JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

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

BASIC DESIGN STUDY REPORT ON THE PROJECT FOR RECONSTRUCTION OF BRIDGES ALONG THE NATIONAL ROAD ROUTE 13 IN THE LAO PEOPLE'S DEMOCRATIC REPUBLIC

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ON
THE PROJECT FOR RECONSTRUCTION OF BRIDGES
ALONG
THE NATIONAL ROAD ROUTE 13
IN
THE LAO PEOPLE'S DEMOCRATIC REPUBLIC

MAY, 1994

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

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PREFACE

In response to a request from the Government of the Lao People's Democratic Republic, the Government of Japan decided to conduct a basic design study on the Project for Reconstruction of Bridges along the National Road Route 13 and entrusted the study to the Japan International Cooperation Agency (JICA).

JICA sent to Laos a study team headed by Mr. Takeo KAI, Development Specialist, JICA and constituted by members of Construction Project Consultants, Inc. and Nippon Koei Co., Ltd., from 3rd December, to 27th December, 1993.

The team held discussions with the officials concerned of the Government of the Lao People's Democratic Republic, and conducted a field survey at the study area. After the team returned to Japan, further studies were made. Then, a mission was sent to Laos in order to discuss a draft report, and as a result, the present report was finalized.

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 teams.

May, 1994

Kensuke Yanagiya

Kensuke Yanagiya
President
Japan International Cooperation Agency

May, 1995

Mr. Kensuke Yanagiya
President
Japan International Cooperation Agency
Tokyo, Japan

LETTER OF TRANSMITTAL

Dear Sir,

We are pleased to submit to you the basic design study report on the Project for Reconstruction of Bridges along the National Road Route 13 in the Lao People's Democratic Republic.

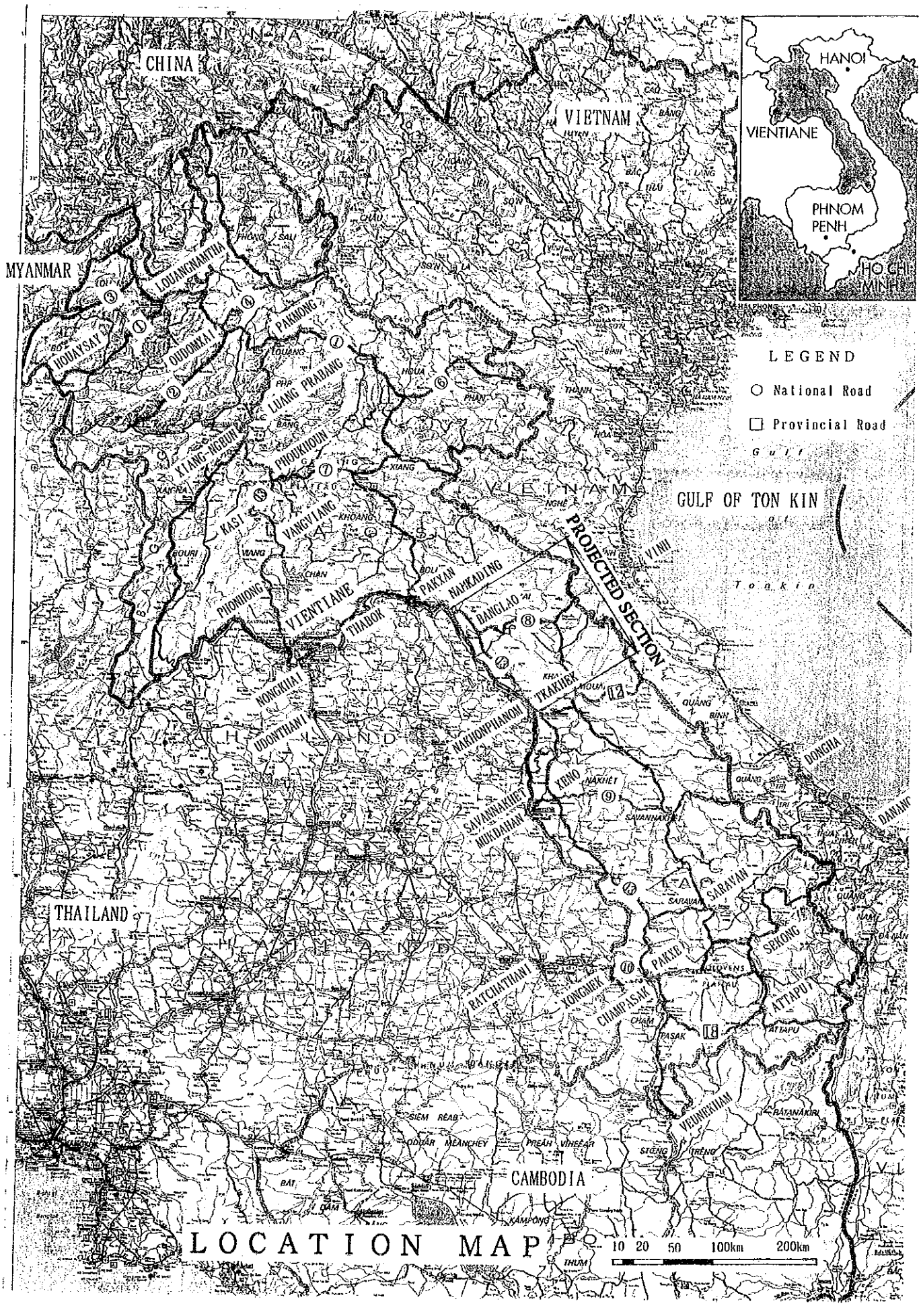
This study was conducted by Construction Project Consultants, Inc. and Nippon Koei Co., Ltd. under a contract to JICA, during the period of November 26, 1993 to May 15, 1994. In conducting the study, we have examined the feasibility and rationale of the project with due consideration to the present situation of Laos, and formulated the most appropriate basic design for the project under Japan's grant aid scheme.

We wish to take this opportunity to express our sincere gratitude to the officials concerned of JICA, the Ministry of Foreign Affairs and the Ministry of Construction. We would also like to express our gratitude to the officials concerned of the Ministry of Communication, Transport, Post and Construction and the Embassy of Japan in Laos for their cooperation and assistance throughout our field survey.

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

Very truly yours,

Kimio CHIBA
Project Manager
Basic Design Study Team on
the Project for Reconstruction of Bridges
along the National Road Route 13 in Lao PDR
Construction Project Consultants, Inc.
Nippon Koei Co., Ltd.


CHINA
VIETNAM
MYANMAR
THAILAND
CAMBODIA
HANOI
VIENTIANE
PHNOM PENH
HO CHI MINH
LEGEND
National Road
Provincial Road
Gulf of Tonkin
GULF OF TON KIN
PROJECTED SECTION
LOUANGNAMTHA
HOUAYSAY
OUDOMXAI
PAKMONG
LUANG PRABANG
PHOUKHOUN
XIANG-NGEUN
KASI
VANGVIANG
PHONHONG
VIENTIANE
THABOK
PAKXAN
NAHKADING
BANGLAO
VINH
THAKHEK
NONGKHAI
UDONTHANI
NAKHONPHANOM
SAVANNAKHET
MUKDAHAN
XENO
DONGHA
SARAVAN
SEKONG
PAKXE
CHAMPASAK
XONGMEK
RATCHATHANI
ATTAPU
PASAK
VEUNKHAM
PATANAKIRI
SIEM REAB
ODDAR MEANCHEY
PREAH VIHEAR
STENG TRENG
KAMPONG THUM
LOCATION MAP
10 20 50 100km 200km

REPUBLIQUE DEMOCRATIQUE POPULAIRE LAO

Système de coordonnées de Vientiane

SERVICE GEOGRAPHIQUE D' ETAT

M. KHAMKEUT

EN SECRET

E-48-XV

Edition 1997

NAM MOUAN

H.NAMKADING

NAM THEUN BRIDGE (Under Construction)

H.SAMBOUN

NAM DUA

H.KHONKEN

H.DANXANG

National Road No.8, B.LAO~51km (Under Construction)

POND/LAKE

POND/LAKE

NAM DUA

H.KHOT

8 (Old Road)

NAM THEUN

B.LAO

NONTLEP

H.LO/H.NAM KOUN

H.SAI

H.IN

NAM THON

NAM HINBOUN

POND

H.LO

NAM PAKAN

NAM HINBOUN

POND

NING NOY

NAM HIMNBOUN

NONG BUA

NONG HOM

H.HET

H.HET

THAKHET

Bridge No.	Location Distance from Namukading (Km+m)
1A	2+500
1B	3+511
2	5+565
3	12+968
4	14+225
5	14+987
6	20+904
7	28+127
8	28+567
9	29+555
10	30+691
12	38+723
13	39+569
14	42+207
16	53+181
17	55+376
18	58+716
19	59+287
22	99+538
23	108+354
24	108+927
26	112+303
27	113+033
28	116+022
29	117+657
30	126+359

N

0 5 10 25KM

Location of Projected Bridge

Source : MCTPC, December 1993

SUMMARY

SUMMARY

Since establishment of the Lao People's Democratic Republic (the Lao P.D.R) in 1975, the Government has adopted a socialist economy. In 1986, it introduced market-oriented New Economic Mechanism (NEM), since when various economic reforms such as trade liberalization, privatization of state enterprises, reform of banking system, etc. have been implemented. The Third Five Year Plan (1991-1995) has started in 1991, in which an emphasis is put on the development of a sound economy through expansion of trade with neighboring countries.

As a landlocked country, maintaining a well developed transport system connecting to neighboring countries, i.e. Thailand, Vietnam, China, Myanmar and Cambodia is extremely important for the development of a sound national economy. Establishing reliable access to international sea ports both in Thailand and Vietnam is considered particularly important.

National Road Route 13 (RN13) is the most important trunk link in the national road network and its total length amounts to some 1,300 km running through the country from the vicinity of the northern border of China to the southern border of Cambodia via Vientiane. It is not only a north-south arterial road domestically, but also a crucially important international link. The east-west trunk roads such as National Roads Route 8 (RN 8) and Route 9 (RN9), and Provincial Road Route 12 (RP12), etc. which connect Laos to Thailand and Vietnam all join RN13. RN13 is subdivided into RN13N and RN13S in the northern region and southern region to Vientiane, respectively.

The section from Namkading to Savannakhet, 266km long on RN13S has received assistance from the International Development Association (IDA). Road improvement, some bridge reconstruction and construction equipment supply, have been made since 1991 under the "Highway Improvement Project". However, there still remain 40 bridges with narrow, aged and dilapidated truss structures or temporary structures (Bailey type panel bridge). Vehicles, particularly of heavy axle loads, meet serious difficulties at these existing bridges, which recently emerged as bottlenecks to smooth traffic flow on the section. In the worst case, collapse while vehicles are crossing is very probable under the current increasing traffic on RN13S.

Under the circumstances, the Government of the Lao P.D.R requested the Government of Japan for grant aid assistance for the reconstruction of the existing bridges within the section from Namkading to Savannakhet 266km long on RN13S.

In response to the request, the Government of Japan decided to conduct a basic design study to examine the Project viability according to the Japanese grant aid system and the Japan International Cooperation Agency (JICA) dispatched a basic design study team from December 3rd 1993 to December 27th 1993. The basic design team conferred with the Government officials concerned in regard to the contents of the request and conducted an extensive data collection exercise with respect to the Project. The study team confirmed the development potentials and projects of similar nature in the Project area along RN13S, present conditions of existing bridges, procurement method of construction materials and equipment, etc. In addition to these activities, a field investigation including a survey of the natural conditions of the site, a traffic survey on the concerned road section, and a preliminary bridge plan were also made during the same period.

Based on the results of the above work, the appropriateness, scope and need for the Project were evaluated in Japan according to Japanese grant aid procedures. After this, the basic design was carried out. This basic design includes structural analysis, quantification of work quantities, construction scheduling, and project evaluation. These studies are compiled in this basic design study report.

Of the 40 bridges surveyed on the project survey sections of RN13S, 26 existing bridges will be improved either to steel girder bridge or RC box culvert according to the circumstances.

Characteristics of the facilities to be reconstructed are as follows:

Phase I

No.	Bridge No.	Distance from Namkading (km)	Name of Stream	Type	Length (m)	Width (m)
1	1A	2+500	Stream to Namkading	Single span steel plate girder	25.6	6.5
2	1B	3+511	Stream to Namkading	Single span steel plate girder	20.5	6.5
3	2	5+565	Tributary to Namkading	Single span steel plate girder	25.6	6.5
4	3	12+968	Khonken	3-span simply supported steel plate girder	52.3	6.5
5	4	14+225	Danxang	RC Box culvert (3-5.0x5.0)	16.6	6.5
6	5	14+987	Samboun	Single span steel plate girder	25.6	6.5
7	6	20+904	Khot	RC Box culvert (3-4.0x4.0)	13.5	6.5
8	7	28+127	Khot	RC Box culvert (5.0x5.0)	6.0	6.5
9	8	28+567	Namdua	3-span simply supported steel plate girder	61.3	6.5
10	9	29+555	Pond/Lake	RC Box culvert (3-5.0x5.0)	16.6	6.5
11	10	30+691	Pond/Lake	Single span steel plate girder	25.6	6.5
12	12	38+723	Nontlep	RC Box culvert (3-5.0x4.0)	16.3	6.5
13	13	39+569	Lo/Namthon	RC Box culvert (3-5.0x5.0)	16.6	6.5
14	14	42+207	Sai	Single span steel plate girder	20.5	6.5

Phase II

15	16	53+181	In	RC Box culvert (3-4.0x3.5)	13.3	6.5
16	17	55+376	Pond	RC Box culvert (3-4.0x3.5)	13.3	6.5
17	18	58+716	Lo	RC Box culvert (3-4.0x3.5)	13.3	6.5
18	19	59+287	Lo	RC Box culvert (3-4.0x3.5)	13.3	6.5
19	22	99+538	Namhinboun	3-span continuous steel plate girder	124.0	6.5
20	23	108+354	Pond	RC Box culvert (3-5.0x5.0)	16.6	6.5
21	24	108+927	Ning Noy	RC Box culvert (3-5.0x5.0)	16.6	6.5
22	26	112+303	Nongbua	RC Box culvert (3-4.0x3.5)	13.3	6.5
23	27	113+33	Nonghom	RC Box culvert (3-4.0x3.5)	13.3	6.5
24	28	116+22	Het	RC Box culvert (3-4.0x3.5)	13.3	6.5
25	29	117+657	Het	Single span steel plate girder	25.6	6.5
26	30	126+359	Tributary to Mekong	RC Box culvert (3-5.0x4.5)	16.6	6.5

Executing agency of the Project is the Roads and Bridges Department under the control of the Ministry of Communication, Transport, Post and Construction (MCTPC). The Roads and Bridges Department has 100 engineers and 580 assistance engineers at the central and provincial offices. Government's rccurrent budget for maintenance of national roads and principal provincial roads amounts to US$ 7.0 million. Thus, it is confirmed that the

technical and financial capacity of the Roads and Bridges Department is sufficient for smooth operation and maintenance of the reconstructed bridges under the Project..

The Project will extend over two phases The anticipated project period is as follows:

1st Phase

Detailed Design:	3 months
Construction of Facilities:	12 months

2nd Phase

Detailed Design:	3 months
Construction of Facilities:	12 months

The Project will resolve bottlenecks of the most important section of RN13S, providing reliable access between Vientiane municipality and the southern economic hubs of Thakhek and Savannakhet. The Project will also contribute to smooth traffic flow on the east-west international trade corridor between Laos and Thailand, and Laos and Vietnam.

In addition to benefits such as saving of time and cost of transport, prevention of traffic blocks caused by floods or probable collapse of bridges, etc., the following beneficial effects are expected:

- Increase in domestic trade between northern and southern economic centers, i.e. Luangphrabang area and the Thakhek/Savannakhet area through Vientiane municipality.

- Increase in transit trade between Thailand, Laos and Vietnam.

- Development and expansion of agriculture, mining and manufacturing industries along RN13S.

- Provision of access to rural population for public services and amenity facilities.

- Promotion of settlement in rural areas.

In conclusion, the Project will contribute significantly to facilitate social stability and public welfare, thus the implementation of the Project under Japanese grant aid is strongly recommended.

BASIC DESIGN STUDY
ON
THE PROJECT FOR RECONSTRUCTION OF BRIDGES
ALONG
THE NATIONAL ROAD ROUTE 13

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

CHAPTER 1 BACKGROUND OF THE PROJECT

CHAPTER 1 BACKGROUND OF THE PROJECT

1.1 Background of the Project

The Lao People's Democratic Republic (the Lao P.D.R) covers a total area of 236,000 km^2 bordered to the east by Vietnam, to the west by Thailand, to the south by Cambodia, and to the north by China and Myanmar, in the Indo-China Peninsula.

Eighty percent of the land is mountainous terrain, and cultivated area is limited only to 5% of the total land. Although the country is located in a tropical monsoon zone, variations in altitude provide a wide range of climatic conditions. Rainfall is concentrated in the rainy season (May-September). Average rainfall is 1,300mm in the northern region and 3,700mm in the southern region.

Population in 1990 is estimated at 4.25 million with annual growth rate of 2.9%. Administratively, there are 17 provinces, 115 districts, 937 wards, about 1,500 villages and Vientiane municipality.

Since establishment of the Lao P.D.R in 1975, the Government has adopted a socialist economy. However, in 1986, it introduced market-oriented New Economic Mechanism (NEM), since when various economic reforms such as trade liberalization, privatization of state enterprises, reform of banking system, etc. have been materialized.

Within the framework of NEM, the Government implemented the Second Five Year Plan (1986-1990) and Third Five Year Plan (1991-1995). The main thrust of the Current Third Five Year Plan is set out as follows:

- To upgrade living standards of the people through provision of housing, food, health, education, farmland, etc.
- To realize stable economic growth
- To minimize inflation
- To maintain economic relations with neighboring countries
- To secure access to both the Gulf of Thailand and the China Sea

The agricultural sector have a share of more than two thirds of the gross domestic product (GDP). Since 1989 economic growth has continued except for the year 1987/88 when agricultural production and electricity fell due to unfavorable climatic conditions. Annual average growth rate in 1992 was 7.0%. Annual growth rate by sector achieved under the

Second Five Year Plan and the target of the Third Five Year Plan are given respectively in Table 1-1.

Table 1-1 Annual Growth Rate of GDP

Sector	Annual Growth Rate (%)	
	Second Five Year Plan (Achieved) (1986 - 90)	Third Five Year Plan (Targeted) (1991 - 95)
Agriculture	3.4	5.7
Industry	7.7	9.6
Construction	8.6	11.1
Service	7.1	7.8
Transport	15.2	11.1
Commerce	5.8	7.0
Export	5.8	7.0
Import	4.8	8.5
Real GDP	5.0	6.9
GDP per capita	2.0	3.9

Source : Third Five Year Plan, March 1991

The transport system in Laos comprises road, river and aviation. As shown in Table 1-2, the total transport volume as of 1987 amounts to 1.03 million tons and 9.90 million persons for freight and passengers respectively. The share of road transport is 0.95 million tons or 92% of freight and 9.46 million persons or 95% of passenger transport. These figures increased rapidly to 1.71 million tons and 15.7 million persons respectively in 1991.

Table 1-2 Trend of Freight and Passenger Transport

Mode	1987	1988	1989	1990	1991
1. Freight (1,000 ton)	1,033	1,332	1491	1,715	1,826
Road	954	1,254	1,404	1,615	1,713
River	78	77	86	99	112
Air	0.9	0.9	1.0	1.2	1.3
2. Freight Ton-Kilometer (million)	183	187	212	244	260
Road	167	171	193	222	235
River	16	16	18	21	24
Air	0.4	0.4	0.5	0.6	0.7
3. Passenger (1000 person)	9,906	11,498	12,648	14,293	16,058
Road	9,455	11,005	12,106	13,680	15,668
River	401	433	476	538	272
Air	50	60	66	75	118
4. Passenger Ton-Kilometer (million)	290	336	368	408	565
Road	242	284	259	344	510
River	32	35	38	42	26
Air	15	18	12	22	29

Source : Basic Statistics 1975 - 1990.
For the years 1990 and 91, refer to Evaluation Report on Fifth Highway Improvement Project, ADB, March 1991

Total freight volume by road in 1987 is estimated to be some 950 thousand tons, of which domestic freight shares 360 thousand tons (38%), and the remainder representing international trade and transit cargo traffic reaches some 490 thousand tons and 90 thousand tons, respectively. The overall trend of freight transport of the country is schematically shown in Fig. 1-1, and the following facts are indicated:

- Domestic transport in the northern region shares only 38 thousand tons (4% of the total freight of the country) compared to 75 thousand tons (8%) in the central/southern region. Since the population of each region is almost equal, it means that the transport volume per capita in the northern region is half of that in the southern region.

- Almost all the domestic transport between the northern and central/southern regions is made by way of Vientiane municipality through National Road Route 13 (RN13).

- Domestic transport between Vientiane municipality and each region amounts to 244 thousand tons (26%).

- International trade transport between Laos and Thailand, and Laos and Vietnam are 275 thousand tons (29%) and 212 thousand tons (22%), respectively.

- As for international trade transport between Laos and Thailand, there are four main ferry facilities crossing the Mekong River at present, i.e. at Vientiane municipality, Thakhek, Savannakhet and Xongmek. Freight transport via Vientiane ferry shares 141 thousand tons (15%), while that by the latter three ferries amounts to 129 thousand tons (13%).

- International freight transport between Laos and Vietnam depends on three main routes in the central/southern region, i.e. National Road Route 8 (RN8), Route 9 (RN9) and Provincial Road Route 12 (RP12). Freight transport through the three routes is 202 thousand tons (21%).

- Transit trade freight from Thailand to Vietnam via Laos is 94 thousand tons (10%).

RN13 plays the most essential role in the national transport system in Laos. It is not only a north-south traversing trade corridor domestically, but also a crucially important international link connecting Laos to China and Myanmar in the north and Cambodia in the south. Furthermore, all the east-west trunk roads such as RN8 , RN9, and RP12 which connect Laos to Thailand and Vietnam, join originally or finally RN13. RN13 is subdivided into RN13N and RN13S in the northern region and southern region to Vientiane municipality, respectively.

Characteristics of domestic and international freight movement through RN13 are summarized as follows:

- Almost all the domestic freight of 400 thousand tons is transported through RN13,

- Almost all the international freight of 600 thousand tons, which includes bilateral trade and transit trade is transported through RN13S.

- Almost all the destinations of import freight from Thailand and Vietnam are the major cities located along RN13S.

- Export freight to Vietnam such as iron ore from Xiang Khouang Province, zinc from Khammouan Province and plaster from Savannakhet Province are destined to Vinh or Danang port in Vietnam. In all cases RN13S plays a key role for the transport.

- Almost all of the transit freight uses ferry facilities in Thakhek, Savannakhet and Xongmek, then moves on RN8, RN9, RP12 and RN13S.

As indicated above, RN13, particularly RN13S plays a key role in both the domestic and international transport system of the country. From the view point of international trade between Laos, Thailand and Vietnam, the Vientiane – Thakhek section of RN13S are of particular importance. Relevant routes branching off from RN13S are schematically shown in Fig. 1-2.

Upgrading works of RN8 is underway by the MCTPC. The construction equipment was provided by Japanese grant aid and completion is expected in 1996.

Thus, improvement of the section Vientiane municipality – Namkading – Thakhek – Savannakhet on RN13S section has been given the highest priority in the current Public Investment Program (PIP).

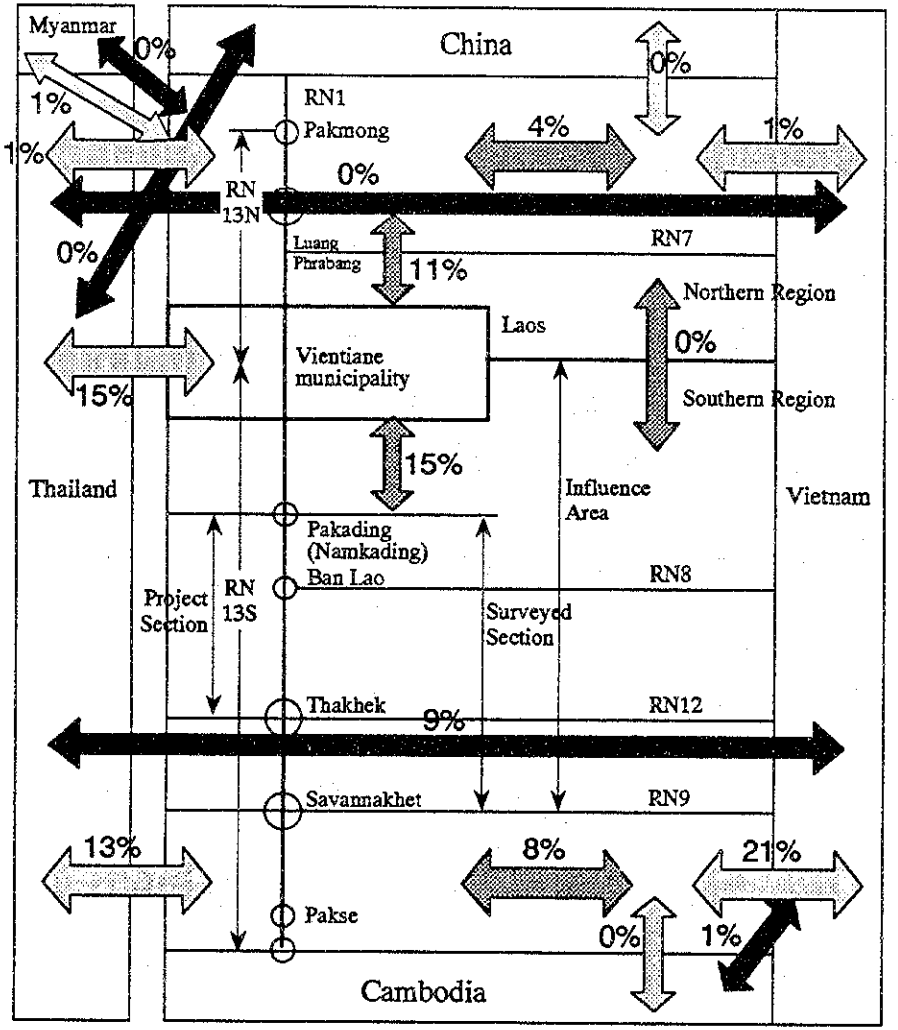


Fig. 1-1 Trend of Movement of Freight (1987/1989)

Source : National Transport Study, UNDP/IDA, March 1991

Item	(%)	1987/1989 (1,000 ton)
1. Domestic Transport (⟺)		
•Northern region	4	38
•Southern region	8	75
•Vientiane/Northern region	11	103
•Vientiane/Southern region	15	141
•Northern region/Southern region	0	0
Total of Domestic Transport	38	357
2. Domestic Transport (⟺)		
(1) Import/Export		
•Northern region/Thailand	1	5
•Vientiane/Thailand	15	141
•Southern region/Thailand	13	129
Sub Total	29	275
•Northern region/Vietnam	1	10
•Southern region/Vietnam	21	202
Sub Total	22	212
•Northern region/China	0	2
•Northern region/Myanmer	1	5
•Southern region/Cambodia	0	0
Sub Total	1	7
Total	52	494
(2) Transit (⟷)		
•Thailand/Northern region/Vietnam	0	2
•Thailand/Southern region/Vietnam	9	85
•Cambodia/Southern region/Vietnam	1	4
•China/Northern region/Thailand	0	1
•Myanmer/Northern region/Thailand	0	2
Total	10	94
Total of International Transport	62	588
Grand Total	100	945

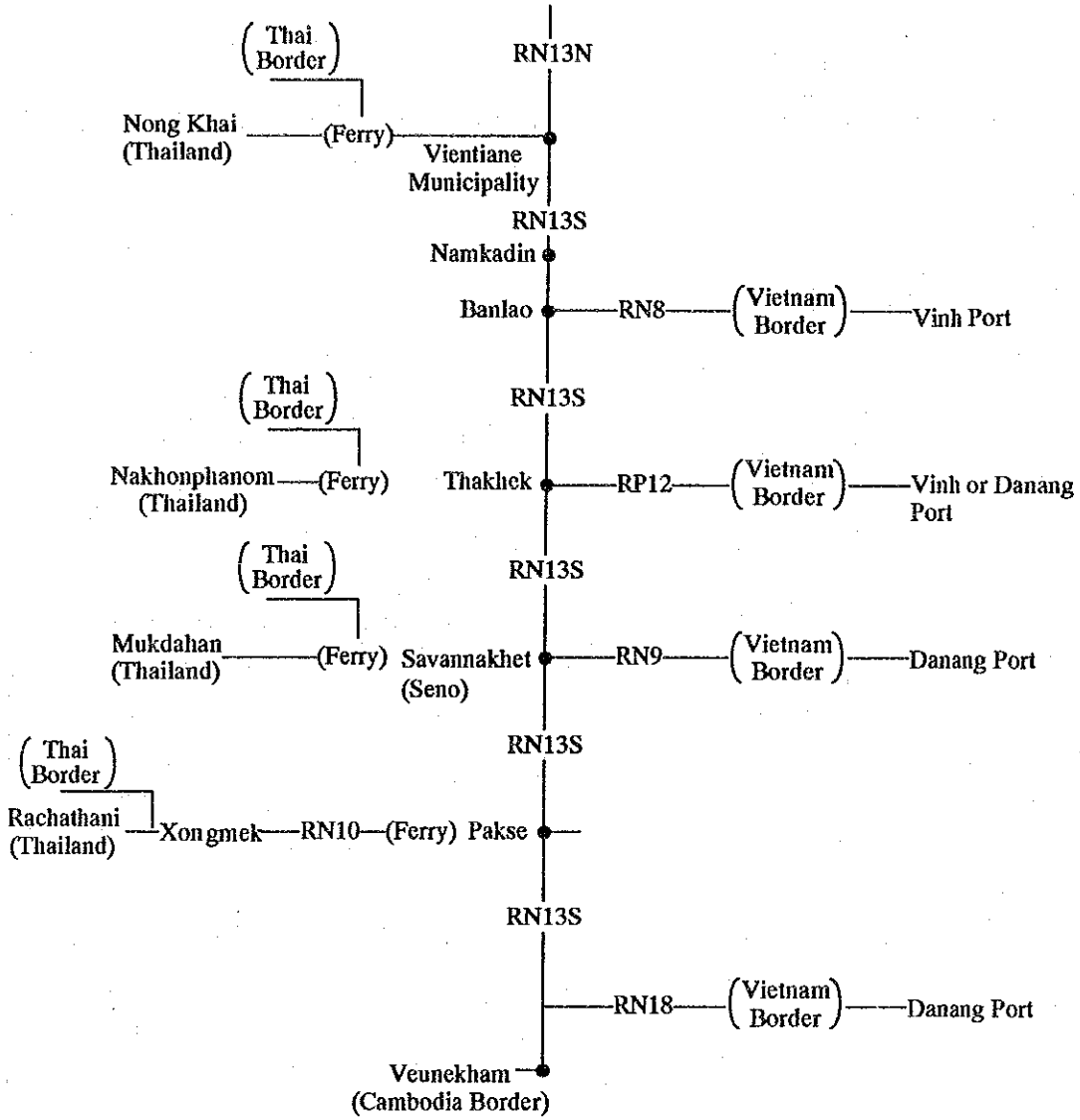


Fig. 1-2 Schematic Diagram of National Road Route 13

Given the above background, the Government of Lao People's Democratic Republic made a request for grant aid assistance to the Government of Japan for the Project for Reconstruction of Bridges along the National Road Route 13 (RN13), which are located within the section from Namkading to Savannakhet.

In response to this request, the Government of Japan decided to conduct a basic design study to examine the project feasibility according to the Japanese grant aid system and the Japan International Cooperation Agency (JICA) dispatched a basic design study team headed

by Mr. Takeo Kai, Development Specialist, JICA to Laos during the period from 3rd December 1993 to 27th December 1993.

The study team examined the following items and confirmed the contents of the project requested and its background with cooperation of the Government of the Lao P.D.R.

(1) Status, necessity and priority of the project within the framework of the national development plan and the transport sector development plan
(2) Present condition of road sub-sector
(3) Present situation of multi-and bilateral assistance in the road sub-sector
(4) Undertakings of the Laotian side for the project and implementation programme proposed by the responsible organization including management plan, maintenance plan, financial plan, staff training programme etc.
(5) Related projects and their scope of works, project period, maintenance system, etc.
(6) The project site conditions (socio-economic and natural conditions, conditions of the existing bridges, etc.)
(7) Collection and analysis of information related to construction works in the country
(8) Design criteria of the roads and bridges
(9) Desirable physical plan based on the comparative design study

Based on the field study, the team has examined the optimal size and dimension of the facilities which will be improved under the project and finalized the basic design study of the project.

Members of the survey team, survey schedule and the minutes of discussion are shown in the Appendices attached hereto.

1.2 Outline of the Request and Main Components

Since establishment of Lao P.D.R in 1975, the Government has adopted a socialist economy. However, in 1986 the Government newly introduced a market-oriented economic policy, i.e., the New Economic Mechanism (NEM), which has comprised a variety of economic reforms such as trade liberalization, privatization of state companies, rebuilding of foreign exchange system and banking system, etc. The Third Five Year Plan started in 1991 along with the NEM, and has given the highest priority to development of the economic infrastructure, especially transport facilities. Several multi- or bilateral assistance institutions such as United Nations Development Programs (UNDP), International Development Association (IDA), Asian Development Bank (ADB), Australia, Sweden, etc. have extended consecutive assistance for road and bridge projects.

The RN13 is one of the most important trunk roads in the national road network whose total length reaches some 1,300 km traversing Pak Mon near the northern border with China through Veune Kham at the southern border with Cambodia , via Vientiane municipality.

An intensive assistance by IDA has been given for improving a section of RN13S 266 km long between Namkading and Savannakhet. Road portion improvement, some bridge reconstruction, construction equipment supply, etc. have been extended since 1991 under the "Highway Improvement Project" assisted by IDA.

However, there still remain 40 bridges with narrow, old and deteriorated truss structures, or temporary facilities (Bailey type panel bridge) on the section. As vehicles, particularly with heavy loads, are always compelled to reduce traveling speed or stop at almost all the bridges, they will become serious bottlenecks for smooth traffic flow within the section. In the worst case, collapse of existing bridges while vehicles are crossing over them will be very probable under a rapidly increasing traffic.

Under the circumstances, the Government of the Lao P.D.R requested the Government of Japan for grant aid assistance for the reconstruction of the existing 40 bridges within the section from Namkading to Savannakhet of 266km long on RN13S.

The 40 bridges which are categorized by length, are as follows:

	Existing Bridge and Box Culverts	Quantity
(1)	Bridge with length exceeding 50m of 2~3 spans	4
(2)	Bridge with length between 25m ~ 35m of single span	18
(3)	RC box culvert with length less than 30m	18

The dimensions of the bridges are listed in Table 1-3.

Table 1-3 List of Surveyed Bridges

No.	Br. No.	Distance from Namkading (km)	River/water course	Existing bridge			
				Length (m)	Nos of Span	Type	Width (m)
1	1A	2+500	Stream to Namkading	24.40	1	BBDS	3.9
2	1B	3+511	Stream to Namkading	24.40	1	BBDS	3.9
3	2	5+565	Tributary to Namkading	12.35	1	BBDS	4.2
4	3	12+968	Khonken	51.85	2	BBTS	4.1
5	4	14+225	Danxang	18.00	1	SP	3.1
6	5	14+987	Samboun	18.00	1	SP	3.1
7	6	20+904	Khot	15.00	1	SP	2.9
8	7	28+127	Khot	21.00	1	SP	2.9
9	8	28+567	Namdua	61.00	2	BBDS	4.1
10	9	29+555	Pond/Lake	21.00	1	SP	2.9
11	10	30+691	Pond/Lake	21.00	1	SP	2.9
12	12	38+723	Nontlep	21.00	1	SP	2.9
13	13	39+569	Lo/Namthon	15.00	1	SP	2.9
14	14	42+207	Sai	21.00	1	SP	2.9
15	16	53+181	In	12.20	1	SGC	2.9
16	17	55+376	Pond	15.00	1	SP	2.9
17	18	58+716	Lo	9.20	1	SGC	2.9
18	19	59+287	Lo	12.53	1	SGC	2.9
19	22	99+538	Namhinboun	103.70	3	BBDD	3.9
20	23	108+354	Pond	30.50	1	BBDSR	4.3
21	24	108+927	Nin Noy	30.50	1	BBDS	3.9
22	26	112+303	Nongbua	18.30	1	BBDS	3.9
23	27	113+033	Nonghom	15.15	1	BBDS	3.9
24	28	116+022	Het	21.35	1	BBDS	3.8
25	29	117+657	Het	30.50	1	BBDS	4.4
26	30	126+359	Tributary of Mekong	21.35	1	BBDS	3.8
27	32	161+103	So	15.15	1	BBDS	4.2
28	33	162+180	So	15.15	1	BBDS	4.2
29	34	162+670	So	7.00	1	CGB	5.0
30	35	165+106	So	18.30	1	BBDS	3.8
31	36	168+440	Gani	18.30	1	BBDS	4.1
32	37	168+708	Sayphay	12.20	1	BBDS	4.1
33	38	172+732	Khambouay	15.15	1	BBDS	4.1
34	39	756+378	Khambouay	12.20	1	BBDS	4.1
35	40	176+936	Tat	27.45	1	BBDS	3.9
36	41	185+551	Tung	21.35	1	BBDS	4.1
37	42	871+706	Nong (From Pond)	24.40	1	BBDS	4.2
38	44	207+070	Noy	30.50	2	BBDS	3.9
39	45	214+800	Nakoktan	21.35	1	BBDS	3.8
40	46	223+497	Namthahao	70.15	3	BBDS	3.9

Legend:

BBDS : Bailey Br. Double Panel, Single Layer
SP : Steel Br. (Pigeaut type or Eiffel type)
CGB : Concrete Girder Br.
SGC : Steel Girder Br. with Concrete Slab
BBDD : Bailey Br. Double Panel, Double Layer
BBTS : Bailey Br. Triple Panel, Single Layer
BBDSR : Bailey Br. Double Panel, Single Layer, Centrally Reinforced

1.3 Programmes Assisted by Foreign Donor Agencies or Countries

The foreign donor agencies and countries have extended assistance toward the improvement of National Road Route 13 (RN13) and the roads which branch off from RN13, as follows: (See Table 1-4)

(1) Asian Development Bank (ADB)

ADB has extended loans for the improvement of roads since the beginning of the 1980s. The "First Road Improvement Project" comprised an improvement of Provincial Road Route 10 (RP10) branching off from RN13 at the suburbs of Vientiane municipality, and the districts roads in Vientiane province. The project was completed in January of 1989. "The Second Road Improvement Project" entailed the improvement of 43 kms of provincial roads in Champasak province and 92 kms of provincial roads in Saravan province together with reconstruction or rehabilitation of 28 bridges, provision of spare parts for the equipment and construction materials. The project started in September 1986, and will finish in early 1995. Following those two projects, ADB has extended assistance for an improvement of RN13 as shown below:

1) Third Road Improvement Project

The project included the following components:-

A. Repair and improvement (Double bitumen surface treatment: DBST) of the 162 km section from Vientiane municipality to Vang Vieng and reconstruction of 38 bridges thereon
B. Provision of construction equipment, a workshop, construction materials and spare parts
C. Provision of equipment, materials and spare parts required for the repair and maintenance works of the national and provincial roads in the provinces of Vientiane, Champasak and Saravan, and Vientiane municipality, for the fiscal year 1989, 1990 and 1991.
D. Construction of a workshop
E. Procurement of a consulting firm for the design and supervision of the project

The construction work was inaugurated by force account of MCTPC in 1989. In December 1992, the road was 95% completed, and 23 of the 38 bridges were already reconstructed.

2) Fourth Road Improvement Project

A. Improvement (DBST) of a section 230 km long from Vang Vieng to Luangpharabang
B. Reconstruction of 27 bridges (12 bridges and 15 box culverts), and repair of the ferry facility of Namou
C. Construction of a workshop
D. Provision of equipment, materials and spare parts required for the repair and maintenance works of the roads in the project influence area of the northern provinces, for the fiscal year 1991, 1992 and 1993
E. Procurement of a consulting firm for the design and supervision of the project

The construction works started in March 1992 and will be completed in early 1996.

3) Fifth Road Improvement Project

The project components are as follows:

A. Improvement (DBST) of the section from Luangphrabang to Pak Mong of 116km long
B. Reconstruction of 34 bridges (12 bridges and 22 box culverts)
C. Provision of equipment, materials and spare parts required for the repair and maintenance works of the roads in the northern and middle provinces, for the fiscal year 1993, 1994 and 1995.
D. Procurement of a consulting firm for the design and supervision of the project

The construction works started in the mid-1993 and will be completed by mid-1996.

4) Sixth Road Improvement Project

The project components are as follows:

A. Improvement (DBST) of 193 km of provincial roads in the provinces of Sekong, Atapue, Champasak and Saravan and construction of approach

facilities to Sekong ferry, construction of Namnoi Bridge (L=183m) and reconstruction of 26 small bridges

B. Procurement of a consulting firm for the design and supervision of the project, a feasibility study of the "Seventh Road Improvement Project" and technical assistance for the privatization of governmental institutions and parastatal enterprises.

The project is scheduled to be complete in June of 1998.

5) Seventh Road Improvement Project

The project will entail an improvement of 160 km long section from Pakse to Veune Kham at the Cambodian border on RN13S and 10 km in Pakse city scheduled for competion in the year 2000. For the feasibility study of the project, selection of a consulting firm is underway.

(2) Swedish International Development Authority (SIDA)

Since 1987, SIDA has extended assistance for the improvement of the section from Vientiane municipality to Namkading on RN13S of 171km long, under the project of "Swedish Road Section Support".

1) Sub-section Vientiane ~ Thabok(75km)

As for the 75 km long sub-section from Vientiane municipality to Thabok, the construction works were commenced in 1987 by force account of MCTPC and about 75% accomplished by the end of 1990. Since then, a 30 km section of the completed pavement works suffered from rapid deterioration, and its repair and restoration was carried out with technical advice from a Swedish contractor.

Since March of 1993, the construction contract for the remaining part of the section has been directly transferred to the contractor. The completion of the sub-section is expected in mid-1994.

2) Sub-section Thabok~ Namkading (96km)

The contract for this section 96km long was awarded to the above Swedish contractor after a force account execution by MCTPC in 1993. Its total completion is expected in 1996. This section had originally comprised

reconstruction of 11 bridges, of which one bridge was completed by force account by MCTPC in 1991, and a further 7 bridges will be constructed by the Swedish contractor under the project. However, since the remaining 3 bridges will suffer a shortage of construction funds from SIDA due to excessive expenditure on the repair works mentioned above, the Government of the Lao P.D.R will start negotiations with the government of Germany for financial assistance for the reconstruction of the three bridges.

(3) International Development Association (IDA)

1) Southern Transport Project

This project includes the following components:

A. Regravelleling, improvement of grade of cross section, construction of drainage and repair of bridges on the section from Seno to Pakse 270 km long on RN13S
B. Provision of Construction Equipment for repair and maintenance of roads, machinery for a workshop and construction materials
C. Employment of a consulting firm for the training of staff of the provincial road maintenance units, assistance in procurement of construction equipment, and materials and supervision of the project

The project implementation was originally scheduled for the period from 1987 to 1991. However, it has been much delayed and is now expected to be completed in 1998.

2) Highway Improvement Project

This project comprises the following components:

A. Improvement of the 233 km long section from Namkading to Seno on RN13S (Double bituminous surface treatment: DBST)
B. Reconstruction of 6 bridges out of the total 47 bridges on the section
C. Provision of construction equipment for the road repair and maintenance units of MCTPC, fuel and spare parts as well as procurement of a consulting firm for the study on management of the units and establishment of a long term road repair and maintenance programme

D. Employment of consulting firm for project coordination between MCTPC and IDA, and institutional building of the structures for the road repair and maintenance of MCTPC

The project started at the end of 1991, and will finish at the end of 1996.

The improvement projects implemented on RN13 are summarized in Table 1-4.

Table 1-4 Improvement Projects Implemented on RN13

Section	Pak Mong	Luang Prabang	Kasi	Vang Vieng	Vientiane	Thabok	Namkading	Savannakhet	Veune Kham (Cambodian Border) Pakse
(1) Distance	116km	166km	64km	162km	75km	96km	223km	275km	194km
		230km			171km				
(2) Type of Pavement (After Project)	DBST	DBST		DBST	DBST		DBST	Spot regravelling	Not decided
(3) Project Situation	Under Const.	Under Const.		Under Const.	Under Const.		Under Const.	Under Const.	F/S starts soon
(4) Funding Agency & Project Title	ADB 5th Road Improvement Project	ADB 4th Road Improvement Project		ADB 3rd Road Improvement Project	SIDA Swedish Road Sector Support		IDA Highway Improvement Project	IDA Southern Transport Project	ADB 7th Road Improvement Project
(5) Expected Completion Year	1998	1996		1993	1996		1996	1998	2000
(6) Contractor	Korean	Vietnamese		Force Account by MCTPC (Rd. No. 13S Enterpise)	Swedish (SKANSKA), after Force Account by MCTPC		Chinese	Force Account by MCTPC	
(7) Consultant	(SWECO) Swedish	(SMEC) Australian		(SMEC) Australian	(SWECO) Swedish		(Const.Eng.Service) Indian	(Const. Corp.) Myanmar	Under Selection Procedure
(8) Remarks	• Inc. reconst. of 11 bridges.	• Inc. reconst. of 12 bridges.		• Inc. reconst. of 38 bridges, comprising 5RC Box Culverts.	• Of 11 bridges located between Thabok and Namkading, only 2 bridges are to be reconstructed under the Project. Remaining 9 bridges reconst-ruction under negotiation with Germany.		• Of whole 47 bridges, 6 bridges are to be recons-tructed under the Project, 2 bridges are to be reconstructed under Australian Project, while remaining 40 bridges reconst-ruction has been requested to the Japanese Government.	• Australian Govt. commit on to reconstruct two bridges, while for remaining some 20 bridges reconst-ruction fund is sought.	

Source: MCTPC, December 1993

CHAPTER 2 OUTLINE OF THE PROJECT

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2.1 Objectives of the Project

National Road Route 13 (RN13) is the sole corridor which runs the length of the country from Pakmong in the north to Veune Kham at the southern frontier with Cambodia by way of Vientiane municipality. The section Namkading - Thakhek - Savannakhet, 266 km long on RN13S, has functioned as one of the most important stretches not only for domestic communication but also for international transport of goods and passengers. However, there still remains 40 single lane bridges of deteriorated or temporary erected structure, which thus presents a serious and dangerous situation. The collapse of those bridges in the near future is very likely. Furthermore, several bridges in the section are subject to flood at every rainy season, and will fail, in the worst case, due to unstable foundations or embankments.

The objective of the Project is to improve the condition of RN13 by replacement of the existing deteriorated bridges by engineered structures with a width of a 2 lane carriageway subject to the highway standards adopted in Laos.

The Project, along with ongoing IDA's "Highway Improvement Project", will resolve the bottlenecks on RN13, thus contributing to an improvement of transportation infrastructure and the growth of the economy of the country.

2.2 Outline of the Project Survey Area

2.2.1 Topographic and Geologic Features

The project survey section of RN13S from Namkading to Savannakhet, 266 km long, runs almost parallel to the Mekong with an average distance of 20 ~ 25 km from the Mekong.

There are three main tributaries to the Mekong along the survey section, i.e. Namkading, Namdua and Namhinboun. The alluvial plain of these tributaries forms the dominant topographic features.

Geologically, the project survey area is classified into the following six dominant formations:

1) "Alluvium" comprises sediments which have been deposited in recent geological period.

2) "Upper Trias" comprises sediments consisting of sandstone with a high content of quartzite.

3) "Middle Trias" comprises sediments of schist and clay, generally in red or violet color. This formation is known as "lateritic soil."

4) "Upper Perm" comprises limestone sediments. These have been transformed into a typical karst area through chemical and physical weathering.

5) "Lower Perm" consists of limestone.

6) "Igneous Rock" consists of granite, which is strongly weathered, and located some 50-100 m below ground level.

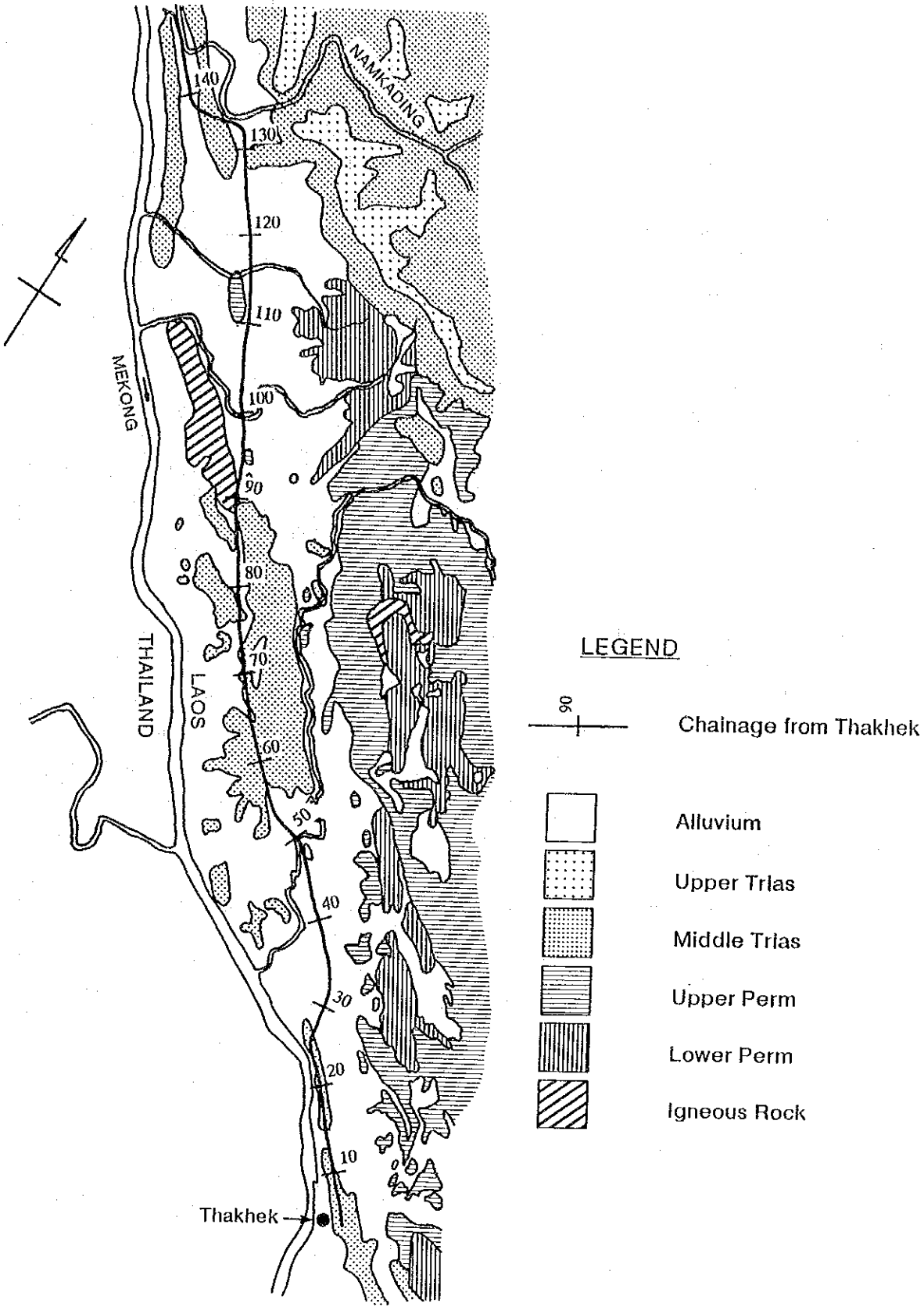
The formation of the area from Namkading to Thakhek is schematically shown in Fig. 2-1.

Considerations from technical point of view are as follows:

1) Alluvium strata is composed of sand, silt and silty clay with N-value of 50 ~ 20, thus not appropriate for a bridge foundation.

2) Middle Trias strata is generally appropriate for a bridge foundation, but N-value of the strata fluctuates according to the location.

3) Upper/Lower Perm strata is appropriate for a bridge foundation.



Source: Geological Map, IBRD/UNDP, June 1981

Fig. 2-1 Geological Map along RN13S from Namkading to Thakhek

2.2.2 Rainfall

There are significant differences of rainfall in Paksan and Thakhek within the project survey area. Rainfall in those two cities during 1990 - 1993 is summarized in Table 2-1.

Table 2-1 Mean Monthly Rainfall (1990-1993)

Paksan

Month	Apri.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Total
rainfall (mm)	81.2	293.8	625.5	752.6	583.6	416.1	44.5	19.2	0.0	5.4	13.3	75.3	2,910.5

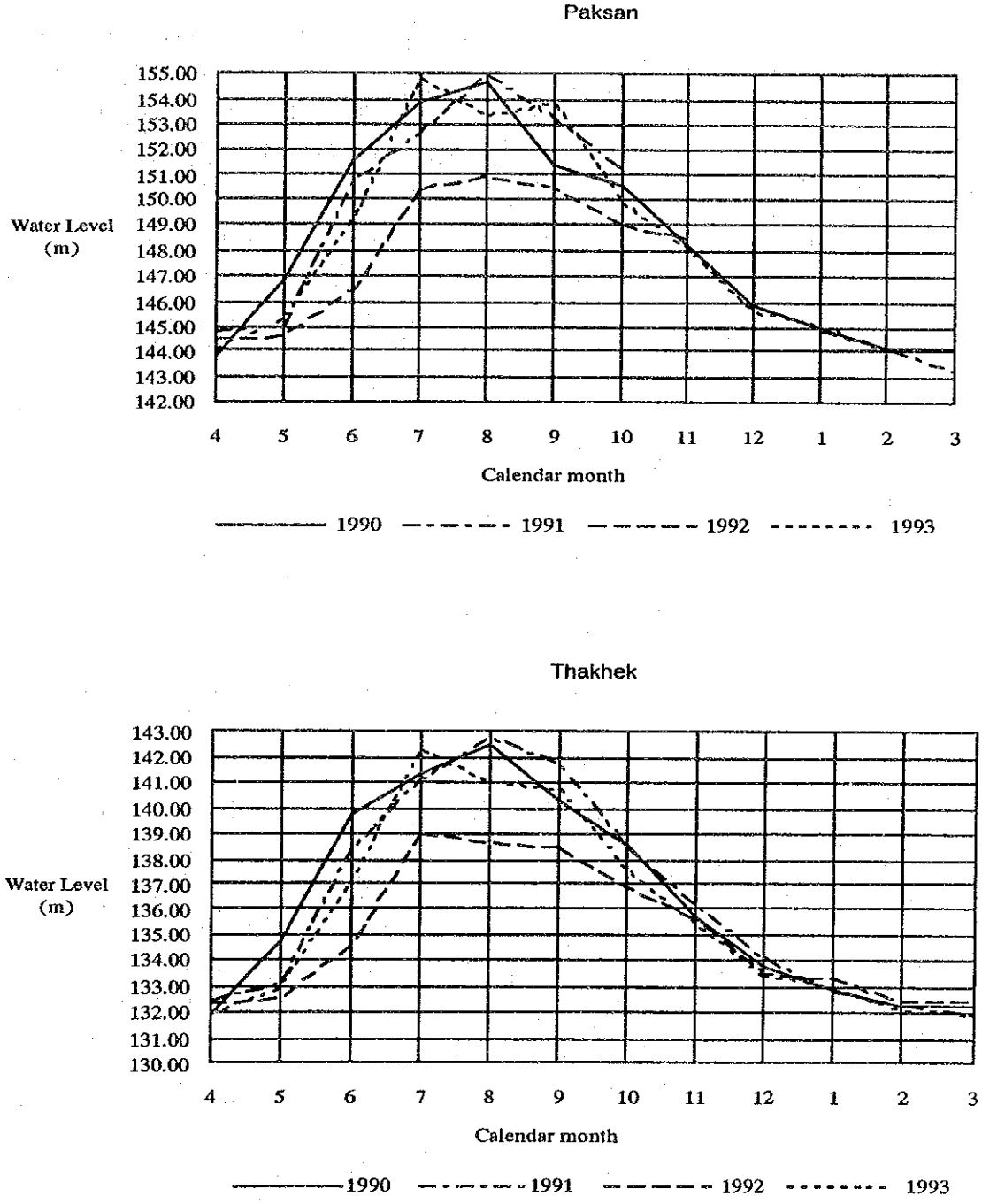
Thakhek

Month	Apri.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Total
rainfall (mm)	54.6	326.0	539.3	494.5	670.9	310.8	51.7	7.2	28.4	8.4	38.2	54.5	2,584.4

2.2.3 Water Level of the Mekong

The maximum flood height of the Mekong recorded at Paksan Station is 155m above sea level (a.s.l.) in 1993. With start of the rainy season at the beginning of May, the water level rises from its lower level at around 144m a.s.l. to the highest level at around 155m a.s.l. in July, August and September. At Thakhek the highest and lowest level is around 143m a.s.l. and 132m a.s.l, respectively.

The water level of the tributaries of the Mekong over which bridges are to be constructed are significantly influenced by backwater from the Mekong, thus, the above draw-down range of about 11m shall be taken into consideration for design of the bridges. The water levels recorded at Paksan and Thakhek stations during 1990-1993 are shown in Figure 2-2.



Source: Mekong Committee, Annual Report

Fig. 2-2 Water Level of Mekong River

2.2.4 Vehicle Traffic on Project Survey Sections

MCTPC completed the National Transport Study (NTS) which was financed by IDA in March 1991. NTS included the traffic surveys on the trunk roads across the country carried out in December 1989 and March 1990 which comprised data at the two stations within the project survey sections, i.e., Namkading Bridge and Namhinboun Bridge. Further, within the basic design study an additional traffic survey was made for the 24 hours on 17th December, 1993 in order to examine current traffic level on the project survey section of RN13S and relevant roads branching off from it.

The survey stations are as follows:

Station No.	Location
No. 1	At existing Namkading Bridge
No. 2	At Ban Lao junction on RN13S with RN8
No. 3	At Ban Lao junction on RN8 with RN13S
No. 4	At existing Namhinboun Bridge
No. 5	At existing Nam Thahao Bridge

(1) Current level and Increased Trend of the Traffic

The traffic volume at Station No. 1 on Namkading bridge is 131 vehicles/day, while that at the same station surveyed under the National Transport Study (NTS) was 73 vehicles/day. This indicates that the traffic volume on Namkading has increased by 80% over the past 4 years (average annual increase rate: 16%). The current rate of increase, 16% per annum, is just twice as large as that forecasted in the NTS (8% per annum toward the year 2000).

The traffic volume, 112 vehicles/day observed at Station No. 4 on Namhinboun shows much more rapid increase rate (20% p.a.), compared to that (55 vehicles/day) observed in NTS (7% p.a.),which were forecast toward the year 2000.

The traffic volume on RN8 at the Ban Lao junction is 36 vehicles/day, which is larger by 60% than that observed in NTS (23 vehicles/day).

The observation indicates that the traffic volume in the project survey section on RN13 and the road branching off from it has increased to 2~3 times the rate forecast 4 years

ago in NTS, which clearly shows that a more rapid economic growth rate in the project survey area is being realized than predicted in NTS.

(2) Constitution of Traffic

The % of heavy vehicles of the total traffic is as follows:

Station	No.1	No.2	No.3	No.4	No.5
% of heavy vehicle	92	74	75	83	76

It is very obvious that the major portion of existing traffic in the project survey area are heavy vehicles.

(3) Distribution of Traffic Volume on RN13S and its Branch Roads

The trend of distribution of traffic on RN13S and its branch roads are schematically shown in Fig. 2-3.

According to NTS, the traffic volume on RN13S at the suburb of Vientiane municipality reaches 2000 ~ 3000 vehicles/day, and reduces to some 250 vehicles/day near and inside Paksan (the latter figure obtained by assuming an increase of 80 ~ 100% from the forecast in NTS).

The traffic, some 130 vehicles/day at Namkading Bridge reduces to some 110 vehicles/day nearing to Ban Lao junction on RN13 with RN8, which then separate to 90 vehicles/day on RN13S and 20 vehicles/day on RN8.

The traffic volume at Hinboun Bridge and near the north of Thakhek is composed of some 90 vehicles/day from Ban Lao and some 20 vehicles from RN8, which reduces to some 100 vehicles/day after Thakhek city, and again increases to some 220 vehicles/day near the north of Seno/Savannakhet.

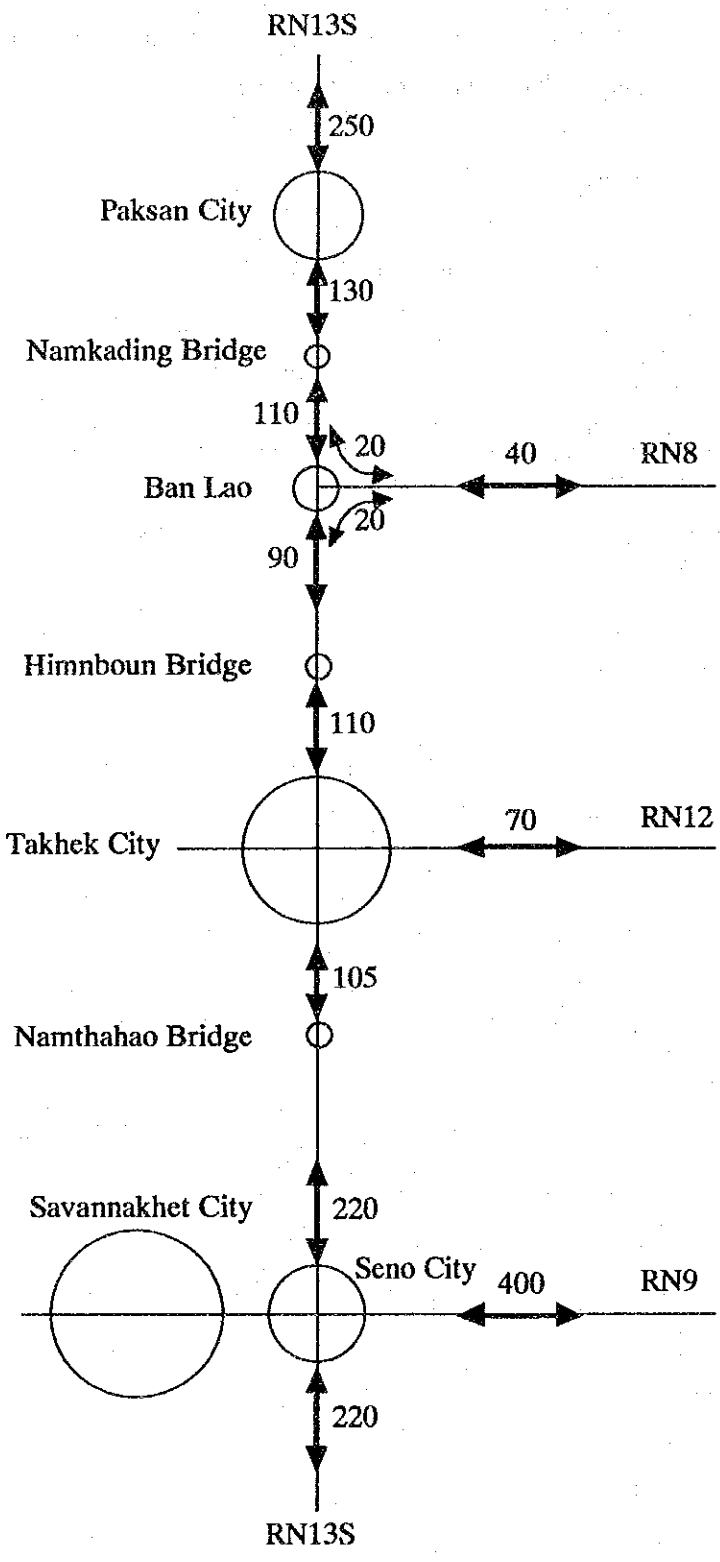


Fig. 2-3 Distribution of Traffic Volume on RN13S and its Branch Roads