KINGDOM OF THAILAND
MINISTRY OF TRANSPORT AND COMMUNICATIONS
DEPARTMENT OF HIGHWAYS

THE TOLL HIGHWAY DEVELOPMENT STUDY IN THE KINGDOM OF THAILAND

FINAL REPORT
—MAIN TEXT—

JULY 1991

JAPAN INTERNATIONAL COOPERATION AGENCY

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PREFACE

In response to a request from the Goverment of the Kingdom of Thailand, the Government of Japan decided to conduct a master plan study on toll highways development and entrusted the study to the Japan International cooperation Agency (JICA).

JICA sent to Thailand a study team headed by Mr. Masahiko Tohi, Katahira & Engineers International from February 1990 to March 1991.

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

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

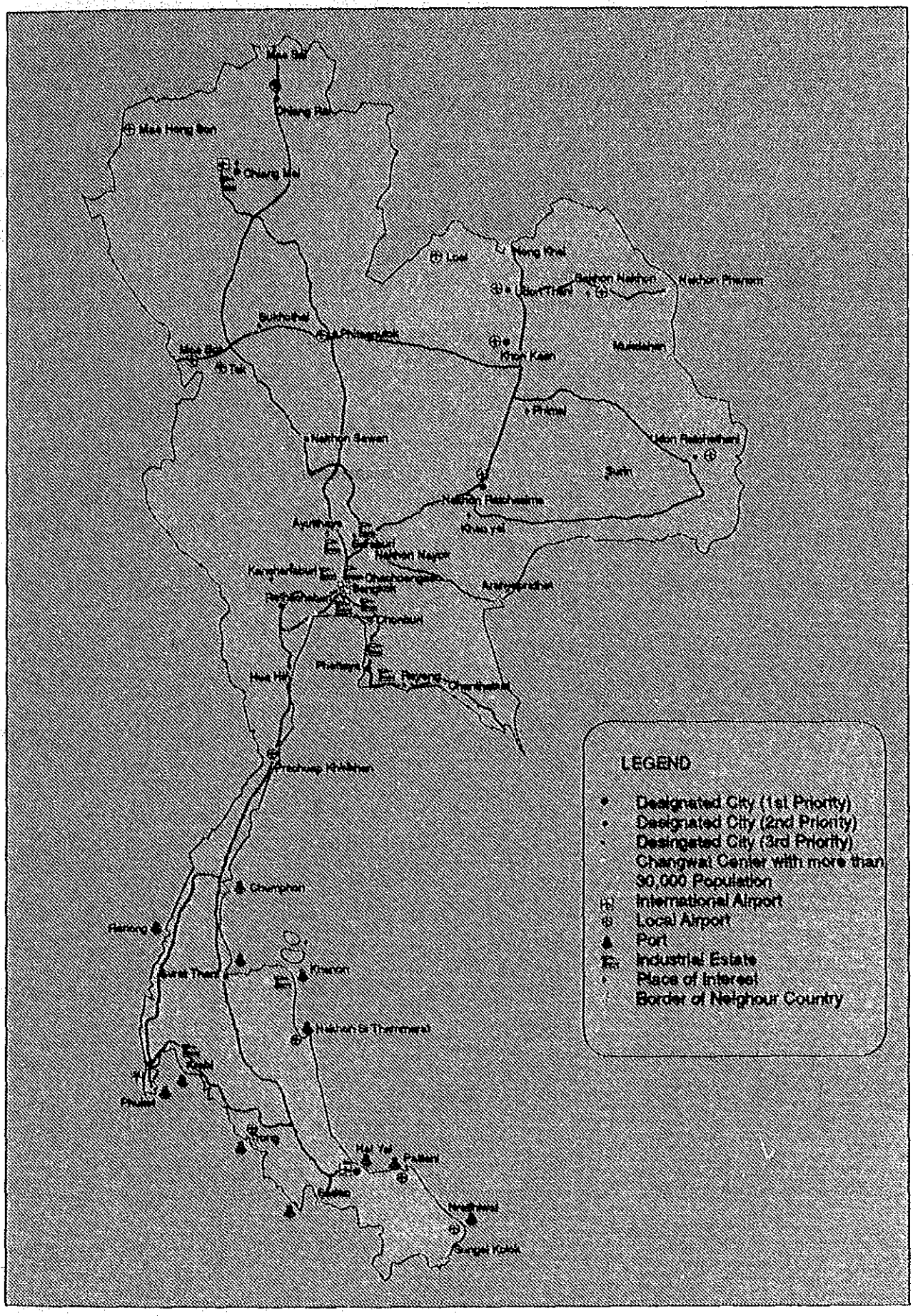
I wish to express my sincere appreciation to the officials concerned of the Government of the Kingdom of Thailand for their close cooperation extended to the team.

July 1991

Kensuke Yanagiya

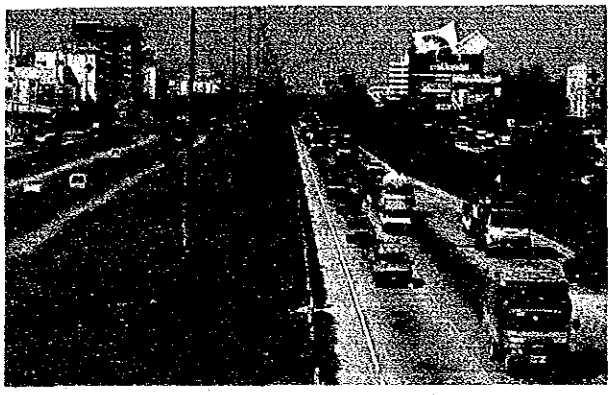
Kensuke Yanagiya
President

Japan International Cooperation Agency

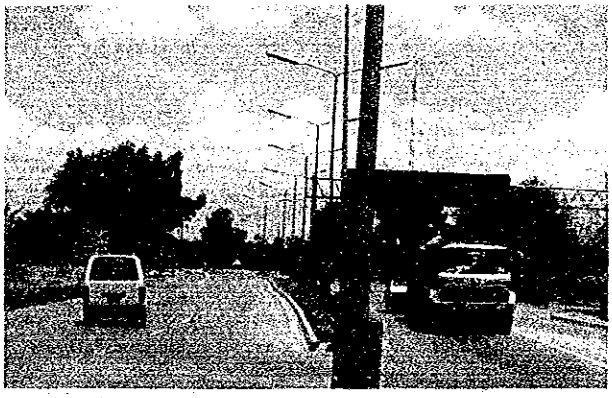

LEGEND
Designated City (1st Priority)
Designated City (2nd Priority)
Designated City (3rd Priority)
Changwat Center with more than 30,000 Population
International Airport
Local Airport
Port
Industrial Estate
Place of Interest
Border of Neighbour Country

STUDY AREA

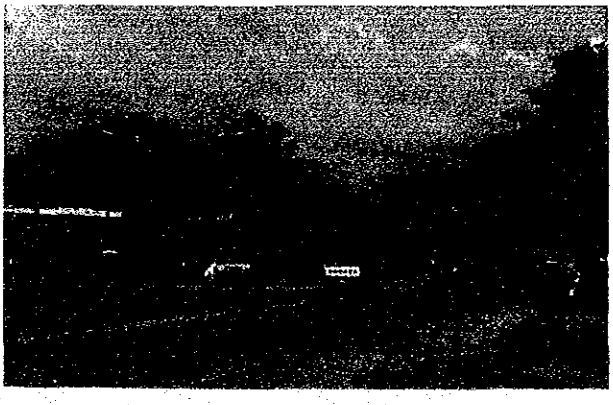
National highway in suburban area with severe congestion and mixed traffic



Multi-lane highway with traffic at saturation level

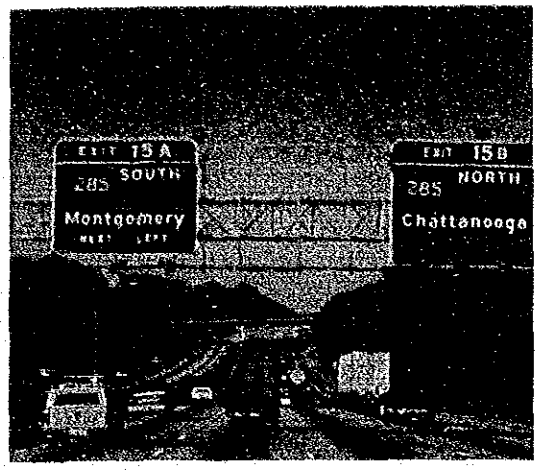


Four-lane highway in rural area with expected congestion in near future



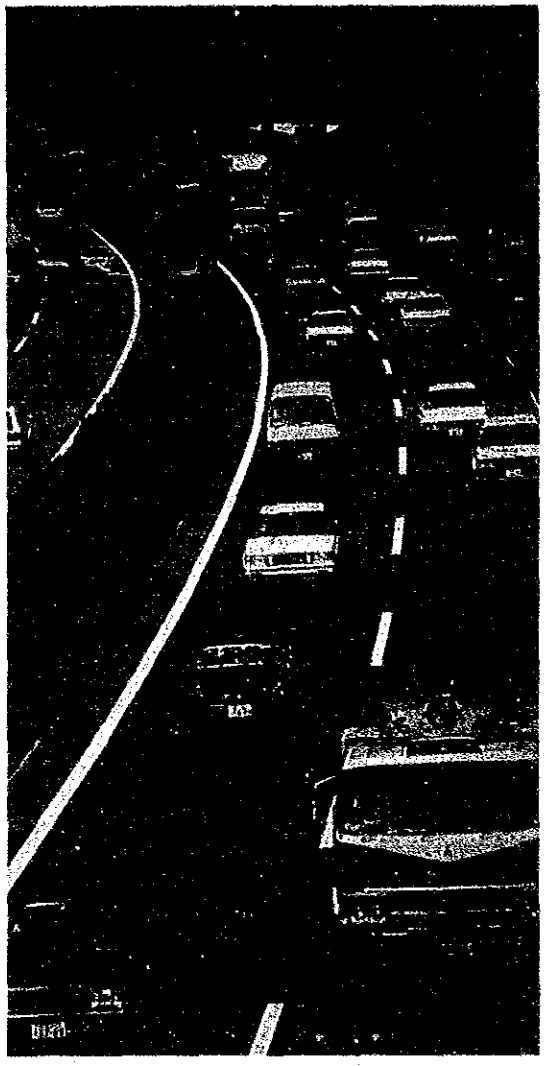
Two-lane highway in rural area under improvement to four-lane

PRESENT HIGHWAY CONDITIONS IN THAILAND

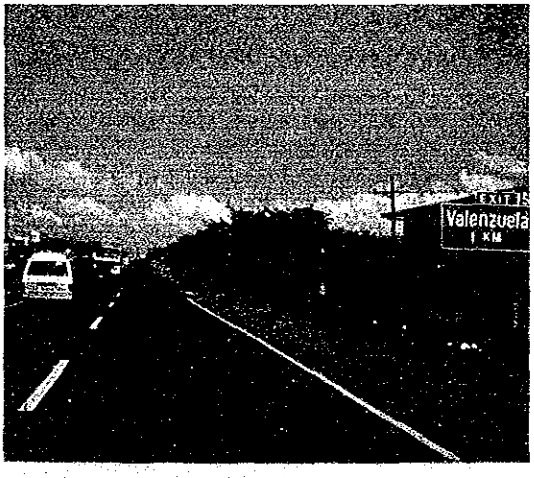


U.S.A.

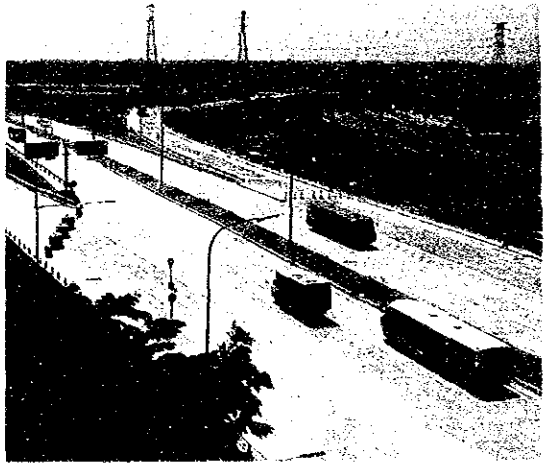
Malaysia



Japan

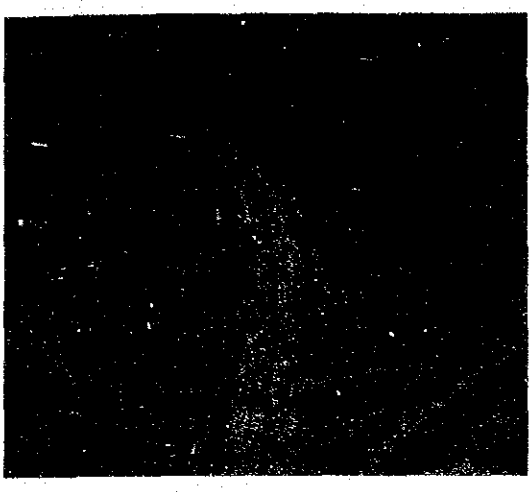


Philippines

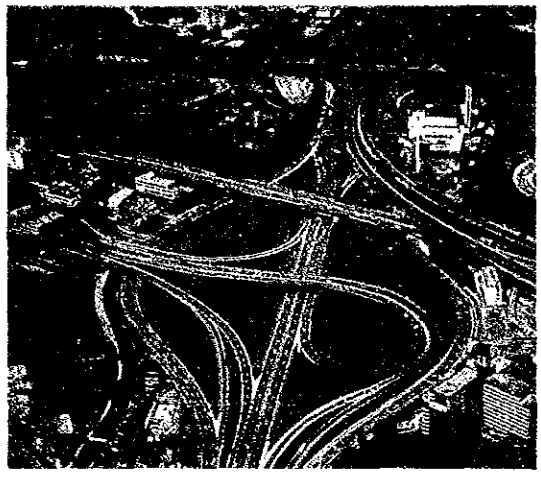


Indonesia

MOTORWAYS IN SELECTED COUNTRIES



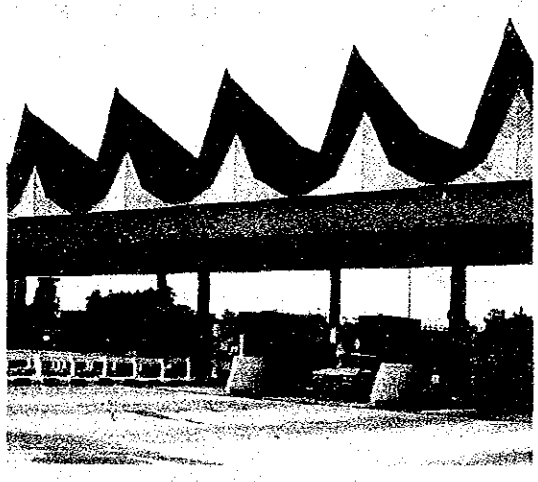
Inter change



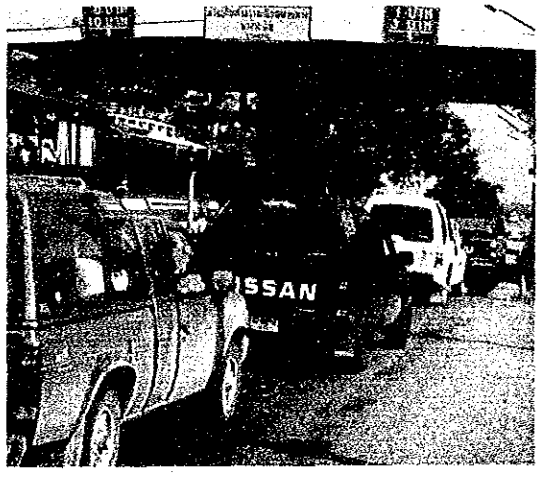
Inter change

Service Area

Parking Area



Toll Gate (Malaysia)



Toll Gate (Thailand)

MOTORWAY FACILITIES

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ABBREVIATIONS

AADT	:	Annual Average Daily Traffic
AASHTO	:	American Association of State Highway and Transportation Officials
ADT	:	Average Daily Traffic
ARD	:	Accelerated Rural Development Bureau
BKK	:	Bangkok
BMA	:	Bangkok Metropolitan Area
BMR	:	Bangkok Metropolitan Region
BOT	:	Built Operation and Transfer
BT (BHT)	:	Baht
C	:	Central Region
C1-C2	:	Divisions in Central Region
CCTV	:	Closed Circuit Television
CRF	:	Capital Recovery Factor
DWT	:	Dead Weight Ton
DOH	:	Department of Highways
EIRR	:	Economic Internal Return Rate
ETA	:	Expressway and Rapid Transit Authority
FIRR	:	Financial Internal Return Rate
FSH	:	Feasibility Study Handbook
GDP	:	Gross Domestic Product
GNP	:	Gross National Products
GPP	:	Gross Provisional Products
GRP	:	Gross Regional Products
HB	:	Heavy Bus
HT	:	Heavy Truck
IBRD	:	International Bank of Reconstruction and Development
JHPC	:	Japan Highway Public Corporation
JICA	:	Japan International Cooperation Agency
KM	:	Kilometer
LB	:	Light Bus
LT	:	Light Truck
MOTC	:	Ministry of Transport and Communications
MT	:	Medium Truck
N	:	Northern Region
N1-N3	:	Divisions in Northern Region
NE	:	Northeastern Region
NE1-NE4	:	Divisions in Northeastern Region

NESDB	:	National Economic and Social Development Board
NG	:	Normal Ground
NPV	:	Net Present Value
OBRR	:	Outer Bangkok Ring Road
OD	:	Origin - Destination
OBRM	:	Outer Bangkok Ring Motorway
PC	:	Passenger Car
PP	:	Pick-up, Passengers
PR/R I	:	Progress Report I
PR/R II	:	Progress Report II
PU	:	Pick-up
PWD	:	Public Works Department
Q	:	Capacity
RID	:	Royal Irrigation Department
S	:	Southern Region
S1-S3	:	Division in Southern Region
SG	:	Soft Ground
TH	:	Toll Highway
TM	:	Toll Motorway
V	:	Speed
VOC	:	Vehicle Operating Cost

FINDINGS

AND

RECOMMENDATIONS

FINDINGS AND RECOMMENDATIONS

It is an unbelievable fact that Thailand has no high grade inter-city motorways with full control of access in spite of its vast land area with high population, and its recent remarkable economic growth.

Main targets of the 7th National Economic and Social Development Plan which is being established are as follows:

- To sustain stable growth of the national economy
- To equally distribute income and development into regional areas.
- To develop quality of life and conserve environment and natural resources.

In order to achieve the targets of the 7th National Plan, the sub-committee for drafting the Transport Plan under NESDB stresses the necessity of developing efficient, fast and safe nationwide motorway system.

Number of trips in 2010 estimated to be nearly 4.3 times of that in 1990. For most of the arterial national highways, assigned traffic volumes exceed the road capacities in spite of the assumption that all of them will be improved to multi-lane highways.

Considering the above situations, this study proposes the establishment of 4,300 km nationwide motorway network by the year 2010.

The project cost of the whole network is estimated to be approximately 356 billion Baht (1990 price). To complete the whole network in 20 years, the required annual investment is approximately 18 billion Baht without price escalation, which is almost the same amount as the present annual budget of the DOH.

In order to supply such a huge investment, the study recommends the introduction of the "Special Funds System" and "Toll Road System" including the "Concession System". When the "Toll

Road System" is applied, the "Pool Payment System" in which profit from highly redeemable motorway sections is used to compensate loss from non-redeemable sections, is recommended to formulate nationwide motorways.

There are different bodies to execute toll motorways in Thailand, i.e. DOH and ETA. The study recommends that ETA should concentrate on expressways in the Bangkok Metropolitan Region, while DOH has the responsibility of inter-city motorways in the whole Kingdom.

However, when DOH directly constructs and operates nationwide motorways, its organization should be excessively enlarged. In order to avoid enlargement of DOH's organization, a public corporation can be established as an execution body under the Ministry of Transport and Communications. This public corporation has the following advantages:

- Offering uniform services (structural standard, toll level, etc.)
- Ease of introducing a Pool Payment System
- Ease of acquiring loans
- Ease of carrying out businesses related to motorways

Before the establishment of such public corporation, DOH can manage directly the construction and operation of toll motorways through the existing organization. In the same time, it is recommended to set up a preparatory committee in the Ministry of Transport and Communications to study functions and organizations of the public corporation to be established.

The economic evaluation for some alternative staging plans for the implementation of the network shows about 23% to 35% in EIRR (economic internal rate of return) which are feasible in all cases.

In addition, the motorways bring following indirect effects which are important for the regional development in Thailand.

- Betterment of national development
- Promotion of manufacturing, tourism, agriculture, fisheries and commercial activities.
- Improvement in living conditions.

Toll rates adopted for forecasting traffic volumes on motorways and for the financial evaluation are 1.0 Baht/Km for light vehicles and 2.0 Baht/Km for heavy vehicles. These rates are determined based on the possibility of repayment of loaned investment costs within appropriate period, and comparative studies on fares of other transport modes.

Financial evaluation carried out for the same staging plans as in EIRR shows 13% to 14% in FIRR (financial internal rate of return).

The year of the break even point, when the accumulated revenues exceed the accumulated expenditures, is found for one selected case to be the year of 2014, i.e. 22 years after starting the operation of motorways.

In order to enable Thailand to progress and prosper towards and in the 21 century, the development of the nationwide motorway network is a must. The motorway development, however, is one of the biggest national projects and consists of numerous problems to be solved. To realize such a huge project, therefore, further detailed studies in various fields, such as relevant laws and regulation, financial system, engineering aspects, socio-economic impacts, environment, etc. are urgently required.

CHAPTER ONE

INTRODUCTION

CHAPTER 1

INTRODUCTION

1.1 BACKGROUND

The recent economic growth of Thailand is remarkable. However the socio-economic activities are extremely concentrated in Bangkok and its surrounding area, and this situation is increasing the inter-regional disparity in the standard of living.

The Government of Thailand, therefore, has been planning for sustaining this remarkable economic growth, decentralization of socio-economic activities from Bangkok and its surrounding area and promotion of well-balanced regional development as one of the most important national policies. In order to achieve this policy, they inferred that development of a nationwide motorway network is indispensable and decided to incorporate the construction plan for some high priority routes of motorways to be operated as toll roads into the next Highway Development Plan (1992－1996).

The Road Development Study in the Central Region (JICA, 1989) also suggested that in order to cope with future economic development and increasing traffic demand in Thailand, only development of ordinary highways is not sufficient and development of an inter-city motorway network is necessitated.

In consideration of needs of the motorway in Thailand, the Government of Thailand requested the Government of Japan to carry out the Toll Highways Development Study in the Kingdom of Thailand (The Study). The Government of Japan decided to conduct the Study and entrusted it to the Japan International Cooperation Agency (JICA), the official agency responsible for the implementation of technical cooperation programs by the Government of Japan.

JICA organized a study team (The Study Team) consisting of 12 experts to commence the Study from the beginning of February

1990 and the Study tasks were completed in July 1991.

1.2 OBJECTIVES

The objectives of the Study are as follows:

1) To prepare a master plan for toll motorway network from the viewpoint of national and regional development.

2) To study toll road system and organization for implemenation and operation of toll road project and examine socio-economic development effect brought about by the toll motorway.

3) To perform technology transfer to Thai Counterpart personnel in the course of the study.

1.3 SCOPE AND SCHEDULE

The Study was carried out, in a whole of the Kingdom of Thailand, in accordance with following items:

1) Data Collection and Review

   a. To collect and review data, reports and information relevant to the Study.
   b. To review data on motorways in various countries.

2) Analysis and Forecast of Socio-economic Characteristics

   a. To analyze present national and regional socio-economic characteristics.
   b. To formulate future framework up to the year 2010.

3) Traffic Survey and Forecast

   a. To conduct the OD survey.
   b. To analyze traffic demand in the Kingdom.
   c. To estimate future traffic requirements.
   d. To forecast traffic volumes on the toll motorways.

4) Motorway Development Policy

To recommend motorway development policy regarding the following aspects:

- national development
- regional development
- road network development
- necessity of toll motorway network

5) Master Planning of the Toll Motorway

a. To formulate a conceptual plan of the toll motorway network.
b. To formulate the toll motorway master plan including the location of the interchanges.
c. To recommend engineering design criteria.

6) System and Organization of Toll Motorway

a. To study system, organization and financial resources for construction and operation of the toll motorway network.
b. To examine toll fee.
c. To recommend system of the toll fee collection.

7) Cost and Benefit Analysis

a. To estimate construction costs of the toll motorways.
b. To examine development effects brought about by the toll motorway development.
c. To carry out economic evaluation for each route of the toll motorway.
d. To carry out financial evaluation for the routes with high priority.

8) Implementation Program

a. To recommend the priority of the toll motorway con struction.
b. To establish an implementation program.

The work schedule of the Study was performed in accordance with the Study Flow Diagram of Figure 1.1, in which work started at the beginning of February 1990 and completed in mid of July 1991,

with a total time length of about 17 months.

1.4 ORGANIZATION

The study was carried out by the Study Team organized by JICA. Guidance for the study was realized through JICA by the Advisory Committee consisting of Japanese Government Officials.

In carrying out the study, the Study Team kept close collaboration with the Counterpart Team organized by the DOH.

The organization of the Study is shown in Figure 1.2.

1.5 REPORTING

During the course of the Study, the following reports were prepared by the Study Team and submitted to DOH in accordance with the schedule of the Study.

1. Inception Report : February, 1990
2. Progress Report (I) : June, 1990
3. Progress Report (II) : October, 1990
4. Interim Report : December, 1990
5. Draft Final Report : March, 1991
6. Final Report : July, 1991

The Final Report, which contains all the results of the Study, is organized to include the following five (5) volumes:

- Summary
- Main Text
- Appendices
- Motorways in Various Countries
- Executive Summary on Motorway Development

STUDY FLOW DIAGRAM

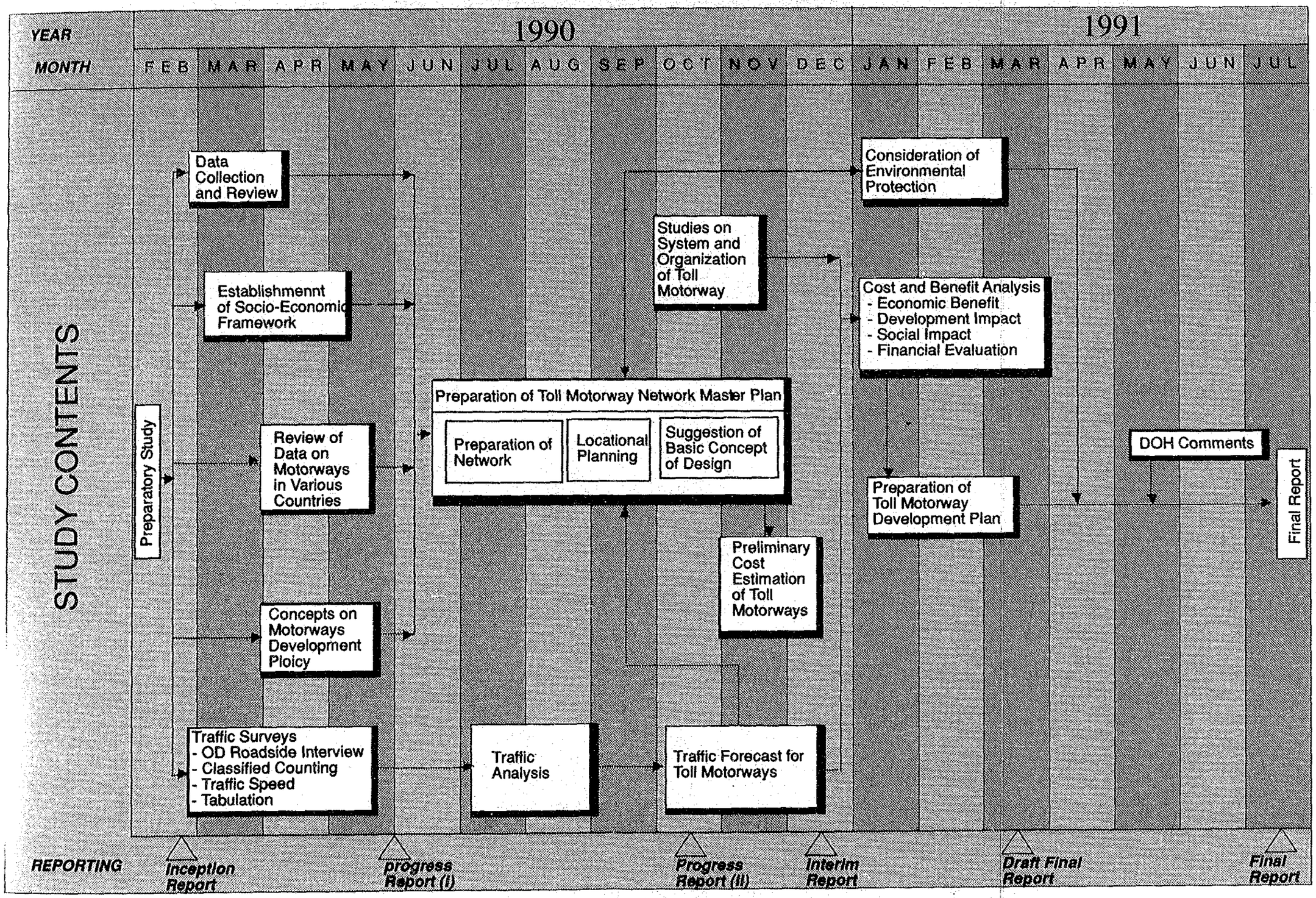

Figure 1.1 STUDY FLOW DIAGRAM

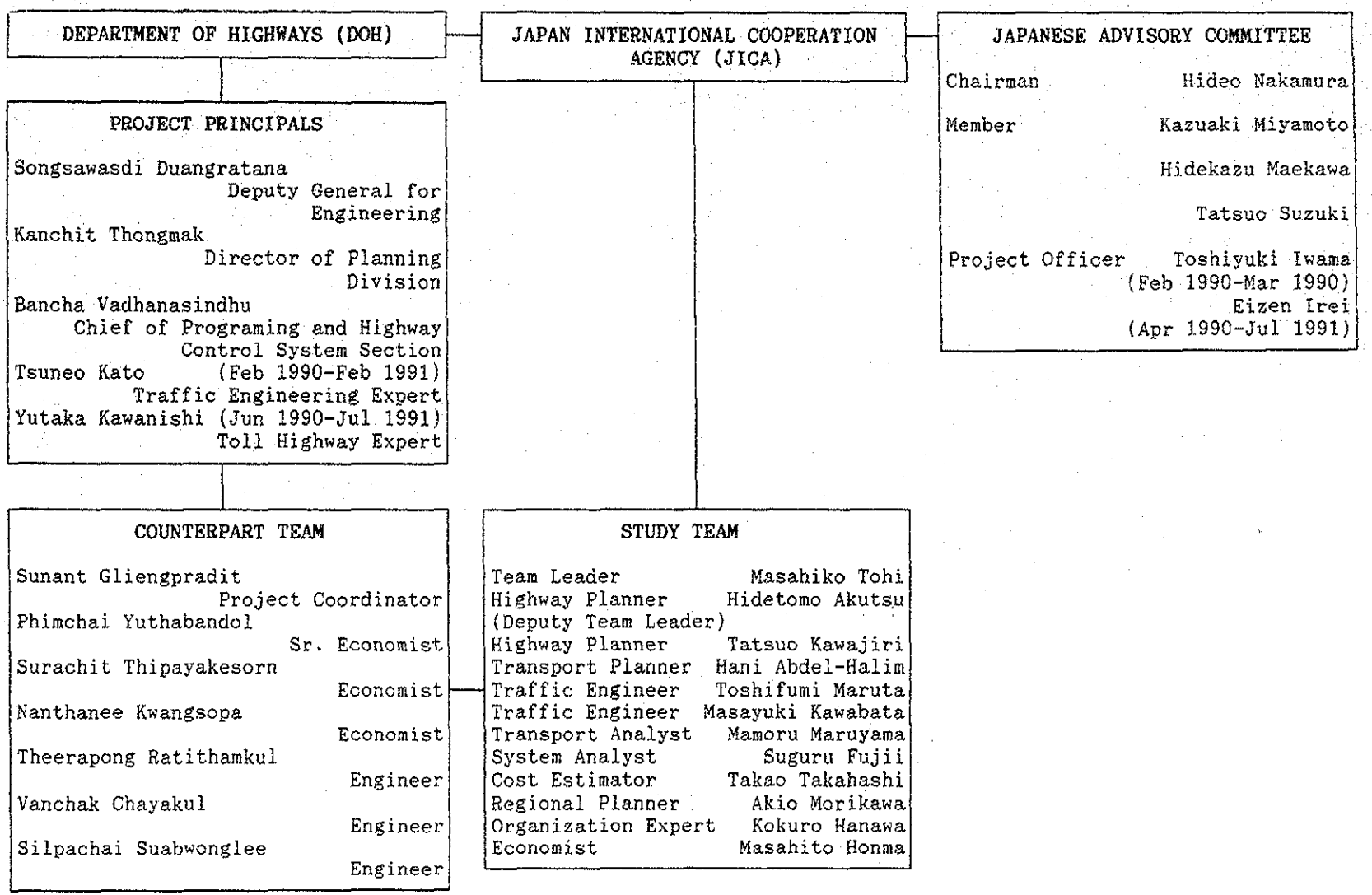

Figure 1.2 ORGANIZATION FOR THE STUDY

CHAPTER TWO

EFFECTS OF MOTORWAYS

CHAPTER 2

EFFECTS OF MOTORWAYS

2.1 INTRODUCTION

Motorways have various and far-reaching effects on a variety of individuals and economic sectors not only in areas where they are constructed but also other parts of the whole country.

The socio-economic effects gained by the introduction of motorways are usually classified into two major categories; "direct effects" and "indirect effects". Direct effects are defined as benefits which road users directly receive by using the motorway. Indirect effects are those which are induced by the direct effects. Most indirect effects can be represented as regional and national development effects.

In addition, and viewed from the standpoint of measuring the effects, some effects are tangible and others intangible. The majority of tangible effects can be evaluated in monetary terms to some extent.

Since Thailand should aim at furthering nationwide development, greater focus should be placed on the regional development effects (indirect effects) than on the direct effects. This, however, does not mean at all that the direct effects bear less importance for motorway projects in Thailand.

The reasons why regional development effects are more important are described below. Regional development will bring a variety of benefits to the whole nation. In addition, if adequate policies and investments accompany motorway development, regional development can be set efficiently and equitably.

2.2 DIRECT EFFECTS OF MOTORWAYS

2.2.1 Savings in Travel Time

The most important effect gained by motorways is travel time savings brought about by the reduction in traveling distance and higher traveling speed. The effect can be measured by using "value of time" as follows:

Value of Saved Time = Value of Time × Saved Time

There are many methods for estimating the values of time. One of the most popular methods uses wage rates as the basis.

2.2.2 Savings in Vehicle Operating Costs

Motorways contribute greatly to energy savings since other significant benefits are savings in vehicle operating costs which comprise; fuel and lubricant consumption, replacement of tire and parts, vehicle maintenance, capital consumption, wage, etc.

2.2.3 Improvement in Traffic Safety

Higher safety in road traffic is a benefit to the road users as well as to the whole society. A portion of the benefits can be measured in monetary terms by taking the approach of determin-

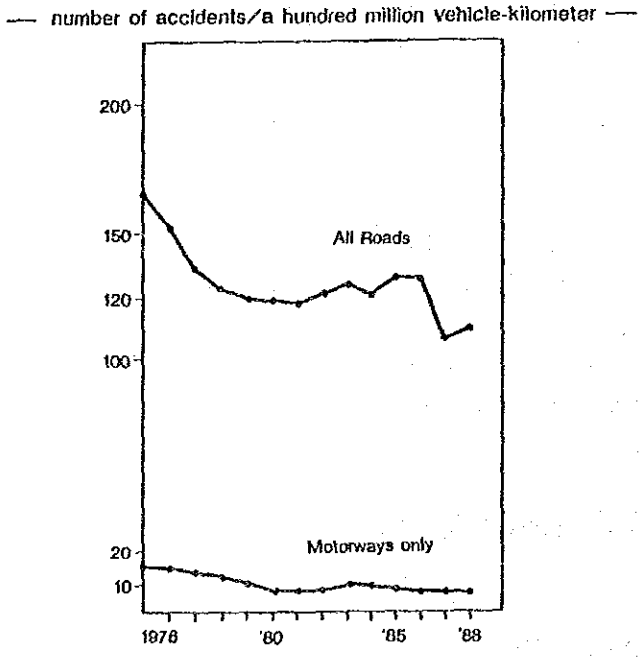

Figure 2.1 COMPARISON OF CASUALTY RATE IN JAPAN

ing the expected cost for a fatal, serious or light injury accident. Figure 2.1 compares the rate of fatal and injury accidents over vehicle-kilometer between all roads and motorways. It is clear that motorways provide higher traffic safety and reduce accidents and casualties.

2.2.4 Other Effects

1) More Comfortable Driving

Improvement in driving comfort reduces driver's fatigue and related effects.

2) Relaxation of Traffic Congestion on Existing Roads

This benefit, which is not for motorway users, is enjoyed by existing ordinary road users. Since most motorways have a function as a bypass from city centers, through-traffic moves from ordinary roads to motorways. Reduction in the number of cars running through the city on ordinary roads alleviates traffic congestion and brings about benefits for road users.

3) Improvement in Punctuality

Motorways enable punctual arrival at destinations. This will help factories to perform detail scheduling of shipment of products and receipt of parts, which affects the logistics of a group of firms; e.g., Just-in-Time System.

4) Betterment of Environment

Since the energy efficiency of a car on a motorway is much better than on ordinary roads, it leads to reducing the total emission of exhausted gas. Also, noise and air pollution in city centers become less because of the less traffic volume on ordinary roads.

5) Promotion of Mobility by Long Distance Bus Services

Motorway network makes it possible to offer high speed bus service for long distance trips which is quite similar to that of railways.