການສຳຫຼວດໂຄງການກໍ່ສ້າງຊົ່ວຄາວ.

ລະຫວ່າງຝ່າຍລາວ

ພະແນກຄົມມະນາຄົມຂົນສົ່ງແລະກໍ່ສ້າງ

ທ່ານ ໄຊ ພະກະຊຸມ

ຫົວໜ້າພະແນກ ຄຊກ.

ທ່ານ ຄຳຫລ້າ ຊາຍາຍົງລາ

ຮອງ ຫົວໜ້າພະແນກ

ທ່ານ ພົມມາ ສົມຍະນິນ

ວິຊາການຊົ່ວຄາວ

ກ/ຊ ຄຊປກ.

ທ່ານ ບຸນທົງ ປະເສີດສັກ

ວິຊາການຊົ່ວຄາວ ກົມຄົມມະນາຄົມ.

ຝ່າຍຢຸ່ນ

ຄະນະສຳຫຼວດ

ທ່ານ ຈິບາ ຄິມິໂອ, ຫົວໜ້າ ຄະນະ

ທ່ານ ຮາຮາ ຊາດາໂອ

ທ່ານ ຈາອິຮາ ໂນບຸອິຊາ

ທ່ານ ຊຸຊຸກິ ໂນບຸງກິ

ຄະນະທີ່ປຶກສາ

ທ່ານ ນາມບຸ ຕາກາອາກິ, ປະທານຂອງຄະນະ

ທ່ານ ໂອກຸດາ ມິຈິ

ທ່ານ ອິມາງິ ຮິໂຣອິຮາ

ໄຈກ້າ

ທ່ານ ໂນຣິ ຊິນອິຈິ

ທີ່ອາໄປ

ກອງປະຊຸມນີ້ຂຶ້ນໃນວັນທີ 17 ແລະ 18 ຂອງເດືອນ ທັນວາ ທີ່ຫ້ອງປະຊຸມ ຂອງພະແນກຄົມມະນາຄົມຂົນສົ່ງແລະກໍ່ສ້າງ (DCTC) ກຳແພງນະຄອນວຽງຈັນ ໂດຍການເປັນປະທານ ທ່ານ ໄຊ. ຄະນະສຳຫຼວດໄດ້ອະທິບາຍ ຮ່າງລະບຽບລາຍງານຂັ້ນສຸດທ້າຍ ແລະ ທີ່ອາໄປໄດ້ຮັບຮູ້ໂດຍ

ໃນທີ່ປະຊຸມ, ທຸກໆຝ່າຍໄດ້ປຶກສາຫາລືກັນເປັນຕົ້ນ ຄະນະສຳຫຼວດ ຄະນະຝ່າຍລາວ ມີຄວາມເຫັນນຳກັນກ່ຽວກັບມຸມຄ່າກວາມກ້ວ້າງ ແລະຄວາມຄິດອັນໃໝ່ກ່ຽວກັບການໃຊ້ທາງ ທີ່ມີແລ້ວມາເປັນທາງເຂົ້າຫາຊົ່ວ, ລາຍລະອຽດຂອງການປະຊຸມມີດັ່ງນີ້.

ຂ. <u>ມຸມຄ່າກ້ວ້າງ.</u>

(DCTC) ຕົກລົງເຫັນດີມຸມຄ່າຂອງໂຄງການກ້ວ້າງທີ່ລະບຸໄວ້ໃນ (DFR) ທາງ DCTC ຖວນວ່າໃນມຸມຄ່ານັ້ນໃຫ້ຄິດໄລ່ການໃຊ້ຈ່າຍຕ່າງໆຂອງພະນັກງານ (DCTC) ເຂົ້າໃນໂຄງການ ຄະນະ ໄດ້ຕອບວ່າຕ້ອງມີການປຶກສາກັນໃນຂັ້ນຕອນຕໍ່ໄປ (DCTC) ໄດ້ເຂົ້າໃຈຕາມຄຳອະທິບາຍ.

ຄ. ຄວາມຄິດເຫັນກ່ຽວການນຳໃຊ້ຖນົນທີ່ມີແລ້ວເຂົ້າໄປຫາຊົ່ວ.

ທາງຄະນະ ໄດ້ອະທິບາຍວ່າມນຫຼັງຈາກທີ່ມີຖນົນໃໝ່ແລ້ວ ມີຄວາມຕ້ອງການ ເນື້ອທີ່ດິນຕື່ມ ແລະ ຄ່າຊົດເຊີຍຫລາຍກວ່າການເລືອກເອົາຖນົນໃນ (DFR) (DCTC) ໄດ້ສະເໜີໃຫ້ເອົາການອະທິບາຍເຂົ້າໃນການອະທິບາຍ ປຶ້ມບົດລາຍງານຫົວໜ້າ.

ທາງຄະນະໄດ້ຕອບວ່າຄວາມຄິດເຫັນໃນການໃຊ້ຖນົນທີ່ມີໃໝ່ແລ້ວນັ້ນ ອາດຈະເປັນໄປບໍ່ໄດ້ເພາະນັ້ນເປັນພຽງແຕ່ຖນົນສຳຮອງໃນການອ້ອມຜ່ານເຂົ້າໃນໂຄງການແລະເຖິງຢ່າງໃດກໍ່ດີການສຶກສາປຽບທຽບນີ້ຄວນຈະອ້າງເຖິງ ໃບຊັ້ນທ້າຍຕິດມາ (DCTC) ຕົກລົງເຫັນດີກັບຂໍ້ນີ້.

ງ. <u>ການຜ່ານ ທາງລົດ ແລະ ທາງຍ່າງ</u>

(DCTC) ຂໍຮ້ອງໃຫ້ຄະນະຕິດຕັ້ງຮາວ, ລະຫ່ວ່າງ ທາງລົດ ແລະ ທາງຍ່າງ ສຳລັບຄວາມປອດໄພແກ່ຄົນເດີນໄປມາ, ຄະນະຕອບວ່າການຜ່ານນັ້ນຜ່ານການຍົກທາງຍ່າງໃຫ້ສູງຂຶ້ນ ແລະ ກໍມີຄວາມປອດໄພແກ່ຄົນຍ່າງໃຊ້ໃນປະຈຸບັນ, ໃນອານາຄົດຈະມີການພິຈາລະນາກັນຕື່ມອີກ.
ທ້າຍສອງຝ່າຍເຫັນດີນຳກັນ ກັບທາງຄະນະ ຈະໃຫ້ຄິດໄລ່ເລື່ອງນ້ຳພັກເພີ່ມເຕີມ ແລະ ຕຶນບ່ອນທີ່ຈຳເປັນ ເພື່ອການຕິດຕັ້ງ ຮາວ ແລະ ລາງ ໃນອານາຄົດຂ້າງໜ້າ.

ຈ. ຄວາມເຫັນຕໍ່ (DFR) ຂອງ (DCTC)

(DCTC) ຮັບຮ່າຄວາມເຫັນອັນລະອຽດທ້າຍຫົວຂໍ້ (DFR) ນັ້ນຈະລະເໝີເຖິງ (JICA) ໂດຍຜ່ານສະຖານທູດຍີ່ປຸ່ນທີ່ວຽງຈັນ ກ່ອນວັນທີ 15 ເດືອນ ມັງກອນ 1991.

ສ. ລົງຄວາມເຫັນສຸດທ້າຍ.

ທ້າຍສຸດ, (DCTC) ສະແດງຄວາມຊອບໃຈຕໍ່ອົງການ (JICA) ແລະ ຄະນະພ້ອມທ້ັງສະແດງຄວາມຊົມເຊີຍໃນການອ່ອນນ້ອມຂອງ (DCTC) ທີ່ໄດ້ສຶກສາລວມກັນຕລອດມາ.

ໃນວັນທີ 19 / 12 / 1990 ທາງຄະນະແລະ (DCTC) ໄດ້ລົງລາຍເຊັນແລະແລກປ່ຽນບົດບັນທຶກຂອງການປະຊຸມ.