PROJECT SUMMARY

1. COUNTRY	Lao People's Democratic Republic
2. NAME OF STUDY	The Study on Improvement of Roads in The Southern Region in Lao P.D.R.
3. COUNTERPART AGENCY	Ministry of Communication, Transport, Post and Construction (MCTPC)
4. OBJECTIVE OF STUDY	-To create a Master Plan (target year:2020) for the improvement of the road network in the southern region of Lao P.D.R., and to conduct a Feasibility Study on the most suitable road improvement project (target year:2007) - To promote technical transfer to Loa counterparts through the study

1. STUDY AREA: Four Southern Laotian Provinces of Champasack, Saravan, Sekong, and Attapeu, as well as the area along Route 1G in Savannakhet Province

2. SCOPE OF STUDY

Master Plan

1) Analysis of socioeconomic framework and identification of development potential in Study regions.
2) Forecast of future traffic demand
3) Evaluating initial environmental impacts
4) Establishment of maintenance and improvement plan
5) Economic Analysis
6) Establishment of Master Plan and selection of road links for Feasibility Study

Feasibility Study

1) Execution of national condition survey
2) Establishment of design standards and criteria
3) Development of preliminary engineering design and cost estimation
4) Evaluating environmental impacts
5) Development of project implementation plan and maintenance plan
6) Economic analysis and evaluation

3. MASTER PLAN

The Master Plan covers national roads in the southern region and prioritise road improvement projects up to the year 2020 and select the most appropriate project for a feasibility study. The Study roads comprise 16 routes with 880km in the total length among 2,025km of the national road in the study area.

Route 14A (between B.Houay Phek. and B.Soukhouma) and 16A(between 1km mark east of Pakson and B.Lak 52) are the most appropriate for implementing and completion by the year 2007 for the southern region of Lao P.D.R.

Route 14A will contribute to improving access to the west part of the Mekong River as well as to the southern part of the west bank, which will fuel development of the Emerald Triangle Area.

Route 16A will contribute to rural development in an area near the Champasack-Attapeu border and also improve East-West connectivity between Thailand, Laos and Vietnam.

4. FEASIBILITY STUDY

The base case **EIRR**s for the two projects, **10.5%** per cent for Route 14A and **10.7** percent for Route 16A, are close to the test discount rate of 12 per cent, indicating that project implementation 2005-20007 may be appropriate based on their benefit to road users. These particular projects are likely to produce significant social and other benefits in their influence areas and beyond, in addition to their direct economic benefits.

Project	EIRR (in%)	NPV(US$ mill)	FYB (in%)	B/C
Route 14A (59.3km)	10.5	-3.32	5.8	0.87
Route 16A(64.1km)	10.7	-2.97	5.8	0.89

Most of the anticipated environmental negative impacts can be avoided or minimized to an acceptable level through compliance with laws and regulations and effective implementation of mitigation measures and rigorous monitoring program.

5. RECOMMENDATIONS:

1) Cross-border agreement needs to be in place at early time.
2) A detailed study of road user charge will be needed to establish an appropriate funding scenario for road maintenance.
3) The environmental monitoring will be designed in order to ensure that the legislative and regulatory measures will be met within a realistic implementation framework.
4) Weighing station (axle-load control) on the Project Road with one in each district will be needed to control overloading.
5) Road safety program for rural children in communities will be needed.
6) Road inventory data, road condition and traffic date require to be updated continuously.
7) In the future, maintenance records and data should be retained on a computer database.
8) A national system of guidance for the preparation of Work Plans should be introduced.
9) Promotion of private sector capacity building for road maintenance is recommended.
10) Standard simplified contract documents for road work should be introduced to promote private sector's participation.
11) Enhancement of training capacity of training institutions on road maintenance will be needed.

ABBREVIATIONS AND ACRONYMS

AASHTO	American Association of State-Highway and Transportation Officials
ADB	Asian Development Bank
ADT	Average Daily Traffic
B/C	Benefit/Cost Ratio
CPC	Committee for Planning and Cooperation
CPI	Consumer Price Index
DBST	Double Bitumen Surface Treatment
DCTPC	Department of Communications, Transport, Post and Construction
DOR	Department of Roads (of MCPTC)
EIA	Environmental Impact Assessment
EIRR	Economic Internal Rate of Return
EMP	Environmental Management Plan
FIRR	Financial Internal Rate of Return
GDP	Gross Domestic Products
HDI	Human Development Index
HDM	Highway Development Management Model
IDA	International Development Association (World Bank)
IEE	Initial Environmental Examination
JICA	Japan International Cooperation Agency
MCA	Multi-Criteria Analysis
MCTPC	Ministry of Communication, Transport, Post and Construction
NBCA	National Biodiversity Conservation Area
NPV	Net Present Value
NTFR	Non-Timber Forest Resources
OD	Origin-Destination
PCU	Passenger Car Unit
P.D.R.	People's Democratic Republic
RMF	Road Maintenance Fund
SEZ	Special Economic Zone
SIDA	Swedish International Development Agency
STEA	Science, Technology and Environment Agency
TAZ	Traffic Analysis Zone
TRRL	Transport and Road Research Laboratory
UNESCO	United Nations Education, Science and Culture Organization
UXO	Unexploded Ordnance
VCR	Volume Capacity Ratio
VOC	Vehicle Operating Cost
VPD	(Motorized, Four-wheeled) Vehicles Per Day
WPA	Wetland Protected Area

The following foreign exchange rate is applied in the Study:
1 US dollar = 10,940 Kip = 125.55Japanese Yen (October 2002), or 1 Kip = 0.01148 Japanese Yen

SUMMARY OF THE STUDY

1. Background and Objective

Since 1986, the Government of Lao P.D.R.(GoL) has exerted great efforts to introduce new economic mechanisms that will change the country from being a socialist economy to a successful market economy. The GoL has been relatively successful in making this transition. However even now, poverty levels in Lao P.D.R. are some 39% and it is one of the least developed nations.

To cope with the accompanying future increases in traffic as a result of economic growth as well as poverty alleviation, the Asian Development Bank, World Bank, and JICA have assisted the GoL with its road infrastructure via grants and loans for such projects as the improvement of Routes 13 and 9 and the Pakse Bridge, as well as for the construction of the Second Mekong International Bridge. However, the GoL realizes that the current state of its road infrastructure is still incapable of handling traffic that has accompanied the above-mentioned socioeconomic growth as well as future potential growth. Especially, in the southern part of the country (i.e., Savannakhet, Champasack, Attapeu, Sekong, and Saravan), which is located between Thailand, Vietnam, and Cambodia and is envisioned to serve as a bridge to integrate these ASEAN member countries, only 28% of the national roads are paved and there are locations with superannuated bridges or no bridges at all. This has not only posed a barrier to the movement of international trade, but has also resulted in this part of Lao being much poorer than the rest of the country.

Given this background, the GoL wishes to draw up a road network improvement plan for the southern provinces that will upgrade inter-provincial connectivity, and that will establish a network that will be compatible with that of the surrounding countries to realize an effective international road system, with the aim of invigorating the socio-economy of southern Laos. In response to this request from the GoL, the Government of Japan has decided to carry out a study to draw up a Master Plan and execute a Feasibility Study for the roads of the southern provinces, i.e., “The Study on Improvement of Roads in the Southern Region in Lao People’s Democratic Republic” (hereinafter referred to as the Study).

Therefore, the ultimate goal of this Study is to assist the GoL in prioritizing and recommending those road improvement projects that are crucial for the socio-economic development of southern Lao.

2. Study Approach

The major focus of the Study is to develop a Master Plan, to select the most suitable road improvement project for a Feasibility Study, and to then examine the technical and economic viability of this project in the Feasibility Study.

1) To analyze the background and present situation of the natural and socio-economic conditions.
2) To analyze the present and future relevant development plans for surrounding areas and countries.
3) To examine the most suitable road network and to establish a road improvement **Master Plan** (target year: 2020) for the improvement of the road network in the southern region.
4) To examine the **feasibility** (target year: 2007) of high-priority road improvement projects and to draw up an implementation plan for the project with the highest priority.

(1) Master Plan

1) Review of the related development plans, socio-economic data, transport sector data and natural condition data.
2) Analysis of socio-economic framework and identification of development potential in Study regions.
3) Conduct of supplementary surveys and analysis (e.g., road inventory, bridge inventory, and traffic survey).
4) Formulation of basic road network.
5) Forecast of future traffic demand
6) Establishment of rural road improvement/construction criteria and engineering standards.
7) Cost estimation of road improvement, construction and maintenance.
8) Initial environmental examination.
9) Evaluation of road links of proposed road network.
10) Establishment of road improvement, construction, and maintenance plans.
11) Economic analysis.
12) Selection of road links for Feasibility Study.

(2) Feasibility Study on high-priority projects.

1) Natural condition survey.
2) Consideration of alternatives.

3) Design standards and criteria (geometry, structure, pavement, etc.).
4) Preliminary engineering design.
5) Environment impact assessment.
6) Project implementation plan.
7) Maintenance and rehabilitation plan.
8) Cost estimation.
9) Economic analysis and evaluation.

3. Road Network in Study Area

Study roads contain parts of all national roads; Route 1,13, 14, 15,16, 18 and 20, excluding Route 9. The total length of the study roads is 2025km.

Although the national road network in the study area is planned to serve the whole area, there still exists virtually missing links on Route 1G, 1J and 14A (total length: approx.122km), some parts of the study roads become impassable condition in rainy season due to lack of bridges and drainage facilities. As a whole, the west-east routes have been relatively in the higher standard compared to the north-south routs such as Route 1G, 1I (under improvement) and IJ. Especially, on Route 1G, two large-scale rivers (i.e., Xe-Bang Hiang and Xe-Done) prevent traffic from crossing the river mostly all year round. In addition, routes running through the less inhabited area or remote areas have also not been upgraded as an all-weathered road including 18A and B, 16 (from Lamarm to Vietnam border) and 15 (Saravan to Vietnam border).

Attapeu, Sekong and Saravan Provinces are amongst the least developed and have until recently lacked all-weather connections to the national road network.

Champasack province is relatively more developed than the other three. Pakse is the most important town and the regional center. Communications between Pakse and the north and south of the country are being transformed by the paving of the main north-south highway Route13S from Savannakhet south to the Cambodian border, which was completed in middle of 2002. This project, together with the opening of the second bridge (Pakse Bridge) over the River Mekong at Pakse in November 2000 and the improvement of Route16 connecting it to the Thai border, should provide a springboard for the development of the whole of the southern region.

The improvement of existing national road that will contribute to provide a reliable arterial rout for connecting between west part of Mekong and Pakse via the Mekong Bridge, is expected to

be carried out at early time. There is not all-weathered national road at all in the western part of the Mekong except town road in Champasack. The improvement of existing national road that will contribute to provide a reliable arterial rout for connecting between Thailand and Vietnam via Pakse, is also expected to be carried out at early time.

4. Evaluating Environmental Impacts

Potential Negative Impacts

Many of the potential negative social impacts can be dealt with through the design and mitigation process. It is clear that the process of resettlement will have to be a sensitive one that follows national procedures and regulations. Careful planning as well as the management of both the construction and operational processes may also minimize the potential impacts of road improvements on the cultural environment in many ways. Many of the potential physical environment impacts are also of a nature where a good quality design and management process can ensure minimal negative impacts.

The highest level of negative impact has to relate to the natural/ecological environment of some of the possible route alignments. There is no doubt that increased access will bring added pressures to negatively exploit national resources. There must also be a concern for the potential loss of animal species due to the intrusion of a road especially given higher levels of vehicular activity and speed. Given the existing level of data it is difficult to quantify this set of impacts but there is no doubt that one of the major considerations in choosing a road alignment must be in recognizing the potential impact on the ecological/natural environment. There is a particular concern of the natural/ecological impacts of any road improvements to routes 1G and18A. Very careful study must be undertaken if the routes are seen as priorities and if they are to be developed to national road standards. There may be a case where access is improved for local purposes but full-scale improvement should be delayed until the natural/ecological capacities are improved and the full impacts of a road on the NBCAs are understood.

Potential Positive Impacts

Improved access will provide a strong set of positive socio-economic impacts. The assumption is that the necessary complementary mitigation and facilitation mechanisms are used to ensure the fullest possible benefits of any road construction and improvement. The social indicators presented above highlight the high priority that must be given to providing all weather access to all residents of the region (or at least those within 5 km of a designated road).

5. Proposed Project

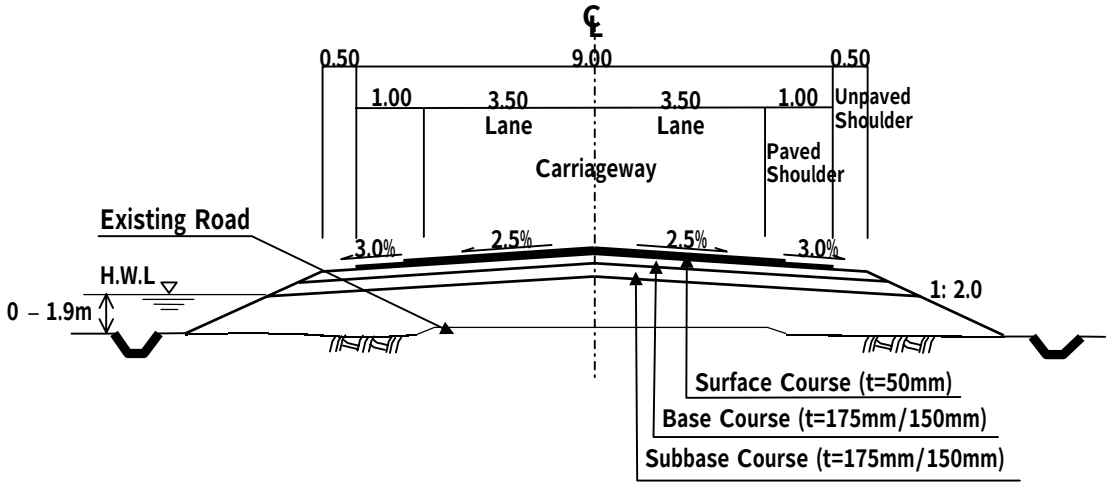
Based on the analyses of the Master Plan, the most appropriate road improvement project to be completed by a year 2007 was selected for further detailed examination by the feasibility study. The Study Team concludes that Route 14A (Ban Houay Phek – Ban Soukhouma :**59.301km**) and Route 16A (Paksong – Ban Lak 52 :**64.138km**) are the most appropriate routes to be examined

Route 14A

This starts from Ban Houay Phek, which is located 2.0 km west of Pakse Bridge, and ends at Ban Soukhouma the capital of Soukhouma District, meaning that the entire route is located in Champasack Province and is 59.301 km in length. The characteristics of this route are as follows:

(i) Terrain is flat over the entire route.
(ii) The route passes through Champasack Town, which is the second largest town in the province.
(iii) Wat Phou and Champasack Ancient City are located along the route.
(iv) The 25 km Missing Link section is located in the northern part of the route.
(v) Flooding from the Mekong River has inundated around 35 km in length of the route and effective countermeasures are therefore crucial.

Traffic volumes forecast for the target year of 2020 is about 1,100VPD (incl. motorcycle 3,000) on north section and 800VPD (incl. motorcycle 4,600) on south section respectively.



Typical Embankment Section (Route 14A)

Route 16A

Route 16A starts from the junction with Route 16 located at the 1.0km mark east of Paksong in Champasack Province and ends at Ban Lak 52, or the junction with Route 1I in Attapeu Province. Total length is 64.138km. The characteristics of these routes are as follows:

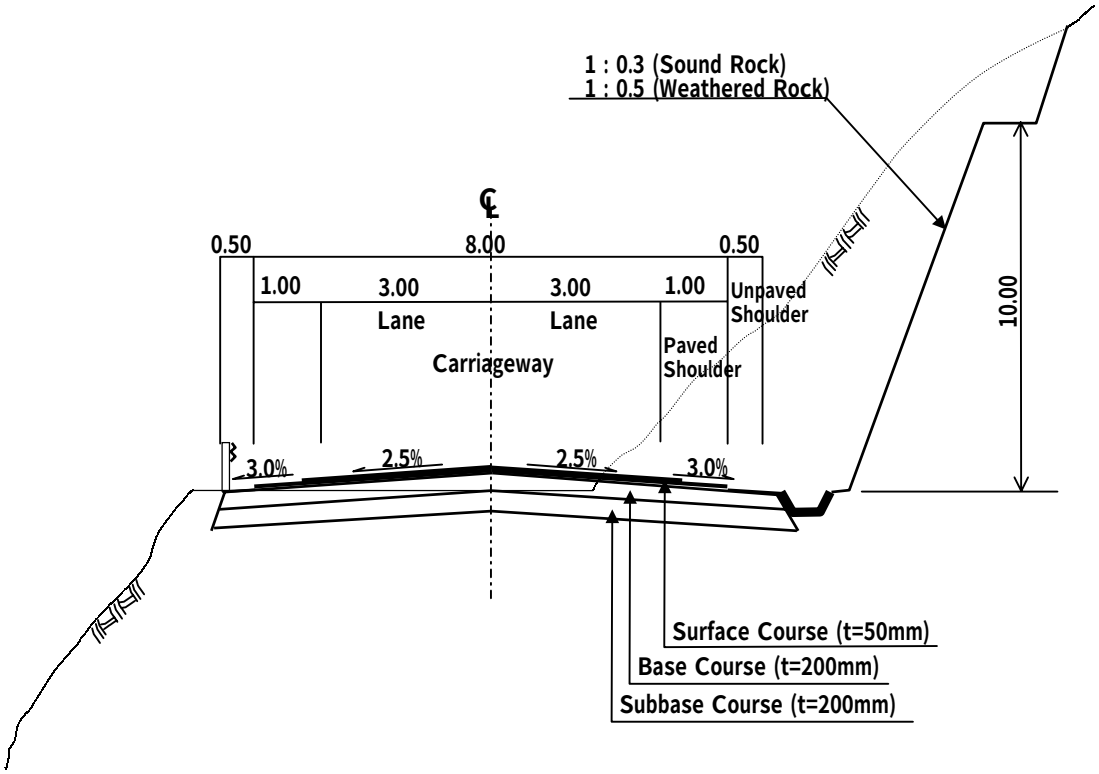
(a) There is an existing road structure over the entire route except a section of the Shortcut Route.

(b) From the starting point to the 34km mark, the route is located in a hilly area. It goes through the Boloven Plateau, which is 900 – 1,300m above sea level.

(c) Then the route diverges from the existing road route. There is a river that is approximately 50m in width on this section. Terrain on this section is generally flat and land-use consists of forest and coffee plantations.

(d) From the 42km to the 58km mark, the terrain is mountainous and the existing road has an inadequate alignment at present (i.e., a small horizontal curvature radius and a steep vertical gradient) and therefore a resetting new alignment is required.

Traffic volumes forecast for the target year of 2020 is about 1,300VPD (incl. motorcycle 2,320) through the route.



Typical Mountainous Section (Route 16A)

6. Project Economic Analysis and Evaluation

The results of the economic analysis are presented in the following table. The indicators evaluated are: economic internal rate of return (EIRR); net present value (NPV) of costs and benefits discounted at the test discount rate of 12 per cent; first (opening) year benefit (FYB), expressed as a percentage of construction cost, escalated to opening year at 12 per cent per annum; and benefit cost ratio (B/C) at a discount rate of 12 per cent. The FYB is an indicator of the optimum year of project opening, while the EIRR, NPV and B/C indicate economic performance over the whole of the economic analysis period. A rate of 12 per cent has been used for the test discount rate as an indicator of the opportunity cost of capital for public sector projects of moderate risk.

The economic feasibility study outcomes for the two routes are very similar: there is no significant difference between the results. The new construction section of Route 14A has a higher EIRR than the improvement section, in spite of a 60 per cent larger construction cost per km, due to the distance savings it produces for diverting traffic and its 40 per cent higher traffic volume.

Economic Analysis Results

Project	EIRR (in%)	NPV (US$ mill)	FYB (in%)	B/C
Route 14A;				
New construction km 0.0-34.0	11.1	-1.41	6.1	0.92
Improvement km 34.0-59.3	9.2	-1.91	5.0	0.77
Combined km 0.0-59.3	10.5	-3.32	5.8	0.87
Route 16A:				
Km 0.0-64.1	10.7	-2.97	5.8	0.89

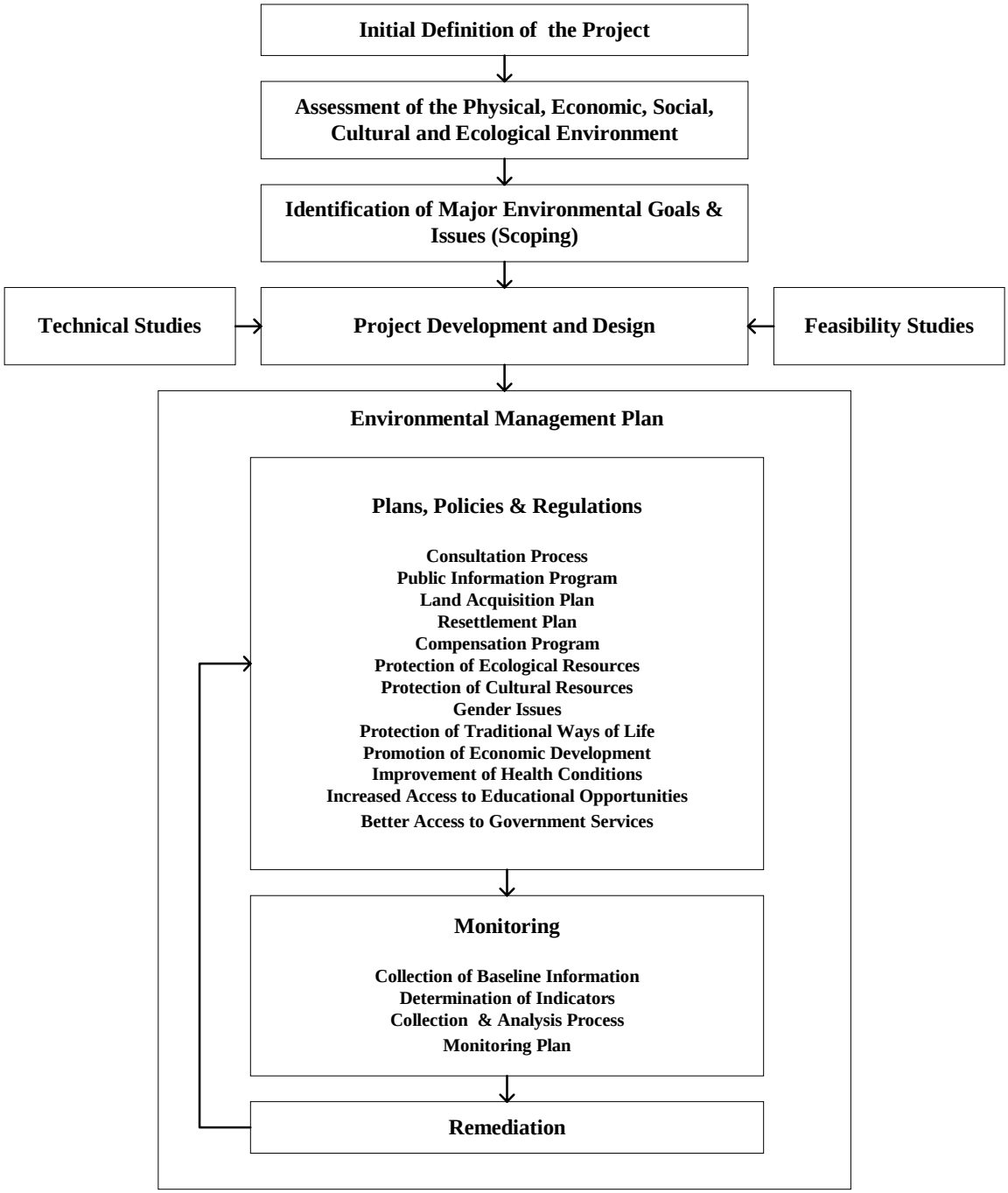
The base case EIRRs for the two projects, 10.5 per cent for Route 14A and 10.7 per cent for Route 16A, are close to the test discount rate of 12 per cent, indicating that project implementation 2005-2007 may be appropriate based solely on their benefits to road users. In fact, these particular projects are likely to produce significant social and other benefits in their influence areas and beyond, in addition to their direct economic benefits.

7. Environmental Management Plan

The environmental management plan is divided into two parts.

- Plan, Policies and Regulations
- Monitoring and Remediation Plan

The nature of the environmental management planning process can be seen in the following chart.



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CHAPTER 1
OVERALL APPROACH AND IMPLEMENTATION PROGRAM OF THE STUDY

1.1 Introduction

The Government of Lao P.D.R. (GoL) wishes to draw up a road network improvement plan for the southern provinces of Savannakhet, Champasack, Attapeu, Sekong, and Saravan that will upgrade inter-provincial connectivity, and that will establish a network that will be compatible with that of neighboring countries to realize an effective international road system, with the aim of invigorating the socio-economy of southern Lao P.D.R.

In response to this request from the GoL, the Government of Japan decided to carry out a study to draw up a Master Plan and execute a Feasibility Study for the roads of the four southern provinces of Champasack, Attapeu, Sekong, and Saravan (including the area of Savannakhet along Route 1G), i.e., "The Study on Improvement of Roads in the Southern Region in Lao People's Democratic Republic" (hereinafter referred to as the Study), in accordance with the relevant laws and regulations in force in Japan and Lao P.D.R.

Accordingly, the Japan International Cooperation Agency (JICA), the official agency responsible for the implementation of the technical cooperation programs of Japan, has undertaken the Study in close cooperation with the authorities concerned in Lao P.D.R. The scope of work for the Study was agreed to and was signed by both sides, Japan and Lao P.D.R., on August 20, 2001.

1.2 Background

Since 1986, the GoL has striven to introduce new economic mechanisms to transform the country from a socialist economy to a successful market economy. This resulted in the country's GDP, exports, and imports growing at an average annual rate of 5.6%, 9.8%, and 5.8%, respectively, between 1985 and 1996, indicating that the GoL has been relatively successful in making this transition. On the other hand, poverty levels in Lao P.D.R. are approximately 39% and Lao P.D.R. is one of the least developed nations, ranked 140th out of the 174 countries in the United Nations Human Development index.

To cope with the increase in traffic as a result of economic growth as well as poverty alleviation, the Asian Development Bank, the World Bank, and JICA have assisted the GoL with its road infrastructure via grants and loans for such projects as the improvement of Routes 13 and 9 and

the Pakse Bridge, as well as for the construction of the Second Mekong International Bridge.

However, the GoL realizes that the current state of its road infrastructure is still incapable of handling existing traffic as well as future potential growth. Especially, in the southern part of the country, which is located between Thailand, Vietnam, and Cambodia and is envisioned to serve as a bridge to integrate these ASEAN member countries, only 28% of the national roads are paved and there are locations with superannuated bridges or no bridges at all. This has not only posed a barrier to the movement of international trade, but has also resulted in this part of the country being much poorer than the rest. The GNP per person is lower than the national average of US$ 300.

Therefore, the ultimate goal of this Study is to assist the GoL in prioritizing and recommending road improvement projects that are crucial for the socio-economic development of southern Lao.

1.3 Objectives

The objectives of the Study were as follows:

1) To create a **Master Plan (target year: 2020)** for the improvement of the road network in the southern region of Lao P.D.R., and to conduct **a Feasibility Study** on the most suitable road improvement project **(target year: 2007)**.
2) To transfer technology to Laotian counterpart personnel in the course of the Study.

1.4 Study Area

The area of the Study covers the four southern provinces of Champasack, Saravan, Sekong, and Attapeu, as well as the area along Route 1G in Savannakhet Province.

1.5 Scope of the Study

The Study covers the work items as agreed upon in the Scope of Work and the related Minutes of Meeting duly signed on 20 August 2001, by the Department of Roads of the Ministry of Communication, Transport, Post and Construction of Lao P.D.R. and the Preparatory Study Team of JICA.

(1) Master Plan

1) Review of the related development plans, socio-economic data, transport sector data and natural condition data.
2) Analysis of socio-economic framework and identification of development potential in Study regions.
3) Conduct of supplementary surveys and analysis (e.g., road inventory, bridge inventory, and traffic survey).
4) Formulation of basic road network.
5) Forecast of future traffic demand
6) Establishment of rural road improvement/construction criteria and engineering standards.
7) Cost estimation of road improvement, construction and maintenance.
8) Initial environmental examination.
9) Evaluation of road links of proposed road network.
10) Establishment of road improvement, construction, and maintenance plans.
11) Economic analysis.
12) Selection of road links for Feasibility Study.

(2) Feasibility Study on high-priority projects.

1) Natural condition survey.
2) Consideration of alternatives.
3) Design standards and criteria (geometry, structure, pavement, etc.).
4) Preliminary engineering design.
5) Environment impact assessment.
6) Project implementation plan.
7) Maintenance and rehabilitation plan.
8) Cost estimation.
9) Economic analysis and evaluation.

1.6 Study Approach

The major focus of the Study is to develop a Master Plan, to select the most suitable road improvement project for a Feasibility Study, and to then examine the technical and economic viability of this project in the Feasibility Study. The basic issues and approach of the Study are as described below.

(1) Appreciation of Issues

1) The southern region of Lao has high socio-economic potential due to the existence of agricultural resources in the Boloven Plateau and around the Mekong River, mines, forests, etc.
2) However, some bridge structures have not been built due to steep terrain and many rivers and also been destroyed by Indochina War. Furthermore, most roads and bridges in the region have deteriorated due to poor maintenance. Therefore, urgent improvement and/or development of suitable roads and bridge structures are required.
3) The poor condition of transport networks in this region blocks poverty reduction effort and stifles economic growth.
4) Recently, various donors such as the Asian Development Bank, World Bank, and Japanese Government have improved some major roads and a bridge in Lao (i.e., Route 13, Route 9, Pakse Bridge) and will construct a new bridge (i.e., the Second Mekong International Bridge). The road network in southern Lao should be improved taking these and other development plans into account in order to realize the maximum synergies possible.

(2) Approach of Study

1) To analyze the background and present situation of the natural and socio-economic conditions.
2) To analyze the present and future relevant development plans for surrounding areas and countries.
3) To examine the most suitable road network and to establish a road improvement Master Plan.
4) To examine the feasibility of high-priority road improvement projects and to draw up an implementation plan for the project with the highest priority.

The Study flow is as shown in Figure 1.6.1 below.

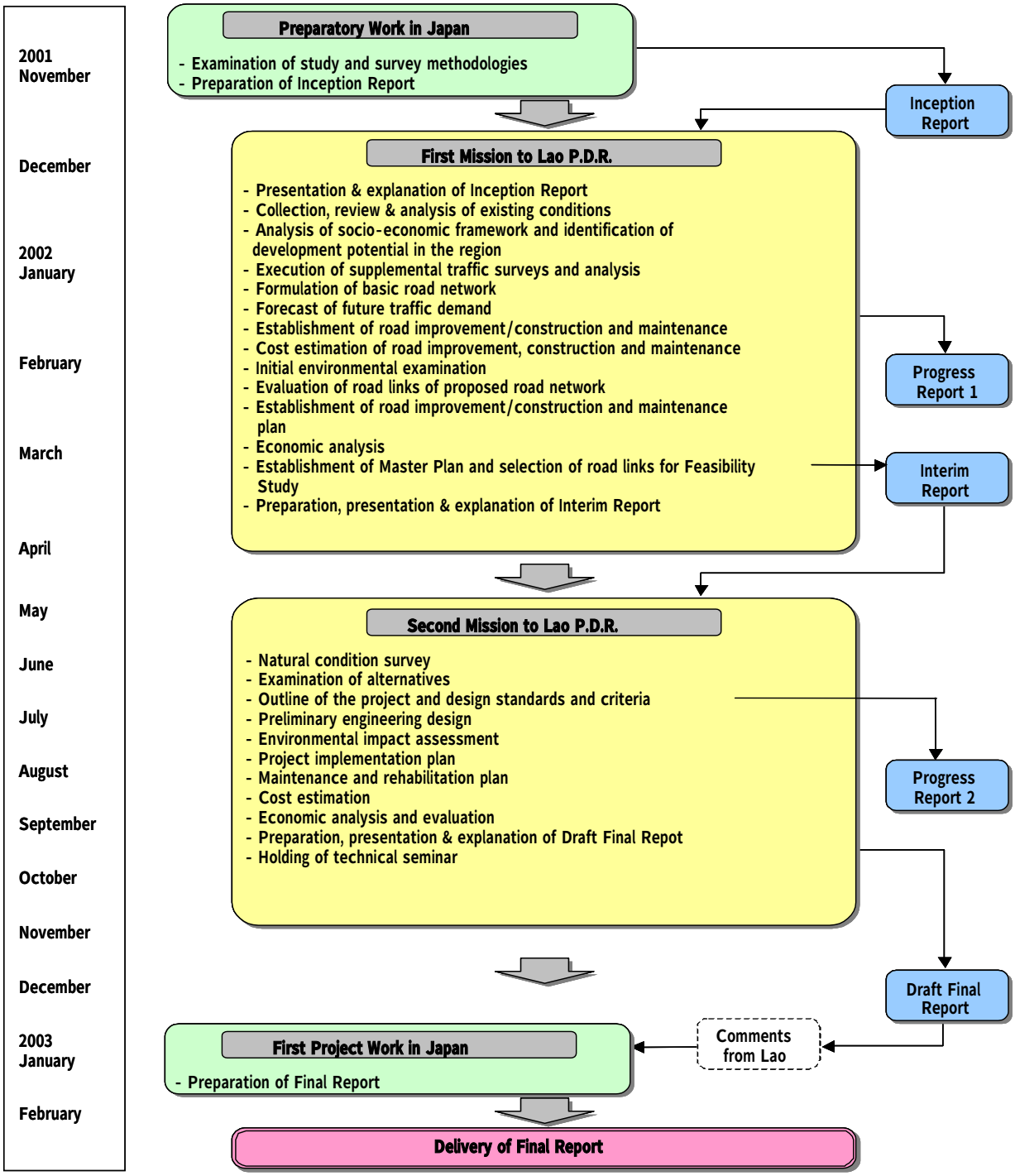


Figure 1.6.1 Study Flow

CHAPTER 2 ROAD SYSTEM

2.1 Road System in Lao P.D.R.

In June 2000, MCTPC set out its 15-year strategy for the road sector in *Strategic Directions for the Development of the Road Sector*. The key sector objective is to support the socio-economic development and integration of the country, by:

- developing road sector institutions and an integrated management system;
- improving resource allocation across the road system, with high priority to preserving existing assets;
- enforcing measures to prohibit overloading;
- establishing sustainable domestic funding for the sector;
- creating an enabling environment for a healthy domestic contracting industry;
- providing "focal sites" accessing agricultural support, health and education services, and connecting all provincial and district centers to an all-weather network;
- minimizing environmental and social impacts;
- improving traffic safety; and
- encouraging community participation in planning and executing road sector work.

The road system is defined in the Road Law (No.04/99/NA) of April 1999, specifying six categories of road; national, provincial, district, urban, rural, and special roads. The national roads and the route numbering system are defined in Ministerial Decision 1311/MCTPC of June 1997. Responsibility for the road system rests with MCTPC, which is delegating some of its responsibilities to provincial DCTPCs. The Department of Roads under MCTPC provides the technical and financial administration of the network.

The road system has been considerably improved over the last decade, with, for example, the first all-weather north-south route from the Chinese border to the Cambodian border (Route13) to be fully open. Nevertheless, major problem areas remain. **Only 39 percent of the national road length (all surface types) was classified as in good/fair condition, with 32 percent classified as poor and 30 percent as in bad condition**. ADB TA No.3070 (March 2000) found that **23 percent of the provincial road network was impassable**; a further 52 percent was **passable for up to six months in a year** and only 22 percent was all-weather road.

The road length in each province by main category and surface type as of end-2000 is given in Table 2.1.1. Data for the combined the five southern provinces are also shown. National roads accounted for 24.2 percent of the 28,738km length, provincial roads for 27.5 percent and urban

roads for 48.3 percent. Just 15.1 percent of the network was paved, 28.2 percent was gravel and 56.7 percent was earth. Vientiane Municipality (an area of 3920 sq. km.) is considerably more developed than the northern and southern provinces.

Table 2.1.1 Road Lengths by Surface Type (year 2000, in km)

		National Roads				Provincial Roads				Urban Roads				All Roads			
No.	Province	Paved	Gravel	Earth	Total	Paved	Gravel	Earth	Total	Paved	Gravel	Earth	Total	Paved	Gravel	Earth	Total
1	Vientiane Municipality	166.1	52.0	15.5	233.6	11.0	237.0	6.0	254.0	202.7	907.7	320.2	1,430.6	379.8	1,196.7	341.7	1,918.2
2	Phongsali	133.0	322.0	0.0	455.0	0.0	0.0	136.0	136.0	0.8	0.1	35.6	36.5	133.8	322.1	171.6	627.5
3	Luang Namtha	138.1	163.0	0.0	301.1	0.0	0.0	201.0	201.0	3.4	0.0	392.0	395.4	141.5	163.0	593.0	897.5
4	Oudomxai	318.0	0.0	0.0	318.0	0.0	55.0	46.0	101.0	3.4	10.0	929.8	943.2	321.4	65.0	975.8	1,362.2
5	Bokeo	0.0	33.0	61.0	94.0	0.0	35.1	284.7	319.8	16.4	52.5	149.2	218.1	16.4	120.6	494.9	631.9
6	Luang Prabhang	413.0	97.0	40.0	550.0	0.0	313.9	100.0	413.9	0.0	81.3	322.7	404.0	413.0	492.2	462.7	1,367.9
7	Houaphan	313.0	129.0	0.0	442.0	0.0	146.0	442.0	588.0	5.0	20.0	510.0	535.0	318.0	295.0	952.0	1,565.0
8	Sayaburi	26.9	240.7	245.8	513.4	6.9	0.7	688.0	695.6	17.3	13.5	702.0	732.8	51.1	254.9	1,635.8	1,941.8
9	Xieng Khouang	230.0	74.0	91.0	395.0	0.0	31.0	390.0	421.0	7.4	156.3	715.6	879.3	237.4	261.3	1,196.6	1,695.3
10	Vientiane	266.0	61.0	74.0	401.0	50.0	371.9	144.6	566.5	18.7	310.4	257.5	586.6	334.7	743.3	476.1	1,554.1
11	Borikhamxai	326.0	55.0	140.0	521.0	3.0	156.0	243.0	402.0	10.5	141.1	376.8	528.4	339.5	352.1	759.8	1,451.4
12	Khammouan	166.0	248.6	35.0	449.6	7.2	208.9	248.4	464.5	21.8	166.6	418.4	606.8	195.0	624.1	701.8	1,520.9
13	Savannakhet	455.0	35.0	117.0	607.0	312.8	477.9	395.3	1,186.0	98.5	652.7	1,305.4	2,056.6	866.3	1,165.6	1,817.7	3,849.6
14	Saravane	89.0	320.0	22.0	431.0	0.0	168.5	440.0	608.5	15.8	184.4	1,771.1	1,971.3	104.8	672.9	2,233.1	3,010.8
15	Sekong	47.0	70.0	86.0	203.0	0.0	0.0	54.5	54.5	4.6	0.0	625.7	630.3	51.6	70.0	766.2	887.8
16	Champasack	362.4	89.9	0.0	452.3	20.0	487.0	266.0	773.0	35.0	238.0	839.0	1,112.0	417.4	814.9	1,105.0	2,337.3
17	Attapeu	21.5	143.0	187.5	352.0	0.0	17.0	303.0	320.0	7.5	98.6	426.2	532.3	29.0	258.6	916.7	1,204.3
18	Xaisomboun	0.0	145.0	103.0	248.0	0.0	82.0	303.9	385.9	0.0	8.0	272.6	280.6	0.0	235.0	679.5	914.5
	Total	3,470.9	2,278.2	1,217.8	6,966.9	410.9	2,787.9	4,692.4	7,891.2	468.8	3,041.2	10,369.8	13,879.8	4,350.6	8,107.3	16,280.0	28,737.9
13-17	Study Area	974.9	657.9	412.5	2,045.3	332.8	1,150.4	1,458.8	2,942.0	161.4	1,173.7	4,967.4	6,302.5	1,469.1	2,982.0	6,838.7	11,289.8
	Study Area as % of Total	28.1	28.9	33.9	29.4	81.0	41.3	31.1	37.3	34.4	38.6	47.9	45.4	33.8	36.8	42.0	39.3

Source: MCTPC, 1ST August 2001
14 Savannakhet includes Route 9.
16 Champasack does not include Route 14 which is not National Road as of 2001.

As of the end of 2000, the total road length in five southern provinces was 11,290km, with 2,045km of national road and 2,942km of provincial road. The percentage distribution of national road in the study area was: **Savannakhet** 30, **Saravan** 21, **Sekong** 10, **Champasack** 22 and **Attapeu** 17 percent. The national road length was 975km paved, 658km gravel and 413km earth. While the five provinces contained 29.4 percent of the total national road length, it accounted for only **28.0 percent of the paved** length.

The unimproved national roads are impassable during the rainy season and some sections are barely passable during the dry season. This is a barrier to domestic and international trade, and has resulted in this part of Lao being poorer than much of the country.

2.2 Study Area Network

In early 2002, the Study Team reviewed the national road network in the five southern provinces for the purpose of the Study. The road network in the Study area and its upgrade

history is illustrated in Figure 2.2.1 and Table 2.2.1. The data for the five provinces shown in previous Table 2.1.1 are updated from the figures in Table 2.2.1. The Study team reviewed the road network and summarized it as shown in Table 2.2.1 for the Study, based on the following consideration:

(1) Route 14 located in Champasack Province is currently classified as a national road and is included in the national road network in the Study area.
(2) For the Study, Route 9 is a cordon line for traffic analysis and not part of the study road network.
(3) Different figures of road inventory are recorded by each organization, e.g. MCTPC and DCTPC. The Study Team has unified them for the purpose of the Study.

Study roads contain part or all of national Routes 1,13, 14, 15,16, 18 and 20, excluding Route 9. The total length of the study roads is **2025km**.

Although the national road network in the study area is planned to serve the whole area, there still exists virtually missing links on Routes 1G, 1J and 14A (total length: approx.122km), **some parts of the study roads become impassable in the rainy season** due to lack of bridges and drainage facilities. As a whole, the east-west routes have been relatively of a higher standard than the north-south routes such as Routes 1G, 1I (under improvement) and IJ. In particular, on Route 1G, two large-scale rivers (i.e., Xe-Bang Hiang and Xe-Done) prevent traffic from crossing for most of the year. In addition, routes running through the less inhabited or remote areas have also not been upgraded to all-weathered standard including Routes 18A and B, 16 (from Lamarm to Vietnam border) and 15 (Saravan to Vietnam border).

Attapeu and Sekong Provinces are amongst the least developed and have until recently lacked all-weather connections to the national road network. Champasack province is relatively more developed. **Pakse is the most important town and the regional center**. Communications between Pakse and the north and south of the country have been transformed by the paving of the main north-south highway Route13S from Savannakhet south to the Cambodian border, which was completed in mid - 2002. This project, together with the opening of the second bridge (**Pakse Bridge**) over the River Mekong at Pakse in November 2000 and the improvement of Route16 connecting it to the Thai border, should provide a springboard for the development of the whole of the southern region.

JICA、the ADB and the World Bank have assisted the GoL with its road infrastructure via grants and loans for such projects as the improvement of Routes 1I,9,13,16 and 20 and the

Pakse Bridge, as well as for the design for construction of the Second Mekong International Bridge in Savannakhet Province.

Table 2.2.1 Length of National Roads in Study Area (year 2002)

Route	Origin	Province	Destination	Province	Road Length (km)					
					Savannakhet	Saravan	Sekong	Champasack	Attapeu	Total
1 G	Junction of Route. 9	Savanakhet	Junction of Route 15	Saravan	67.0	63.0				130.0
1 H	Junction of Rou8te 15	Saravan	Junction of Route 20	Saravan		22.0				22.0
	Junction of Route 20	Saravan	Junction of Route 16	Sekong		12.0	10.5			22.5
1 I	Junction of Route 18	Sekong	Junction of Route 18 A	Attapeu			17.3		59.3	76.6
1 J	Junction of Route 16 B	Attapeu	Border of Cambodia	Attapeu					81.0	81.0
13 S	Junction of Route 9	Savannakhet	Border of Cambodia	Champasack	105.0	88.0		202.0		395.0
14 A	Phone Thong Dist.	Champasack	Border of Cambodia	Champasack				137.5		137.5
14 A1	Ban Ang Kham	Champasack	Ban Don Talath	Champasack				32.0		32.0
14 B	Junction of Route 16	Champasack	Border of Cambodia	Champasack				149.0		149.0
14 C	Ban Nong Nga	Champasack	M. Moonlapa -mok	Champasack				42.0		42.0
14 C1	Ban Hieng	Champasack	Ban Sam Kha	Champasack				23.0		23.0
14 C2	Ban Phong Photh	Champasack	Ban Nong Te	Champasack				6.0		6.0
15	Junction of Route 13 S	Saravan	Junction of Route 1H	Saravan		73.0				73.0
	Junction at Ban Phone Dou	Saravan	Border of Vietnam	Saravan		165.0				165.0
16	Border of Thailand	Champasack	Lamarm	Sekong			51.0	121.0		172.0
	Lamarm	Sekong	Border of Vietnam	Sekong			123.0			123.0
16 A	Junction of Route 16	Champasack	Junction of Route. 1 I	Champasack			12.0	59.0		71.0
18 A	Junction of Route 13 S	Champasack	Junction of Route 18 B	Attapeu				30.3	82.2	112.5
18 B	Junction of Route 18 A	Attapeu	Border of Vietnam	Attapeu					123.0	123.0
20	Junction of Route 16	Champasack	Junction of Route 1 H	Saravan		30.0		39.0		69.0
	TOTAL				172.0	453.0	213.8	840.8	345.5	**2,025.1**

Source: Study Team

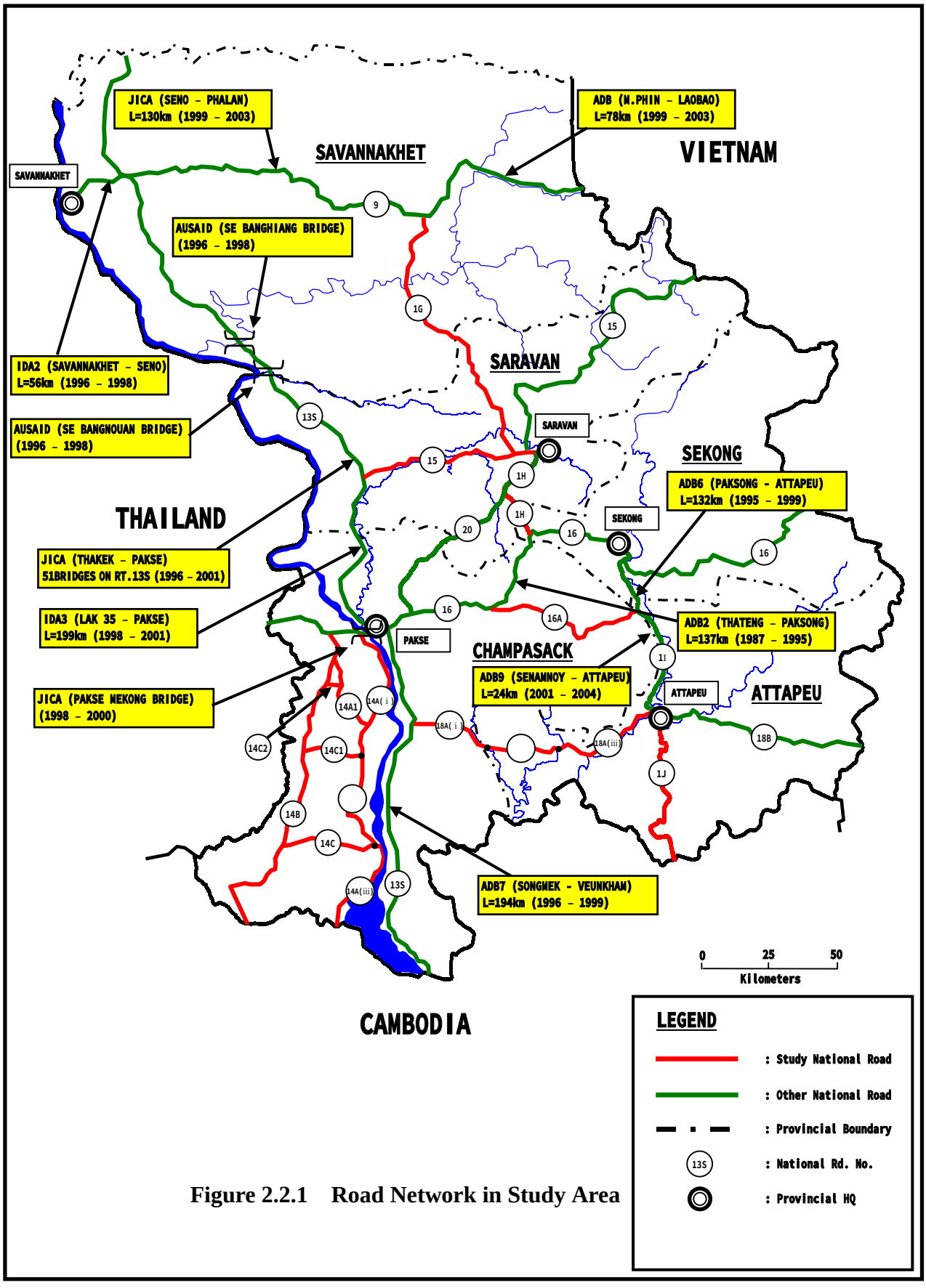


Figure 2.2.1 Road Network in Study Area

CHAPTER 3 SOCIO-ECONOMIC FRAMEWORK AND REGIONAL DEVELOPMENT

3.1 Traffic Analysis Zone and Administrative District

Formulating socio-economic framework is important in order to forecast the traffic demand and to examine how the road improvement contributes to the life of the residents and development of the study area. Among many relevant issues, this report deals with population, land use, economic growth, and vehicle ownership by district. These data processed in this section are used for the analysis of "Traffic Demand." These data and forecasts gives general picture of the each district i.e., Traffic Analysis Zone.

The spatial unit of the socioeconomic framework is Traffic Analysis Zone (TAZ). In this study, administrative districts are treated as TAZs. Districts are the smallest unit for public administration and very few data are readily available at the smaller level i.e. village. There are 42 districts in the study area (15 in Savannakhet, 8 in Saravan, 4 in Sekong, 10 in Champasack, and 5 in Attapeu). Since the Study copes with national road network, the size of districts is appropriate for the analysis of socioeconomic issues as well as traffic volume.

3.2 GDP

In 1986 a New Economic Mechanism was introduced to transform the economy from a centrally planned system to an open market system. GDP growth averaged 5.5 per cent during Socio-Economic Development Plan I 1981-1986; 4.5 per cent in the Second Plan 1986-1991; 6.4 per cent in Plan III 1991-1996; and 6.2 per cent in the Fourth Plan 1996-2001. The Plan IV growth target of 8.0-8.5 per cent was not achieved, primarily as a result of very high inflation and an unstable exchange rate in the period 1997-1999 following the collapse of the Thai economy. Inflation peaked in March 1999 at a year-on-year rate of 167 per cent. It is now under 10 per cent.

GDP per capita in dollar terms has fluctuated considerably with the exchange rate: US$414 in 1985, US$211 in 1990, US$380 in 1995 and US$330 in 2000.

The economy remains predominantly based on subsistence agriculture, which with fisheries accounted for 85 per cent of employment in the 1995 census and contributed an estimated 51 per cent of GDP in 2000. Half of the villages are isolated during the rainy season and rural income levels are low.

Since 1985, there has been a significant decline in the contribution to GDP of agriculture and forestry and a growth in the importance of the other sectors, as shown in Table 3.2.1. Annual

growth rates by sector for the last five years are given in Table 3.2.2. The trend is forecast to continue: the sector shares in 2005 are from Socio-Economic Development Plan V.

Table 3.2.1 Sectoral Contributions to GDP (in %)

Sector	1985	1990	1995	2000	2005
Agriculture and forestry	70.7	60.7	54.3	51.3	47.0
Industry and handicrafts	10.9	14.4	18.8	22.6	26.0
Services	18.4	24.9	26.9	26.1	27.0

Source: Socio-Economic Development Strategy Government, February 2001

Table 3.2.2 Sectoral Growth 1996-2000 (in %)

Sector	1996	1997	1998	1999	2000
Agriculture and forestry	2.8	7.0	3.1	8.2	5.1
Industry and handicrafts	17.3	8.1	9.2	7.9	7.5
Services	8.5	7.5	5.5	6.9	6.2
GDP	6.9	6.9	4.0	7.3	5.9
GDP/capita $ (current)	397	364	262	284	330

Source: Country Economic Review ADB August 2001

Rice is produced in all provinces, but the study area has a relatively high share, with 2000 production of 0.56 million tons, 25.3 per cent of the total crop. Its yield of 3.23 tons per ha was a little above the national average. Rice accounted for 87 per cent of national agricultural production (in tons) in 2000.

There is very little industry, with most of it handicrafts. There are only 665 establishments employing more than 10 people. Of these, 101 were located in the study area, half of them in Champasack.

A balanced approach to development is targeted in the *Socio-Economic Development Strategy*, with an indicative rate of GDP growth to 2020 of around 7 per cent per annum.

For master planning purposes, forecasts should be relatively conservative, given the current uncertain international situation. The Study Team has therefore considered the Strategy target to represent the top end of the forecasting range. The annual GDP growth rates used for vehicle fleet forecasting are given in Table 3.2.3.

Table 3.2.3 GDP Forecasts to 2020 (in % per annum)

Case	1999-2010	2010-2020
High	7.0	7.5
Central	6.0	6.0
Low	5.0	5.0

Source: Consultants

Tables 3.2.4 and 3.2.5 provide the most recent basic data for the 17 provinces and the

Xaisomboun special zone. The share represented by the four study provinces excluding Savannakhet Province, is shown for each indicator.

Table 3.2.4 Basic Statistics by Province (1)

No.	Province	Area Sq.Km.	Population Mid-2000	Density Pop/SqKm	Vehicle Registrations Mid-2000 M/Cycles	Motor Veh.	Total	Road Length End-2000 Km. Paved	Gravel	Earth	Total	Metre Paved+Gravel/ Sq.Km.	000 Pop.	Vehicles/ Km. Paved
1	Vientiane Municipality	3,920	597.8	152.5	81,307	25,748	107,055	380	1,197	342	1,918	402	2.6	282
2	Phongsali	16,270	174.4	10.7	775	196	971	134	322	172	628	28	2.6	7
3	Luang Nam tha	9,325	130.9	14.0	992	340	1,332	142	163	593	898	33	2.3	9
4	Oudomxai	15,370	239.8	15.6	1,747	444	2,191	321	65	976	1,362	25	1.6	7
5	Bokeo	6,169	129.6	21.0	1,911	318	2,229	16	121	495	632	22	1.1	136
6	Luang Prabhang	16,875	416.1	24.7	5,518	1,134	6,652	413	492	463	1,368	54	2.2	16
7	Houaphan	16,500	279.1	16.9	1,301	296	1,597	318	295	952	1,565	37	2.2	5
8	Sayaburi	16,389	332.8	20.3	1,075	270	1,345	51	255	1,636	1,942	19	0.9	26
9	Xieng Khouang	15,880	228.8	14.4	2,860	854	3,714	237	261	1,197	1,695	31	2.2	16
10	Vientiane	15,927	326.9	20.5	6,901	1,840	8,741	335	743	476	1,554	68	3.3	26
11	Borikhamxai	14,863	186.6	12.6	1,349	327	1,676	340	352	760	1,451	47	3.7	5
12	Khammouan	16,315	310.8	19.0	6,302	1,371	7,673	195	624	702	1,521	50	2.6	39
13	Savannakhet	21,774	766.2	35.2	21,486	4,638	26,124	866	1,166	1,818	3,850	93	2.7	30
14	Saravane	10,691	292.3	27.3	1,788	161	1,949	105	673	2,233	3,011	73	2.7	19
15	Sekong	7,665	73.2	9.5	476	131	607	52	70	766	888	16	1.7	12
16	Champassak	15,415	571.9	37.1	14,283	2,484	16,767	417	815	1,105	2,337	80	2.2	40
17	Attapeu	10,320	99.4	9.6	537	131	668	29	259	917	1,204	28	2.9	23
18	Xaisomboun	7,105	61.7	8.7	84	65	149	0	235	680	915	33	3.8	n.a.
	Total	236,773	5,218.3	22.0	150,692	40,748	191,440	4,351	8,107	16,280	28,738	53	2.4	44
	Study Area	44,091	1,036.8	23.5	17,084	2,907	19,991	603	1,816	5,021	7,440	55	2.3	33
	Study Area as % of Total	18.6	19.9	106.7	11.3	7.1	10.4	13.9	22.4	30.8	25.9	104.3	97.7	75.4

Sources: Basic Statistics of Lao PDR 2000 and MCTPC

Table 3.2.5 Basic Statistics by Province (2)

No.	Province	Population 000 Mid-2000	Urban %*	Rural % *	H'hlds 000 1998 Est.	Persons/ Household	Rice Production Area Ha'000	Yield T/Ha	000 T.	Veg/Beans 000 T.	Establish. >10 Pers.	Visits '000 in 2000
1	Vientiane Municipality	597.8	62.8	37.2	89.41	6.37	70.75	3.72	263.1	103.2	189	486.6
2	Phongsali	174.4	6.9	93.1	25.57	6.50	21.74	2.05	44.5	1.8	3	na
3	Luang Nam tha	130.9	17.1	82.9	20.28	6.15	19.22	2.40	46.2	12.6	9	24.8
4	Oudomxai	239.8	16.7	83.3	35.82	6.38	29.43	2.24	65.9	23.1	30	na
5	Bokeo	129.6	4.9	95.1	21.97	5.62	11.98	3.01	36.1	6.0	21	25.3
6	Luang Prabhang	416.1	10.1	89.9	63.58	6.23	43.71	2.19	95.7	39.5	9	165.2
7	Houaphan	279.1	6.4	93.6	35.91	7.40	26.69	2.37	63.2	9.0	5	na
8	Sayaburi	332.8	7.3	92.7	51.3	6.18	37.58	2.67	100.3	26.2	36	7.5
9	Xieng Khouang	228.8	6.3	93.7	36.85	5.91	25.01	2.59	64.7	16.5	12	na
10	Vientiane	326.9	16.4	83.6	51.77	6.01	46.83	3.32	155.5	69.8	61	na
11	Borikhamxai	186.6	5.7	94.3	29.83	5.96	38.49	2.95	113.6	77.9	53	35.7
12	Khammouan	310.8	14.7	85.3	52.14	5.68	43.16	3.38	145.9	65.1	31	13.7
13	Savannakhet	766.2	13.2	86.8	114.47	6.37	126.65	3.42	433.7	92.7	101	109.0
14	Saravane	292.3	5.8	94.2	46.6	5.97	56.06	3.18	178.1	26.2	22	na
15	Sekong	73.2	15.8	84.2	10.59	6.58	7.13	2.43	17.3	4.9	19	na
16	Champassak	571.9	11.9	88.1	87.46	6.23	91.68	3.41	312.7	56.6	51	34.8
17	Attapeu	99.4	5.1	94.9	17.66	5.36	17.32	2.81	48.7	3.9	9	na
18	Xaisomboun	61.7	7.7	92.3	8.07	7.28	6.08	2.72	16.5	1.1	4	na
	Total	5,218.3	16.7	83.3	799.3	6.22	719.51	3.06	2201.7	636.0	665	902.6
14-17	Study Area	1,036.8	9.8	90.2	162.3	6.08	172.19	3.23	556.8	91.5	101	na
	Study Area as % of Total	19.9	na	na	20.3	97.8	23.9	105.7	25.3	14.4	15.2	na

Source: Basic Statistics of Lao PDR 2000

Note: * as of mid-1997

3.3 Population

The last national census was held in March 1995, recording a population of 4.575 million. With the estimated mid-2000 figure 5.218 million, population has been growing at an annual average rate of 2.54 per cent since the census. The population is relatively young, with an estimated 54.2 per cent aged under 20 in mid-2000. Two National Statistical Center population forecasts were prepared on the basis of the 1995 census data: Alternative 1 with a continuation of fertility and mortality rates unchanged and Alternative 2, with a gradual decline in both fertility and infant mortality. Fertility does now seem to be declining: in mid-2000 685,000 were aged 0-4 years compared with 807,000 aged 5-9 years.

Table 3.3.1 shows the Alternative 1 and 2 forecasts as well as the Government's *Socio-Economic Development Strategy* paper of February 2001, at five-yearly intervals .

Table 3.3.1 Population Forecast to 2020

Forecast	Forecasted Population						Growth Rate % per Annum				
	1995	2000	2005	2010	2015	2020	1995-00	2000-05	2005-10	2010-15	2015-20
Alternative 1	4,575	5,193	5,916	6,752	7,694	8,738	2.57	2.64	2.68	2.64	2.58
Alternative 2	4,575	5,146	5,763	6,415	7,069	7,687	2.38	2.29	2.17	1.96	1.69
Socio-Economic Strategy Feb. 2001	4,575	5,218	5,900	6,700	na	8,300	2.67	2.49	2.58	na	na
Consultants' High	4,575	5,218	5,930	6,730	7,600	8,500	2.67	2.59	2.56	2.46	2.26
Consultants' Central	4,575	5,218	5,900	6,660	7,450	8,300	2.67	2.49	2.45	2.27	2.18
Consultants' Low	4,575	5,218	5,860	6,520	7,200	7,900	2.67	2.35	2.16	2.00	1.87

The Study Team's high, central and low forecasts to 2020 are also given in Table 2.2.7.

For master planning purposes, the same growth rates have been applied for each province and district. The forecast of provincial populations in the study area is given in Table 3.3.2.

Table 3.3.2 Population Forecast - Study Area (in '000)

Province	2000	2005	2010	2015	2020
Saravan	292.3	330.5	373.1	417.4	464.9
Sekong	73.2	82.8	93.4	104.5	116.4
Champasack	571.9	646.8	730.0	816.7	909.7
Attapeu	99.4	112.4	126.9	141.9	158.1
Total	**1037**	**1173**	**1323**	**1480**	**1649**
Index 2000=100	100.0	113.1	127.6	142.7	159.0

Source: Study Teams' central forecast

Figure 3.3.1 illustrates the spatial distribution of population. Each red spot indicates a village, and scale of the spot represents the size of village. Green lines represent national roads. Improvement of a national road where more red spots are concentrated can benefit more beneficiaries. Figure 3.3.2 shows the present land use of the study area.

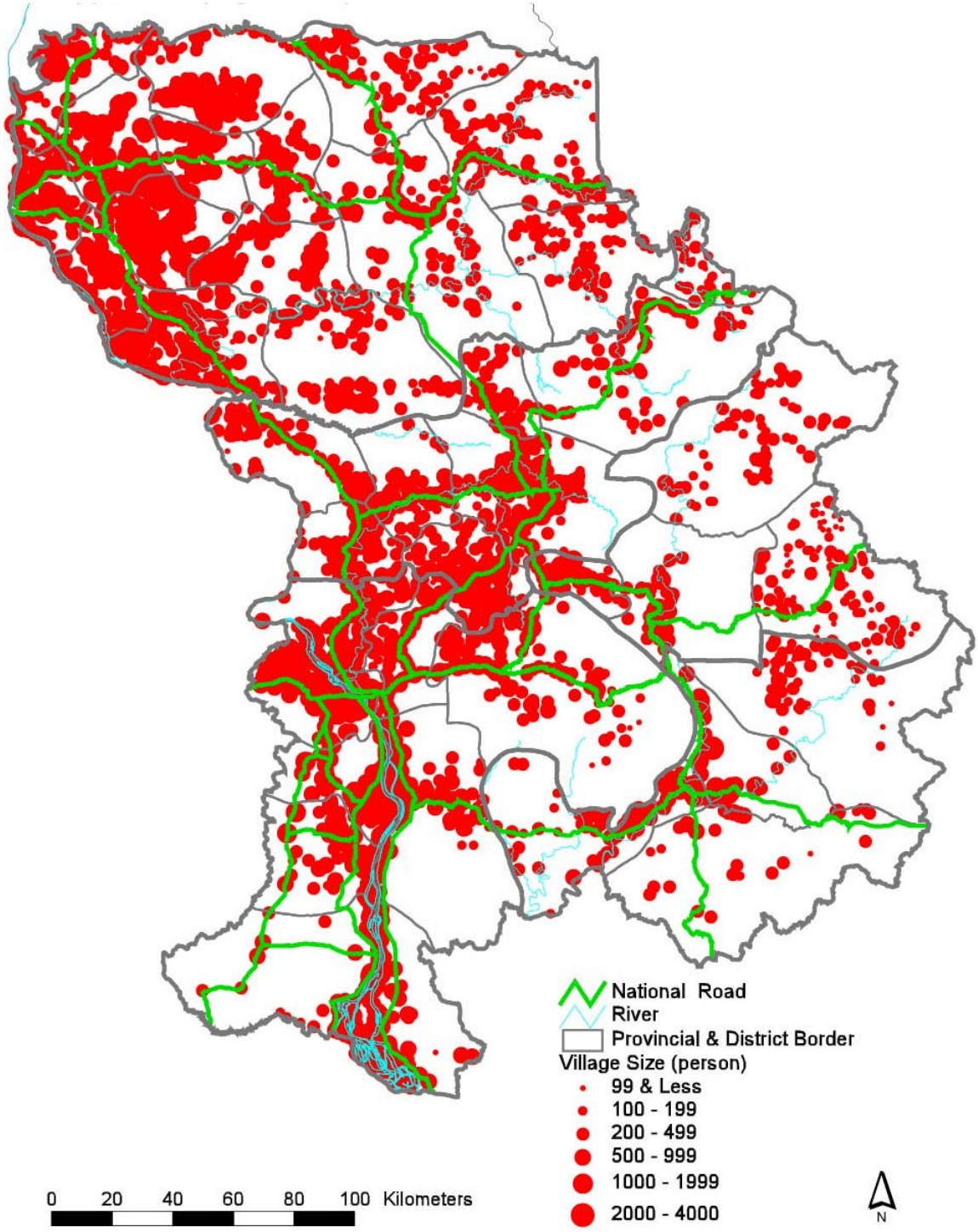


Figure 3.3.1 Distribution of Total Population in the Study Area

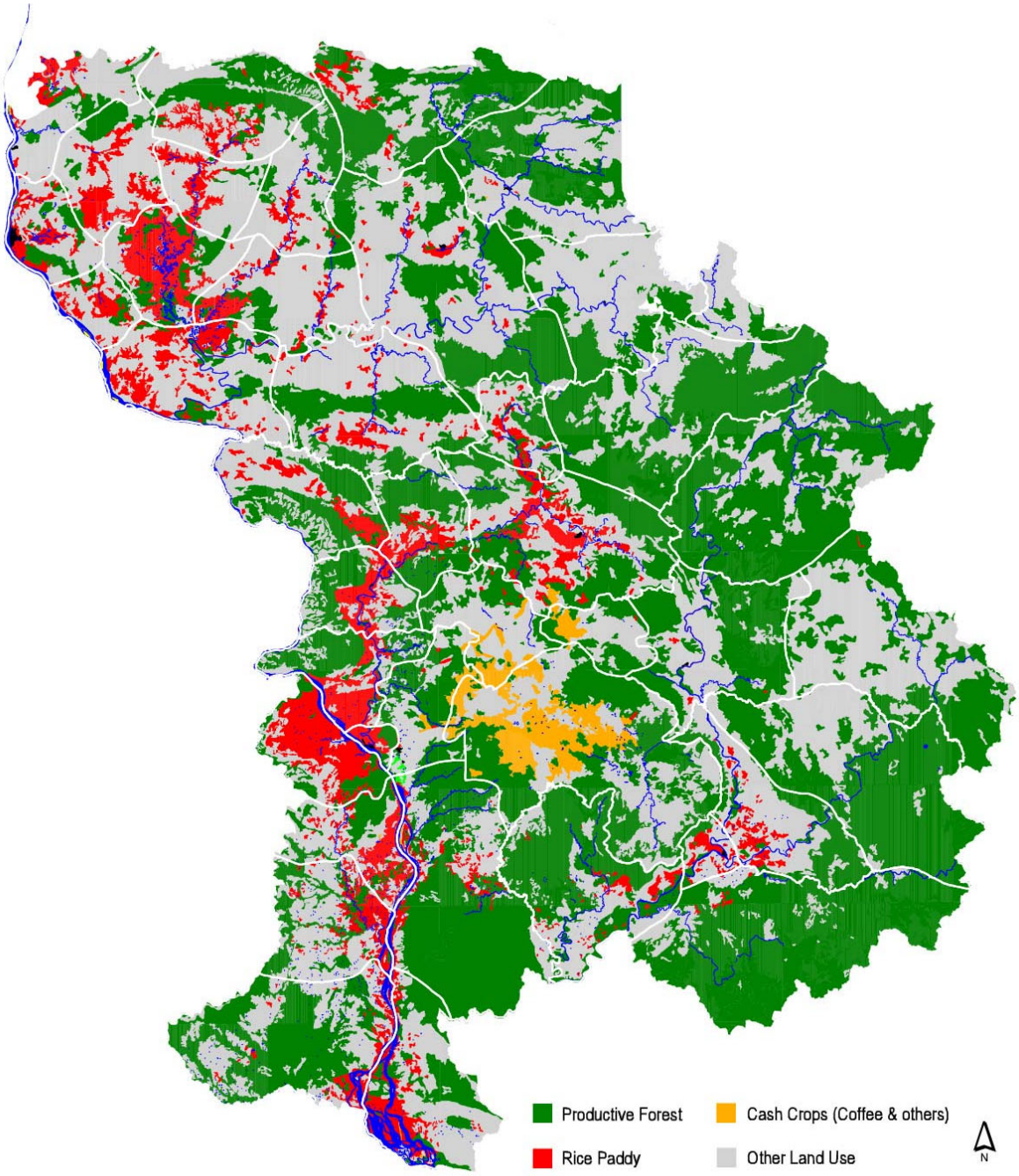


Figure 3.3.2 Present Land Use of the Study Area

3.4 Vehicle Ownership

The composition of the vehicle fleet by province in mid-2000 is given in Table 3.4.1. Motorcycles and tuk-tuks accounted for 79 per cent of the fleet. Vientiane is an order of magnitude more motorized than the rest of the country, with 43 motor vehicles vehicle (motorized four-wheeled) per thousand population (179 including motor-cycles and tuk-tuks), compared with 6 (34) per thousand in Savannakhet, the next highest province. The study area average is just 3 (19) per thousand. Pick-ups are the most numerous motor vehicle type, accounting for 35 per cent of motor vehicle registrations, compared with 25 per cent trucks and 22 per cent cars. There were, however, 10 motorcycles registered for each pick-up.

Table 3.4.1 Vehicle Fleet by Province Mid-2000

No.	Province	Motor Cycle	Tuk -Tuk	Car	Pick -Up	Van	Jeep	Truck	Bus	Total	Veh/000 Pop.	Veh/000 Pop.*
1	Vientiane Municipality	78,980	2,377	7,214	8,215	1,182	2,109	5,870	1,108	107,055	179	43.0
2	Phongsali	745	30	9	105	16	44	18	4	971	6	1.1
3	Luang Namtha	982	10	13	156	21	70	70	10	1,332	10	2.6
4	Oudomxai	1,735	12	15	317	17	51	41	3	2,191	9	1.9
5	Bokeo	1,907	4	12	194	10	33	56	13	2,229	17	2.5
6	Luang Prabhang	5,357	161	169	568	60	206	117	14	6,652	16	2.7
7	Houaphan	1,295	6	16	86	8	79	103	4	1,597	6	1.1
8	Sayaburi	1,056	19	13	147	13	12	71	14	1,345	4	0.8
9	Xieng Khouang	2,775	85	129	159	35	139	356	36	3,714	16	3.7
10	Vientiane	6,729	172	116	687	82	142	694	119	8,741	27	5.6
11	Borikhamxai	1,284	65	49	94	12	23	133	16	1,676	9	1.8
12	Khammouan	6,108	194	223	279	49	112	593	115	7,673	25	4.4
13	Savannakhet	20,850	636	444	2,353	240	533	942	126	26,124	34	6.1
14	Saravane	1,774	14	9	48	12	15	66	11	1,949	7	0.6
15	Sekong	464	12	17	34	8	13	46	13	607	8	1.8
16	Champassak	13,872	411	327	801	86	372	733	165	16,767	29	4.3
17	Attapeu	514	23	9	30	6	16	56	14	668	7	1.3
18	Xaisomboun	80	4	5	21	6	11	17	5	149	2	1.1
	Total	146,507	4,235	8,789	14,294	1,863	3,980	9,982	1,790	191,440	37	7.8
14-17	Study Area	16,624	460	362	913	112	416	901	203	19,991	19	2.8
	Study Area as % of Total	11.3	10.9	4.1	6.4	6.0	10.5	9.0	11.3	10.4	52.6	36.0

Source: MCTPC
Note: * excluding motorcycles and tuk-tuks.

Table 3.4.2 shows the development of the fleet by type of vehicle. Growth in the period 1990-1999 totaled 84 per cent for motor vehicles and 152 per cent for motorcycles and tuk-tuks, an overall fleet growth of 134 per cent. The growth in GDP for the period was 74 per cent. This gives elasticity to GDP for 1990-1999 of 1.14 for motor vehicles and 2.06 for motorcycles and tuk-tuks. With Vientiane being a special case, it is also necessary for forecasting purposes to consider the development of the non-Vientiane fleet separately. This is shown in Table 3.4.3.

Table 3.4.2 National Vehicle Fleet 1990-2000 (in '000)

Class of Vehicle	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000*
Car	5.73	6.13	6.36	6.63	7.02	7.59	7.80	8.06	8.29	8.62	8.79
Pick-Up	5.98	6.46	6.96	7.64	8.39	9.86	10.65	11.67	12.71	13.64	14.29
Jeep	1.09	1.17	1.28	1.47	1.72	2.10	2.44	2.74	3.17	3.74	3.98
Van	0.47	0.50	0.55	0.69	0.81	0.96	1.08	1.22	1.41	1.69	1.86
Truck	7.86	7.95	8.09	8.16	8.50	7.71	8.12	8.47	8.86	9.50	9.98
Bus	^	^	^	^	^	1.67	1.67	1.69	1.72	1.78	1.79
Sub-total	21.14	22.21	23.24	24.58	26.44	29.90	31.77	33.86	36.16	38.96	40.70
Motor-cycle	57.88	64.69	71.73	78.57	90.52	104.88	120.37	132.55	141.68	143.85	146.51
Tuk-tuk	0.90	0.94	0.99	1.79	2.68	3.83	4.16	4.22	4.24	4.24	4.24
Sub-total	58.78	65.64	72.73	80.35	93.19	108.71	124.54	136.77	145.91	148.08	150.74
Total	79.91	87.85	95.97	104.94	119.64	138.61	156.30	170.63	182.07	187.04	191.44
As Indices 1990 = 100.0:											
Motor vehicles	100.0	105.1	110.0	116.3	125.1	141.4	150.3	160.2	171.1	184.3	192.5
Motor-cycles/Tuk-tuks	100.0	111.7	123.7	136.7	158.6	185.0	211.9	232.7	248.3	251.9	256.5
All vehicles	100.0	109.9	120.1	131.3	149.7	173.4	195.6	213.5	227.8	234.1	239.6
GDP	100.0	104.0	111.2	117.8	127.4	136.4	145.9	156.0	162.1	173.9	183.9
Cumulative Elasticity to GDP:											
Motor vehicles	na	1.27	0.89	0.92	0.92	1.14	1.10	1.07	1.14	1.14	1.10
Motor-cycles/Tuk-tuks	na	2.92	2.12	2.06	2.14	2.33	2.44	2.37	2.39	2.06	1.86
All vehicles	na	2.48	1.79	1.76	1.81	2.02	2.08	2.03	2.06	1.81	1.66

Source: MCTPC

Note: * mid-year, other figures end-year

The fleet growth 1990-1999 excluding Vientiane was higher: 98 per cent for motor vehicles, 204 per cent for motorcycles and tuk-tuks and 179 per cent overall. Elasticity to GDP were 1.33 for motor vehicles and 2.76 for motorcycles and tuk-tuks.

Table 3.4.3 Vehicle Fleet Excluding Vientiane 1990-1999 (in '000)

Class of Vehicle	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Car	0.95	1.02	1.06	1.10	1.17	1.27	1.36	1.45	1.63	1.55
Pick-Up	2.38	2.57	2.77	3.00	3.30	3.89	4.30	5.04	5.80	5.82
Jeep	0.49	0.53	0.58	0.65	0.74	0.87	1.07	1.36	1.68	1.77
Van	0.19	0.20	0.23	0.26	0.29	0.34	0.38	0.46	0.61	0.62
Truck	3.22	3.25	3.31	3.34	3.49	3.17	3.33	3.50	3.82	3.92
Bus	^	^	^	^	^	0.67	0.69	0.64	0.66	0.68
Sub-total	7.23	7.58	7.94	8.35	8.99	10.21	11.13	12.44	14.19	14.35
Motor-cycle	22.11	24.72	27.41	30.02	34.55	44.99	53.25	62.18	68.57	66.46
Tuk-tuk	0.34	0.36	0.38	0.68	1.01	1.64	1.83	1.85	1.87	1.86
Sub-total	22.46	25.08	27.78	30.70	35.56	46.63	55.08	64.03	70.44	68.32
Total	29.69	32.65	35.72	39.05	44.55	56.84	66.21	76.48	84.63	82.66
As Indices 1990 = 100.0:										
Motor vehicles	100.0	104.8	109.8	115.4	124.3	141.3	153.9	172.1	196.2	198.4
Motor-cycles/Tuk-tuks	100.0	111.7	123.7	136.7	158.4	207.7	245.3	285.2	313.7	304.2
All vehicles	100.0	110.0	120.3	131.5	150.1	191.5	223.0	257.6	285.1	278.5
GDP	100.0	104.0	111.2	117.8	127.4	136.4	145.9	156.0	162.1	173.9
Cumulative Elasticity to GDP:										
Motor vehicles	na	1.20	0.87	0.87	0.89	1.13	1.18	1.29	1.55	1.33
Motor-cycles/Tuk-tuks	na	2.92	2.12	2.06	2.13	2.96	3.17	3.31	3.44	2.76
All vehicles	na	2.50	1.82	1.77	1.83	2.51	2.68	2.81	2.98	2.41

Source: MCTPC

A General Traffic Forecast 1998-2010 was prepared in 1998 as part of the Third Highway Improvement Project, under a TA to the Planning and Technical Division of the Department of Roads. This related fleet growth to GDP growth rates of 5.0 per cent (low); 6.0 per cent (medium) and 8.0 per cent (high). Elasticity to GDP of 2.0 for motorcycles, 1.3 for cars and 1.05 for trucks were assumed.

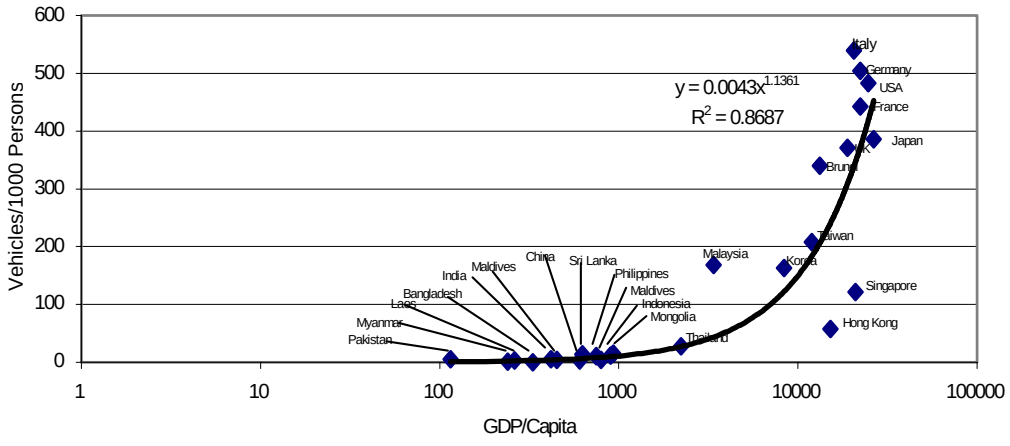
The Study Team has developed vehicle fleet forecasts to 2020 on a similar basis. Venetian's development is much earlier than the rest of the country and its ownership will approach saturation in motor-cycle and tuk-tuk ownership during the forecasting period. It is also expected to have lower elasticity for motor vehicles. In the other provinces, the substantial improvements to the road system recently completed or underway are expected to stimulate motor vehicle fleet growth from its existing very low base level.

Elasticity to GDP has been increased only slightly after 2010. GDP per capita outside Vientiane (including in the study area) will not (during the forecasting period) reach the level at which explosive growth[1] in motor vehicle ownership can occur. By 2020 GDP per capita is forecast to be US$810.

Table 3.4.4 presents the Study Team's GDP forecasts, the assumed elasticity and the resulting vehicle forecasts for motor vehicles and for motor-cycles / tuk-tuks. The number of vehicles per thousand populations is also shown, for the central population forecast. The elasticity is related to the GDP growth rate: higher GDP growth will result in a higher elasticity, for the

[1] GDP/capita and vehicle ownership are related. As GDP/capita increases from US$1,000 to US$10,000, an explosive growth in the vehicle fleet is expected. Vehicle ownership grows much faster than GDP/capita, in other words, elasticity of vehicle ownership to GDP/capita increases. However, in the study area, GDP/capita does not reach the explosive point at all. A graph shown below illustrates the relation between GDP/capita and vehicle ownership. Lao PDR is in a group of low GDP where elasticity is rather stable. Forecast elasticity for every five years until 2020 is given in Table 3.4.4. The forecast vehicle fleet growth rate is also given in Table 3.4.4.

GDP/Capita and Vehicle Ownership



same level of vehicle ownership. The combined impact of GDP and elasticity results in a large range between the low and the high forecasts by 2020, particularly for the non-Vientiane fleet.

Table 3.4.4 GDP and Vehicle Fleet Forecast to 2020

Item	Growth	1999	2005	2010	2015	2020	Growth Rate % pa 1999-05	2005-10	2010-15	2015-20	Forecast Vehicle Fleet '000 1999	2005	2010	2015	2020	Vehicles/'000 Population * 1999	2005	2010	2015	2020
GDP Index 1999=100.0	High	100.0	150.1	210.5	302.2	433.8	7.0	7.0	7.5	7.5										
	Central	100.0	141.9	189.8	254.0	340.0	6.0	6.0	6.0	6.0										
	Low	100.0	134.0	171.0	218.3	278.6	5.0	5.0	5.0	5.0										
Elasticity to GDP:																				
Vientiane Motor Vehicles	High	na	1.10	1.10	1.20	1.20	7.6	7.6	8.8	8.8	24.6	38.2	55.1	83.9	127.7	42.1	56.5	72.2	98.3	134.4
	Central	na	1.05	1.05	1.10	1.10	6.3	6.3	6.5	6.5	24.6	35.4	48.0	65.9	90.4	42.1	52.4	62.9	77.2	95.1
	Low	na	1.00	1.00	1.05	1.05	5.0	5.0	5.2	5.2	24.6	33.0	42.1	54.3	70.1	42.1	48.8	55.2	63.7	73.8
Vientiane M/cs Tuk-tuks	High	na	1.00	0.90	0.70	0.50	7.0	6.4	5.5	4.0	79.7	119.6	163.0	212.7	259.0	136.5	177.0	213.6	249.3	272.6
	Central	na	1.00	0.90	0.75	0.65	6.0	5.5	4.6	4.1	79.7	113.1	147.5	184.9	225.6	136.5	167.3	193.3	216.8	237.4
	Low	na	0.95	0.90	0.80	0.75	4.8	4.5	4.1	3.8	79.7	105.5	131.7	160.8	194.1	136.5	156.0	172.6	188.5	204.3
Elasticity to GDP:																				
Non-Vientiane Motor Vehicles	High	na	1.40	1.40	1.50	1.50	9.3	9.4	10.6	10.6	14.4	24.4	38.2	63.1	104.3	3.2	4.7	6.5	9.6	14.2
	Central	na	1.30	1.30	1.40	1.40	7.5	7.6	8.1	8.1	14.4	22.2	31.9	47.0	69.3	3.2	4.2	5.4	7.1	9.4
	Low	na	1.20	1.20	1.30	1.30	5.9	5.9	6.3	6.3	14.4	20.2	26.9	36.6	49.7	3.2	3.9	4.6	5.5	6.8
Non-Vientiane M/cs Tuk-tuks	High	na	2.10	2.10	2.00	1.90	12.7	13.0	13.4	12.8	68.3	140.2	258.6	484.0	884.6	15.1	26.8	43.9	73.4	120.4
	Central	na	2.10	2.10	2.10	2.00	11.1	11.3	11.3	10.9	68.3	128.4	219.5	375.5	629.5	15.1	24.6	37.2	56.9	85.6
	Low	na	2.10	2.10	2.10	2.10	9.4	9.6	9.6	9.6	68.3	117.1	185.1	292.4	462.1	15.1	22.4	31.4	44.3	62.9
Total Motor Vehicles	High						8.2	8.3	9.5	9.6	39.0	62.6	93.2	147.0	232.0	7.6	10.6	14.0	19.7	28.0
	Central						6.7	6.8	7.2	7.2	39.0	57.6	79.9	112.9	159.6	7.6	9.8	12.0	15.2	19.2
	Low						5.3	5.3	5.7	5.7	39.0	53.2	69.0	90.9	119.8	7.6	9.0	10.4	12.2	14.4
Total M/cs and Tuk-tuks	High						9.8	10.2	10.6	10.4	148.0	259.8	421.6	696.7	1143.6	29.0	44.0	63.3	93.5	137.8
	Central						8.5	8.7	8.8	8.8	148.0	241.4	367.0	560.4	855.0	29.0	40.9	55.1	75.2	103.0
	Low						7.0	7.3	7.4	7.7	148.0	222.6	316.8	453.2	656.2	29.0	37.7	47.6	60.8	79.1

Source: Consultants
Note: * With central population forecast

Assuming that the study area fleet grows at the same rate as that of the non-Vientiane fleet, the fleet forecast would be as given in Table 3.4.5.

Table 3.4.5 Study Area Vehicle Fleet Forecast (in '000)

Item	1999	2005	2010	2015	2020
Motor vehicles					
High	2.78	4.71	7.37	12.2	20.1
Central	2.78	4.29	6.16	9.1	13.4
Low	2.78	3.90	5.19	7.1	9.6
Vehicles per 1,000 population:					
Central	2.7	3.7	4.7	6.1	8.1
Motor-cycles / Tuk-tuks:					
High	16.8	34.4	63.5	118.9	217.6
Central	16.8	31.5	53.9	92.3	154.7
Low	16.8	28.8	45.5	71.9	113.5
Vehicles per 1,000 population					
Central	16.6	26.9	40.7	62.3	93.8

3.5 Regional Development

There are some important projects planned or under implementation in the Study area. Five major projects discussed here are;

(a) Urban Development Project,
(b) Focal Site Project,
(c) Rice Irrigation Project, and
(d) Hydrological Power Plant Development, and
(e) Boloven Plateau Agriculture Development.

Among them, (1), (3) and (5) facilitate further development of already-prosperous areas, while (2) and (4) spur the improvement rather disadvantaged and isolated areas.
Route 1J relates with (1), (2) and (4). Route 1H relates with (1) and (2). Route 14A relates with (1),(2) and (3). Route 16A encourages (5). Route 18A relates with (1),(2) ,(3)and (4).

The very basis of the development strategy of the study area is to enhance the competitive advantages by formulating growing network among core cities (**Pakse as the super core**), and to apply social, agricultural, and environmental policy to the rural areas.
Developing strategy is broken down by sectors and shown below.

(1) Development of Growing Cores

(1-1) Industry and Commerce

First of all, southern Lao needs growing cores. The super core is **Pakse** city and its surroundings, with satellite cores like Saravan, Sekong, and Attapeu. These centers lead the economic development of the area and the nation. More and more public and private investment shall be implemented for a better return in the sector of industry and commerce. The area along the Mekong River would be the pole of economic growth. This artery leads the economic growth and drives the region to the next stage.

(1-2) Agriculture and Tourism

Sufficient agricultural products are the very basis of the prospective economic development. **Pakse and its surroundings** can produce **stable agricultural surplus** (mostly rice) that can support the development of the whole southern Lao. More investment and improved management is required for advanced agriculture. In addition, major tourism resources are concentrated in Champasack Province. Efficient organization and arrangement of area tourism have a big possibility to bring in significant amount of foreign currency. A master plan to improve the tourism is needed beside the active investment in tourism.

(1-3) Public Investment for Infrastructure and Others

Roads and electric power plants shall be constructed or improved as soon as possible. However, the most important criterion for prioritizing is cost-benefit performance. Concentrated road improvement and electric power distribution in the growing cores will effectively enhance the development of the centers.

(1-4) International Trade

International trade could drastically change the local economy either positively or negatively. The international connection to Vietnam via Route 15east, Route16east, and Route 18B will extensively vitalize the economic condition of the Pakse and other cities. International transportation should be improved to achieve the prosperity of the Greater Mekong Region, which brings great benefits to the Study area also.

(2) Poverty Reduction

While encouraging the growing core, poverty reduction in remote areas is one of the most important issues of the nation. **Food security, primary education, primary health care, accessibility** should be improved to the acceptable stage. Since the resource allocation for the social development is very limited, relevant projects should employ community participation methods.

(3) Market Oriented Agriculture, Fishery and Livestock

As farmland and yield are growing, farmers expect more and more product surplus. To connect this to further development, farmers should be more price-conscious. This will facilitate farmers to come out of subsistence agriculture. Cash crops of the **Boloven Plateau** will lead this effort.

(4) Infrastructure Network

Infrastructure network such as to connect every district capital with all weather roads should be a goal of mid-long term development plan. This expensive attempt includes not only national roads but also provincial ones. However, MCTPC and DCTPC should carefully examine the anticipated economic performance of their investment.

(5) Sustainable Forestry

In case of year 2000, timber and furniture earn US$26,293,738 and covers 77.9% of the total value exported from the provinces in the Study area. Cutting trees or selling forest concession to the private sector is one of the easiest ways to get revenue to the government account. Nevertheless, **forestry should be managed** in the most conservative manner. Since long years

are required to grow a tree for timbers and many of the local communities are rely on the forest, mainly on the non-wood forest products. Forestry needs long-tern and well-planned investment, and if appropriately managed this sector brings sustainable income to the area.

Figure 3.5.1 shows spatial distribution of the major development projects. National road network as corridor or axis for well-balanced development should be developed.

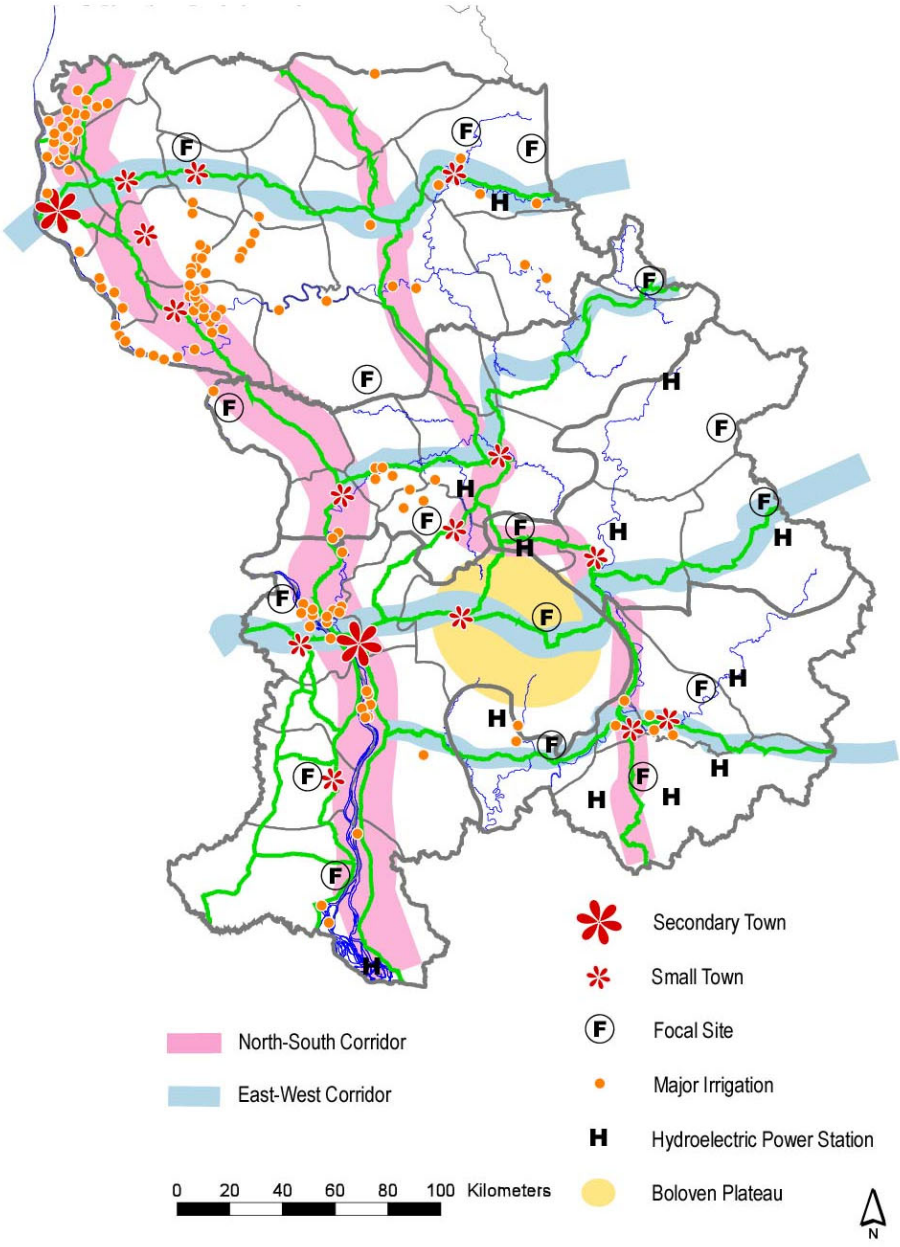


Figure 3.5.1 Spatial Distribution of Major Development Projects and National Roads

CHAPTER 4 MASTER PLAN AND MOST APPROPRIATE ROAD IMPROVEMENT PROJECTS FOR FEASIBILITY STUDY

4.1 Master Plan Concept

The southern part of the country is expected to **serve as a bridge to integrate neighboring ASEAN countries** (Thailand, Vietnam and Cambodia) to stimulate **economic growth**. The poor condition of the transport network in the region **hinders poverty reduction efforts and stifles economic growth**.

The study focuses on the following aspects.

- Basis Access, providing reliable all-weather access for people living in isolated areas, to reduce poverty
- The role of international / regional corridor, providing new and important road links

The study undertakes a **Multi-Criteria Analysis (MCA) approach** which integrates economic evaluation of road investments using conventional Cost Benefit Analysis(CBA), with its enhancements criteria on **socioeconomic impacts**, **environmental impacts**, etc. Multi-criteria analysis (MCA) can incorporate not only cost + benefit + impact, but socioeconomic impacts and environmental impacts. Cost-Benefit Analysis (CBA) is a comprehensive accounting of all real costs and benefits associated with a project. In the case of road projects, this includes users and non-users, as well as road agency costs. Where the impact on non-users is negligible, a CBA of road alternatives centers around the trade-offs between total life-cycle costs of infrastructure (i.e., capital and maintenance) and user costs and benefits (e.g., vehicle operating cost and time savings). The enhancements of the CBA are aimed at finding broader measures of benefits and cost applicable in case of a **low-volume** traffic road.

4.2 Road Links to be Improved

The road improvement projects have been selected from among national road links in the southern region that are not passable for 12 months, excluding links which have already been committed for implementation i.e., Route No.15 (Junction at Ban Phone Dou – Vietnam Border), Route No.16 (Lamarm – Vietnam Border) and Route No.18B in the study area.

This chapter presents a Master Plan for road improvement in the southern region of Lao P.D.R., which prioritizes projects up to 2020 and selects the most appropriate road projects to be

improved by the year 2007 for further consideration in the Feasibility Study. The Master Plan covers only national roads in the four southern provinces of Champasack, Saravan, Sekong, and Attapeu (together with Route 1G south of Route 9 in Savannakhet).

The 2025 km national road network of the Study area connects all of the South's provincial centers, is potentially an efficient network. In conjunction with Route 9, this network is capable of adequately providing for likely future cross-border and transit movements between Laos, Thailand, Cambodia and Vietnam. That is no network deficiencies have been identified that would require the development of new routes in the area before 2020. The priority is therefore to upgrade existing roads and to complete missing road links and bridges to allow the network to function fully for 12 months a year. Network capacity, other than single-lane bridges at some locations, is not seen as a constraint before 2020.

The study area's basic paved road network connecting provincial capitals and to the borders of the three neighboring countries is largely complete and will be completed by already committed projects. The three outstanding objectives for the network are:

- to restore Route 1 as a north-south route (233.5km of this route have been evaluated);
- to improve access for areas west of the Mekong (389.5km); and
- to further improve east-west links (256.5km).

Some 43 per cent of the national road network (879.5 km) in the Study area has been evaluated for improvement, together with specific bridges. Of this length, 122 km is currently impassable, while the remainder consists of earth and gravel roads of widely varying standards together with one short paved stretch. The remaining 1,145 km of network has either been paved, is being paved, or will be paved via a project with an identified funding source.

The selected roads comprise **16 routes** or links of 879.5 km total length out of the 2025.1 km of national roads in the study area. The present road conditions and characteristics of these roads are summarized in Tables 4.2.1.

Table 4.2.1 Candidate Roads for Improvement

Route	Origin	Destination	Length (km)	Summary of Road Conditions
1G	JCT. of Rt. 9	JCT. of Rt. 15	130.0	Including 32 km missing link. Bad conditions through the whole section
1H	JCT. of Rt. 20	JCT. of Rt. 16	22.5	Improved road with a gravel surface
1J	JCT. of Rt. 18B	Border of Cambodia	81.0	Including 65 km missing link
14A(i)	Phong Thoth Dist.	Ban Sam Kha	54.0	Including 25 km missing link. Agriculture potential is rich. Wat Phou will be World Heritage
14A(ii)	Ban Sam Kha	JCT. of Rt. 14C	51.5	Vehicles can pass for only 2 months at Houay Kamouan River.
14A(iii)	M. Moonlapamok	Border of Cambodia	32.0	Many rivers cross the route.
14A1	Ban Ang Kham	Ban Don Talath	32.0	Fair condition through the route.
14B	JCT. of Rt.16	Border of Cambodia	149.0	The first 11.2 km of the road has been improved with gravel surface.
14C	Ban Nong Nga	M. Moonlapamok	42.0	The road has been improved with gravel surface at some sections.
14C1	Ban Hieng	Ban Sam Kha	23.0	The road has been improved with gravel surface at some sections.
14C2	Ban Phone Photh	Ban Nong Te	6.0	Improved road with gravel surface.
15	JCT. of Rt. 13S	JCT. of Rt. 1H	73.0	Improved road with gravel surface.
16A	JCT. of Rt. 16	JCT. of Rt. 1I	71.0	The road passes through the Boloven Plateau and mountainous area.
18A(i)	JCT. of Rt. 13S	Border of Province	30.6	Fair condition through the route
18A(ii)	Border of Province	Xe Piane River	39.7	Two big rivers cross the route. Bad conditions through the whole section
18A(iii)	Xe Piane River	JCT. of Rt. 18B	42.2	Fair condition through the route

Source: Study Team

4.3 Preferred Road Links and Bridges

Twelve road projects and four bridge projects were selected as potential road improvement projects. In consideration of the big disparities in economic viability, as well as to their lengths, Routes 14A and 18A were divided into three sub-links for economic analysis.

The projects (except for the four bridges) were evaluated by conventional **cost-benefit** analysis and evaluation was carried out by applying a rating system based on the following factors:

- **Socio-Economic (Regional Development)Impacts**
- **Environmental Impacts**

The relative impacts for each road link were first evaluated using a non-metric grading system (i.e., A,B,C, etc.). The assigned grades for each of the factors were then converted into metric scores (see Table 4.3.1).

Table 4.3.1 Grade and Score

A^+	98	A	95	A^-	92
B^+	88	B	85	B^-	82
C^+	78	C	75	C^-	72
D^+	68	D	65	D^-	62
E^+	58	E	55	E^-	52

Based on the analyzed data, the grade and corresponding score of the impact of each candidate road link and bridge are summarized in Table 4.3.2. The most appropriate project for implementation was selected based on the sum of these scores. The road links and/or bridges with the highest total number of points were considered to be the most appropriate projects for implementation. Notice that the table provides four weighting systems that reflect different orders of priority. Determining weighting in some instances is a function of national priorities coupled with regional and local interests. The Study Team notes the following targets set forth in the 'Fifth Five-Year Socio-Economic Development Plan,' which indicate the strong set of positive socio-economic impacts that road improvement will have in southern Lao:

- **to realize continued economic growth,**
- **to reduce current poverty levels by half,**
- **to achieve food security,**
- **to eliminate slash-and-burn cultivation,**
- **to pay serious attention to both state and private enterprise reform, and to develop human resources in various sectors.**

The intent here is to provide sufficient information to decision-makers to make informed choices based on an understanding of the impacts that different sets of weights have on road and bridge prioritization.

The highest-ranking projects in terms of cost-benefit impacts are road link **14Ai** and Route **16A**. In terms of socio-economic impacts, road link 18Ai, ii and iii are evaluated the highest. For environmental impacts, road links 1H, 14A1, 14B, 14C2 and 15 had the least impact and therefore are highly rated.

Table 4.3.2 Overall Impacts

Route and Bridge	Cost-Benefit Impacts	Socio-Economic Impacts	Environ-mental Impacts	Total Score			
				Weight (equally)	Weight (C:S:E) (40:40:20)	Weight (C:S:E) (45:35:20)	Weight (C:S:E) (35:45:20)
	(C)	(S)	(E)	Case 1	Case 2	Case 3	Case 4
1G	D 65	A- 92	D+ 68	75.0	76.4	75.1	77.8
1H	B 85	C+ 78	A+ 98	87.0	84.8	85.2	84.5
1J	E 55	B+ 88	C+ 78	73.7	72.8	71.2	74.5
14A i	A 95	B 85	B+ 88	89.3	89.6	90.1	89.1
14A ii	D 55	B 85	B+ 88	76.0	73.6	72.1	75.1
14Aiii	E 55	B 85	B+ 88	76.0	73.6	72.1	75.1
14A1	C 75	C+ 78	A+ 98	83.7	80.8	80.7	81.0
14B	E 55	C- 72	A+ 98	75.0	70.4	69.6	71.3
14C	E 55	C- 72	A 95	74.0	69.8	69.0	70.7
14C1	E 55	D+ 68	A 95	72.7	68.2	67.6	68.9
14C2	E 55	D+ 68	A+ 98	73.7	68.8	68.2	69.5
15	B 85	C 75	A+ 98	86.0	83.6	84.1	83.1
16A	A 95	B 85	C 75	85.0	87.0	87.5	86.5
18A i	D 65	A+ 98	C 75	79.3	80.2	78.6	81.9
18A ii	E 55	A+ 98	C 75	76.0	76.2	74.1	78.4
18Aiii	C 75	A+ 98	C 75	82.7	84.2	83.1	85.4
Bridge (Route 1I) H-Lamphan	D 65			65.0			
Bridge (Route 16) H-Phakkud	D 65			65.0			
Bridge (Route 16) Xe-Kong,	E 55			55.0			
Bridge (Route 20) 19Nos	D 65			65.0			

The Study Team recommends that Case 4 (C:S:E = 35:45:20) in Table 4.3.2 be applied as the criteria/weight composition for prioritizing projects. As the table indicates for this Case, road link **14Ai has the highest** and Route **16A has the second** highest total evaluation score and they are therefore recommended as the most appropriate projects for the Feasibility Study.

4.4 Establishment of Road Improvement Master Plan to 2020

The selected road improvement projects were prioritized in the Master Plan using the ranking and scoring system described in the previous section as well as the following factors:

- ◆ Urgency and Necessity
- ◆ Funding
- ◆ Other Related Road Improvement Projects
- ◆ Level of Technology

It is important to note that not all road links, especially those with relatively low traffic volume, necessarily conform to national standards (i.e., road surface type). Therefore, the Study Team suggests that there be a range of alternatives regarding road surface criteria and its implementation schedule to meet the all-weather needs of residents, and that priority setting take into account staged improvement (e.g., surface dressing in the first stage and asphalt-concrete in the second stage).

The Master Plan is driven by a series of imperatives, but clearly economic development and the alleviation of poverty must be seen as the main driving forces. In addition, preservation of the environment is also essential.

To establish the Mater Plan, the following conclusions from a traffic view point should also be taken into account.

- **From the perspective of traffic demand and time savings, construction of the missing link on Rt. 14A is desirable. For example, vehicles that currently use the ferry to cross the Mekong River at Champasack would divert to this route for significant reductions in travel times. The construction of this link would also promote tourism and encourage agricultural activity by providing improved access.**
- **Routes 16A and 18A are similar in the role that they play in the network and therefore directly compete. Accordingly, scarce resources should only be used to improve one of these routes. Either of these routes would serve as an important east-west corridor connecting the province of Attapeu and Vietnam with the more populous and richer western part of southern Lao. According to the July 2000 "Study on the National Transport Development Strategy in the Socialist Republic of Vietnam," which was financed by JICA, this is becoming especially important as Vietnam puts more emphasis on its links with southern Lao via Attapeu.**

Note that although distance via Rt. 16A is a little longer than via Rt. 18A in terms of length (*), its improvement would also provide better access to markets for the coffee-rich Boloven Plateau, while improving Rt. 18A would have little commercial value and could potentially be destructive environmentally.

- From the perspective of linking up central southern Laos with the north-south Rt. 13, the improvement of Rt. 15 can be said to be desirable. This would also provide better access between Savannakhet, Pakse and Saravan, which already form an important trip-making axis. In addition, the population density along this route is relatively high; thereby, ensuring sufficient demand.
- Even with the improvement of Rt. 1G and the construction of its missing link, there will be little traffic on this road. This is because most of the traffic on Rt. 9, which has a high proportion of goods vehicles and traffic from Vietnam, is headed for Savannakhet and the northern part of Laos. In addition, Rt. 1G competes with Rt. 15 East for traffic from Vietnam and careful consideration should be given to whether or not both require improvement.
- The improvement of the portion of Rt. 1H under study has merit in that it connects two of the most important routes in southern Lao (i.e., Rt. 16 and Rt. 20) and should be carried out in the near future.
- In terms of traffic flows and economic interconnectivity, improvements to the road network in southern Lao should focus more on east-west connections rather than north-south connections.

A timetable for the improvement of the road links and bridges in the Master Plan to all-weather passable standard has been prepared, as shown in Figure 4.4.1.

The implementation schedule of the most appropriate road improvement project has been examined and developed considering optimal commencement time and the completion date (the end of 2007). However, the Study Team would like to state that the project schedules in the timetable are purely indicative and should be carefully considered when deciding to proceed with a feasibility study for a particular project.

(*) At feasibility study stage a shortcut section was included for Rt. 16A. With this section the distance via Rt. 16A is a little shorter than via Rt. 18A.

Route	Origin	Destination	Road Length (km)
1G	Junction of Route 9	Junction of Route 15	130
1H	Junction of Route 20	Junction of Route 16	22.5
1J	Junction of Route 18B	Combodia Border	81
14A	Phone Thong District	Combodia Border	137.5
14A1	Ban Ang Kham	Ban Don Talath	32
14B	Junction of Route 16	Combodia Border	149
14C	Ban Nong Nga	M. Moonlapamok	42
14C1	Ban Hieng	Ban Sam Kha	23
14C2	Ban Phong Photh	Ban Nong Te	6
15	Junction of Route 13S	Junction of Route 1H	73
16A	Junction of Route 16	Junction of Route 1I	71
18A	Junction of Route 13S	Junction of Route 18B	112.5

Bridges to be improved or constructed apart from the above road

- Bridge (Route I) : Houay-Lamphan
- Bridge (Route 16) : Houay-Phakkud
- Bridge (Route 16) : Xe-Kong
- Bridges (Route 20) : 19Nos.

*Brdige Project should not be implemented before 2007. The schedule should be examined by each Feasibility Study.

Figure 4.4.1 Road Improvement Master Plan to 2020

4.5 Selection of Priority Road Improvement Projects

Based on the analyses of the Master Plan, the priority road improvement projects to be completed by 2007, have been selected for detailed examination in the Feasibility Study.

The Study Team concluded that **Road Link 14A(i) (between Phon Thong Dist. And Ban Sam Kha) and Route 16A** are the most appropriate for implementing and completion by 2007. It was also suggested by the Lao Government that the Feasibility Study extend the recommended section of improvement for 14A(i) by about 4km down to the junction for the district capital of **Sukhuma**.

Route 14A(i) will provide direct access to the west bank area of the Mekong as well as to the southern part of the west bank, which will fuel development of the Emerald Triangle Area.

- This route would be improved to all weather road to connect Pakse (core city center in the southern region) and major points in the west bank of the Mekong (i.e., Champasack town, B.Phonnggam, Wat Phou, B.Dontalat and B.Soukhouma etc.) in order to promote regional development and to stimulate international tourism.
- This route is located in one of the most rice-rich areas in the nation. The population has a high literacy rate, which may have a potential to facilitate industry and commercial activities.
- This route also promotes development of the far south area of the west bank which remains undeveloped.
- This route provides all weather access to 'missing link section' along the west side of the Mekong. Regional development and poverty reduction in this area will be promoted.
- Vehicles currently using the ferry to cross the Mekong at Champasack would divert to this route, with significant reduction in travel times.
- This route leads toward the south and the Cambodia border via Route 14 A(ii) and 14A(iii) and therefore will contribute to the development of the Emerald Triangle Area, Thai, Lao and Cambodia.

Route 16A will contribute to rural development in an area near the Champasack-Attapeu border and also improve East-West connectivity between Thailand, Lao P.D.R. and Vietnam.

- This route would be improved to all weather road between Pakson and Route 1H, in order to promote regional development.
- Improvement of this route provides better access to market for the coffee-rich Boloven Plateau.
- Improvement of this route contributes as an important east-west corridor connecting