JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

MINISTRY OF COMMUNICATION, TRANSPORT,
POST AND CONSTRUCTION
LAO PEOPLE'S DEMOCRATIC REPUBLIC

THE FEASIBILITY STUDY
ON
THE CONSTRUCTION OF THE MEKONG BRIDGE AT PAKSE
IN
THE LAO PEOPLE'S DEMOCRATIC REPUBLIC

FINAL REPORT

VOLUME I
MAIN REPORT

JUNE 1996

NIPPON KOEI CO., LTD.
CONSTRUCTION PROJECT CONSULTANTS, INC.

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Note

Following exchange rates are applied in this report :

US$1.00 = Kip 920 = Yen 100 = Baht 24.0

Kip 1.0 = Yen 0.109

(As of November 1995)

PREFACE

In response to a request from the Government of the Lao People's Democratic Republic, the Government of Japan decided to conduct the Feasibility Study on the Construction of the Mekong Bridge at Pakse in the Lao People's Democratic Republic and entrusted the study to the Japan International Cooperation Agency (JICA).

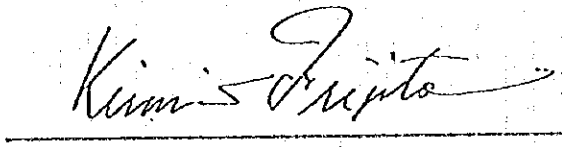
JICA sent to Laos a study team headed by Mr.Junji Mashiba and composed of the members of Nippon Koei CO., LTD. and Construction Project Consultants, INC. two times between July 1995 and March 1996.

The team held discussions with the officials concerned of the Government of Laos, and conducted field surveys at the study area. After the team returned to Japan, further studies were made and the present report was prepared.

I hope that this report will contribute to the promotion of the project and to the enhancement of friendly relations between our two countries.

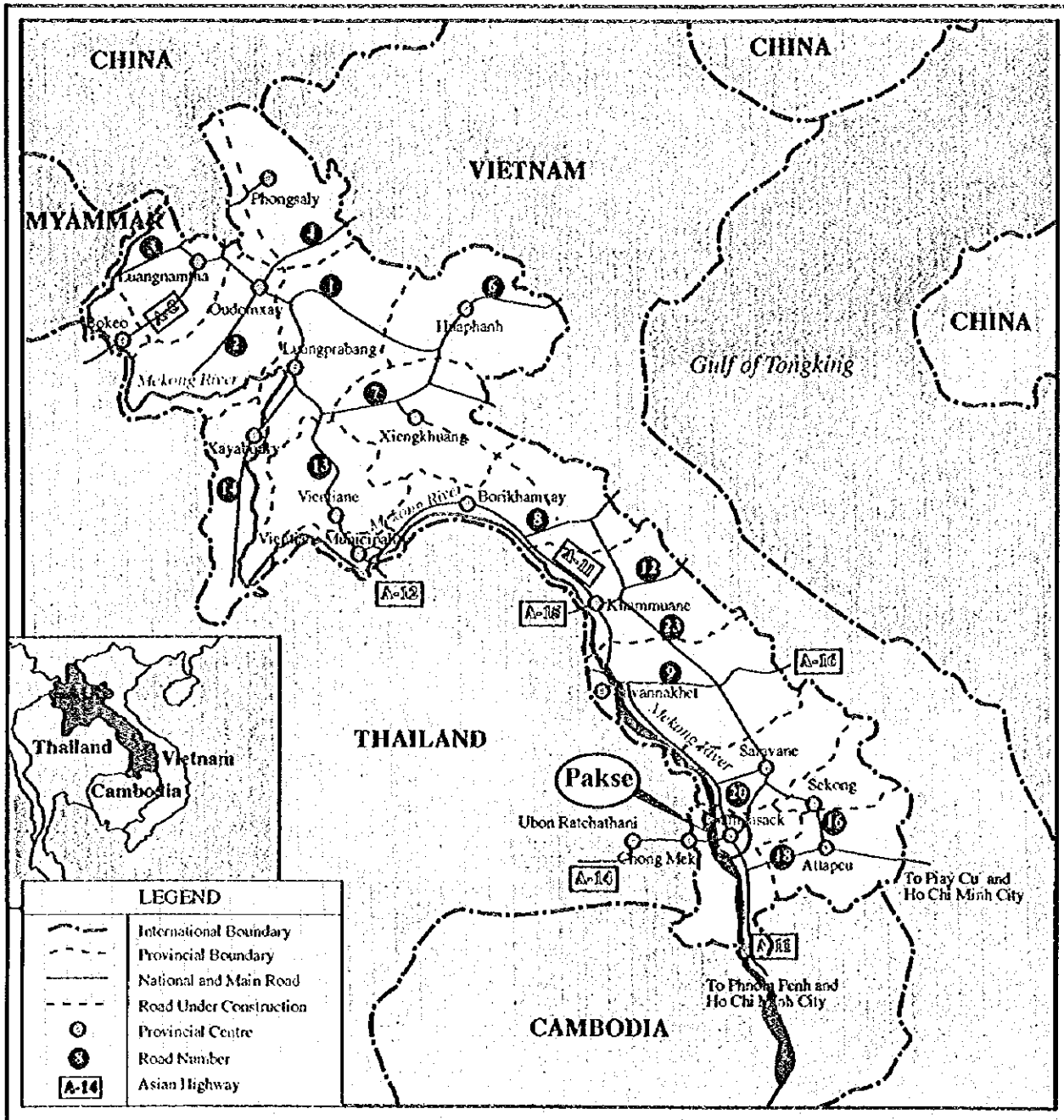
I wish to express my sincere appreciation to the officials concerned of the Government of the Lao People's Democratic Republic for their close cooperation extended to the team.

June 1996



Kimio Fujita

President
Japan International Cooperation Agency

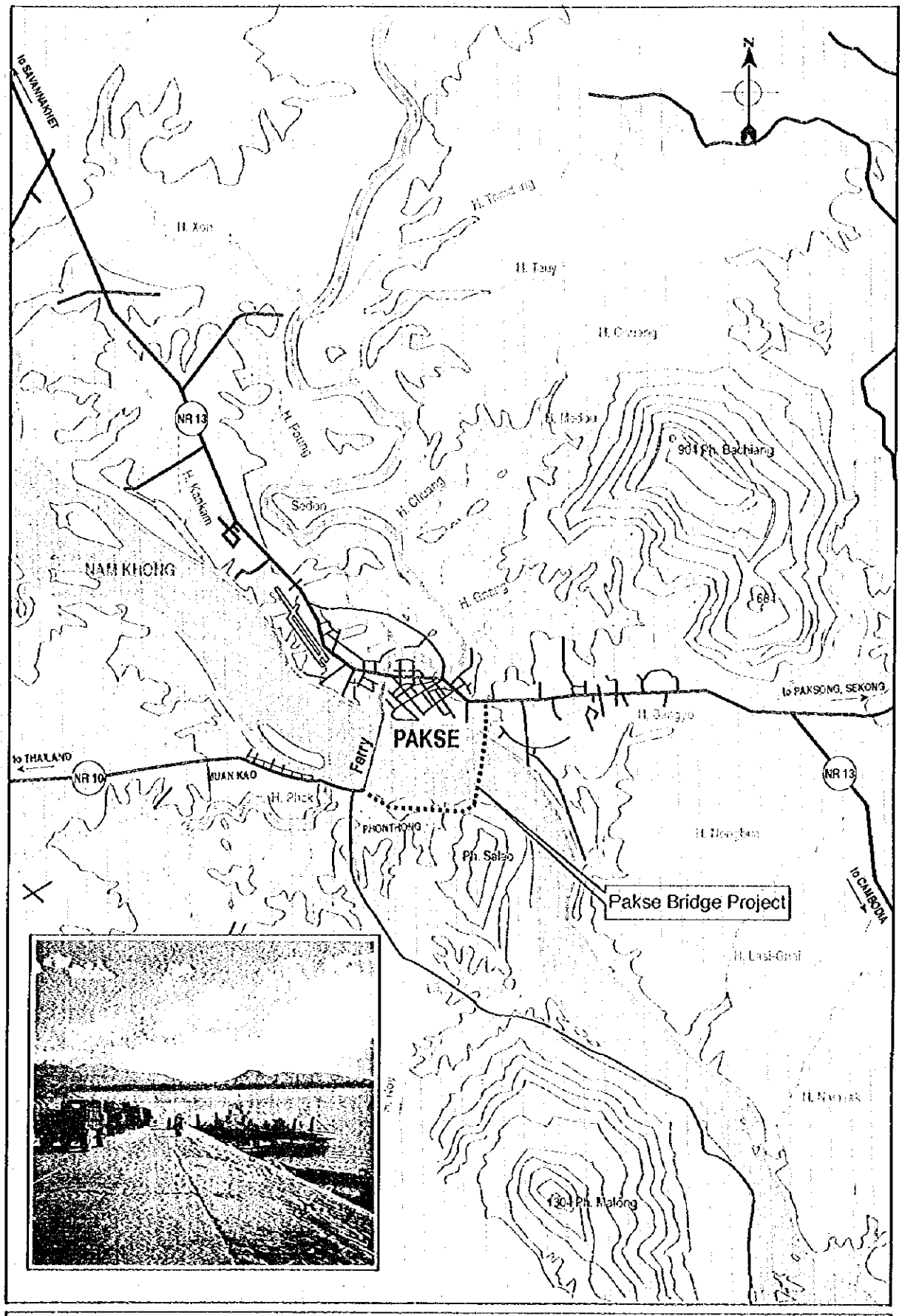


LOCATION MAP

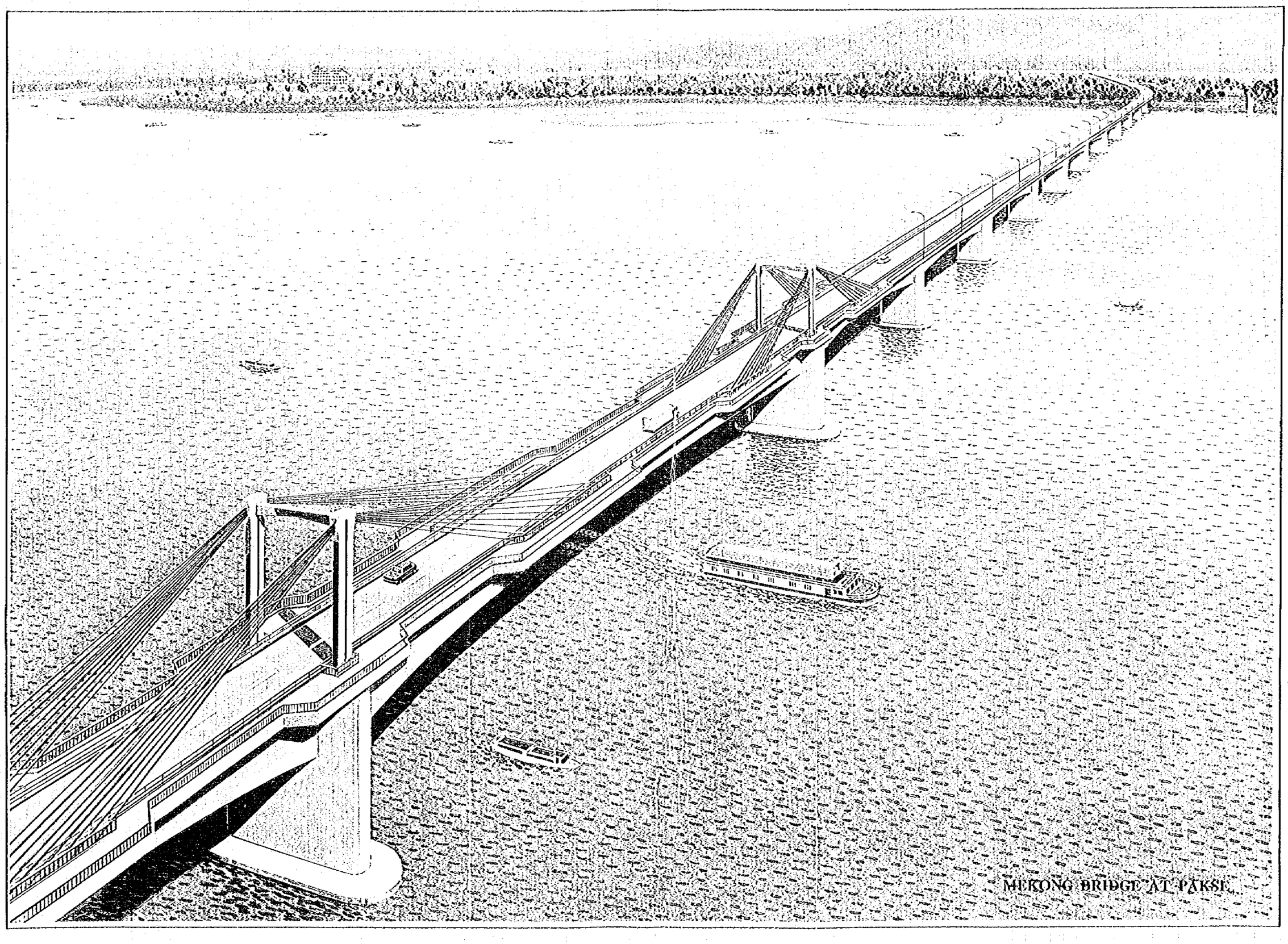
PROFILE OF LAO P.D.R.

Area	: 237,000 km^2	GDP	: 1,108.6 billion Kip (1994)
Population	: 4.61 million (1995)	GDP per capita	: US$260 (1995)
Population Density	: 19/km^2 (1995)	Currency	: Kip
Capital	: Vientiane		US$1 = 920 Kip (Sept. 1995)

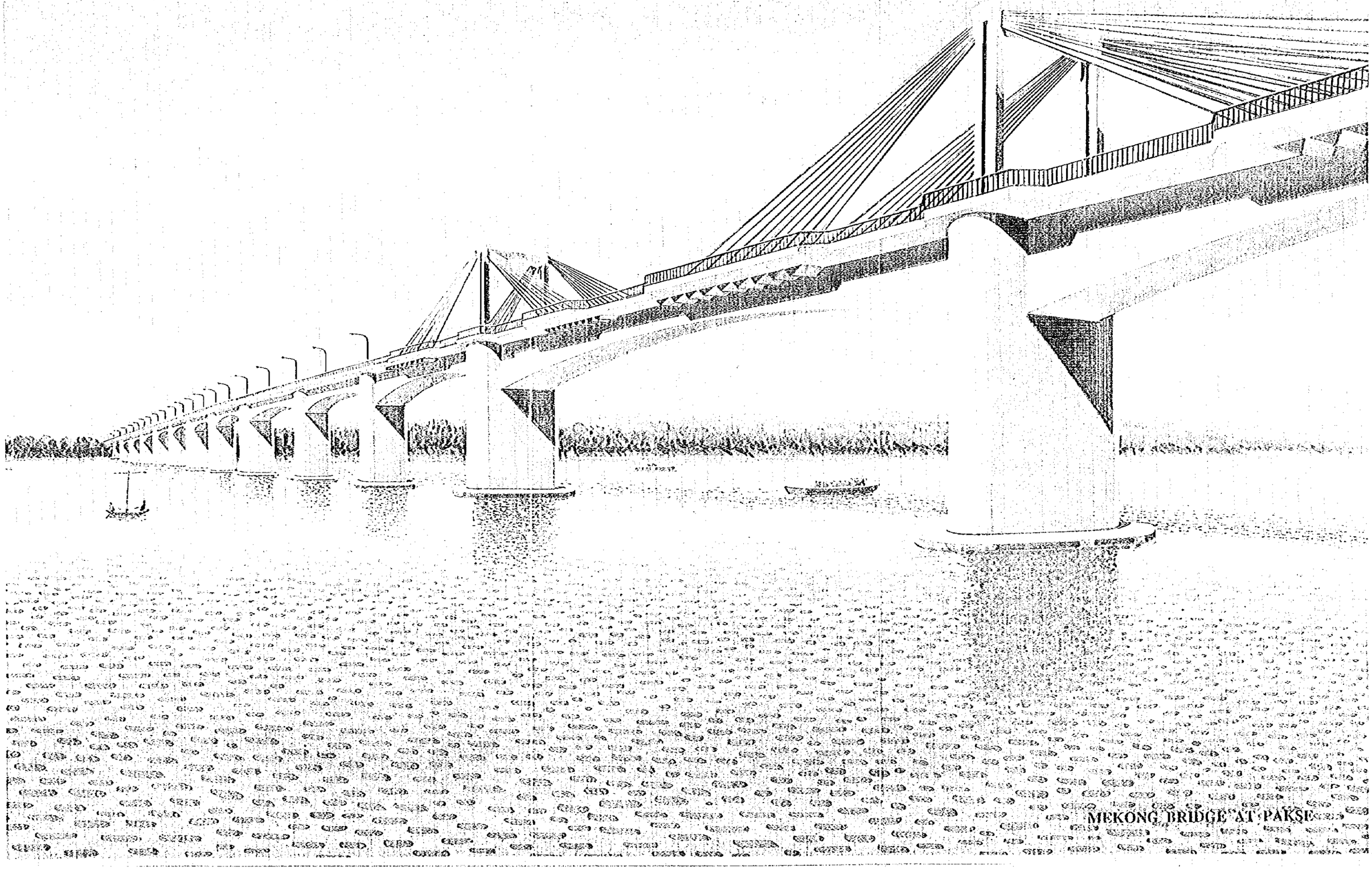
THE FEASIBILITY STUDY ON THE CONSTRUCTION OF THE MEKONG BRIDGE AT PAKSE



PAKSE BRIDGE PROJECT SITE



MEKONG BRIDGE AT PAKSE



MEKONG BRIDGE AT PAKSE

EXECUTIVE SUMMARY

CONTENTS OF SUMMARY

EXECUTIVE SUMMARY

A CONCLUSIONS AND RECOMMENDATIONS OF THE STUDY

A.1 Proposed Bridge Route

The proposed bridge route was selected from the three alternatives grading the appraised points on the evaluation items which consist of economic evaluation, engineering evaluation and environmental evaluation. The route is located at 2 km downstream of the existing ferry route.

A.2 Project Facilities

The outline of the project facilities is shown below:

(1) Bridge

- Location : 2 km downstream of existing ferry route
- Bridge width : Total width 11.8 m
  Carriageway 3.5 m each in both direction
  Shoulder 0.5 m each on both sides
  Sidewalk 1.5 m each on both sides
- Bridge length : 1,380 m
- Span length : Main spans 102 m x 10, 150 m, 100m
  Side spans 70 m, 40 m
- Bridge type : Continuous rigid frame PC (extra-dosed) box girder
- Foundation type : Extrusion type cast-in-situ RC pile

(2) Approach roads

- Road width : 11 m
- Carriageway : 3.5 m each in both direction
- Shoulder : 2 m each on both sides
- Total length : 3,030 m
  Pakse side 680 m
  Phontong side 2,350 m
- Pavement : DBST for carriageway and SBST for shoulder

A.3 Project Cost

The estimated project cost is shown below:

(Unit: US$1,000)

Classified Cost	Foreign Currency	Local Currency	Total
Construction Cost	42,884	9,884	52,768
Engineering Cost	3,324	369	3,693
Land Acquisition Cost	-	485	485
MCTPC' administration Cost	-	792	792
Contingency	8,622	2,036	10,658
Total	54,830	13,566	68,396

A.4 Project Feasibility

The project of the construction of the Mekong bridge at Pakse is technically feasible.

The Economic Internal Rate of Return (EIRR) of the project is estimated at 8.0%. This result is based on the only quantifiable direct benefits such as savings in river crossing time and savings in ferry waiting time. In addition to the direct benefits, the Pakse bridge will stimulate the regional economy and is expected to generate huge amount of indirect benefits. Considering such wide range and long term indirect benefits, the implementation of the Pakse bridge will be sufficiently justified.

A.5 Necessity of the Project

Necessity of the Mekong bridge at Pakse is emphasized from the following aspects:

1) Eliminating the bottleneck point at Mekong river and provide safety transportation facility
2) Formation of regional all-weather road network with other road improvement projects
3) Formation of international road network linking with neighboring countries
4) Promotion of regional and nationwide development (agricultural, industrial , commercial and tourism development)
5) Betterment in living conditions

A.6 Conclusions and Recommendations

A.6.1 Conclusions

It is found that the Project of the construction of the Mekong bridge at Pakse is technically feasible. The construction of the Mekong bridge also is judged viable by the economic evaluation which shows an IRR of 8 % considering the present economic status in Lao PDR.

The Project will accompany various intangible benefits that will contribute to the

development and well-being of the region in and around the project area.

The Project also will contribute to forming a prospective transportation network of the East West corridor formulation in Indochina.

The construction of bridge will not be anticipated to cause any serious technical, environmental and social issues in the course of bridge construction and after the completion.

It is concluded that the Mekong Bridge construction at Pakse is an indispensable project and that it is a realistic solution for the development of economy as well as road transportation of the country.

A.6.2 Recommendations

It is preferable that the completion date of the Project will be set taking into consideration the time of the completion of the relevant Projects ADB 7th projects going on currently.

The detailed design stage for the implementation of the Project, the works of which comprise site investigation, design of roads and structures and preparation of tender documents should be started before the beginning of rainy season.

B SUMMARY OF THE STUDY

B.1 Introduction

B.1.1 Study Background

Although the southern provinces of Lao PDR are rich in agricultural resources such as rice, coffee, fruit, crops, timber product, etc., and Pakse is located at only one hour distance from the Thai border, such commodities have not been transported efficiently because of a bottleneck to cross the Mekong river.

The crossing over the Mekong river was and is always a key issue for the improvement of road network in Indochina countries. The road rehabilitation projects for NR10 and NR13S, in the Southern provinces, are under way by the assistance of Asian Development Bank (ADB), therefore efficient international links centered at Pakse will be completed with the construction of the Mekong bridge at Pakse.

Under such situation the Government of Lao PDR requested to the Government of Japan for the feasibility study on Construction of Mekong Bridge at Pakse.

In response to the request the Government of Japan has decided to conduct the Feasibility Study on Construction of Mekong Bridge at Pakse.

Accordingly, JICA the official agency responsible for the implementation of the technical cooperation program of the Government of Japan, undertook the Study and organized a study team. The Study Team commenced the study July 1995 and the study was completed in May 1996.

B.1.2 Objectives of the Study

The objectives of the Study are to conduct the feasibility study for the construction project of Mekong bridge at Pakse including its approaches for the period up to the year 2010.

B.1.3 Reports

A set of documents was prepared as the Final Reports which consist of the following four volumes

- Summary
- Volume I : Main Report
- Volume II : Annexes
- Volume III : Drawings

Volume I (Main Report) has been structured to reflect the overall approach, methodology and results of the Study including conclusions and recommendations.

Background information, sources of information and detailed calculations are presented in Volume II (Annexes). Volume III (Drawings) provides drawings for bridge and road design, and associated works. The Summary summarizes the findings, conclusions and recommendations.

B.2. Socio-Economic Conditions

B.2.1 Present Conditions

(1) Population of the Country

The total population of the Lao PDR is about 4.6 million in 1995. An average annual growth rate of population from 1985 to 1995 was 2.4 % per annum. Population density of the whole country and Vientiane are 19 persons and 136 persons per km2 respectively.

(2) National Economy

The nominal Gross Domestic Product (GDP) has amounted to 1,108,620 million Kip and per capita GDP was estimated at about US$ 260 in 1994. The actual GDP in constant prices has recorded an average growth rate of 6.2% per year for the period of 1990 to 1994. Although agriculture is still a dominant sector in Laos, that share in GDP has decreased from 60.7% in 1990 to 56.4% in 1994. On the other hand, the industrial sector has expanded its share from 14.4% in 1990 to 17.5% in 1994.

(3) Present Conditions of the Study Area

Population in the Study Area, 4 southern provinces, is estimated at 913,000 in 1995 which is about 25% of the whole country. Among the provinces in the Study Area, the Champasak Province is a direct area of influence by the project and its population is about 500,000 which is 55% of the Study Area. Population of the Pakse district was about 60.000 with population density of 187.3 persons per km2 in 1994.

Agriculture activities in the Study Area are dominated by rice cultivation. Harvested area for rice and its production are about 77% of total crops in the area and 25% of the whole country. The central feature is the Boloven Plateau which extends to the eastern part of Pakse. Production of coffee in the Plateau is about 90% of the whole country and exported to Thailand.

In addition to agricultural industry, development of hydroelectric schemes are the most important industry in the Study Area. At present, two hydroelectric power stations are under operation, one is 45 MW station at Xeset in the Saravane province and the other is Selabam 5 MW hydrostation in the Champasak province. From these stations, electricity ca be exported to Thailand in the rainy season.

B.2.2 Development Plans

(1) National Development Plan

The present economic policy in Laos is based on the New Economic Mechanism (NEM) program which was introduced since 1986. This program aims at transforming the conventional controlled economy into a more flexible market oriented economy. The Government promoted various policies such as the privatization of the majority of state-owned enterprises, a market-adapted commodity economy through the price reform.

Following the 3rd Five Year Plan (1991 – 1995), the Government of the Lao PDR has decided to embark on an ambitious policy agenda for the next five years up to the year 2000. These policies are reflected in the "Public Investment Program (PIP) 1994 – 2000" which was announced in 1994 and indicates that GDP growth will be maintained at 8% up to 2000.

(2) Development Plans in the Study Area

The road improvement projects in the Study area have been executed or are planned in the series of ADB2nd, 6th, 7th and IDA3rd improvement projects.

- ADB 2nd Project : (bituminous pavement work for PR 13A and PR20 from Pakse toSaravane/to Paksong, completed in 1995)
- ADB 6th Project : (improvement of PR13 from Paksong/B.Beng, and PR16 from Thateng/to Sekong/to Attapeu, will be completed by 1998)
- ADB 7th Project : (covers sections of NR 13S from Pakse to the Cambodia borderwith a 160 km long, and NR10 from Pakse to the Thai border with a 40km long, will be completed by 2000)
- IDA 3rd Project : (improvement of NR13S from Savannakhet to Pakse, will be completed by the end of 1996)

The main agricultural projects in the Study area are summarized as follows :

- Lao Upland Agricultural Development Project (LUADP)
  The LUADP is financed by the World Bank and Lao PDR with technical assistance of the Australian and French Governments which are also taking a part of funding. The project aims at to increase farmers' income through introducing more suitable production techniques for coffee and field crops, vegetables, fruits and other economic trees.

- Swedish International Development Agency (SIDA) Project
  Main purpose of SIDA projects is to provide agriculture infrastructures in order to reduce slash and burn cultivation and to prevent deforestation.

- Integrated Agricultural and Rural Development Project in Boloven Plateau

The project area covers the Boloven Plateau with approximate area of 7,000 km^2. The ultimate objectives of the project are to increase farming output in the area through improvement and development of irrigation, drainage, rural infrastructures, and to achieve substantial and sustainable improvement in the living conditions of the habitants and their life improvement.

B.3. Natural Conditions at Project Site

B.3.1 Precipitation

The average annual total precipitation amounts to around 2,000 mm, some 95% of which assemble in rainy season, while there is few record that the daily precipitation exceeds 100 mm. The annual total precipitation of 2,938 mm was recorded as the annual maximum in 1979 and the monthly precipitation of 923 mm as the maximum in August 1978, while the mean precipitation in the past August was some 500 mm.

B.3.2 River Hydrology

The maximum flood discharge in 100-year return period is estimated at around 54,000 cubic meters. Annual average maximum discharge is around 36,000 cubic meters while the discharge at the lowest low water levels around 1,700 cubic meters. The water flow velocity in time of flood is 2.1 - 2.8 m/sec, while the mean velocity in dry season is less than 0.5 m/sec.

B.3.3 Geography and Geology

Pakse locates at 700 km downstream from Vientiane and 869 km upstream from the estuary of the Mekong river. Average land height of Pakse city area as well as the paddy fields extended along river banks is around 100 m from sea level. Generally the geography around the Project site presents the plains but Mount Saleo of 385 m height.

The base rock of sand stone and mud stone lays widely in the river side area around Pakse. Mount Saleo is a mountain of sandstone. The basalt of 5 - 6 m thickness covers partially the sandstone around left river bank in the area of southern part of Pakse city. On the plains around both river banks the laterite layers of around 10 m thickness deposits. In the river the sands and gravel of 2 - 20 m thickens deposit but hard sand stone exposes around the shore line near the foot of Mount Saleo.

B.4. Alternative Routes

The proposed bridge route will be connected with NR10 in Phonthong side, and with NR 13 in Pakse side. Using the existing topographical map (scale of 1/20,000) several alternative routes were found, and among them three alternative routes (Route-A, B, C)

were selected for comparative study to select the optimal route of the Project.

Route-A: Selected as upstream side route to Pakse town connected with NR 13 to the north of Pakse air port. The proposed bridge length is longest among the alternatives, but river water depth is shallowest. The total route length is 5,360 m.

Route-B: Selected as downstream side route to Pakse town. The closest to Pakse town. Both of the proposed bridge length and water depth are middle. The total route length is 4,410 m.

Route-C: Selected as the shortest bridge length route. The route location is faraway from Pakse town and the approach roads become long. The water depth is the deepest among alternatives. The total route length is 5,790 m.

B.5. Traffic Forecast

B.5.1 Present Traffic Volume

The river crossing traffic volume surveyed by the Study Team (31 July 1995 - 6 August 1995) are summarized as follows :

Vehicle Type	Traffic Volume (day)
Motorcycles	388
Car,Pickup,etc.	95
Bus, Truck	113
(Sub-total)	(596)
Bicycle, Pedestrian	1,942

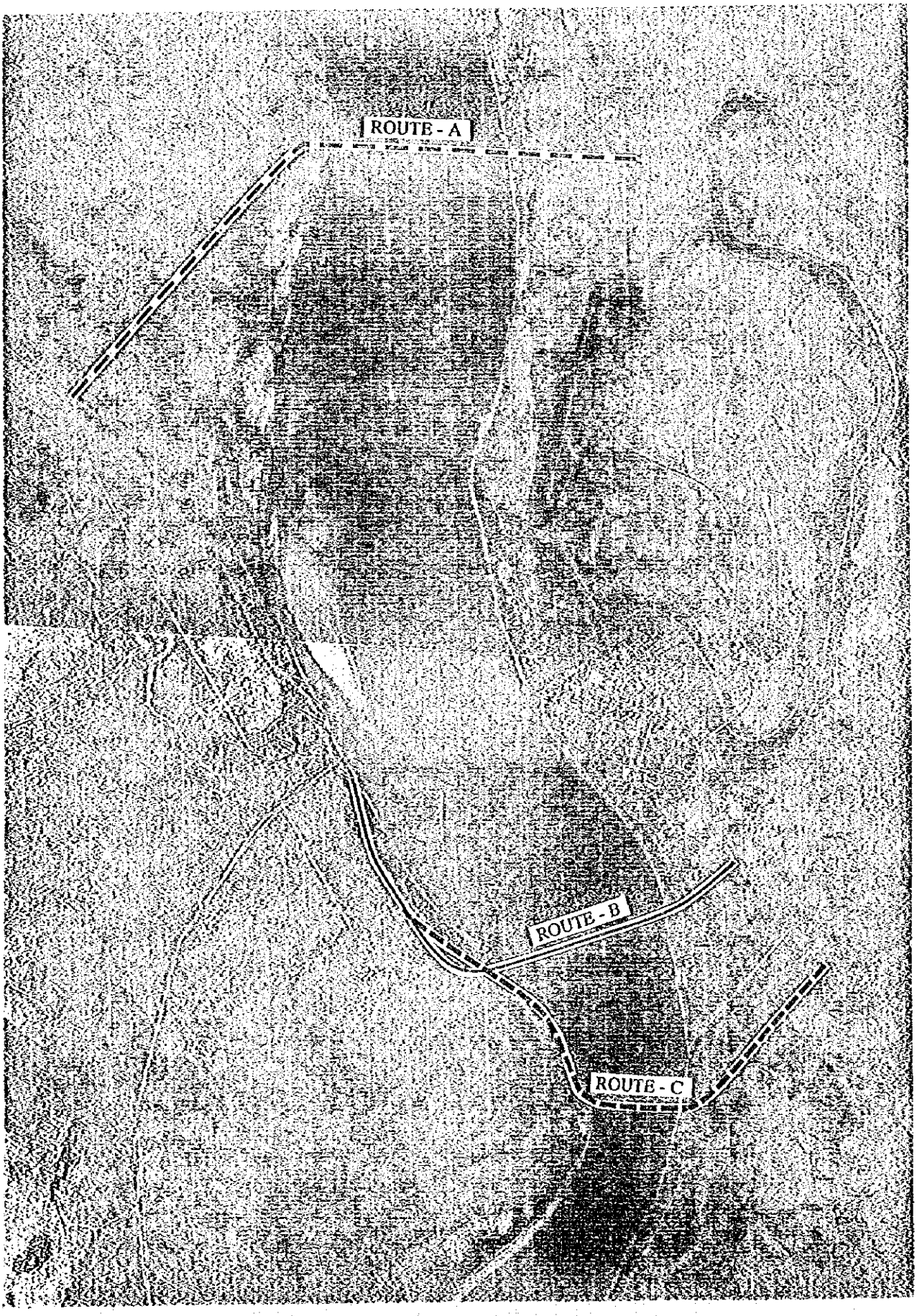
B.5.2 Future Traffic

Future traffic volumes on the project bridge were forecast estimating the future O-D matrix of the traffic crossing the Mekong river.

The results of traffic forecast are as shown below:

Route	Vehicles / day (ADT)			Growth rate per year	
	2000	2010	2020	2000-10	2010-20
A	1,467	3,474	5,775	9.0%	5.2%
B	1,460	3,451	5,737	9.0	5.2
C	1,448	3,422	5,691	9.0	5.2

Present traffic volume 596 vehicles (including motorcycles) will grow to about 5,700 vehicles in 2020 and it is about 9.6 times of the present traffic.



MEKONG BRIDGE PROJECT AT PAKSE

B.6. Selection of Optimal Bridge Route

B.6.1 Preliminary Design for Alternative Routes

(1) Design Conditions

Taking into consideration the traffic volume of existing ferry, future traffic demand and ADB 7th project, the fundamental cross elements for proposed routes were determined as follows:

Number of traffic lane	:	Dual single lane
Carriageway width	:	3.5 m per each lane
Shoulder width	:	2.0 m for approach roads 0.5 m for bridge
Sidewalk width	:	1.5 m at both side (bridge section only)

The live loads corresponding to AASHTO HS25 was applied in the preliminary design.

The existing design standards and design criteria, Road Design Manual compiled by MCTPC IN 1994, were advantageously applied to the Project. However the international standards including Japanese were also applied. Especially Road Bridge Specifications recompiled by Japan Road Association in 1992 were applied for bridge design. The geometric design of roads was made with design speed of 80 km/h.

(2) Bridge Length

The proposed bridge length of each alternative route was determined as follows:

Route-A:	1,560 m	(Total route length : 5,360 m)
Route-B:	1,380 m	(Total route length : 4,410 m)
Route-C:	1,100 m	(Total route length : 5,790 m)

(3) Structural Type Selection

Considering the superstructure size and span length aimed, the foundation types applicable to site conditions of each alternative route were nominated as follows:

- Direct foundation with spread footing
- Cast-in-situ pile foundation of extrusion type
- Inter-locking steel pipe pile well
- Open caisson

Cast-in situ pile foundation of extrusion type, pile diameter of 1.5 m, was selected for all alternative routes in the aspect of construction cost and workability of foundation.

Selecting 8 superstructure types applicable to the Project as shown beneath, the

economic span length was looked for by each type.

Steel bridge type:	Continuous steel box girder with RC deck Continuous steel box girder with steel deck Through type arch girder Continuous through type steel truss girder
PC bridge type:	Continuous PC box girder Continuous rigid frame PC box girder with center hinges Extra-dosed PC box girder Cable stayed PC box girder

The optimal bridge type and the optimal span length were found as follows:

Route-A:	Continuous rigid frame PC box girder, Span length = 100 m
Route-B:	Continuous rigid frame PC box girder, Span length = 100 m
Route-C:	Continuous rigid frame PC box girder, Span length = 150 m

For a section of Route-B having deep foundations the span length of more than 100 m which is given as the economic span for Route-C was applied since the foundation conditions of Route-B around this section are similar to Route-C.

B.6.2 Economic Benefits for Alternatives

(1) Economic Benefits of Bridge Construction

Estimated benefits by each benchmark year by alternative route are shown below :

SUMMARY OF BENEFIT ESTIMATION

(US$1,000)

BENEFIT	ROUTE	2000	2010	2020
Users Cost Savings	A	362	2034	4149
(VOC)	B	391	2219	4509
(Time Costs)	C	349	2021	4095
Savings in Ferry Service Costs		996	3750	6038

Note: Opening timing of the Bridge is scheduled to be at the middle of 2000.
A half of yearly benefits is reckoned.

(2) Economic Project Costs

The economic costs are calculated by deducting such transfer items as taxes and duties from market prices and expressed in constant 1995 price as presented below.

ECONOMIC PROJECT COSTS

(US$1,000)

ROUTE	Total ('96-2000) (1995 prices)	1996	1997	1998	1999	2000
ROUTE-A	74,688	1,386	24,413	23,078	20,621	5,190
ROUTE-B	62,689	1,160	20,618	20,369	17,257	3,286
ROUTE-C	62,456	1,148	20,793	20,172	17,089	3,254

(3) Preliminary Economic Evaluation

The cost benefit cash flows were tabulated in order to calculate the values of Economic Internal Rate of Return (EIRR) by each alternative. The Route-B showed the highest EIRR of 8.0% among alternatives while Route-A and Route-C were 6.8% and 7.8% respectively.

B.6.3 Optimal Bridge Route

The optimal bridge route was selected grading the appraised points on the evaluation items which consist of economic evaluation, engineering evaluation and environmental evaluation. The evaluation results scored with apprised points are shown in the following Table.

EVALUATION TABLE FOR THE ALTERNATIVE ROUTES

		Route-A	Route-B	Route-C
Project Length (m)		5,360	4,410	5,790
Bridge Length (m)		1,560	1,380	1,100
Evaluation Items	Weighting			
(1) Economic Evaluation	**0.65**	**0.65**	**1.69**	**1.56**
Economic Internal Rate of Return (EIRR %)	0.60	1 (6.8%)	3 (8.0%)	2 (7.8%)
Initial Capital Cost	0.40	1	2	3
(2) Engineering Evaluation	**0.15**	**0.32**	**0.44**	**0.15**
Alignment / Road Network	0.35	2	3	1
River Hydrology	0.10	3	2	1
Superstructure	0.05	2	3	1
Foundation	0.20	2	3	1
Construction Period	0.05	2	3	1
Future Maintenance	0.25	2	3	1
(3) Environmental Evaluation	**0.20**	**0.46**	**0.35**	**0.39**
Biophysical Environment	0.25	3	1	2
Human/Built Environment	0.40	3	2	1
Critical Development Restriction	0.15	1	2	3
Public Consultation Outcome	0.20	1	2	3
Summation		**1.43**	**2.48**	**2.1**
Score Out of the Full Marks of 100		**48**	**83**	**70**
Evaluated Priority Rank		**3**	**1**	**2**

According to the above results, it was concluded that Route-B should be selected for the optimal bridge route of this project.

B.7. Engineering Study of Proposed Route

The further engineering study on the proposed route following the preliminary design was carried out to clarify the Project features and to facilitate the data for the project evaluation and to establish the implementation plan.

B.7.1 Design of Structures

The structural type selected is a 14-span continuous rigid frame PC box girder with center hinges having a main span length of 100 - 102 m and 150 m. The geometric main dimensions of box girder structure are determined for the span of 102 m length. For the section of 150 m span extradosed PC cables system are adopted not to change the main dimensions of girder.

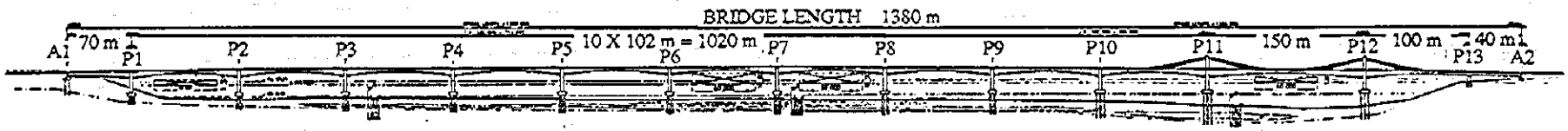
The Pavement for approach roads consists of Subbase Course, Base Course and Surface Course. Subbase Course having a 15 cm thickness shall be constructed with lateritic soil. Base Course is constructed with a mixture of gravel with lateritic soil. It should have a thickness of 20 cm. The Road surface of the carriageway are paved by DBST using screened gravel.

The general view as a results of structural design is shown in following plate.

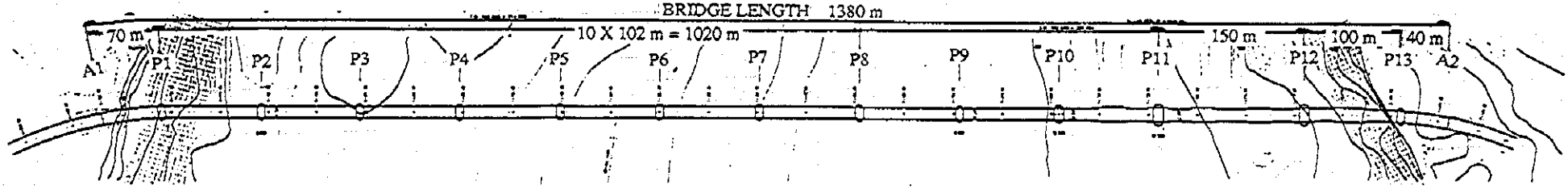
B.7.2 Construction Method and Schedule

For the reasonable construction period of the Project a term of around 3 years is proposed. As the foundation works should be done in dry season, August will be optimal commencement month considering a term of 3 months for preparatory works. It takes for 2 dry seasons for substructure to be constructed. The erection of superstructure can be started one year later the commencement of foundation construction. For the erection method of PC box girder precast segment method is recommended in the aspect of construction schedule management and quality control.

PROFILE OF MAIN BRIDGE

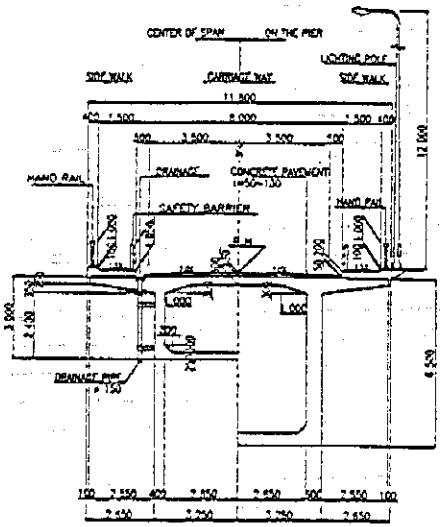


PLAN OF MAIN BRIDGE

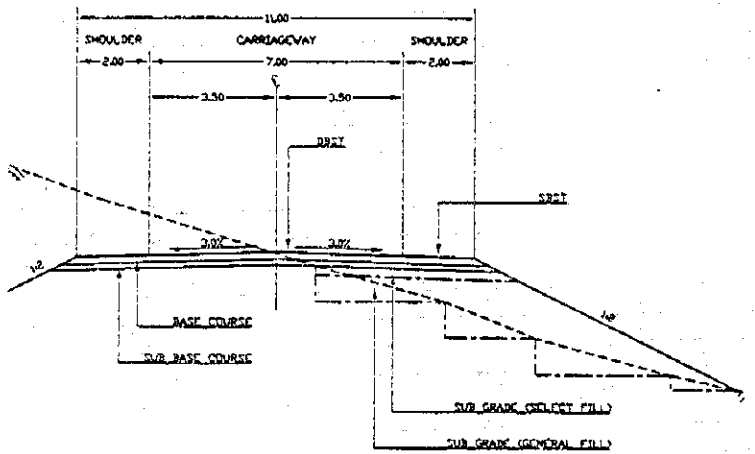


TYPICAL CROSS SECTIONS

MAIN BRIDGE



APPROACH ROAD



B.8 Project Cost

B.8.1 Capital Cost

The Capital cost for the Project comprises the construction costs including bridge and approach roads construction, land acquisition and compensation costs, engineering services, project administration costs, and physical and price contingencies. The total project cost was estimated at US$68.4 million as shown below.

PROJECT COST

(Unit: x 1000)

Item	L.C	F.C	Total
	US$	US$	US$
A. Construction Costs	9,884	42,884	52,768
1. Preparatory Works	816	4,887	5,703
2. Bridge Construction	7,551	35,909	43,460
3. River Bank Protection	338	206	544
4. Approach Road Construction	1,179	1,882	3,061
B. Physical Contingency	988	4,288	5,277
C. Engineering Services	369	3,324	3,693
D. Administration Costs	792	0	792
E. Land Acqusition and Compensation Costs	485	0	485
F Price Contingency	1,048	4,334	5,418
Total	13,566	54,831	68,397

B.8.2 Maintenance Cost

The maintenance cost comprise administration cost, routine and periodic inspection costs, routine maintenance cost and periodic maintenance cost. The annual maintenance cost of the bridge of a length of 1,380 m and the approach roads of a total length of 3.03 km (Pakse side: 0.68 km, Phontong side: 2.35 km) was estimated at US$15,000 per years.

B.9. Project Evaluation

B.9.1 Economic Evaluation

(1) Economic Project Costs

Economic costs of the selected route are summarized in the table below which were estimated based on the design work :

ECONOMIC PROJECT COSTS (1995 PRICES)

(US$1,000)

YEAR / ITEM	Total ('96-2000) (1995 Prices)	1996	1997	1998	1999	2000
- Construction Cost	52,768		19,124	14,833	15,729	3,082
- Physical Contingency	5,276		1,912	1,483	1,573	308
Sub-total	58,044		21,036	16,316	17,302	3,390
- Engineering Service	3,693	1,387	520	826	804	156
- Administration	792	79	158	238	238	79
- Land Acquisition and Compensation	485		436	49		
TOTAL	63,014	1,466	22,150	17,429	18,344	3,625

The annual maintenance costs after opening are estimated at US$15,000 per year.

(2) Economic Benefits

The direct benefits of the project bridge consist of mainly the time savings of the traffic that will divert from the ferry boats to the new bridge. In addition to those benefits, the future ferry service costs which would be not needed after opening of the bridge are also counted as benefits from a view point of national economy. The calculated benefits including savings in future investment costs for the new slope type jetties in 2000 are summarized as follows :

BENEFIT ESTIMATION

(US$1,000)

BENEFIT	TRAFFIC	Year		
		2000	2010	2020
Users Cost Savings (VOC and Time Cost)	Normal Traffic	371	2,101	4,275
	Induced Traffic	20	118	234
	Sub-total	391	2,219	4,509
Savings in Ferry Service Costs	Operations	781	3,750	5,823
	Investment(Boats)	215	0	215
	Investment(Jetties)	500		
	Sub-total	1,496	3,750	6,038
TOTAL		1,887	5,969	10,547

In addition to the above benefits, the Pakse bridge is expected to generate many kinds of indirect benefits through realization of non-waiting, continuous and all-weather traffic flows. These indirect benefits will be enjoyed as regional development effects such as agricultural, industrial and tourism development.

(3) Results of Economic Evaluation

Based on the conventional Discount Cash Flow analysis, evaluation indicators were

calculated as below :

	Discount Rate	7%	9%	10%
-	Net Present Value (NPV : US$'000)	8,996	-6,374	-11,571
-	Benefit Cost Ratio (B/C)	1.18	0.87	0.75
-	Economic Internal Rate of Return (EIRR : %) = 8.0%			

EIRR of the project bridge is estimated at 8%. The results above are based on the only quantifiable direct benefits. In addition to the direct benefits, regionwide and nationwide development effects by the Project should be taken into account for the evaluation. Considering such wide range and long term indirect effects together with the direct benefits, the implementation of the Project will be sufficiently justified.

B.9.2 Sensitivity Analysis

The sensitivity tests were carried out by changing key factors within the probable range as shown below:

			(Change in EIRR)
1)	GDP growth	(low growth: 6% p.a. high growth: 10% p.a.)	6.9% - 8.5%
2)	Traffic demand	(-30% to +30%)	5.9% - 9.8%
3)	Time value	(-30% to +30%)	7.1% - 8.8%
4)	Ferry operation costs	(-30% to +30%)	6.8% - 9.1%
5)	Construction cost	(-30% to +30%)	10.2% - 6.5%

B.9.3 Financial Analysis

(1) Possibility of Toll Bridge

Imposing toll charges on bridge users will be justified from a point of "Beneficiaries Pay Principle" and originally ferry tariff has been levied on the river crossing traffic.

Results of analysis indicate that the recovery of the initial investment costs with the toll revenues will be very difficult because of low financial returns. On the other hand, the annual maintenance costs can be covered sufficiently with the annual toll revenues.

(2) Financial Resources and Investment Capacity

The size of the Pakse bridge project in terms of the project cost (63 US$ million) is about 10 times of the total local fund of MCTPC budget of 1994/95 and also 3.6 times of the total budget for all CTPC sectors. Considering such project size and the present Government financial situation, implementation of the project only by the local fund or local loans will impose a big burden to the Government budget.

B.9.4 Environmental Impact Assessment

The environmental impact caused by implementation of the Project and the proposed mitigation measures against the impact are summarized as shown in the table below. Carrying out these mitigation measures described in the Table is seemed to be not so difficult while resettlement will be required for 44 families.

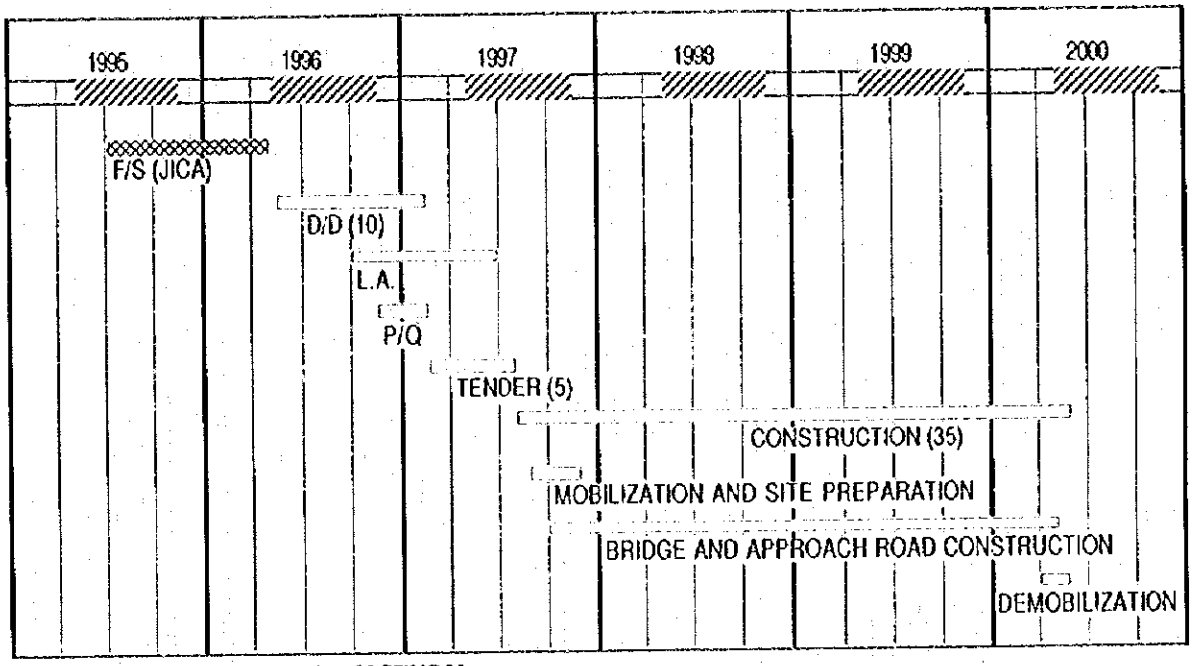
SUMMARY OF PROPOSED MITIGATION MEASURES

Activity	Environmental Component Affected	Predicted Impact	Rating[1] of Potential Impact and Severity	Proposed Mitigation Measure
Vehicle Traffic	Air	Periodic air pollution over Pakse Town	A	1. Good traffic management to prevent congestion at intersections 2. Establish landuse controls within ROW and within the 200m wide impact zone
	Noise	Increase in overall ambient noise level plus periodic annoying noise episodes	S	1. Provide vegetation buffers (plantings of trees, shrubs) 2. Create noise berms and use natural attenuation features
Capping of existing wells in ROW	Aquatic and Human	Loss of potable water supply	V	Reconnection of water supply
Resettlement	Human/Built	Community and family stress	V	Compensation and relocation assistance
		Relocation of 44+ families	V	Same
Clearing of ROW and approach road alignment	Human/Built and Agriculture	Removal of 70,000 m^2 of rice fields plus many market garden and grazing plots	V	Compensation and assistance Revegetation
Construction of a vertically elevated approach road	Human/Built	access restrictions to fields and property	V	Placement of nine 2.5m x 3m box culverts along approach road, with location based on engineering limits and consultation with residents. Specification of operational period maintenance needs
	Visual	Obstruction of views with embankment walls	S	Vegetation screens and buffer zones planted and maintenance of these once operational period begins

A: annoying but tolerable impact
S: significant degradation
V: very severe impact needing immediate mitigation to prevent occurrence .

B.10. Implementation Program

The implementation schedule of the Project was studied considering the optimal commencement time in a year for foundation construction in the river and using the condition that the construction project would be completed by middle of 2000. Prior to the commencement of the construction it is necessary to carry out such pre-construction works as soils and geological investigation, detailed design, land acquisition, financial arrangement, etc. The overall project implementation schedule considered above conditions is shown below.



Legend:
F/S: FEASIBILITY STUDY
D/D: DETAILED ENGINEERING DESING
L.A.: LAND ACQUISITION AND COMPENSATION
P/Q: PREQUALIFICATION
////: REAINY SEASON

OVERALL IMPLEMENTATION SCHEDULE OF MEKONG BRIDGE CONSTRUCTION AT PAKSE

THE FEASIBILITY STUDY
ON
THE CONSTRUCTION OF THE MEKONG BRIDGE AT PAKSE
IN
THE LAO PEOPLE'S DEMOCRATIC REPUBLIC
FINAL REPORT

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ABBREVIATIONS

AASHTO	American Association of State Highway and Transportation Officials
ADB	Asian Development Bank
ADT	Average (Annual) Daily Traffic
CBR	California Bearing Ratio
CPC	Committee for Planning and Cooperation
DBST	Double Bitumen Surface Treatment
DCTPC	Department of Communication, Transport, Post and Construction (province or district)
DWT	Dead Weight Ton
EIA	Environmental Impact Assessment
EIRR	Economic Internal Rate of Return
FIRR	Financial Internal Rate of Return
FWL	Flood Water Level
GDP	Gross Domestic Product
GHW	Giga Hour Watts
GPP	Gross Provincial Product
GVW	Gross Vehicle Weight
HDM	Highway Design and Maintenance Standard Model
HWL	High Water Level
IDA	International Development Association (World Bank)
ILO	International Labor Organization
IMC	Interim Mekong Committee
IRR	Internal Rate of Return
JICA	Japan International Cooperation Agency
JRA	Japan Road Association
JY	Japanese Yen
LUADP	Lao Upland Agricultural Development Project
LWL	Low Water Level
MCTPC	Ministry of Communication, Transport, Post and Construction (Lao PDR)
MOAF	Ministry of Agriculture and Forestry
MSL	Mean Sea Level
MW	Megawatts
N/A	Not Available
NEM	New Economic Mechanism
NPV	Net Present Value
NR	National Road
NSC	National Statistical Centre (Lao PDR)
NTS	National Transport Study
O-D	Origin and Destination
OSTE	Organiszation for Science, Technology and Environment
PIP	Public Investment Program
PMD	Prime Ministerial Decree

PR	Provincial Road
RCD	Reverse Circulation Drill
ROW	Right of Way
RTIM	Road Transport Investment Model
SBST	Single Bitumen Surface Treatment
SEP	Self Elevated Platform
SIDA	Swedish International Development Agency
SPT	Standard Penetration Test
STP	Sewage Treatment Plant
THC	Total Hydrocarbons
TPU	Transport Planning Unit (MCTPC)
TRRL	Transport and Road Research Laboratory (of the UK)
TRU	Truck Unit
TSP	Total Suspended Particulate
TVA	Tax on Value Added
USc	United State cent
USD, US$	United States Dollar
VOC	Vehicle Operating Cost
WMO	World Meteorological Organization
cif	cost, insurance and freight
J¥	Japanese Yen

CHAPTER 1

INTRODUCTION

1. INTRODUCTION

1.1 Authority

This Final Report on the Feasibility Study on the Construction of the Mekong Bridge at Pakse (hereinafter referred to as "the Study") was prepared in accordance with the Scope of Work for the study on the captioned Project agreed upon between Ministry of Communication, Transport, Post and Construction (hereinafter referred to as "MCTPC") of the Lao People's Democratic Republic (Lao PDR) and Japan International Cooperation Agency (hereinafter referred to "JICA") on April 6, 1995. This Report also presents the general observation on the economy and transportation in Lao PDR as well as the Project area, the proposed bridge routes, the traffic study in and around the Project site, the environmental examination, engineering site surveys, preliminary design of alternative routes, selection of the optimal bridge route, design of proposed route, cost estimate, economic evaluation, environmental impact assessment and implementation plans.

1.2 Background

Since "New Economic Mechanism (NEM)" has been introduced as a policy for national socio-economic development in 1986, the Lao PDR has begun to step forword to reorganize her economy under the market economy principle. The new policy is expected to promote foreign investment, activate national economy and increase international trade with surrounding Indochia countries .

In order to stimulate and activate economy on the basis of an international trade with market economy countries, relationship with Thailand shall be focused on as the first priority, which recently keeps good economic performance and accumulates biggest economic power in the surrounding countries. In this sense, the Pakse Area and Mekong bridge at Pakse shall be paid special attention as a regional development center in the South Region with a short highway connection to Thai boarder.

Although the southern provinces of Lao PDR are rich in agricultural resources such as rice, coffee, fruit, crops, timber product, etc., and Pakse is located at only one hour distance from the Thai border, such commodities have not been transported efficiently because of a bottleneck to cross the Mekong river.

The crossing over the Mekong river was and is always a key issue for the improvement of road network in Indochina countries. The road rehabilitation projects in the Southern provinces such as National Road 13 and National Road 10 are under way by the assistance of Asian Development Bank (ADB) and efficient and all season international links will be completed with the construction of the Mekong bridge at Pakse.

Under such situation, the Government of Lao PDR requested to the Government of Japan for the feasibility study on Construction of Mekong Bridge at Pakse.

In response to the request, the Government of Japan has decided to conduct the Feasibility Study on Construction of Mekong Bridge at Pakse.

Accordingly, JICA the official agency responsible for the implementation of the technical cooperation program of the Government of Japan, undertook the Study and organized a study team. The Study Team commenced the study July 1995 and the study was completed in March 1996.

1.3 The Feasibility Study on the Construction of the Mekong Bridge at Pakse

1) Objectives of the Study

The objectives of the Study are to conduct the feasibility study for the construction project of Mekong bridge at Pakse including its approaches for the period up to the year 2010 and to carry out technology transfer to the counterpart personnel of the Government of Lao PDR in the course of the Study.

2) Study area

The Mekong river basin in and around Pakse, Champasak province, is of the subject area for the Study.

3) Scope of the Study

The study is composed of the works in Laos including field survey as the first stage and the home office works in Japan as the second stage. The scope of the study stagewise is summarized as follows:

(1) The works in Laos (Stage 1)

The study in Laos was carried out the following items:

- Data collection and analysis
- Site survey which was composed of traffic survey, topographic/bathymetric survey and traffic volume survey
- Traffic forecast
- Environmental examination
- Comparative study and evaluation of alternatives on proposed bridge routes

(2) The works in home office in Japan (Stage 2)

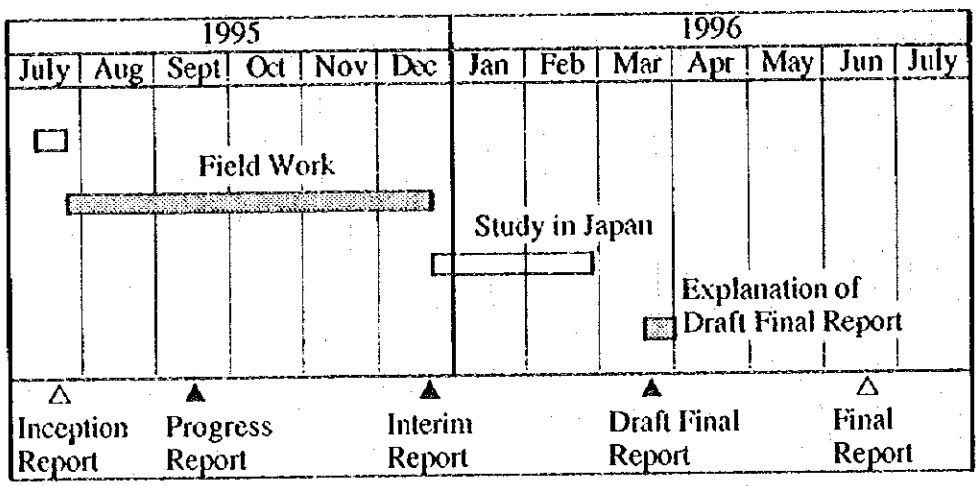
The study in home office in Japan was carried out the following items:

- Preliminary design and cost estimate on the optimum bridge route
- Planning and scheduling of construction works
- Maintenance program
- Environmental impact assessment

- Economic and financial evaluation
- Implementation program
- Conclusions and recommendations

1.4 Implementation of the Study

The Study run for about 11 months from the middle of July 1995 through May 1996 and was carried out in the following schedule.



The study was carried out by the Study Team composed of staff from Japanese consultants, Nippon Koei Co., Ltd. and Construction Project Consultants Inc. entrusted by JICA, under the supervision of the Advisory Committee organized by JICA which comprises Japanese Government officials.

The objective and the scope of work for the Study were determined by the Scope of Work document signed between MCTPC and JICA on April 6, 1995. Points of agreements reached during the discussions held prior to the signing were officially recorded in the Minutes of Discussion also signed on April 6, 1995. These documents are reproduced in A.1-1 and A.1-2 (Annexes : Volume II).

The Study was broadly divided into three (3) phases :

The works in Laos (Stage 1)

- Phase I : Project characteristics, Traffic study and Preparation of Bridge route alternatives.

- Phase II : Preliminary design of alternative routes, Preliminary evaluation and selection of the optimal bridge route.

The works in home office in Japan (Stage 2)

- Phase III : Engineering study of proposed route, project cost estimate, evaluation and implementation program

Phase I Study was commenced on July 18, 1995 with the arrival of the Study Team. Explanation on the Inception Report was proceeded by the Study Team prior to the arrival of the Advisory Team. The Advisory Team visited and stayed in Vientiane in early August, 1995. Discussions were held on the Inception Report between MCTPC, the Advisory Team and the Study Team on August 8, 1995. Points of agreement were recorded in the Minutes of Meeting signed on 10, 1995 as attached in A.1-3 (Annexes : Volume II).

Meetings were held in early September 1995, with MCTPC and the Study Team on progress. The main items discussed at the meetings were the results of the future traffic forecast and alternative bridge routes.

The second visit of the Advisory Team was from December 12 to December 16, 1995 to discuss the contents of the Interim Report which includes works , findings and study results during the Phase II Study. During the stay of the Advisory Team, the Interim Report was submitted to MCTPC by the Study Team on December 13, 1995. As a conclusion, the route of the project bridge proposed by the Study Team was accepted along with other study results such as traffic study, preliminary design and so on. Points of agreement were recorded in the Minutes of Meeting signed on December 15, 1995, as attached in A.1-4 (Annexes : Volume II).

Phase III Study followed in the form of desk work in Japan from January to March 1996 to conduct design of the project facilities and to evaluate the project feasibility. A Draft Final Report was prepared as the outcome of the Study by incorporating the earlier reports of Progress Report, Interim Report and the results of the Phase III Study.

The Advisory Team and the Study Team visited Vientiane from March 20th to March 27th, 1996 to submit the Draft Final Report to MCTPC. During their stay, a meeting was held to discuss the contents of the Draft Final Report and points of discussion were recorded in the Minutes of Meeting signed on March 26, 1996 as attached in A.1-5 (Annexes : VolumeII).

MCTPC reviewed again the contents of the Draft Final Report and afterwards, the Study Team completed this Final Report in June, 1996.

1.5 Organization

The Study was carried out by the Study Team appointed by JICA. On commencement of the Study, JICA organized the Advisory Committee composed of experts and Japanese Government officials, to advise the Study Team and review the results of the Study. The Study Team kept close collaboration with the counterpart officials of MCTPC in carrying out the Study.

The members participated in the Study are listed below :

JICA Advisory Committee

Mr.Kozo HIGUCHI	Chairman, Honshu-Shikoku Bridge Authority
Mr.Seiichi SAITO	Bridge Planner, Ministry of Construction
Miss Mari ITO	Coordinator, JICA

JICA Study Team

Mr.Junji MASHIBA	Team Leader (NK).
Mr. Kenji NAGASAKI	Deputy Team Leader (CPC)
Mr. Akio MORIKAWA	Traffic Engineer (NK)
Mr. Junji YASUI	Bridge Engineer (NK)
Mr. Takao SAKAMOTO	Bridge Engineer (CPC)
Mr. Keishi IHARA	Highway Engineer (CPC)
Mr. Seiji IKEDA	Geologist (NK)
Dr. J.R.Montano MICHEL	Meteo-Hydrologist (NK)
Mr. Geza.C. TELEKI	Environmental Expert (CPC)
Mr. Atsuya SAISHO	Construction Planner (NK)
Mr. Masahito HOMMA	Economist (NK)

(NK) : Nippon Koei Co., Ltd.

(CPC) : Construction Project Consultants, Inc.

Ministry of Communication, Transport, Post and Construction

Dr. Khamseng SAYAKONE	Deputy Director, Communication Department
Mr. Somad PHOLESENA	Acting Director, Communication Department
Mr. Bounchanh SINTHAVONG	Deputy Director, Communication Department
Mr. Lattanamany KHOUNYVONG	Deputy Director, Cabinet
Mr. Math SOUNMALA	Deputy Director, Cabinet
Mr. Phetsamone VIRAPHANTH	Deputy Director, Cabinet
Mr. Khanngeun KHAMVONGSA	Director, International Relations Division, Office of the Permanent Secretary
Mr.Say VIXAYXONGDETH	Director, Inland Waterway Division
Dr. Koung SOUK ALOUN	Deputy Director, CTPC of Champasack Province
Mr. Khamla SAYAVONGSA	Head, Administration Division
Mr. Oulay PHADOUANGDETH	Acting Director, Technical Division
Mr. Dapkeo DOUANGACHANH	Senior Engineer, Technical Division
Mr. Khamphay SIRIPHONE	Civil Engineer, Technical Division

CHAPTER 2

SOCIO--ECONOMIC CONDITIONS IN LAOS AND STUDY AREA

2. SOCIO-ECONOMIC CONDITIONS IN LAOS AND STUDY AREA

2.1 Socio-Economic Conditions in Laos

2.1.1 Population

According to the 1995 census, the population of Lao PDR is estimated at about 4.6 million and annual growth rate for the last 10 years (1985 - 1995) is 2.44 %. The population density is estimated about 19.4 persons/km^2 in the whole country and 135.7 persons/km^2 in the capital city of Vientiane(Table 2.1-1). The total number of households is about 7.52 million in 1995 and average household size is estimated at 6.1 persons/household.

2.1.2 Labor Force and Employment

(1) Labour Force

The preliminary result of 1995 census showed that the total population was about 4,581,000 persons of which 2,137,000 persons were estimated to be working age population (defined as 16-60 years old for males and 16-55 years old for females) as presented in Table 2.1-2. The percentage ratio of labour force to the total population is about 46.6% in the whole country in 1995.

(2) Status of Labour Force Participation

The sample survey, the Lao Urban Labour Force Survey, conducted in August 1994 indicated that 3.4 % of the total working age population were unemployed (Table2.1-3). Another sample survey, the Lao Expenditure and Consumption Survey 1992/93, estimated also a low unemployment rate at 4% (Table 2.1-4). (The definition of the status " unemployment" of the survey is " no work to do on any of the seven days in the week preceding the interview" which is different from the criteria of the ILO definition.)

(3) Employment Structure

The Lao Urban Labour Force Survey 1992 indicated that 42% of the total households engaged in the agriculture sector as shown in Table 2.1-5.

2.1.3 Structure of the National Economy

(1) General

With the introduction of the New Economic Mechanism (NEM) in 1986, the Government of Lao P.D.R. started to move toward a market determined resource allocation and has concentrated on addressing infrastructure development, leaving much of the development of agriculture and industry to the private sector. This process of

privatization is now still under way and stimulating economic activities in the country.

1) Gross Domestic Product (GDP)

Over the past four years (1990 - 1994) fairly steady growth averaging 6.2% per year has been achieved. Especially in 1994, actual GDP has recorded an 8.% of high growth rate. This growth has been led almost totally by private sector activity. Although the agriculture sector is still a dominant sector of the economy, considerable growth has been achieved in the industrial sector.(Table 2.1-6, and Figures 2.1-1 and 2.1-2)

2) National Budget

Until the introduction of the New Economic Mechanism (NEM), the traditional revenue of the Government was based on transfers from state enterprises whose profitability was assured by price controls. Although these revenue bases were severely affected by NEM, a substantial progress has been made in tax base revenue and accordingly the Government revenue as a proportion of GDP has been increased from 10% in 1990 to about 13 % in 1994. In addition, the deficits in current balance has turned into positive surplus since 1992/3 (Table 2.1-7, Figure 2.1-3).

3) Trade

The export amount of Lao PDR totaled US$ 203 million in 1993, 3.5 times of US$ 57.9 million in 1988 as shown in Table 2.1-8. Between 1988 and 1993, while the share of electricity and timber exports fell from 50.9% of total export to 12.6%, the share of manufactured exports increased from 5.5% to 35.5%. The total imports amounted US$353 million in 1993 of which machinery and raw materials (54%), rice and other foods (9%) and petroleum (6%) are the major import items as shown in Table 2.1-9.

4) Prices and Consumer Price Index

As compared to December last year, prices (in Vientiane Municipality) have slowly increased. In 1989, however, consumer price index jumped by 82% in a year. Since 1990, consumer price index has moderately increased in a tendency toward lower prices as shown in Table 2.1-10 and Figure 2.1-4. But in 1995 as of September, consumer price index has increased again very fast compared to the previous year (34% up in 9 months). This high increase of price index was due to mainly the increase in price level of food.

5) Vehicle Ownership

The past trend of vehicle registration in the whole country is presented in Table 2.1-11. The average growth rate in the total number of vehicles for the period 1977 - 1992 was estimated to be 12 % p.a. The composition ratios of motorcycles and heavy vehicles have increased for the same period. The ownership rate per 1,000 population was about 27 vehicles / 1,000 persons in 1992.

TABLE 2.1-1 MID-YEAR POPULATION BY PROVINCE

Province	Land Area (km2)	Population (1000 persons)		Average Annual Growth Rate (%) 1985 - 95	Density in 1995 (persons/km2)
		1985	1995		
Whole country	236,800	3,618	4,605.3	2.44	19.4
1 Vientiane Mun.	3,920	381	531.8	3.39	135.7
2 Phongsaly	16,270	124	153.4	2.15	9.4
3 Luangnamtha	9,325	98	115.2	1.63	12.4
4 Oudomxay	15,370	189	211.3	1.12	13.7
5 Bokeo	6,196	56	114.9	7.45	18.5
6 Luangprabang	16,875	298	367.2	2.11	21.8
7 Huaphanh	16,500	212	247.3	1.55	15.0
8 Xayabury	16,389	226	293.3	2.64	17.9
9 Xiengkhuang	15,880	163	201.2	2.13	12.7
10 Vientiane	15,927	267	286.8	0.72	18.0
11 Borikhamxay	14,863	123	164.9	2.97	11.1
12 Khammuane	16,315	215	275.4	2.51	16.9
13 Savannakhet	21,774	549	674.9	2.09	31.0
14 Saravane	10,691	189	258.3	3.17	24.2
15 Sekong	7,665	51	64.2	2.33	8.4
16 Champasack	15,415	407	503.3	2.15	32.7
17 Attapeu	10,320	70	87.7	2.28	8.5
Special Region	7,105		54.2		7.6

Source : NSC, Committee for Planning and Co-operation

TABLE 2.1-2 LABOUR FORCE IN THE LAO PDR

	1985	1995	Annual Growth (%)
Total Population (P) ('000 persons)	3618	4581 (*)	2.39
Labour Force (L)	1674	2137	2.47
of which : Female	858	1086	2.38
: Male	816	1051	2.56
(L/P) x 100 %	46.3	46.6	

Note (*) : Preliminary result from 1995 census.
Labour force in 1995 is estimated based on the percentage of labour force obtained from the1985 Census
Source : Basic Statistics about Socio-Economic Development in the LAO - PDR 1975 - 1995 CPC, NSC.

TABLE 2.1-3 CURRENT ECONOMIC ACTIVITY STATUS
(AGE GROUP OF 15 YEARS OR MORE)

	Sample persons	%
Total	157,674	100
Usually employed	89,995	57.1
Usually unemployed	5,393	3.4
Usually inactive	6,327	4.0
Not stated	55,959	35.5

Source: Ministry of Labour Force and Social Welfare (Urban Labour Force Survey 1994).

TABLE 2.1-4 CURRENT LABOUR FORCE PARTICIPATION

Structure	Percentage of Population
Employed	83
Unemployed	4
Not labour force	13

Source : Lao Expenditure and Consumption Survey 1992.93 CPC, NSC.

TABLE 2.1-5 EMPLOYMENT STRUCTURE (1992)

Agriculture	42%	Services	3%
Government	15%	Wholesale Trade	1%
Retail Trade	14%	Utilities	1%
Manufacturing	11%	Restaurants	1%
Construction	4%	Others	<1%
Transport & Communication	4%		

Source : Lao Urban Labour Force Survey, July 1992

TABLE 2.1-6 GROSS DOMESTIC PRODUCT (GDP) BY INDUSTRIAL ORIGIN AT 1990 CONSTANT PRICES

GDP by Industrial Origin at 1990 constant prices (1990 - 1994)

	1990	1991	1992	1993	1994	Annual Average Growth (%)
GDP (Mill.Kip)	612,681.0	637,160.0	681,797.0	721,842.1	780,061.2	6.22%
Agriculture	371,835.0	365,347.0	395,537.0	406,233.5	439,786.5	4.29%
Industry	88,105.0	105,634.0	113,587.0	125,258.0	136,566.5	11.58%
Services	147,377.0	156,993.0	163,038.0	175,632.6	187,070.3	6.14%
Import Duties	5,364.0	9,186.0	9,635.0	14,718.0	16,637.9	32.71%
Population	4,140,000	-	-	-	4,591,000	2.62%
Per Capita GDP (Kip/person)	147,991	-	-	-	169,911	3.51%

Yearly Growth Rate of GDP (1990 - 1994) (%)

GDP	6.7	4.0	7.0	5.9	8.1
Agriculture	8.7	-1.7	8.3	2.7	8.3
Industry	16.2	19.9	7.5	10.3	9.0
Services	-0.5	6.5	3.9	7.7	6.5
Import Duties	-34.0	71.3	4.9	52.8	13.0

Composition Ratio (%)

GDP	100.0	100.0	100.0	100.0	100.0
Agriculture	60.7	57.3	58.0	56.3	56.4
Industry	14.4	16.6	16.7	17.4	17.5
Services	24.1	24.6	23.9	24.3	24.0
Import Duties	0.9	1.4	1.4	2.0	2.1

Source : National Statistical Centre (NSC)

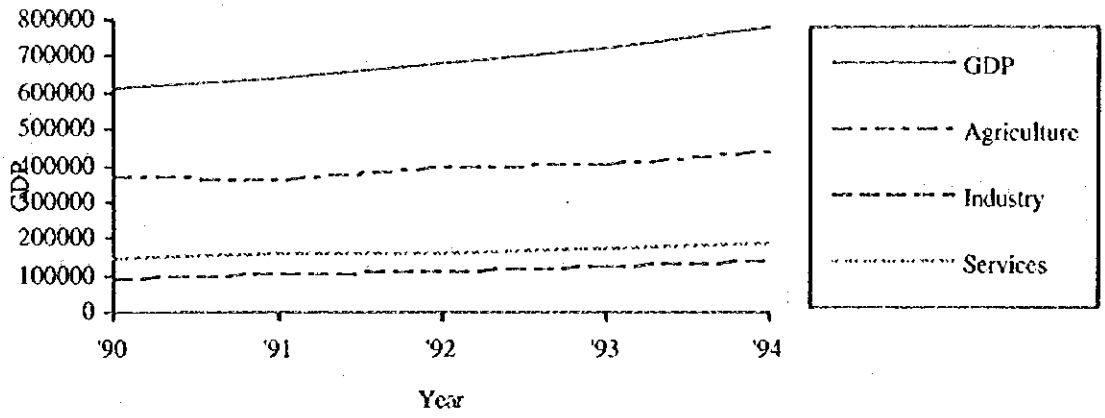


FIGURE 2.1-1 PAST TREND OF GDP (1990 TO 1994: 1990 PRICES)

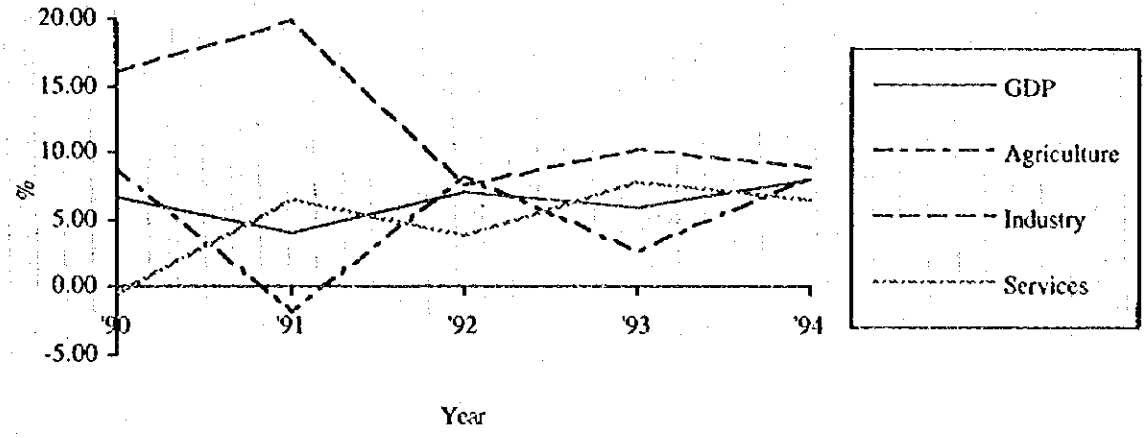


FIGURE 2.1-2 YEARLY GROWTH RATE OF GDP

TABLE 2.1-7 PAST BUDGET PERFORMANCE

(unit : Million Kip)

Items	Year				
	1990	1991	1992	1992/3	1993/4
(1) Government Revenue	60,960	74,673	90,456	113,256	136,500
Grants	22,960	32,550	39,946	31,270	39,456
(2) Current Expend	69,864	81,956	92,424	104,930	123,620
incl. interest payments	2,254	3,080	2,674	6,829	7,270
(3) Capital Expend	73,583	69,123	82,217	79,450	91,000
(4) Current Balance = (1)-(2)	-8,904	-7,283	-1,968	8,326	12,880
GDP	615,020	725,569	848,206	940,362	1,061,100
					(as a proportion of GDP : %)
(1) Government Revenue	9.9	10.3	10.7	12.0	12.9
Grants	3.7	4.5	4.7	3.3	3.7
(2) Current Expend	11.4	11.3	10.9	11.2	11.7
incl. interest payments	0.4	0.4	0.3	0.7	0.7
(3) Capital Expend	12.0	9.5	9.7	8.4	8.6
(4) Current Balance = (1)-(2)	-1.4	-1.0	-0.2	0.9	1.2

Original Source : World Bank Country Economic Memorandum, Jan.1994

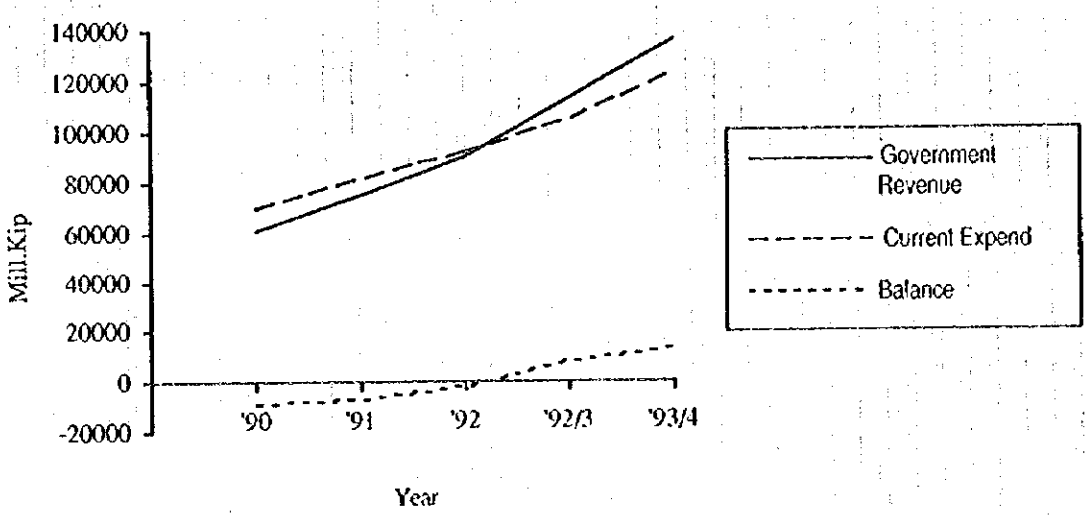


FIGURE 2.1-3 PAST TREND OF BUDGET PERFORMANCE

TABLE 2.1-8 COMPOSITION OF OFFICIAL EXPORT

(Unit:Million US$)

Item	1988	1989	1990	1991	1992	1993
1. Export to Convertible Area						
Electricity	11.3	15.0	19.2	21.3	17.0	17.1
Timber	18.2	4.0	3.2	3.0	9.7	8.5
Wood Products	2.6	11.6	15.4	37.9	33.0	38.2
Coffee	0.5	3.6	1.4	2.2	2.4	3.3
Metals	-	-	-	1.3	2.2	4.0
Garments/Textiles	-	4.0	7.0	15.1	27.3	37.0
Agriculture/Forestry Products	0.0	9.0	7.0	3.7	7.3	9.2
Motor bikes	-	-	-	-	19.5	22.0
Re-export						
- Logs, Wood Products	-	-	4.9	9.7	5.4	8.1
- Cars	-	-	-	-	6.4	20.7
Others	4.2	-	-	-	-	35.0
Sub-total	36.8	47.2	58.1	94.2	130.2	203.1
2. Export to Non-Convertible Area						
Coffee	6.8	5.2	7.2	0.9	0.0	0.0
Logs/Wood Products	9.3	5.8	7.3	0.8	0.0	0.0
Metals	3.2	3.1	3.0	0.4	0.0	0.0
Others	1.8	2.0	3.1	0.3	2.4	0.0
Sub-total	21.1	16.1	20.6	2.4	2.4	0.0
Total	57.9	63.3	78.7	96.6	132.6	203.1

Source : Research Department, Lao PDR Central Bank
Note : - Not available
Figures in 1993 are estimated amounts.
Export to the non-convertible currency countries shifted to convertible currencies in 1992.

TABLE 2.1-9 COMPOSITION OF OFFICIAL IMPORT

(Unit:Million US$)

Item	1988	1989	1990	1991	1992	1993
1. Import from Convertible Area						
Rice and other foods	5.7	9.2	7.1	13.0	31.6	30.5
Provincial imports	9.2	15.4	11.3	15.4	0.0	35.3
Petroleum products	5.3	12.2	7.3	21.1	24.3	19.7
Machinery / raw materials						
- Garment industry	-	-	-	-	20.4	31.5
- Re-exports	-	-	-	-	22.0	97.0
- Other	8.8	11.2	29.2	61.3	52.3	62.7
Other imports	25.0	19.7	9.9	30.1	25.4	49.6
Aid-related imports	29.2	57.1	55.4	64.6	68.4	26.9
(% of total)	18.2	27.2	27.7	28.6	28.0	7.6
Sub-total	54.0	67.7	64.8	140.9	176.0	326.3
2 Non-Convertible Area	36.4	51.1	62.9	1.2	0.0	0.0
Aid-related imports	29.8	17.9	2.3	3.0	0.0	0.0
(% of total)	18.6	8.5	1.2	1.3	0.0	0.0
Total cash imports	101.3	134.7	142.3	158.4	176.0	326.3
Total aid-related imports	59.0	75.0	57.7	67.6	68.4	26.9
Total of all imports	160.3	209.7	200.0	226.0	244.4	353.2

TABLE 2.1-10 CONSUMER PRICE INDEX

(Vientiane Mun.)
Dec.1987 = 100)

Year	1987=100	Yearly
Dec.1987	100	
Dec.1988	113	13
Dec.1989	206	82
Dec.1990	242	17
Dec.1991	267	10
Dec.1992	283	6
Dec.1993	309	9
Dec.1994	330	7
Sep.1995	441	34

Source: State Bank of Lao PDR
and NSC

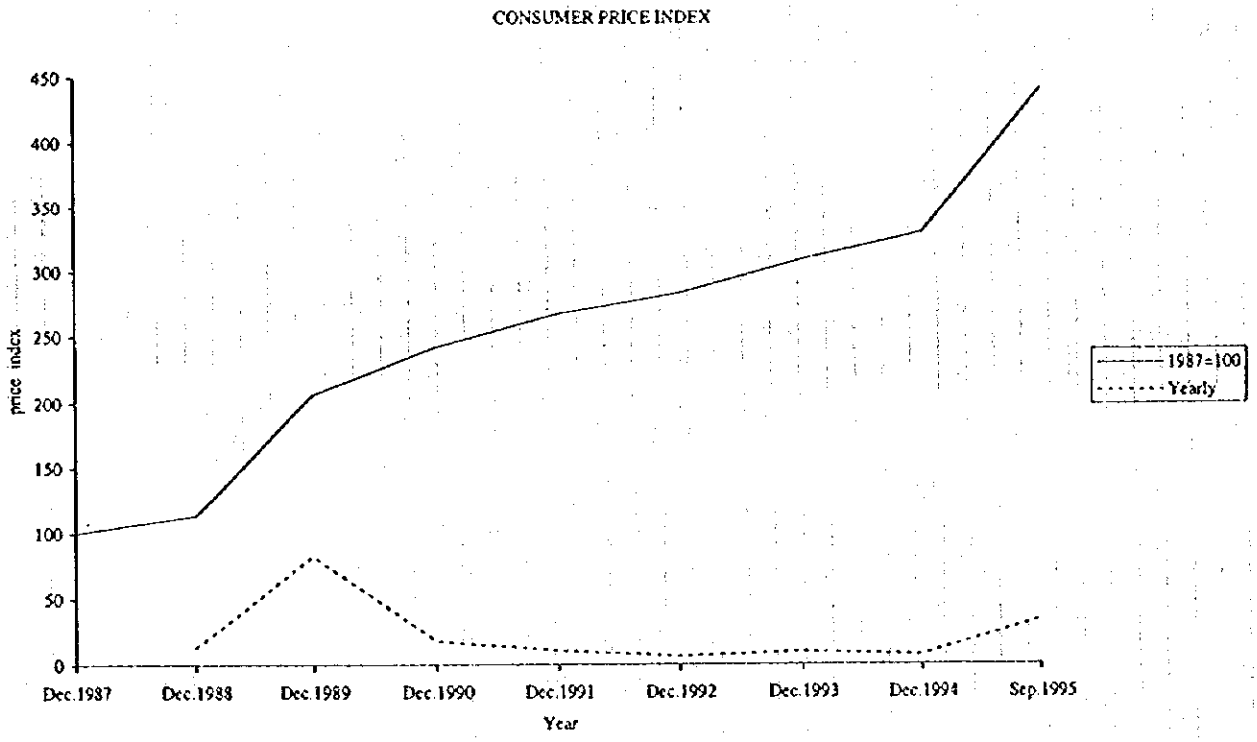


FIGURE 2.1-4 CONSUMER PRICE INDEX (1987=100)

(VIENTIANE MUN.)

TABLE 2.1-11 PAST TREND OF VEHICLE REGISTRATION

Year	Motorcycles	Light Vehicles	Heavy Vehicles	Total
1977	9,271	10,112	1,791	21,174
1980	11,096	11,308	2,889	25,293
1985	21,396	15,655	3,815	40,866
1986	24,233	16,844	4,027	45,104
1987	27,858	17,798	4,353	50,009
1988	32,074	19,008	4,743	55,825
1989	52,140	24,022	9,601	85,763
1990	59,391	25,515	10,566	95,472
1991	74,823	21,265	14,702	110,790
1992	79,877	22,059	14,984	116,920
Average Annual Growth Rate (%)				
('77 - '92)	15.4	5.3	15.2	12.1
Vehicle Composition (%)				
1977	43.8	47.8	8.5	100.0
1985	52.4	38.3	9.3	100.0
1990	62.2	26.7	11.1	100.0
1992	68.3	18.9	12.8	100.0
Vehicles/1000 population				
1992	18.3	5.1	3.4	26.8

Note : Light Vehicle : include car, pickup and jeep.
Heavy Vehicle : bus, truck more than 2.5 GVW.
Source : ADB 6th Road Improvement Project, ADB 1993

(2) Agriculture and Forestry

The present Lao economy depends heavily upon the performance of the agriculture sector. About 52% of the total land area is covered with agriculture land and forest use (Table 2.1-12), while 56% of GDP in 1994 were shared by agriculture and forestry. This sector contributes approximately 30% of official export earnings. Most of these exports have historically consisted of raw timber and wood products, but recent abuses with indiscriminate logging have forced the Government to impose severe restrictions.

Table 2.1-13 indicates the harvested area and production of major crops in Lao PDR from 1976 to 1994. More than 85% of the harvested area and 75% of the total production (in terms of tons) was rice, about 600,000 ha and 1,577,000 tons in 1994. Overall, Lao PDR is self-sufficient in rice during years of good weather but its annual paddy output is subject to sharp reduction caused by drought, and /or floods. Due to severe drought in both 1991 and 1993, as examples of recent experiences, production of rice was substantially declined as shown in Table 2.1-13.

Coffee is mainly planted in Boloven Plateau in Southern provinces, about 96% of the total area planted and is one of the important agricultural exports. Livestock husbandry is mainly characterized by small scale units.

In order to increase of productivity of agriculture and to improve living standard, the Government has taken effective efforts in the sector as introducing market-oriented economic system and providing the individual cultivation right.

(3) Industry

The sector of industry in the Lao PDR has experienced high growth in GDP with about 12% annual rate from 1990 to 1994. However, the Government policy for this sector is to promote small-scale industries and handicrafts with emphasis placed on value-added activities and import substitution. At present, medium and large scale industries are few and mostly undertaken by foreign companies in joint ventures.

Table 2.1-14 shows the number of business establishments by scale for the whole country registered in 1990 - 1991. Of the total manufacturing establishments, about 92% was shared by small size establishments.

(4) Mining

The mining sector in the Lao PDR represents one of the country's most promising long term prospect for growth. Although the sector accounted for only 1.4% of GDP in 1992, its growth rate was 12% per year. Development of minerals and energy in Laos, however, has been low because of the agrarian nature of the economy, scarce financial restriction on investments. The only significant minerals to have been exploited recently in the first and second five year plan (1981-1985, 1986-1990) are shown in Table 2.1-15. Comparing those actual output shown in the table with the targets of the two five

year plans (tin: 1,500 tons, gypsum: 180,000 tons, coal: 15,000 tons), it is easily found out that the targets were not realized.

The followings are main existing mines explained in the National Transport Study (NTS) for the purpose of transport demand analysis:

- The gypsum mine, about 60 km east of Savannakhet. The average production is about 90,000 tons per year. The proven reserves exceed 15 million tons (although the actual production during 1988 - 1989 was only 50 - 70,000 tons due to the transport problems within Vietnam).

- The tin mine and concentration facilities at Phontiou in Khammouan Province. The average production is about at 500 tons per year.

- The coal mine, at Bo Chan in Vientiane Province. The present production is about 3,500 tons per year.

Although they are believed to be large reserves of several other minerals in the country, exploration has so far been limited.

(5) Energy

About 90% of the energy in the country is produced from fuel woods, while electricity provides only 5% and petroleum the remaining 5%. Regarding the electricity, it has been estimated that the Lao PDR has an potential of over 18,000 MW within its borders of which only about one percent has been developed.

The largest hydropower plant in the country is Nam Ngum power station located on the Nam Ngum river 80 km north of Vientiane. It has an installed capacity of 150 MW generating 800 Gwh annually and about 70 % of output is exported to Thailand. The second largest power station is Xeset in Saravane Province which has 45 MW capacity and generates 180 Gwh annually. The present total hydrogenerating capacity of the country is 220 MW including other small hydroplants and diesel plants.

The following four significant distribution grids are working at present as major distribution networks :

- The Vientiane grid, with 67,000 consumers covering the Vientiane plain.

- Luang Prabang grid, serving some 5,500 consumers.

- Savannakhet and Thakhek grid, serving about 24,000 consumers and

- Champassak, Saravane and Sekong grid, with a total of 13,000 consumers and is being significantly extended through the Southern Provinces Electrification Project.

TABLE 2.1-12 LAND USE OF LAOS (1989)

Land categories	Area (1,000ha)	Share (%)
Total	**23,685**	**100**
Agricultural land	**1,009**	**4.3**
Rice Paddy	915	3.9
Permanent Crops	10	0.0
Other Agricultural	84	0.4
Current Forest	**11,185**	**47.2**
Potential Forest	**8,805**	**37.2**
Other Wooded Areas	**1,552**	**6.6**
Other Non-forest Land	**1,134**	**4.8**
Grass Land	634	2.7
Barren Land	112	0.5
Urban Area	134	0.6
Swamp/water	253	1.1

Source : Department of Forestry, Forest Inventory Division (July 1991)

TABLE 2.1-13 HARVESTED AREA AND PRODUCTION OF CROPS

Harvested Area (1,000 ha)								
	1976	1980	1985	1990	1991	1992	1993	1994
Rice	521.8	724.3	653.5	637.4	556.9	592.6	538.4	599.9
Maize	28.4	27.6	26.8	27.1	34.2	22.5	27.1	28.1
Starchy roots	5.5	9.1	10.3	28.3	16.6	14.5	14.3	21.9
Vegetable/Beans	3.7	5.2	7.1	7.2	6.8	6.0	15.0	16.5
Soybeans	2.9	4.7	3.2	5.1	6.1	6.1	5.5	6.3
Peanuts	4.7	10.7	6.7	6.5	5.6	7.7	5.9	5.0
Tabacco	1.3	4.0	3.7	11.7	10.2	10.5	7.1	7.3
Cotton	3.0	7.0	5.6	5.9	8.0	7.8	7.9	7.2
Sugarcane	0.7	0.9	2.9	3.5	2.8	3.3	3.4	2.7
Coffee	5.0	6.5	3.5	17.1	17.9	17.7	18.9	20.0
Tea	-	0.1	0.1	0.4	0.4	0.6	2.3	3.9
Total	577.0	800.1	723.4	750.2	665.5	689.3	645.8	718.8
Production of Harvested Area (1,000 tons)								
	1976	1980	1985	1990	1991	1992	1993	1994
Rice	660.9	1053.1	1396.1	1491.5	1223.4	1502.3	1250.7	1577.1
Maize	30.4	28.4	33.3	66.6	68.6	57.7	47.6	55.8
Starchy roots	47.3	80.3	85.4	218.5	132.1	104.8	112.9	159.5
Vegetable/Beans	28.4	42.6	39.4	53.5	51.2	56.6	125.1	156.4
Soybeans	1.7	3.3	2.1	4.2	5.5	5.1	4.5	6.0
Peanuts	3.5	7.9	5.2	6.4	5.6	6.8	5.3	4.8
Tabacco	5.6	16.6	15.7	56.4	45.3	48.3	29.2	31.8
Cotton	2.3	4.9	3.2	4.9	4.7	5.3	5.9	5.9
Sugarcane	17.0	24.1	73.0	96.4	80.5	94.4	89.6	65.1
Coffee	2.8	4.4	6.1	5.2	8.0	7.4	7.6	9.0
Tea	0.0	0.3	0.5	1.6	1.7	1.0	1.5	1.9
Total	799.9	1265.9	1660.0	2005.2	1626.6	1889.7	1679.9	2073.3

Source : Basic Statistics about the Socio-Economic Development in the LAO PDR 1975-1995, CPC, NSC.

TABLE 2.1-14 NUMBER OF ESTABLISHMENTS BY INDUSTRIAL SECTOR

(Unit : place)

Industrial Sector	Establishment Size			Total
	Large	Middle	Small	
Agricultural, forestry and fishery	11	12	8	31
Mining	8	2	6	16
Manufacturing	89	93	2232	2414
Electricity and water supply	7	4	6	17
Construction	127	142	37	306
Communication and storage	44	73	3206	3323
Commerce	99	218	16318	16635
Bank and insurance	9	3	0	12
Other services	50	64	2939	3053
TOTAL	444	611	24752	25807

Source : Basic Statistics 1975 - 1995, CPC, NSC.

Remark : Large > 30 employees
Middle = 10-29 employees
Small < 10 employees

TABLE 2.1-15 PRODUCTION OF TIN, GYPSUM, SALT AND COAL

(tons)

Year	Tin	Gypsum	Salt	Coal
1980	400	30,000	-	-
1981	255	40,000	3.3	-
1982	356	-	5.1	111
1983	362	70,000	6.5	750
1984	430	84,000	7.8	830
1985	520	100,000	9.1	1,000
1986	559	98,000	8.6	1,556
1987	201	70,000	13.8	1,550
1988	-	-	-	-
1989	232	-	-	-
1990	432	-	-	3,500

Source : Lao PDR Government Reports, EIU, Country Profile (1990-1991).

2.1.4 National Development Plan

(1) New Economic Mechanism Program (NEM)

Since 1986 Laos has embarked on an new reform program whose main purpose is to transform the Lao economy into a market economy. This reform program consists of the following components :

- the removal of the official distribution network and of the state marketing boards,
- a price reform to help the emergence of prices reflecting relative scarcities,
- the establishment of more clearly defined property rights and the privatization of the majority of state-owned enterprises,
- the development of factor markets
- the opening up of the Lao economy to international competition,
- a financial reform to favour the creation of a market-adapted banking and financial system,
- a tax and budget policy reform,
- a reform of the system of macroeconomic management and
- institutional reforms necessary to the functioning of a market economy

Under the NEM the Government has pursued and managed various improvement of bureaucratic activities as well as stabilization of national economy. Some of these consequences are observed in the actual achievements during the Third Five Year Plan period as shown below :

Average Growth Rate per year (%)

	3rd Five Year Plan (1991-1995)	Actual achievement (1991-1994)
GDP	7.0 %	7.0 %
Agriculture	5.7 %	6.4 %
Industry	9.6 %	8.9 %
Service	7.8 %	6.0 %
Per Capita GDP	3.9 %	4.2 %

The above results indicate that the growth targets of the Third Five Year Plan are almost satisfied with a 7.0 % of growth rate of total GDP.

In the circumstances, the Government of Lao PDR has decided to embark on an ambitious policy agenda for the next 5 years up to the year 2000. These policies are reflected in the Public Investment Program (PIP) as shown in Table 2.1-16 which indicates that the GDP growth will be maintained at 7% per year to 1995/6 and then at 8% up to 2000. At the same time, the proportion of the Government revenues funded from domestic resources is expected to reach to around 30% of GDP.

Table 2.1-17 shows the Program Budget from the year 1994/5 to 1999/2000 with an

allocation plan to each sector. A high growth rate (43.8 % per annum) is attached to the budget for industrial sector and at the same time the highest proportion to the total amount of budget is to be allocated to the transport sector for the next five years. Among the transport sectors, about 88 % of budget will be input to the road sector as shown in Table 2.1-18.

TABLE 2.1-16 PUBLIC INVESTMENT PROGRAM TARGETS

	1994/5	1995/6	1996/7	1997/8	1998/9	1999/0
Growth in GDP (real)	7%	7%	8%	8%	8%	8%
GDP $US million (1994 prices)	1474	1577	1703	1839	1986	2145
Public Investment Program (PIP)	146.7	180.3	210.1	240.6	270.8	291.3
PIP as Proportion of GDP	10.0	11.4	12.3	13.1	13.6	13.6
Proportion PIP financed from domestic revenue	13%	17%	20%	23%	29%	29%

Original Source : CPC Projected Program targets
Source : "Public Investment Program 1994 - 2000" June 1994

TABLE 2.1-17 PROGRAM BUDGET (1994/5 - 1999/00)

PROGRAM	Total Funds Allocation (US$ million : in 1994 prices)							Growth Rate per	Compo-sition of
	'94/5	'95/6	'96/7	'97/8	'98/9	'99/ 2000	TOTAL	Annum	Total US$
(1) Agriculture & Forestry	23.7	32.5	40.9	50.7	54.5	61.0	263.3	20.8	19.65
(2) Industry (excl. Electricity)	1.3	6.0	8.0	8.5	7.5	8.0	39.3	43.8	2.93
(3) Electricity	15.0	13.5	14.0	14.0	13.0	15.0	84.5	0.0	6.31
(4) Transport	53.7	65.5	74.7	87.3	108.1	108.7	498.0	15.1	37.17
(5) Telecommunications	7.0	8.7	11.5	13.0	18.0	19.5	77.7	22.7	5.80
(6) Other Infrastructure (MCTPC)	12.0	12.0	12.0	13.5	17.0	20.0	86.5	10.8	6.46
(7) Culture (Ongoing Program)	4.0	4.3	4.6	5.0	5.4	5.8	29.1	7.7	2.17
Education	20.3	21.8	23.1	24.3	23.5	26.5	139.5	5.5	10.41
(8) Health	9.7	13.5	17.8	20.8	23.8	26.8	112.4	22.5	8.39
(9) Economic Restructuring	0.0	2.5	3.5	3.5	0.0	0.0	9.5	-	0.71
TOTAL PIP	146.7	180.3	210.1	240.6	270.8	291.3	1339	14.7	100.00

Source : "Public Investment Program 1994 - 2000, Outline " June 1994

TABLE 2.1-18 PROGRAM BUDGET FOR TRANSPORTATION SECTOR

PROGRAM	Total Funds Allocation (US$ million)						
	1994/5	1995/6	1996/7	1997/8	1998/9	1999/00	TOTAL
(1) ROADS	**51.0**	**60.2**	**66.0**	**75.7**	**92.5**	**93.5**	**438.9**
Ongoing and committed*							
Rd#13N Vientiane-Luang Prabang-Paknong	15.0	12.0	7.0				34.0
Rd#13S Vientiane-Cambodia (Pavements)	5.0	5.0	10.0	10.0	11.0	8.0	49.0
Rd#13S Vientiane-Cambodia (Bridges)	2.0	3.0	3.0	4.5	5.0	7.0	24.5
Other National Road Links (Pavements)	15.0	15.0	10.0	10.0	10.0		60.0
Other National Roads (Bridges)	10.0	8.0	6.0				24.0
New Programs							
Second Mekong Bridge (South Laos)**						9.0	9.0
Regional Links (Central & South Laos to Thailand, Viet Nam)		2.0	4.0	8.0	10.0	5.0	29.0
Regional Links (Northern Laos to Thailand, VietNam			3.0	8.0	12.0	15.0	38.0
Road No.1		3.0	5.0	8.0	8.0	6.0	30.0
Other National Roads				2.0	3.0	5.0	10.0
Feeder Roads (construction by Provinces)	2.0	3.0	4.0	6.0	9.0	12.0	36.0
Feeder Roads (Rural Development Program)		6.0	10.0	14.0	18.0	20.0	68.0
Road Maintenance (national)	1.0	1.5	2.0	3.0	4.0	4.0	15.5
Road Maintenance (provincial)	0.5	0.7	1.0	1.2	1.5	1.5	6.4
Bridge Maintenance	0.5	1.0	1.0	1.0	1.0	1.0	5.5
(2) RIVER TRANSPORT	**0.5**	**1.3**	**1.7**	**1.6**	**1.6**	**1.2**	**7.9**
Ongoing and Committed							
Hydrographic Surveys	0.5						0.5
Port reconstruction		0.5	0.6				1.1
New Programs							
Surveying and installation Nav.Aids		0.2	0.2	0.2	0.2	0.2	1.0
River Channel improvements		0.3	0.3	0.3	0.3	0.3	1.5
River Port rehabilitation/upgrading				0.3	0.3	0.3	0.9
Bank Stabilization		0.3	0.6	0.8	0.8	0.4	2.9
(3) AVIATION	**2.2**	**4.0**	**7.0**	**10.0**	**14.0**	**14.0**	**51.2**
Ongoing and Committed							
Navigation Systems improvements		1.0	1.0				2.0
Airport rehabilitation	1.2	2.0	3.0	5.0	6.0	3.0	20.2
Master plan Implementation	1.0	1.0	3.0	3.0	5.0	6.0	19.0
New Programs							
Navigation Systems				2.0	3.0		5.0
Airport rehabilitation						3.0	3.0
Terminal rehabilitation						2.0	2.0
(4) RAILWAYS							
No public commitments							
TOTAL - TRANSPORT	**53.7**	**65.5**	**74.7**	**87.3**	**108.1**	**108.7**	**498.0**

Source : "Public Investment program 1994 -2000, Outline" June 1994
Note : * : All rephased; ** : Completion 2002

2.1.5 Transportation in Laos

(1) General

Since Laos, located in the Indochina Peninsula, is a landlocked country sharing its border with China, Vietnam, Cambodia, Thailand and Myanmar, the Transportation system in Laos is developed in economic/political relation to such neighbor countries. Especially, the establishment of effective transportation system with Thailand and Vietnam which have international seaports is expected to enable to access their seaports for the socio-economic development in Laos.

The transportation system in Laos is mainly composed of roads, inland waterway and aviation, and no railway. The vertebra of the transportation system is the road transport overwhelmingly. As shown in Table 2.1-19 the total transport volumes as of 1993 amount to 1,730 thousand tons for freight and to 16.8 million persons for passenger. The shares of road transport are 1,437 thousand tons or 83.1% freight transport and 16.0 million persons or 94.9% of passenger transport, which of inland waterway transport are 290 thousand tons or 16.8% of freight transport and 7.0 million persons or 4.2% of passenger transport as of 1993.

TABLE 2.1-19 TRANSPORT VOLUME

	Freight (1,000 tons)				Passenger (1,000 persons)			
Year	Roads	Waterway	Air	Total	Roads	Waterway	Air	Total
1989	583	29	1	613	91,015	490	105	91,610
1990	542	263	1	806	12,588	583	117	13,288
1991	615	1066	1	1,682	14,118	636	118	14,872
1992	1,409	284	2	1,695	15,648	690	160	16,498
1993	1,437	290	2	1,729	15,961	703	162	16,826

(2) Road Network

The total length of the roads for the whole country as of 1994 is 18,344 km while the ones as of 1992 and 1993 were 14,130 km and 14,176 km respectively according to the Basic Statistics of Lao PDR as shown in Table 2.1-20. This stretch of road length by around 4,000 km for recent one year was caused by registration of rural roads. Of the whole road network 2,450 km and 5,140 km are paved and gravel respectively. The remainings are earthen and mostly not passable for vehicles in rainy season.

TABLE 2.1-20 LENGTH OF ROADS FOR WHOLE COUNTRY

Unit: km

	1992	1993	1994
Tarred Roads	2,403	2,450	2,446
Graveled Roads	4,724	4,622	5,138
Earthen Roads	7,003	7,104	10,760
Total length of the roads	14,130	14,176	18,344

The road network is classified into 4 classes consisting of National Road, Provincial Road, local roads and special roads. The National Road serves the nation's socio-economic and cultural development and national defense, connecting the capital city with other provinces and neighboring countries. Provincial Road serves socio-economic and cultural development within a province and links province to province or district to district . Local roads are distributed in towns, villages and districts. Special roads intend to serve mining, industrial or forestry development.

However, the identification of the National Road network as well as the Provincial Road network is not completely clarified. In the Decree No 43/CM of October 1987 the National Road system was defined as "existing" and "intended", the total length of the former being 3374 km. After that MCTPC made adjustment and estimated the length of National Road Network to be 5,449 km which is composed of 3,782 km of Official, 1,195 km of Unofficial and 472 km of Assumed. Of the National Road Network defined as "existing" 1,570 km are paved, 1,060 km are gravel and the remainings are earthen according to National Transport Study (NTS) 1991.

The National Road Network in Lao PDR is shown in Figure. 2.1-5. The major National Roads as the internal network are NR 1, NR 2, NR 4, NR 6, NR 7, NR 8, NR 9 and NR 13. The NR 13 having a length of 1,370 km is the trunk road in the Lao PDR, which links Luang Prabang in the North with Khon, the border with Cambodia, in the South. This route passes through the major urbanized area of Vientiane, Thakhek, Savannakhet and Pakse. NR 7, NR 8 and NR 9 lead to the Vietnam borders, and NR 1 to China. Among these National Roads NR 1, 4, 6, 7 located in the northern provinces are less than 5 meters in width and in an poor surface condition although paved roads. NR 8, NR 9, NR 12 and NR 10 were and will be playing an important role as the international routes for land -locked Laos. NR 8 leads from Thakhek via Lak Xawo to Vinh, sea port of Vietnam. NR 9 leads from Savannakhet to Da Nang, sea port of Vietnam. NR 12 will link Thakek with Hon La of Vietnam and NR 10 connects Pakse through Chong Mek with Ubon Ratchathani in Thailand.

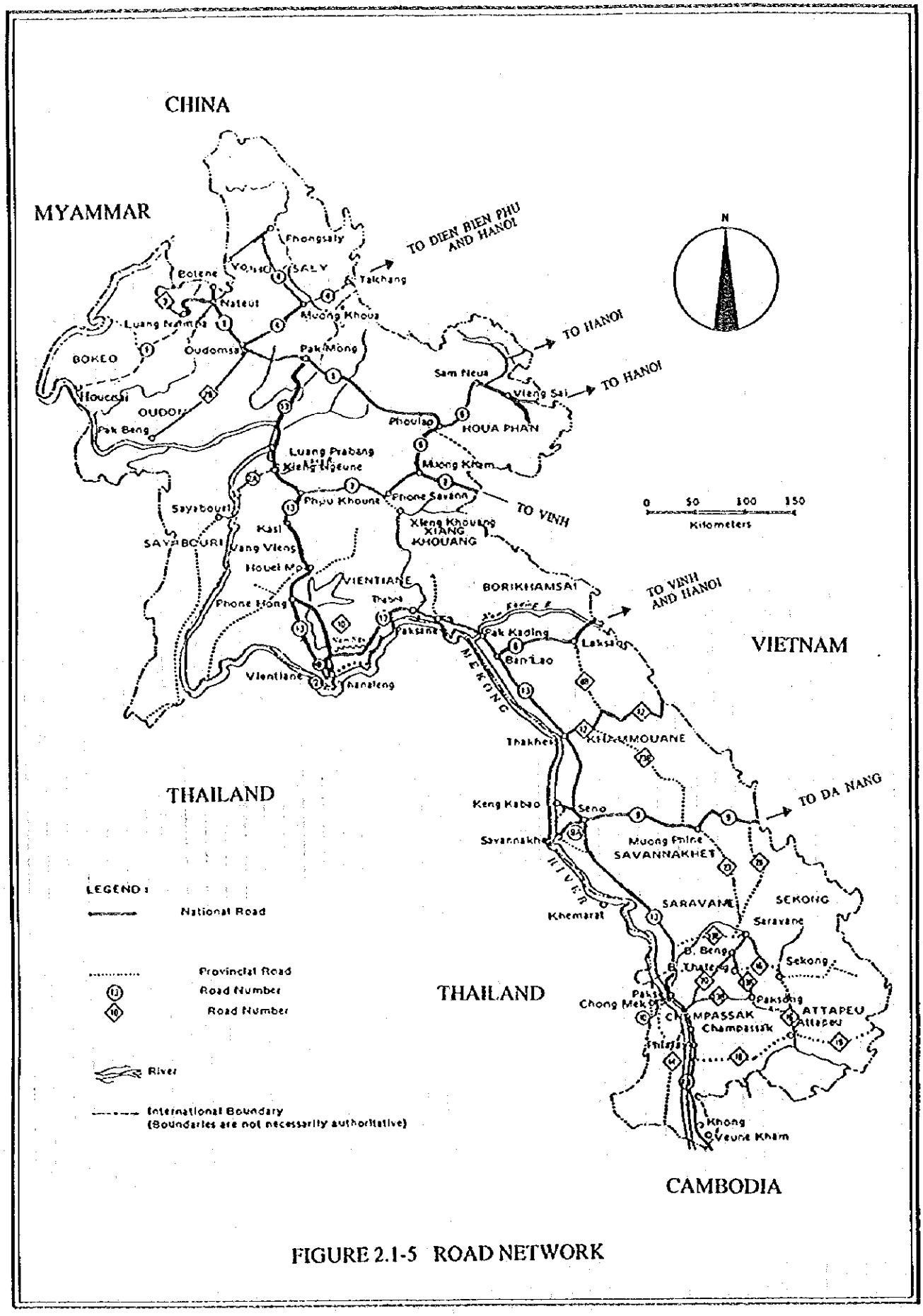


FIGURE 2.1-5 ROAD NETWORK

(3) Inland Waterway

The Mekong river, 40% of the whole length of around 5,000 km run through Lao PDR, plays a major role of inland water-borne transport. The waterway section from Ban Housei Sai to Luang Phrabang is navigable throughout the year for 25 - 40 DWT boats. The section from Luang Phrabang to Vientiane is observed to be passable for 60 DWT boats during the high-water season although there are many rapids and the section is not navigable in the dry season except small boats. The section between Vientiane and Savannakhet, the main river transport section of the Mekong river in Laos, is navigable throughout the year and for up to 200 DWT vessels in rainy season although there are many sand bars and rocks. The section from Savannakhet to Pakse is not passable except during a few months of the rainy season for small boats limittedly. The section from Pakse to Khinak which is located near the border with Cambodia, the southmost running of the Mekong river in Laos, is used for tour traffic and local trade traffic through the year. (Referred from NTS and Statistics on Inland Water-borne Transport, IMC 1987).

The year-round traffic densities in line haul on the Mekong river, according to the survey of Interim Mekong Committee (IMC) conducted from November 1985 to October 1986, on the section of 459 km reach from Vientiane to Savanakhet were 5,990 thousand ton-km for freight and 7,846 thousand p-km for passenger. These densities are as almost equal as ones on the section of 714 km reach from Vientiane to Ban Houei Sai.

The share of river transport decreases in recent years since NR 13 is being improved, NR 8 has been completed and there was some opening of Thai border crossing by ferry and new bridge.

(4) Aviation

There is one airline enterprise in Laos at present. Lao Aviation, which was reorganized as an autonomous enterprise in 1989, services on both domestic and international airlines. The domestic services operate Y-7 (52 seats), Y-12 (18 seats) and ATR-42 (50 seats). The main airlines of domestic services link Vientiane with Pakse, Savanakhet, Luangprabang, Xayaboury, Xiengkhuang, Namtha, Thakhek and Vienxay on a regular basis. The international services with B-737 (150 seats) link Vientiane Bangkok, Hanoi and Phnompen via Ho Chi Min, and with ATR-42 Chiangmai. Two foreign airline, Thai International Airline and Vietnam Airline, enter the services to Vientiane. There are some non-regular flight between Vientiane and the capitals of neighbor countries. The international transport volume by Lao Aviation as of 1994 are 83,000 persons for passenger and 2,000 tons for freight, while by Thai International are 78,000 persons and 2,500 tons. The volume by Vietnam Airline are small.

(5) Current Transportation Policies

1) Policies and Strategies

Although Lao PDR is landlocked surrounding by 5 countries, the location is centered among the countries in the Indochina Peninsula. This geographical situation, changing the viewpoint, enables Lao PDR to be also the center of communication/ transportation in the Indochina area. However, the network of the existing transportation systems and facilities are all old and deteriorated and limited in capacity, which previously impeded the development of socio- economy in Lao PDR.

To resolve situations above and to expedite the development of socio-economy the government of Lao PDR has established the Development plan for Socio-economy to year 2000. In the transportation sector of the Development Plan the policies and strategies for establishing an efficient transport network are summarized as follows:

- to complete the construction of vertical and horizontal strategic roads, rehabilitate and develop the roads to every province and to every important town in all over the country and concentrate to develop the rural roads in complex in the cooperation with other sectors;
- to establish an efficient network between road transport and other transport mode such as water-borne transport, aerial way and traditional transport;
- to establish the exit roads to seaports in the seashore of Indochina;
- to develop the roads and railways for mining, agriculture, forestry industry and exportation;
- to conduct the inland transport, transit transport, and transport through the borders to be lawful.

2) Development Plan for Transport

Succeeding to the Strategy plans for State Investment to year 2000, the development plans for Communication, Transport , post and Construction for the Period from 1995 - 2000 have been established by MCTPC. The major development plan on transportation sector by transport mode are follows:

Road

- Continue to complete the betterment construction of NR 13 with double bitumen surface treatment;
- Construct the strategic road NR 1 from Thathom - Xieng Khouang - Kha Keut to be completed as 2-season passable road;
- Construct and rehabilitate the Xieng Khouang road to link with international road, Houei Sai - Boten, Hongsa - Pak Beng and Luang Namtha - Xiengkok;
- Construct NR 8 as paved road;
- Rehabilitate NR 9 to be passable through seasons;
- Survey/design and construct paved road for NR 18;
- Rehabilitate NR 7 as paved road;
- Improve NR 10 (Pakse - Muang Kao - Thai border);

- Study for the Construction of the Mekong bridges at Pakse, Pak Beng and Savannakhet.

Waterway

- Survey the fluvial way in the Mekong river from North to South;
- Construct and/or rehabilitate the ports in the Economic Quadrangle Area to Luang Prabang;
- Continue to construct the bank protection of the Mekong river to prevent from the erosion;

Aerialway

- Continue to rehabilitate Wattay airport and study for New International Airport in new location;
- Rehabilitate the domestic airfields, medium size and small size airfields, following the existing Master Plan for the Aviation Development in which planned to rehabilitate and upgrade Luang Prabang Airport for the landing of B 737;
- Rehabilitate the airport services to open widely the domestic and international airlines;

Railway

- Survey, design and implement the construction of railway from Vientiane to Nongkhai in Thailand;
- Survey the feasibility for some railways: From China border to Vientiane, Vientiane to Xienkhoung, Vientiane to southern provinces, Thakhek to Vietnam and on the NR 8.

3) Current Projects

The Government of Lao PDR, each year, has spent about 30% - 40% of the total national budget to the maintenance and construction project for communication, transportation system, out of which the road projects account for more than 90%. The sources of the fund almost depend on the foreign Aids. The main donor among the aid agents and countries is Asian Development Bank (ADB) which has extended loans since the beginning of 1980's. The major current projects for the improvement of roads as of 1995 are follows:

- ADB 4th Road Improvement Project for NR 13N

This project comprises of the improvement of a section 223 km long with double bitumen surface treatment (DBST) from Vang Vieng to Luang Phrabang, the reconstruction of 27 bridges and repair of the ferry facility of Nam Ou, the construction of a workshop and the provision of equipment, materials and spare parts for road maintenance work. The construction started in March 1992 and will be completed in the end of 1995. The total cost amounts 32.4 million USD.

- ADB 5th Road Improvement Project for NR 13N

The project components are to improve the section from Luang Phrabang to Pak Mong

of 114 km long as DBST, to reconstruct 34 bridges and to provide equipment, materials and spare parts for road maintenance. The construction started in the mid-1993 and will be completed by mid-1996. The total cost amounts 20.5 million USD.

- ADB 6th Road Improvement Project for NR 16

The project components are composed of the improvement with DBST of a section 193 km long between Saravan and Attapeu via B. Beng, Tha Teng and Xe Kong and the construction of 27 bridges. The construction has started this year. The total budget amounts 26.3 million USD.

- ADB 7th Road Improvement Project for NR 10 and NR 13S

The status of this project is now at the tender stage for construction implementation, the components of which are composed of the improvement of the whole length of NR 10 (39 km) from the Thai border to Pakse and the improvement of 160 km long section from the Cambodian border to Pakse. The completion is scheduled in the year 2000.

- Pavement Project for NR 6

This project financed by Germany is to construct pavement along the section of 93 km long from Phoulao to Xam Neua. The construction started in 1994 and will be completed in 1997. The budget is composed of a loan of 15 million DM and a grant of 2.5 million DM.

- 39 Bridges Reconstruction Project along NR 13S

This project comprises the reconstruction of 15 bridges/culverts and their approach roads along NR 13S between Namkading and Thakhek. The project cost granted by Japan amounts 1,080 million yen. The project started in January 1995 and will completed in February 1996. The phase - 2 project between Thakhek and Savanakhet is now under the design stage.

- 3 Bridges Reconstruction Project along NR 13S.

The objective of this project is to reconstruct 3 bridges with long spans along NR 13S (Xebangfay bridge, Xebanghiang bridge and Xebangnouan bridge). The finance for this project is granted by AIDAB. The project is now at the tender stage.

2.2 Socio Economic Conditions in Study Area

2.2.1 Definition of Study Area

(1) Project's Area of Influence

The project bridge is planned at the strategic location in the Southern part of the Lao PDR from the viewpoints of transportation and commodity flows. Pakse is at the location accessing to Cambodia and Southern Vietnam via NR 13, and to the gateway of Thailand via NR 10. In the eastern side of Pakse, there exist a wide hinterland of the project bridge with high development potential in agricultural activities. The study area which would be affected directly and indirectly by the project bridge consists of the following four provinces in the southern part of Lao P.D.R. :

- Saravane province
- Sekong province
- Champasak province and
- Attapeu province

The present socio-economic conditions of the influenced area are summarized in Table 2.2-1 in order to grasp its potential in the whole country. The shares of socio-economic activities of the study area in the whole country are as follows:

Land area	=	18.6% of the whole country
Population	=	19.8%
Rice production	=	25.3%
Vegetable production	=	37.7%
Coffee production	=	91.5%
Tea production	=	51.1%
No. of establishments	=	20.9%

About 20% of total population and establishments of the country are concentrated in the study area.

Another feature of the area is represented by the production of agricultural commodities. The Champasak province almost monopolizes coffee production of the country with about 92% of share in 1994.

(2) Champasak Province - Direct Influence Area

The area of influence explained above is an extremely wide area. Therefore, analysis below will focus on the direct influence area of the project bridge, mainly within the Champasak Province.

The Champasak province is a direct influence area of the project bridge and at the same time, Pakse, the provincial capital city, is a center of economic activities in the southern provinces.

TABLE 2.2-1 ECONOMIC INDICES OF SOUTHERN PROVINCES

Province	Index		
	Population '95 (1,000 persons)	Rice Production '94 (tons)	Vegetable Production '94 (tons)
Southern 4 Provinces			
1. Saravane	258	124,582	18,275
2. Sekong	64	13,100	30,800
3. Champasak	503	226,702	1,830
4. Attapeu	88	34,230	2,450
(A) Total	913	398,614	53,355
(B) Whole Country	4,605	1,577,023	141,391
(A)/(B)*100 %	**19.8**	**25.3**	**37.7**

Province	Coffee Production '94 (tons)	Tea Production '94 (tons)	No. of Establishments'91
Southern 4 Provinces			
1. Saravane	1,253	907	994
2. Sekong	720		98
3. Champasak	6,280	86	3,940
4. Attapeu	17		350
(A) Total	8,270	993	5,382
(B) Whole Country	9,035	1,943	25,807
(A)/(B)*100 %	**91.5**	**51.1**	**20.9**

Source : "Basic Statistics about the Socio-economic Development 1975 - 1995" National Statistical Centre, Committee for Planning and Co-operation.