

KINGDOM OF THAILAND  
MINISTRY OF TRANSPORT AND COMMUNICATIONS  
DEPARTMENT OF HIGHWAYS

# THE TOLL HIGHWAY DEVELOPMENT STUDY IN THE KINGDOM OF THAILAND

FINAL REPORT  
—SUMMARY—

JULY 1991

JAPAN INTERNATIONAL COOPERATION AGENCY

SSF

CR(3)

91-070(1/4)

RY



JICA LIBRARY



1092703(6)

22715



KINGDOM OF THAILAND  
MINISTRY OF TRANSPORT AND COMMUNICATIONS  
DEPARTMENT OF HIGHWAYS

# **THE TOLL HIGHWAY DEVELOPMENT STUDY IN THE KINGDOM OF THAILAND**

FINAL REPORT  
—SUMMARY—

JULY 1991

JAPAN INTERNATIONAL COOPERATION AGENCY

国際協力事業団

22715

## PREFACE

In response to a request from the Government 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).

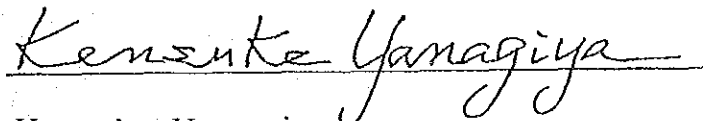
JICA sent to Thailand a study team headed by Mr. Masahiko Tohi, Katahira & Engineers International from February 1990 to March 1991.

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  
President

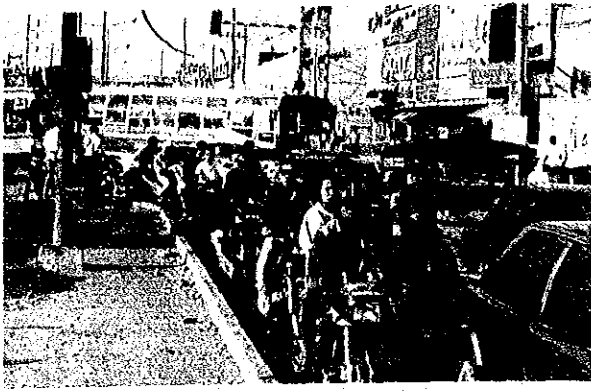
Japan International Cooperation Agency



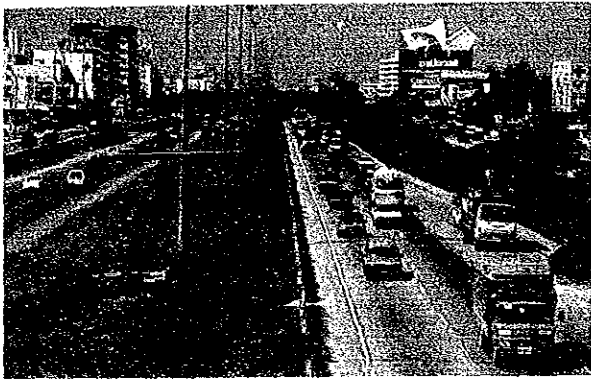








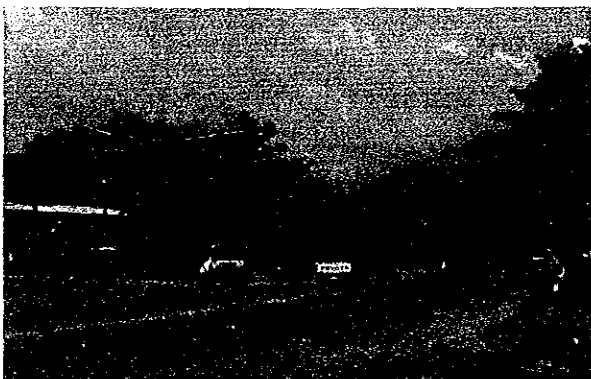
**National highway in suburban area  
with severe congestion and mixed traffic**



**Multi-lane highway with traffic at saturation  
level**



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



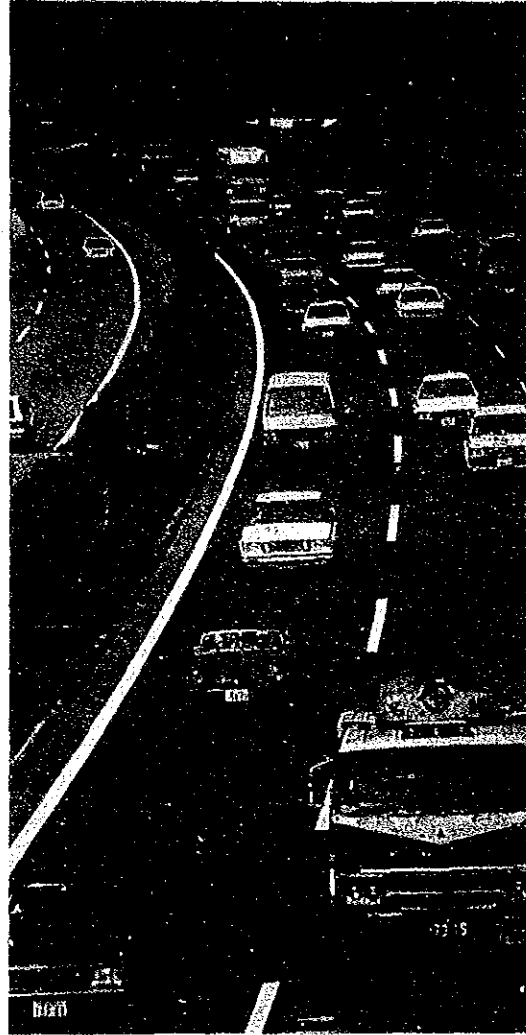
**Two-lane highway in rural area under  
improvement to four-lane**

**PRESENT HIGHWAY CONDITIONS IN THAILAND**





U.S.A.



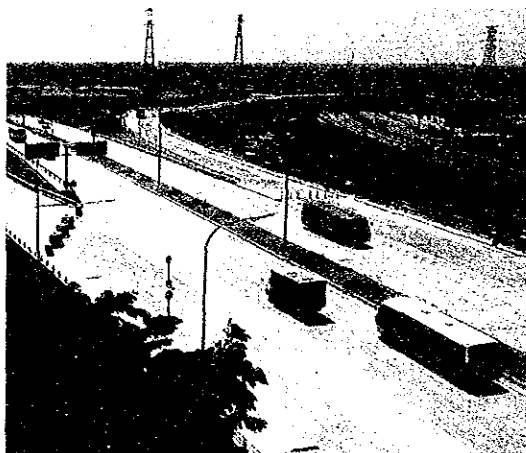
Japan



Malaysia



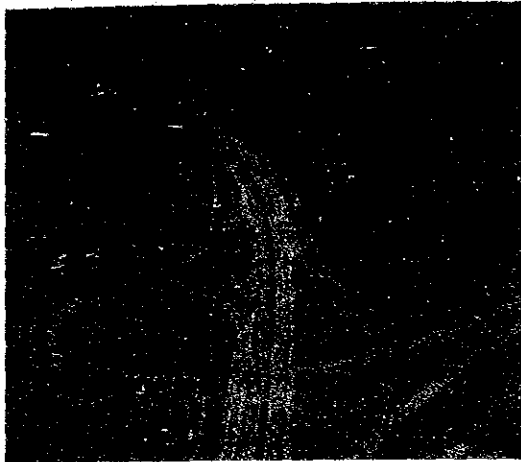
Philippines



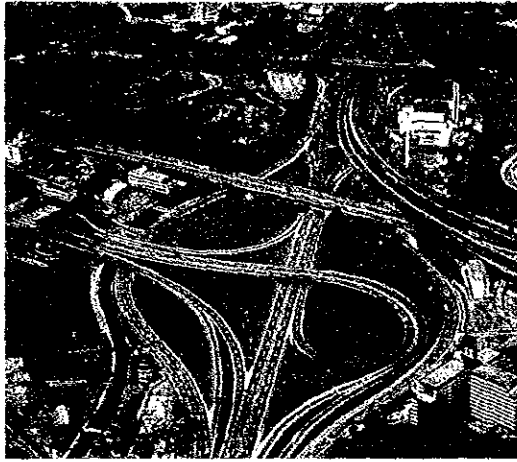
Indonesia

MOTORWAYS IN SELECTED COUNTRIES





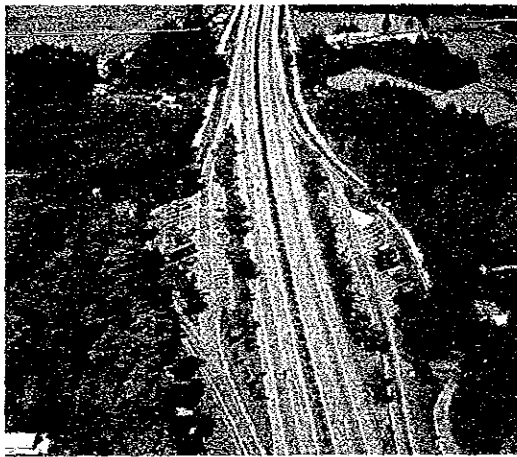
**Inter change**



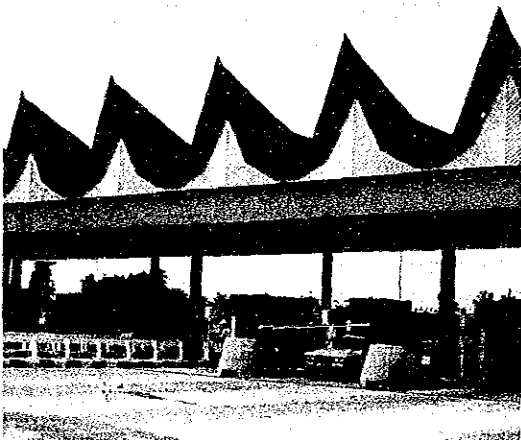
**Inter change**



**Service Area**



**Parking Area**



**Toll Gate (Malaysia)**



**Toll Gate (Thailand)**

**MOTORWAY FACILITIES**





# CONTENTS

	Page
PREFACE	iv
THE STUDY AREA	vi
LIST OF FIGURES	viii
LIST OF TABLES	x
ABBREVIATIONS	x
FINDINGS AND RECOMMENDATIONS	x
CHAPTER 1 INTRODUCTION	1
1.1 BACKGROUND	1
1.2 OBJECTIVES	1
1.3 SCOPE AND SCHEDULE	2
1.4 ORGANIZATION	2
1.5 REPORTING	2
CHAPTER 2 EFFECTS OF MOTORWAYS	7
2.1 DIRECT EFFECTS OF MOTORWAYS	7
2.2 REGIONAL DEVELOPMENT EFFECTS	8
CHAPTER 3 CURRENT CONDITIONS IN THAILAND	9
3.1 SOCIO-ECONOMIC CONDITIONS	9
3.1.1 Population	9
3.1.2 Economy	14
3.1.3 Registered Vehicles	18
3.2 TRANSPORT CONDITIONS	20
3.3 HIGHWAY CONDITIONS	22
CHAPTER 4 DEVELOPMENT PLAN AND SOCIO-ECONOMIC FRAMEWORK	29
4.1 THE NATIONAL ECONOMIC AND SOCIAL DEVELOPMENT PLAN	29
4.2 ESTABLISHMENT OF SOCIO-ECONOMIC FRAMEWORK	31
CHAPTER 5 TRANSPORTATION DEVELOPMENT PLAN	35
5.1 FUTURE PLAN OF TRANSPORTATION SECTORS	35
5.2 CONCEPT OF THE SEVENTH HIGHWAY DEVELOPMENT PLAN	36

CHAPTER 6 TRAFFIC SURVEY, ANALYSIS AND FORECAST 37

6.1	INTRODUCTION .....	37
6.2	TRAFFIC SURVEYS .....	37
6.3	ESTABLISHMENT OF PRESENT AND FUTURE OD TABLES .....	40
6.4	TRAFFIC ASSIGNMENT .....	45

CHAPTER 7 MOTORWAY NETWORK MASTER PLAN 51

7.1	MOTORWAYS DEVELOPMENT POLICY .....	51
7.2	PROCEDURE FOR ESTABLISHMENT OF MASTER PLAN .....	52
7.3	TARGET LENGTH OF MOTORWAYS .....	53
7.4	ESTABLISHMENT OF TENTATIVE MOTORWAY NETWORK .....	53
	7.4.1 Basic Idea for Planning .....	53
	7.4.2 Tentative Motorway Network .....	57
7.5	ESTABLISHMENT OF PROPOSED MOTORWAY NETWORK .....	58
	7.5.1 Assessment of the Tentative Motorway Network .....	58
	7.5.2 Proposed Motorway Network — 4,300 km — .....	60
7.6	CHARACTERISTICS OF 4,300 KM MOTORWAY NETWORK .....	63
	7.6.1 Traffic .....	63
	7.6.2 Coverage .....	64
7.7	BASIC FACTORS OF DESIGN AND PLANNING .....	67
	7.7.1 Basic Factors of Design .....	67
	7.7.2 Planning of Motorway Facilities .....	68
7.8	ROUTING .....	69
7.9	ROUTES INSIDE OBRR TO CONNECT WITH PROPOSED MOTORWAYS .....	70

CHAPTER 8 ENVIRONMENTAL CONSIDERATIONS 73

8.1	OUTLINE OF MOTORWAY ENVIRONMENTAL PROBLEMS .....	73
8.2	ENVIRONMENTAL IMPACT ASSESSMENT AND FORECAST .....	75
	8.2.1 Environmental Impact Assessment .....	75
	8.2.2 Forecasting Methodology .....	76
8.3	ENVIRONMENTAL PROTECTION MEASURES .....	76

CHAPTER 9 SYSTEM AND ORGANIZATION 81

9.1	FINANCIAL SYSTEM .....	81
	9.1.1 Special Fund System (Earmarked Tax Revenue System) .....	81
	9.1.2 Toll Road System .....	82

9.2	MANAGEMENT SYSTEM .....	86
9.2.1	Proposed Execution Bodies .....	86
9.2.2	Proposed Public Corporation .....	87
9.2.3	Maintenance and Traffic Operation .....	89
9.2.4	Traffic Control and Management System .....	90
CHAPTER 10 ECONOMIC EVALUATION .....		91
10.1	CONSTRUCTION COSTS .....	91
10.2	MAINTENANCE AND OPERATION COSTS .....	93
10.3	BENEFITS .....	93
10.3.1	Direct Benefits .....	94
10.3.2	Regional Development Effects .....	96
10.4	ECONOMIC ANALYSIS .....	99
10.4.1	Economic Costs .....	99
10.4.2	Conditions for Economic Analysis .....	99
10.4.3	Results of Economic Analysis .....	100
10.4.4	Economic Sensitivity Analysis .....	100
CHAPTER 11 FINANCIAL EVALUATION .....		101
11.1	FINANCIAL COST .....	101
11.2	TOLL RATE .....	101
11.3	FINANCIAL ANALYSIS .....	102
CHAPTER 12 IMPLEMENTATION SCHEDULE .....		107
12.1	IMPLEMENTATION SCHEDULE .....	107
12.2	INVESTMENT PROGRAM .....	110

## LIST OF FIGURES

	Page
Figure 1.1	STUDY FLOW DIAGRAM ..... 3
Figure 1.2	ORGANIZATION FOR THE STUDY ..... 5
Figure 3.1	POPULATION DISTRIBUTION — 1988 ..... 10
Figure 3.2	POPULATION DENSITY BY CHANGWAT — 1988 ..... 11
Figure 3.3	URBAN POPULATION BY MUNICIPALITY ..... 13
Figure 3.4	SHARE OF TRANSPORT MODES — 1987 ..... 21
Figure 3.5	NATIONAL HIGHWAY NETWORK ..... 23
Figure 3.6	CUMULATIVE NO. OF SECTIONS AND ADT OF ALL NATIONAL HIGHWAYS — 1989 ..... 24
Figure 3.7	TOLL REVENUE AND NUMBER OF CARS ..... 25
Figure 4.1	REGIONAL URBAN GROWTH CENTERS ..... 30
Figure 4.2	FUTURE POPULATION BY REGION..... 32
Figure 4.3	FUTURE GDP AT 1972 CONSTANT PRICES.... 33
Figure 4.4	FUTURE GRP AT 1972 CONSTANT PRICES.... 33
Figure 6.1	FLOW CHART TO ESTABLISH PRESENT AND FUTURE OD TABLES ..... 41
Figure 6.2	PRESENT AND FUTURE TRIP GENERATION AND ATTRACTION BY DIVISION ..... 43
Figure 6.3	FLOW CHART FOR TRAFFIC ASSIGNMENT OF FUTURE TRIPS ..... 45
Figure 6.4	ASSIGNED TRAFFIC VOLUMES ON NATIONAL HIGHWAY NETWORK — 1990 ..... 47
Figure 6.5	ASSIGNED TRAFFIC VOLUMES ON NATIONAL HIGHWAY NETWORK ("Without Project" Case) — 2010 ..... 48
Figure 6.6	ASSIGNED TRAFFIC VOLUMES ON PROPOSED TOLL MOTORWAY NETWORK ..... 49
Figure 7.1	PROCEDURES FOR ESTABLISHMENT OF MASTER PLAN OF THE MOTORWAY NETWORK ..... 52
Figure 7.2	LOCATIONAL MAP OF MAJOR POINTS ..... 55
Figure 7.3	PROPOSED MOTORWAY NETWORK ..... 61
Figure 7.4	SHARE IN TRIPS BETWEEN NATIONAL HIGHWAY AND TOLL MOTORWAY NETWORKS — 2010 ..... 64
Figure 7.5	BOUNDARIES OF AREA—COVERED WITHIN 60 MINUTES ..... 65
Figure 7.6	CROSS SECTION ELEMENTS ..... 68
Figure 7.7	PROPOSED URBAN MOTORWAY NETWORK INSIDE OBRR ..... 72

Figure 8.1	ENVIRONMENTAL IMPACT ASSESSMENT PROCEDURE ..	75
Figure 8.2	MEASURES FOR NOISE IN HIGHWAY STRUCTURE ..	79
Figure 9.1	TOLL RATES AND GNP PER CAPITA .....	84
Figure 9.2	ORGANIZATIONAL STRUCTURE OF PUBLIC CORPORATION .....	89
Figure 9.3	TRAFFIC MANAGEMENT SYSTEM STRUCTURE ..	90
Figure 10.1	BETTERMENT OF NATION WIDE DEVELOPMENT ..	97
Figure 10.2	COMPARISON OF INTERNATIONAL TRAVELING TIME .....	98
Figure 12.1	STAGING PLAN OF SCENARIO-1, CASE 1-1 ...	109

## LIST OF TABLES

	Page
Table 3.1	POPULATION BY REGION ..... 9
Table 3.2	GROSS DOMESTIC PRODUCT ..... 14
Table 3.3	GDP BY SECTOR ..... 14
Table 3.4	GRP AT CURRENT MARKET PRICES ..... 15
Table 3.5	GRP AT 1972 CONSTANT PRICES ..... 15
Table 3.6	PER CAPITA GRP AT CURRENT MARKET PRICES .. 16
Table 3.7	PER CAPITA GRP AT 1972 CONSTANT PRICES ... 17
Table 3.8	NUMBER OF FACTORIES BY REGION ..... 17
Table 3.9	INTERNATIONAL TOURIST ARRIVAL ..... 18
Table 3.10	NUMBER OF GUEST ARRIVAL ..... 18
Table 3.11	NUMBER OF REGISTERED VEHICLES ..... 19
Table 3.12	NUMBER OF REGISTERED VEHICLES — 1988 ..... 19
Table 3.13	REGISTERED VEHICLES BY REGION UNDER MOTOR VEHICLE ACT — 1988 ..... 20
Table 3.14	LENGTH OF HIGHWAYS UNDER DOH RESPONSIBILITY — 1988 (KM) ..... 22
Table 3.15	NUMBER OF TRAFFIC ACCIDENTS AND CASUALTIES ON DOH HIGHWAYS — 1988 ..... 26
Table 4.1	ESTIMATED POPULATION GROWTH RATE ..... 31
Table 7.1	TARGET LENGTH OF MOTORWAYS IN THAILAND .. 53
Table 7.2	TENTATIVE MOTORWAY NETWORK ..... 57
Table 7.3	ASSESSMENT OF TENTATIVE NETWORK BY ROUTE .. 59
Table 7.4	4,300 KM MOTORWAY NETWORK ..... 60
Table 7.5	TRAFFIC CHARACTERISTICS OF TOLL MOTORWAY AND NATIONAL HIGHWAY NETWORKS — 2010 ..... 63
Table 7.6	POPULATION AND AREA COVERAGE RATES — 2010 .. 64
Table 7.7	COVERED MAJOR POINTS BY 4,300 KM NETWORKS .. 66
Table 7.8	BASIC FACTORS OF DESIGN ..... 67
Table 7.9	WIDTH OF CROSS SECTION ELEMENTS ..... 67
Table 7.10	CONTROL POINTS ..... 70
Table 7.11	CONNECTED ROUTES INSIDE OBRR ..... 71
Table 8.1	ENVIRONMENTAL QUALITY STANDARDS FOR NOISE .. 77
Table 10.1	TOTAL CONSTRUCTION COST BY ROUTE ..... 92
Table 10.2	TOTAL BENEFIT ..... 95
Table 10.3	ECONOMIC CONSTRUCTION COST ..... 99
Table 10.4	SUMMARY OF ECONOMIC EVALUATION ..... 100

Table 11.1	FINANCIAL CONSTRUCTION COST .....	101
Table 11.2	TOLL REVENUES .....	102
Table 11.3	FINANCIAL EVALUATION .....	103
Table 11.4	AMOUNTS OF INTEREST CHANGES .....	105
Table 12.1	IMPLEMENTATION SCHEDULE .....	108
Table 12.2	INVESTMENT AMOUNT BY STAGE .....	110

## 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-C3	: Divisions of Central Region
CCTV	: Closed Circuit Television
CRF	: Capital Recovery Factor
DWT	: Dead Weight Ton
DOH	: Department of Highways
EIRR	: Economic Internal Rate of Return
ETA	: Expressway and Rapid Transit Authority
FIRR	: Financial Internal Rate of Return
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
MA	: Muang Amphoe
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 : Divisions 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.

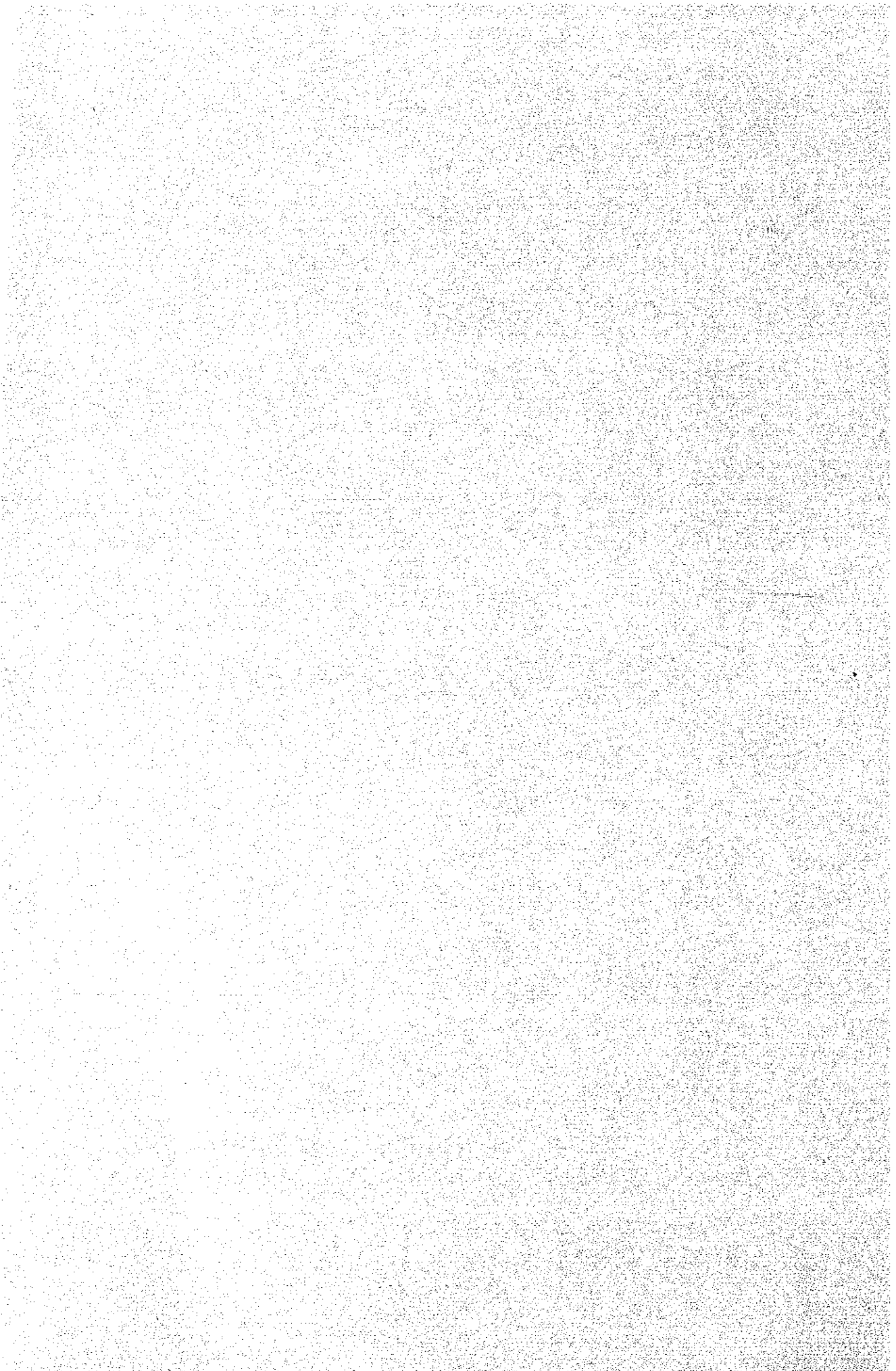
In order to enable Thailand to progress and prosper towards and in the 21 century, the development of the nationwide motorway network is a must. The motorway development, however, is one of the biggest national projects and consists of numerous problems to be solved. To realize such a huge project, therefore, 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

Main targets of the Seventh National Economic and Social Development Plan (the National Plan) which is being established are as follows:

- To sustain stable growth of 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 National Plan, the Government of Thailand inferred that development of an efficient, fast and safe nationwide motorway network is indispensable, therefore it 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 and complete it in the mid of July 1991, taking about 17 months.

### 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 implementation and operation of toll motorway 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.

The Study covered the whole of the Kingdom of Thailand except the area inside Outer Bangkok Ring Road.

### 1.3 SCOPE AND SCHEDULE

The tasks and schedule of the Study are shown in Figure 1.1.

### 1.4 ORGANIZATION

The Study was carried out by the Study Team organized by JICA under guidance of the Advisory Committee consisting of Japanese Government Officials keeping close collaboration with the Counterpart Team organized by the Department of Highways (DOH).

The organization of the Study is shown in Figure 1.2.

### 1.5 REPORTING

During the course of the Study, an Inception Report, two Progress Reports, an Interim Report and a Draft Final Report were prepared and submitted to DOH.

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

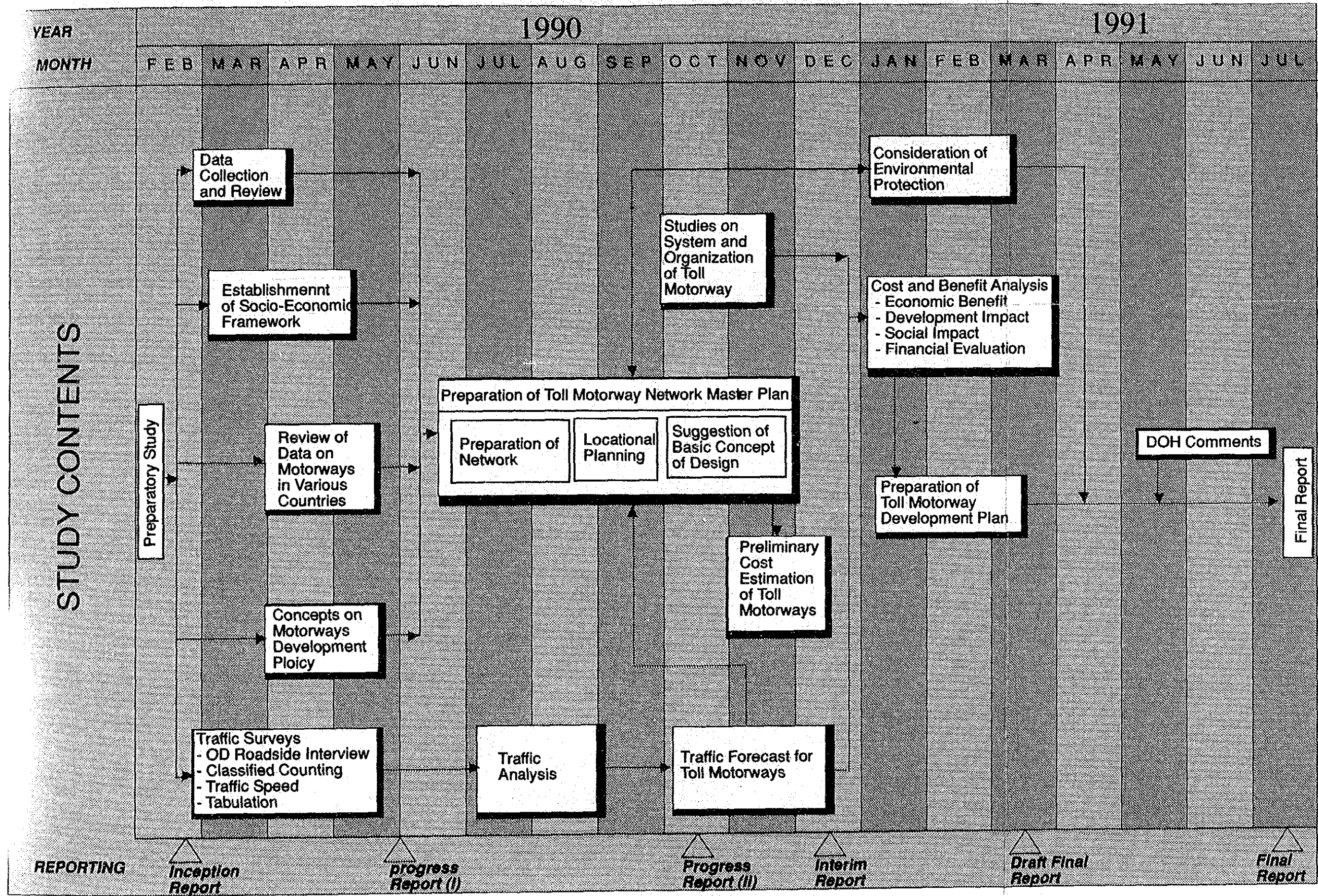


Figure 1.1 STUDY FLOW DIAGRAM



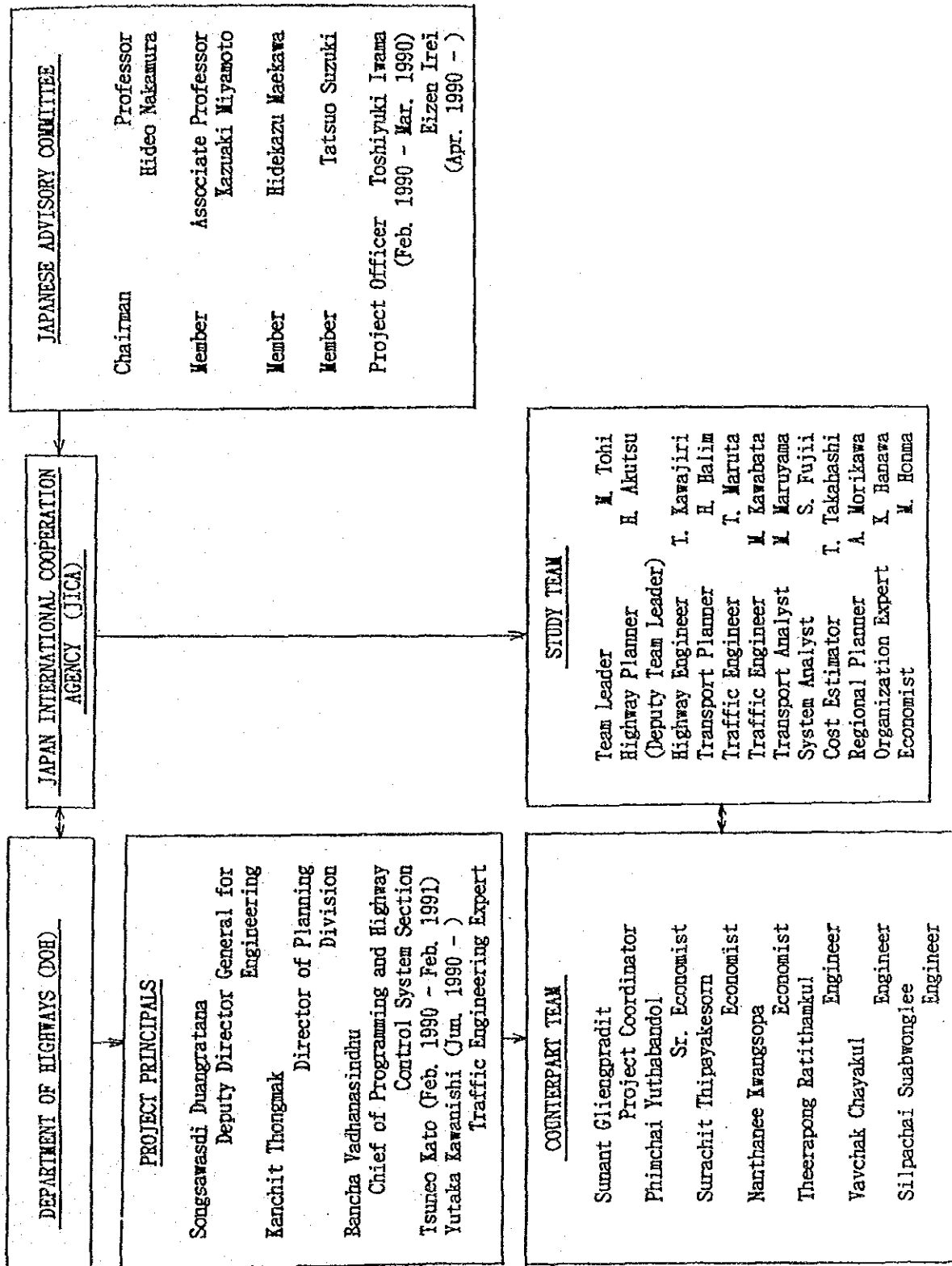


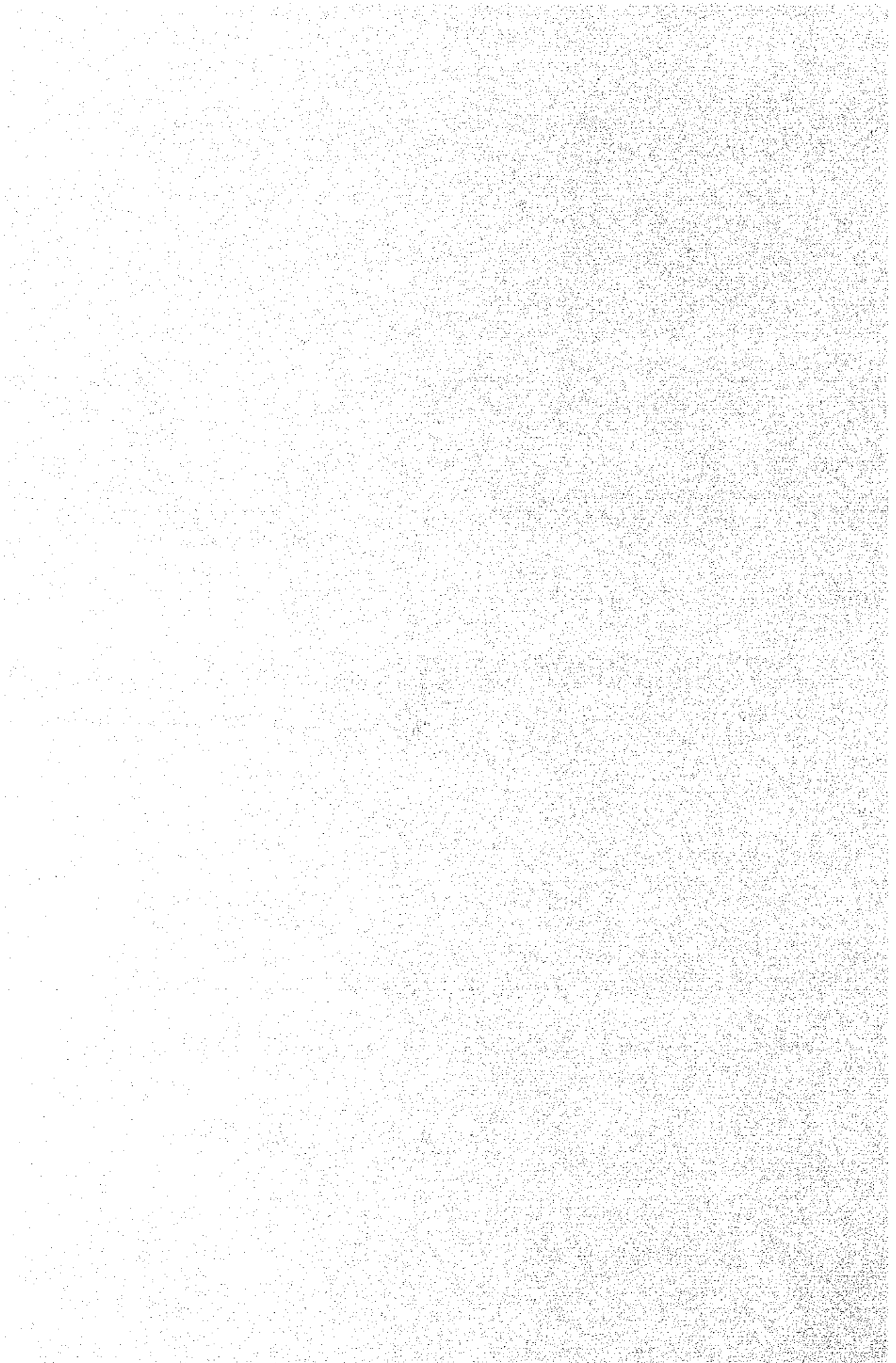
Figure 1.2 ORGANIZATION FOR THE STUDY





## **CHAPTER TWO**

### **EFFECTS OF MOTORWAYS**



## CHAPTER 2

### EFFECTS OF MOTORWAYS

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.

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.

#### 2.1 DIRECT EFFECTS OF MOTORWAYS

Expected direct effects are enumerated as follows:

- 1) Savings in Travel Time
- 2) Savings in Vehicle Operating Costs
- 3) Improvement in Traffic Safety
- 4) Other Effects
  - More Comfortable Driving
  - Relaxation of Traffic Congestion on Existing Roads
  - Improvement in Punctuality
  - Betterment of Environment
  - Promotion of Mobility by Long-Distance Bus Services
  - Less Cargo Damage and Savings in Packing Cost

## 2.2 REGIONAL DEVELOPMENT EFFECTS

Regional development effects (indirect effects) are enumerated as follows:

### 1) Betterment of Nationwide Development

- Promotion of Development in Local Areas
- Redistribution of Excess-Agglomerated Activities in Metropolises to Other Areas

- . Betterment of economic activities distribution
- . Increase in population and income in local areas
- . Alleviation of diseconomy in metropolises

### 2) Promotion of Industries

- Manufacturing
- Tourism
- Agriculture and Fisheries
- Commercial

### 3) Improvement in Living Conditions

- Widening of Life Opportunities
- Regionwide Medical Care
- Recovery from Disasters

### 4) Other Effects

- Higher Productivity
- Increase in Tax Revenues
- Increase in Exports
- Creating Demand by Road Investment - Multiplier Effects
- Enhanced National Identity

**CHAPTER THREE**

**CURRENT CONDITIONS  
IN  
THAILAND**



## CHAPTER 3

### CURRENT CONDITIONS IN THAILAND

The Kingdom of Thailand with an area of some 513,115 square kilometer is situated in the center of the Southeast Asian mainland between latitude 5° and 20° north and longitude 97° and 105° east. The countries bordering on Thailand are Laos, Myanmar, Kampuchea and Malaysia.

#### 3.1 SOCIO-ECONOMIC CONDITIONS

##### 3.1.1 Population

Thailand had a total population of 54,960,917 or 107.1 persons per square kilometer in 1988. The average annual growth rate during the periods 1975-1980, 1980-1985 and 1985-1988 was 2.1%, 2.0% and 2.0%, respectively as shown in Table 3.1.

Table 3.1 POPULATION BY REGION

REGION	Population in Thousand Persons				Annual Growth Rate %			Density in 1988 (persons per Sq km)
	1975	1980	1985	1988	1975-1980	1980-1985	1985-1988	
WHOLE KINGDOM	42,390.5	46,961.0	51,777.7	54,960.9	2.07	1.97	2.01	107.1
NORTHEASTERN	14,533.7	16,088.1	18,061.1	19,254.2	2.05	2.34	2.16	114.0
NORTHERN	8,912.9	9,587.4	10,391.1	10,731.6	1.47	1.62	1.08	63.3
SOUTHERN	5,225.5	5,823.4	6,441.4	6,861.1	2.19	2.04	2.13	97.0
EASTERN	2,544.9	2,883.7	3,300.4	3,595.2	2.53	2.74	2.89	98.5
WESTERN	2,577.7	2,813.5	3,098.4	3,217.4	1.77	1.95	1.26	74.7
SUB CENTRAL	2,428.3	2,537.6	2,663.5	2,791.9	0.88	0.97	1.58	168.3
BNR	6,575.5	7,227.3	7,821.8	8,509.5	3.22	1.59	2.85	1,096.8

Source: Registration Division, Department of Local Administration, Ministry of Interior.

The Kingdom of Thailand is divided here into seven Regions and 73 Changwats (Provinces).

Table 3.1 shows population growth by Region, while Figure 3.1 shows the regional distribution of population in 1988. North-eastern Region has the biggest population of 19,254,200 persons with a share of 35 percent of the total population. Population density in Bangkok Metropolitan Region (BMR) shows the highest of 1,096.8 persons per square kilometer. The lowest population density is 63.3 persons per square kilometer in the Northern Region. The highest population growth rate shows 2.9% in BMR and Eastern Region during 1985-1988.

In population by Changwat, Bangkok Metropolitan Administration (BMA) shows the biggest of 5,717 thousand persons. In terms of population density, BMA shows also the highest density of 3,652.4 persons per square kilometer and followed by Nonthaburi at 958.2 and Samut Prakarn at 785.9 persons per square kilometer. Mae Hong Son in the Northern Region shows the lowest population density of 13.1 persons per square kilometer. These are illustrated in Figure 3.2.

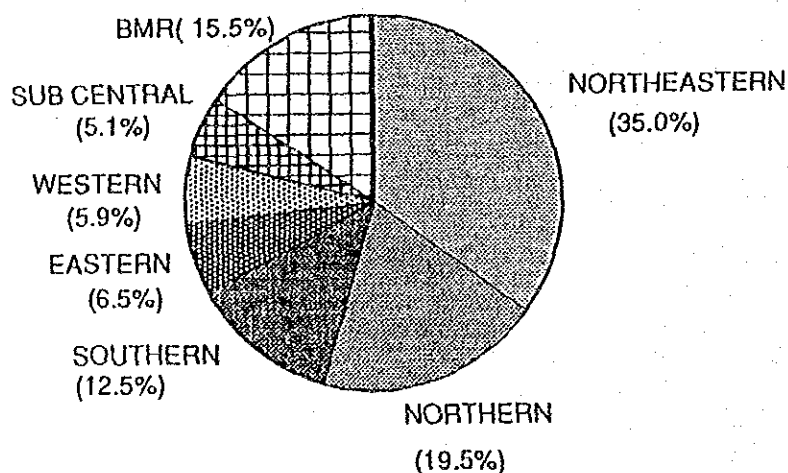


Figure 3.1 POPULATION DISTRIBUTION - 1988



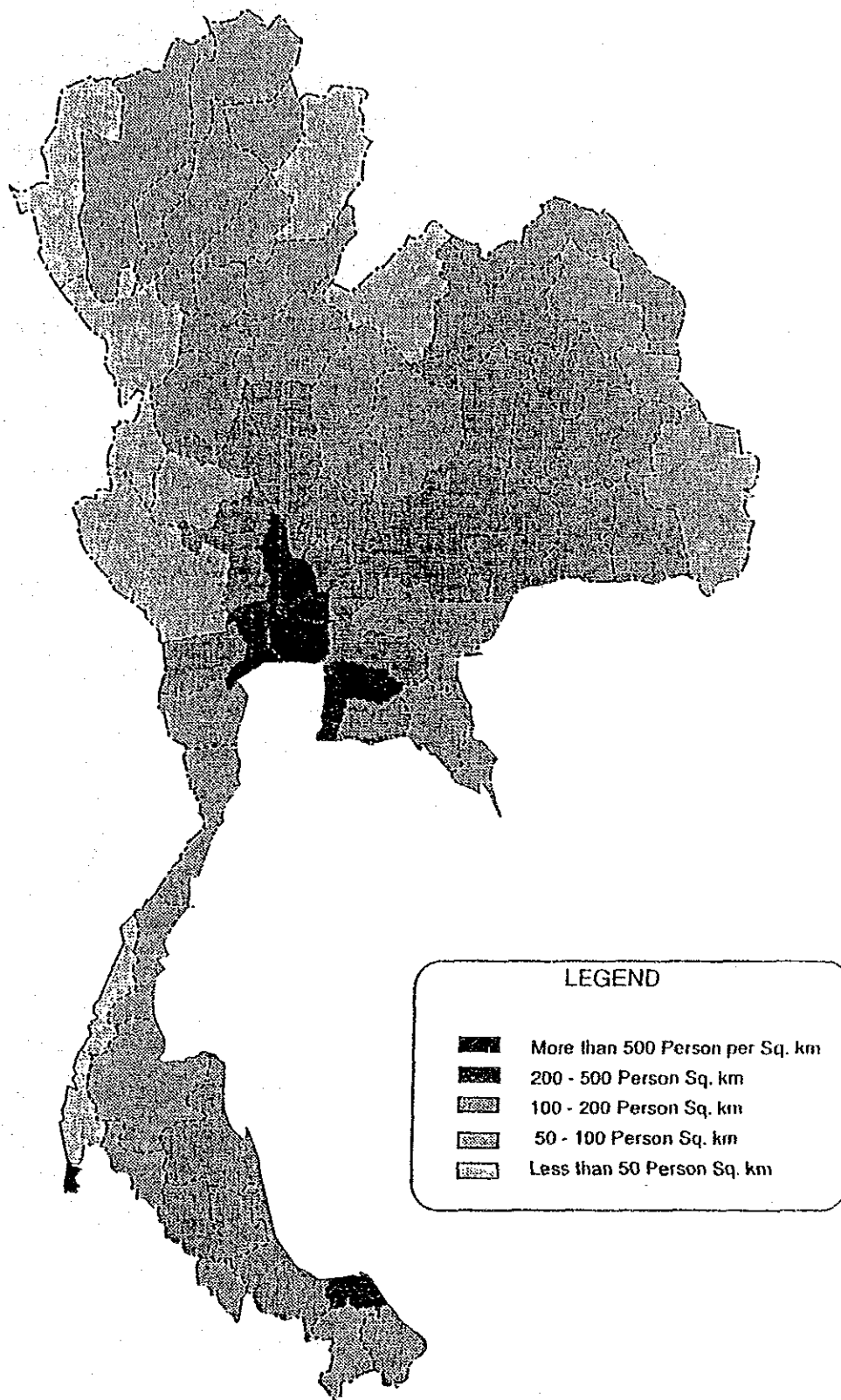


Figure 3.2 POPULATION DENSITY BY CHANGWAT — 1988

Urban population of the Kingdom in 1988 reached at 9,949,400 persons with a share of 18.1% of the total population. The number of municipalities is counted at 132.

Figure 3.3 shows the urban population by municipality. Urban population in BMA is the biggest of 5,717,000 persons with a share of 10.4% of the total population. Except BMA, the municipalities show that more than 100,000 persons are in the following seven cities: Nonthaburi at 218,000 persons, Nakhon Ratchasima at 205,000 persons, Chiang Mai at 164,000 persons, Hat Yai at 138 thousand persons, Khon Kaen at 131 thousand persons, Nakhon Sawan at 105,000 and Ubon Ratchathani at 100,000 persons.

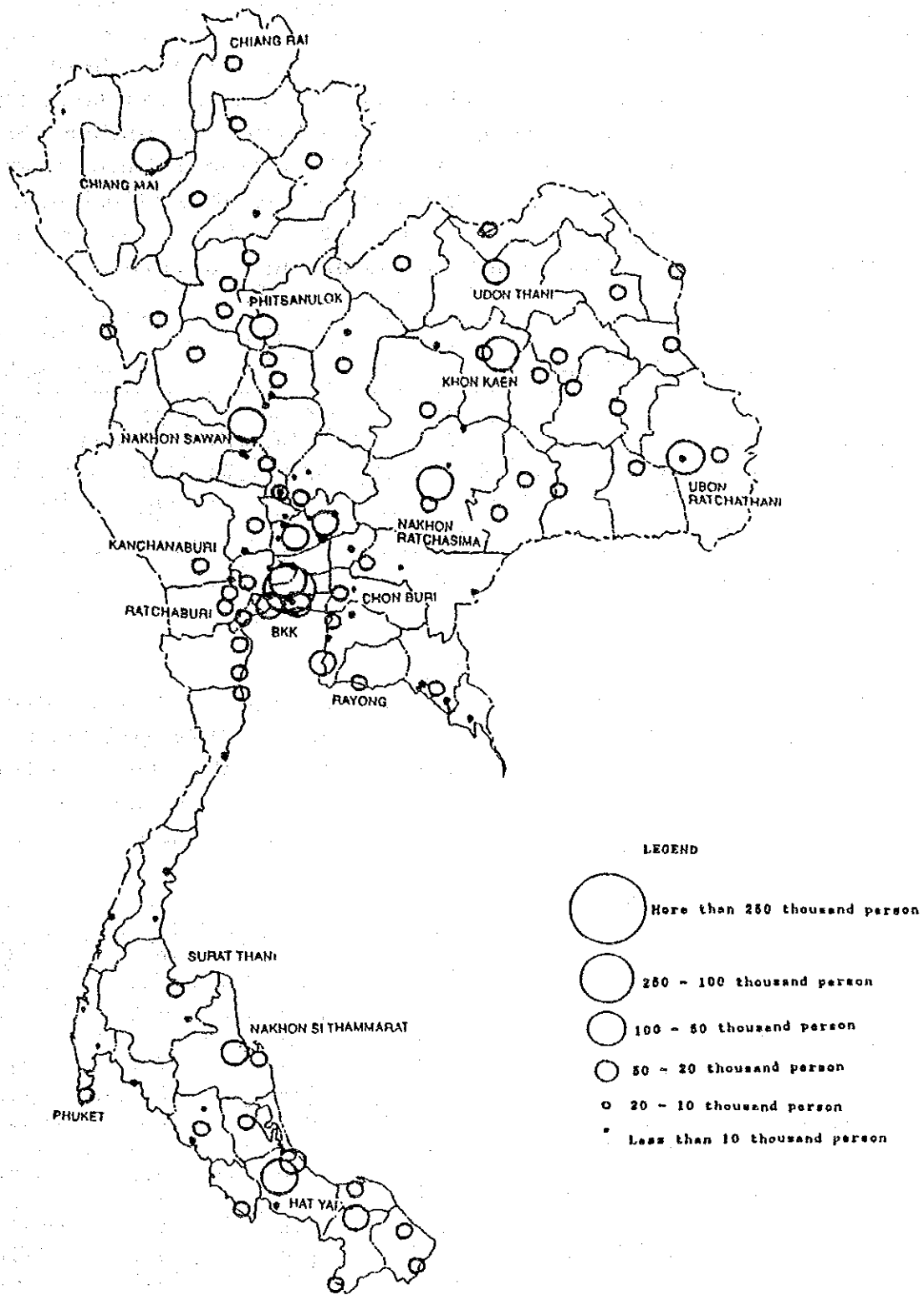


Figure 3.3 URBAN POPULATION BY MUNICIPALITY

### 3.1.2 Economy

#### 1) Gross Domestic Product

In 1987, the Gross Domestic Product (GDP) amounted to 1,234 billion Baht with a growth rate of 8.4% which was higher than the growth during the period of the Fifth National Plan, 1982-1986, of 5.3%. In 1988, a higher growth of 11.0% was estimated due to the increase of export and the influx of foreign investment. This shows that Thailand's economy had upturned.

Table 3.2 GROSS DOMESTIC PRODUCT (million Baht)

	1981	1986	1987	1988
GDP AT CURRENT MARKET PRICES	760,195	1,094,679	1,234,030	1,465,736
GDP AT 1972 CONSTANT PRICES	318,439	411,814	446,361	495,374
GDP GROWTH RATE ( % )		5.3	8.4	11.0

Source: National Economic and Social Development Board (NESDB).

Table 3.3 shows GDP by sector. Percentage share of agriculture had decreased from 20.4% in 1981 to 16.9% in 1988 and that of manufacturing had increased from 21.7% in 1981 to 23.0% in 1988.

Table 3.3 GDP BY SECTOR ( % )

Sector	1981	1986	1987	1988
Agriculture	20.4	19.1	17.3	16.9
Mining and Quarrying	2.4	2.4	2.3	2.4
Manufacturing	21.7	21.7	22.7	23.0
Construction	4.5	3.9	3.9	4.0
Electricity and Water Supply	2.1	2.7	2.7	2.8
Transportation and Communication	6.5	7.3	7.3	7.3
Wholesale and Retail Trade	17.3	16.3	16.7	17.1
Banking, Insurance and Real Estate	2.6	2.9	3.4	3.6
Ownership of Dwellings	4.7	4.4	4.3	4.1
Public Administration and Defense	5.3	5.3	5.1	4.8
Services	12.5	14.0	14.2	14.0
GDP	100	100	100	100

Source: NESDB.

## 2) Gross Regional Product

The Gross Regional Products (GRP) are shown in Table 3.4. In 1987, BMR accounted for 605 billion Baht, i.e. 49.0% of whole kingdom's GDP, and was followed by Northeastern and Northern regions.

Table 3.4 GRP AT CURRENT MARKET PRICES (million Baht)

REGION	1981	1986	1987
NORTHEASTERN	101,715 (13.4)	144,412 (13.2)	155,367 (12.6)
NORTHERN	96,744 (12.7)	126,170 (11.5)	138,283 (11.2)
SOUTHERN	81,026 (10.7)	111,449 (10.2)	122,471 (9.9)
EASTERN	57,161 (7.5)	100,961 (9.2)	100,497 (8.1)
WESTERN	45,884 (6.0)	59,161 (5.4)	62,731 (5.1)
SUB CENTRAL	37,054 (4.9)	45,035 (4.1)	49,516 (4.0)
BMR	340,611 (44.8)	507,489 (46.4)	605,165 (49.0)
WHOLE KINGDOM	760,195 (100)	1,094,679 (100)	1,234,030 (100)

Source: NESDB.

Remark: Figures in parenthesis show the composition ratio.

Table 3.5 shows the annual growth rate of GRP. BMR had increased drastically from 5.0% in 1981-1986 to 15.3% in 1986-1987 due to acceleration in the industrialization. Except BMR, the growth rates of other regions were nearly equal to or less than the national average.

Table 3.5 GRP AT 1972 CONSTANT PRICES (million Baht)

	GRP			Annual Growth Rate (%)	
	1981	1986	1987	1981-1986	1986-1987
NORTHEASTERN	45,186	59,741	60,733	5.7	1.7
NORTHERN	40,279	51,191	52,327	4.9	2.2
SOUTHERN	30,803	39,853	41,862	5.3	5.0
EASTERN	21,780	31,562	32,267	7.7	2.2
WESTERN	17,355	23,135	23,434	5.9	1.3
SUB CENTRAL	15,513	18,412	19,027	3.5	3.3
BMR	147,523	187,921	216,711	5.0	15.3
WHOLE KINGDOM	318,439	411,814	446,361	5.3	8.4

Source : NESDB.

Agriculture was the major economic sector except for the BMR. In the BMR, manufacturing was the biggest sector and followed by whole sales and retail trade. Percentage share of agricultural sector in BMR is only 3.1 percent.

### 3) Gross Provincial Products

In Gross Provincial Products (GPP) by Changwat, BMA reached the highest GPP of 489,344 million Baht in 1987 with a share of 39.7% of GDP. Samut Prakan was the second highest GPP of 57,986 million Baht which shared only 4.7% of GDP.

### 4) Per Capita GDP, GRP and GPP

Per capita GDP had increased from 15,925 Baht in 1981 to 26,876 Baht in 1988 as shown in Table 3.6. As shown in this table, per capita GRP of BMR had increased 1.5 times from 47,785 Baht in 1981 to 71,566 Baht in 1987 and is followed by Eastern Region. Other regions show lower per capita GRP comparing with the national average of 23,021 Baht in 1987.

Table 3.6 PER CAPITA GRP AT CURRENT MARKET PRICES (Baht)

REGION	1981	1986	1987	1988
BMR	47,785	61,358	71,566	-
EASTERN	19,752	30,989	31,094	-
WESTERN	16,265	19,538	19,795	-
SUB CENTRAL	14,652	17,235	18,742	-
SOUTHERN	13,460	16,339	17,506	-
NORTHERN	10,101	12,208	13,185	-
NORTHEASTERN	6,067	7,879	8,343	-
WHOLE KINGDOM	15,925	20,790	23,021	26,876

Source: NESDB.

The growth rates of per capita GDP during 1981 — 1986, 1986 — 1987, and 1987 — 1988 were 3.2%, 6.5% and 9.1% respectively as shown in Table 3.7.

Table 3.7 PER CAPITA GRP AT 1972 CONSTANT PRICES

(Baht)

REGION	GRP				Annual Growth Rate %		
	1981	1986	1987	1988	1981-1986	1986-1987	1987-1988
BMR	20,696	22,720	25,628	-	1.9	12.8	-
EASTERN	7,526	9,687	9,984	-	5.2	3.1	-
WESTERN	6,152	7,640	7,395	-	4.4	-3.2	-
SUB CENTRAL	6,134	7,046	7,202	-	2.8	2.2	-
SOUTHERN	5,117	5,843	5,984	-	2.7	2.4	-
NORTHERN	4,205	4,953	4,989	-	3.3	0.7	-
NORTHEASTERN	2,695	3,260	3,261	-	3.9	0.1	-
WHOLE KINGDOM	6,671	7,821	8,327	9,083	3.2	6.5	9.1

Source: NESDB.

The growth rate of per capita GRP in BMR was the highest of 12.8% during 1986 to 1987 and that in other regions is lower than the national average of 6.5%. In recent years, differentials of per capita GRP between BMR and other regions have expanded increasingly.

### 5) Manufacturing

The number of industrial factories in the Kingdom was counted about 87,000 in 1987. Among them, rice mill factories occupied more than half of the total as shown in Table 3.8.

According to the number of factories by region, except for BMR, the main type of factories in the Kingdom is agro-industry.

Table 3.8 NUMBER OF FACTORIES BY REGION

REGION	1986			1987		
	Rice Mills	Others	Total	Rice Mills	Others	Total
NORTHEASTERN	25,907	4,811	30,718	25,774	5,230	31,004
NORTHERN	10,970	3,475	14,445	10,834	3,818	14,652
SOUTHERN	4,538	2,742	7,280	4,513	3,007	7,520
EASTERN	1,885	3,097	4,982	1,884	3,189	5,073
WESTERN	1,475	2,325	3,800	1,458	2,377	3,835
SUB CENTRAL	1,398	1,013	2,411	1,398	1,069	2,467
BMR	772	21,072	21,844	776	21,894	22,670
WHOLE KINGDOM	46,945	38,535	85,480	46,637	40,584	87,221

Source: Ministry of Industry.

## 6) Tourism

International tourist arrivals in Thailand in 1988 reached 4,230,737, with an increase of 21.5% over the previous year.

Arrivals by air of all tourists numbered 3,290,145 or 77.8%, 895,078 or 21.2% by land and 45,514 or 1.1% by sea, as shown in Table 3.9.

According to the record of guest arrivals at all types of accommodation establishments in major cities, which is shown in Table 3.10, Bangkok reached 4,884,951, and Pattaya and Hat Yai followed.

Table 3.9 INTERNATIONAL TOURIST ARRIVAL (persons)

Mode	1986		1987		1988	
	Arrival	Change(%)	Arrival	Change(%)	Arrival	Change(%)
Total	2,818,092	+15.6	3,482,958	+23.6	4,230,737	+21.5
Air	2,110,800	+14.9	2,653,624	+25.7	3,290,145	+24.0
Land	669,751	+19.7	783,074	+16.9	895,078	+14.3
Sea	37,541	+17.2	46,260	+12.6	45,514	- 1.6

Source: Tourism Authority of Thailand

Table 3.10 NUMBER OF GUEST ARRIVAL (persons)

City	1987	1988
Total	8,617,079 (100.0)	9,886,817 (100.0)
Bangkok	4,369,306 ( 50.7)	4,884,951 ( 49.4)
Chiang Mai	827,666 ( 9.6)	945,879 ( 9.6)
Kanchanaburi	168,298 ( 2.0)	168,677 ( 1.7)
Pattaya	1,417,451 ( 16.4)	1,727,025 ( 17.5)
Phuket	546,949 ( 6.3)	726,173 ( 7.3)
Hat Yai	1,030,274 ( 12.0)	1,169,655 ( 11.8)
Sungai Kolok	257,135 ( 3.0)	264,457 ( 2.7)

Source : Tourism Authority of Thailand

Remark : Figures in parenthesis show the composition ratio.

### 3.1.3 Registered Vehicles

Table 3.11 presents the number of registered vehicles under the



Motor Vehicle Act of the Police Department between 1973 and 1985. The data of 1988 are presented in Table 3.12 after introducing the Land Transport Act.

Table 3.11 NUMBER OF REGISTERED VEHICLES (1973 - 1985)

		1973	1975	1977	1979	1981	1983	1985
Whole Kingdom	Passenger Cars	250,689	290,399	331,266	392,798	345,599	411,982	545,375
	Motor Cycles	408,224	479,477	647,509	861,015	1,163,981	1,716,175	1,816,186
	Motor Tricycles	8,060	6,424	8,556	8,944	8,678	11,261	13,262
	Buses	21,572	22,717	31,295	32,079	170,183	221,006	256,256
	Vans & Trucks	179,394	238,057	346,222	416,850	466,463	568,802	598,764
	Others	19,135	24,087	31,358	40,490	42,025	47,701	50,613
	Grand Total	887,074	1,061,161	1,396,206	1,732,176	2,196,929	2,976,927	3,280,756

Source: Police Department

Although there are some differences between the number of registered vehicles by type in 1985 and in 1988 due to the change of registration method, the total number of registered vehicles has drastically increased from 3,280,756 in 1985 to 6,382,940 in 1988 with an annual growth rate of 24.8%.

Table 3.12 NUMBER OF REGISTERED VEHICLES - 1988

Type of Vehicle	Under Motor Vehicle Act	Under Land Transport Act	Total
Passenger car	1,146,512		1,146,512
Personal van and truck	723,882	254,244	978,126
Taxi and Service car	65,399		65,399
Bus		83,222	83,222
Motorcycle	3,894,824		3,894,824
Others	214,857		214,857
Total	6,045,474	337,466	6,382,940

Source: Department of Land Transport, Ministry of Transport and Communications.

According to the registered vehicles under Motor Vehicle Act,

the total number of registered vehicles in BMR was counted at 2 millions in 1988 with a share of 33.5% of the total number of vehicles. As for the Passenger cars in BMR, especially, they have the highest share of 76.1% of the total passenger cars as shown in Table 3.13.

Table 3.13 REGISTERED VEHICLES BY REGION UNDER MOTOR VEHICLE ACT - 1988

Region	Passenger Car	Personal Van and Truck	Taxi and Service	Motor-cycle	Others	Total
Northeastern	54,103	131,689	5,684	625,732	40,759	857,967
	4.7	18.2	8.7	16.1	19.0	14.2
Northern	76,489	159,778	5,649	920,259	87,906	1,250,072
	6.7	22.1	8.6	23.6	40.9	20.7
Southern	39,514	94,758	5,328	659,189	1,996	800,785
	3.4	13.1	8.1	16.9	0.9	13.2
Eastern	41,772	88,225	2,569	264,529	5,800	402,895
	3.6	12.2	3.9	6.8	2.7	6.7
Western	26,871	59,620	1,060	277,104	5,944	370,599
	2.3	8.2	1.6	7.1	2.8	6.1
Sub Central	35,234	44,998	3,823	232,793	18,225	335,073
	3.1	6.2	5.8	6.0	8.5	5.5
BMR	872,529	144,814	41,295	915,218	54,227	2,028,083
	76.1	20.0	63.1	23.5	25.2	33.5
Total	1,146,512	723,882	65,399	3,894,824	214,857	6,045,474
	100	100	100	100	100	100

Source: Department of Land Transport, Ministry of Transport and Communications.

### 3.2 TRANSPORT CONDITIONS

The major domestic transport modes in Thailand consist of road, railway, coast, inland water and air transports. Each mode has been developed in such a manner to connect every part of the country with Bangkok.

Figure 3.4 shows domestic passenger and freight transports for each transport mode. As shown in this figure, the road acts a vital role among transport modes in the country.

In the passenger transport, the road occupies 90.5% of the share in terms of passenger-km and in the freight transport 84.0% in terms of ton-km.

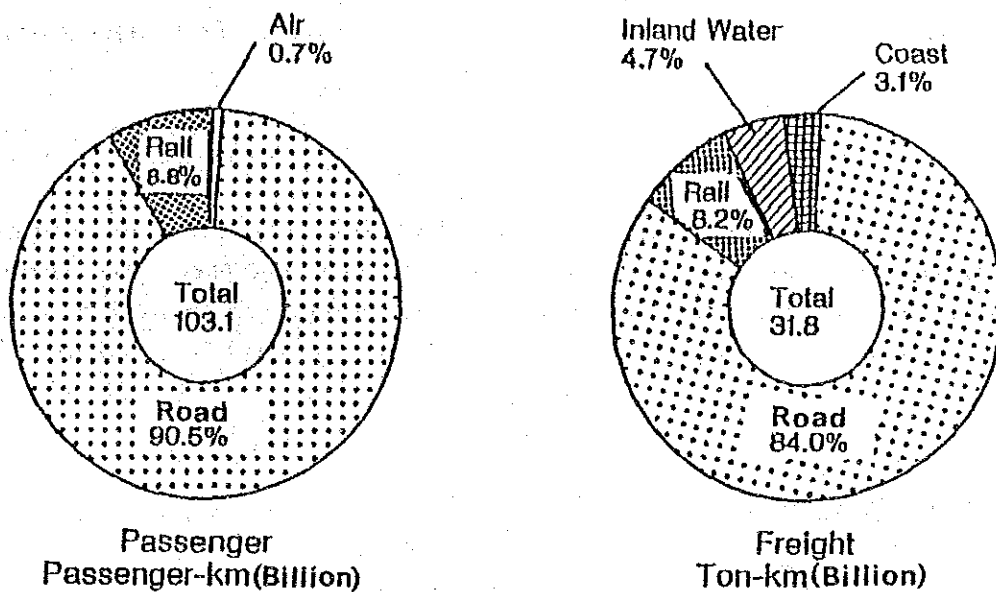


Figure 3.4 SHARE OF TRANSPORT MODES - 1987

#### 1) Road Transport

There are various types of roads in Thailand and they are constructed and maintained by various agencies. The length of all of these roads reaches 176,530 km in 1988, increasing at a pace of about 3,000 km per year for the past 7 years from 1981 to 1988.

#### 2) Railway Transport

The State Railway of Thailand, owned by the Government, has a railway system radiating from Bangkok with a total length of 3,735 km as of the end of fiscal year 1985.

#### 3) Coast Transport

Main coastal ports are located along the Gulf of Thailand except Phuket on the Andaman Sea. The coast transport is mainly carried out between Bangkok and ports in Southern Region.

#### 4) Inland Water Transport

Main rivers utilized for the inland water transport are Chaophraya, Thachin and Meaklng rivers with their tributaries. The inland water transport has lost its importance compared