

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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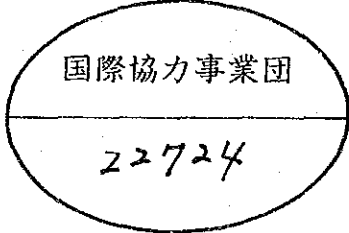
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PREFACE

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).

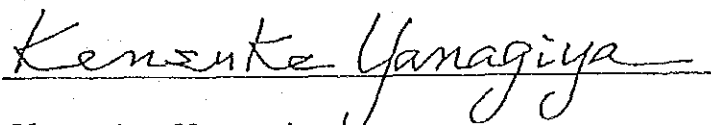
JICA sent to Thailand a study team headed by Mr. Masahiko Tohi, Katahira & Engineers International from February 1990 to March 1991.

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



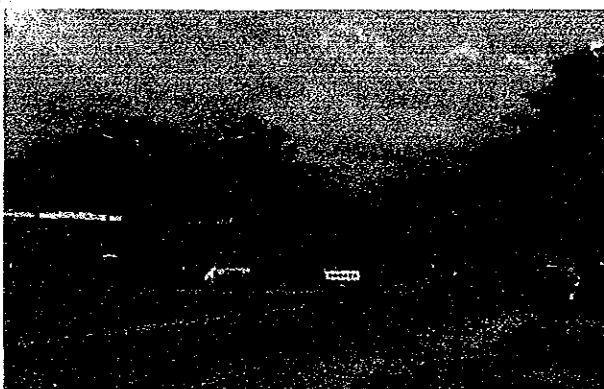
**National highway in suburban area
with severe congestion and mixed traffic**



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

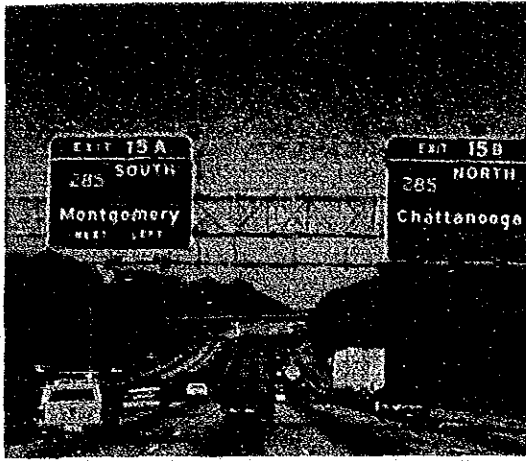


**Four-lane highway in rural area with
expected congestion in near future**

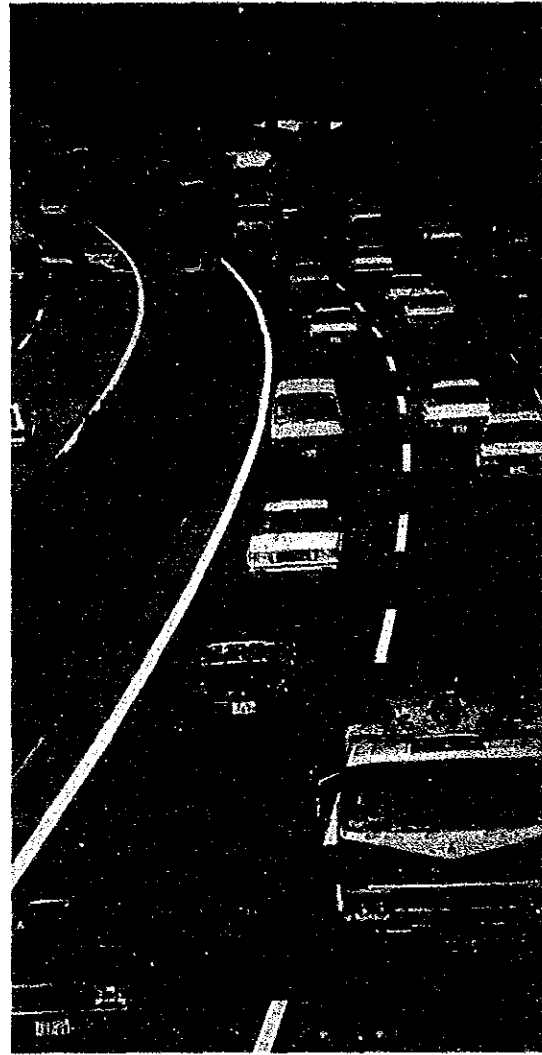


**Two-lane highway in rural area under
improvement to four-lane**

PRESENT HIGHWAY CONDITIONS IN THAILAND



U.S.A.



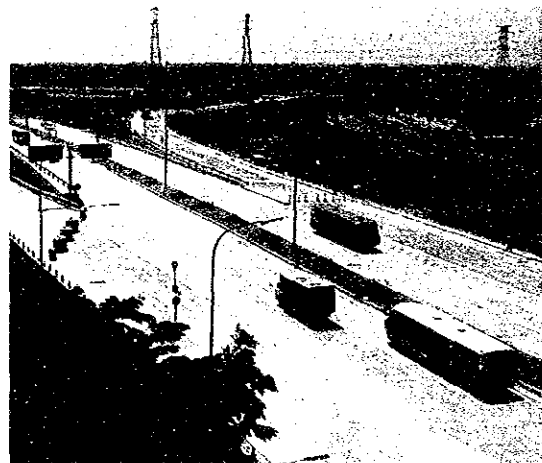
Japan



Malaysia

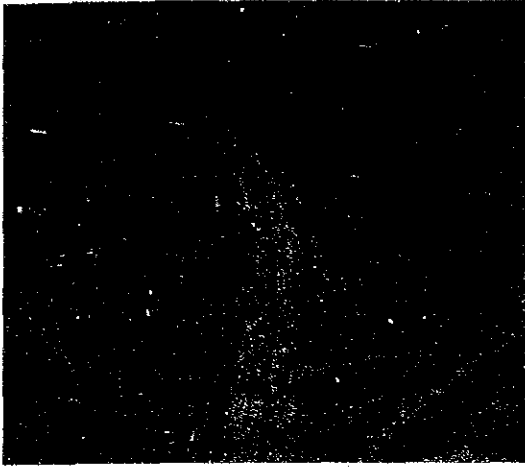


Philippines

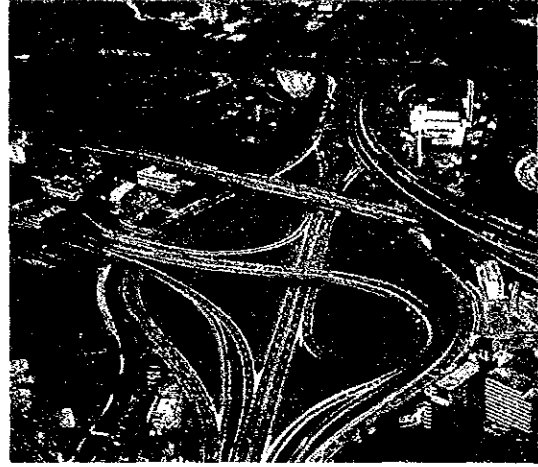


Indonesia

MOTORWAYS IN SELECTED COUNTRIES



Inter change



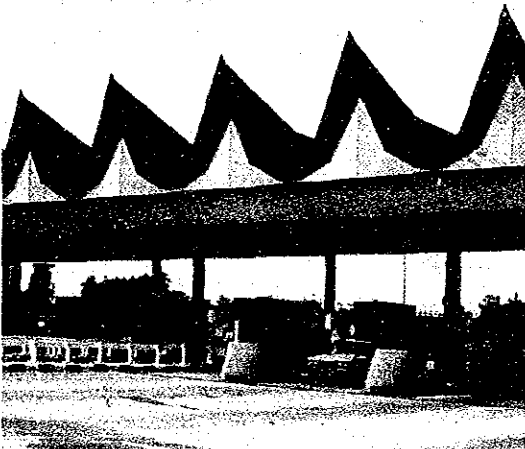
Inter change



Service Area



Parking Area



Toll Gate (Malaysia)



Toll Gate (Thailand)

MOTORWAY FACILITIES

CONTENTS

	Page
PREFACE	i
THE STUDY AREA	ii
APPENDICES	ix
LIST OF FIGURES	xiii
LIST OF TABLES	xviii
ABBREVIATIONS	xxiv
FINDINGS AND RECOMMENDATIONS	xxvi
CHAPTER 1 INTRODUCTION	1- 1
1.1 BACKGROUND	1- 1
1.2 OBJECTIVES	1- 2
1.3 SCOPE AND SCHEDULE	1- 2
1.4 ORGANIZATION	1- 4
1.5 REPORTING	1- 4
CHAPTER 2 EFFECTS OF MOTORWAYS	2- 1
2.1 INTRODUCTION	2- 1
2.2 DIRECT EFFECTS OF MOTORWAYS	2- 1
2.2.1 Savings in Travel Time	2- 1
2.2.2 Savings in Vehicle Operating Costs	2- 2
2.2.3 Improvement in Traffic Safety	2- 2
2.2.4 Other Effects	2- 3
2.3 REGIONAL DEVELOPMENT EFFECTS	2- 4
2.3.1 Betterment of Nationwide Development	2- 4
2.3.2 Promotion of Industries	2- 5
2.3.3 Improvement in Living Conditions	2- 7
2.3.4 Other Effects	2- 8
2.3.5 Negative Effects	2- 8
CHAPTER 3 CURRENT CONDITIONS IN THAILAND	3- 1
3.1 LAND CONDITIONS	3- 1
3.2 SOCIO-ECONOMIC CONDITIONS	3- 2
3.2.1 Population	3- 2
3.2.2 Economy	3- 7
3.2.3 Registered Vehicles	3-15
3.3 TRANSPORT CONDITIONS	3-16
3.3.1 Transport Modes	3-16

3.3.2	Road Transport	3-19
3.3.3	Railway Transport	3-20
3.3.4	Coast Transport	3-20
3.3.5	Inland Water Transport	3-24
3.3.6	Air Transport	3-24
3.4	HIGHWAY CONDITIONS	3-27
3.4.1	Highway Network	3-27
3.4.2	Traffic Condition	3-28
3.4.3	Budget of DOH	3-30
3.4.4	Management for Toll Highways	3-31
3.4.5	Design Standards	3-34
3.4.6	Traffic Accidents on Highways	3-35
3.4.7	Expressways in Bangkok	3-36
CHAPTER 4 DEVELOPMENT PLAN AND SOCIO- ECONOMIC FRAMEWORK		4- 1
4.1	THE NATIONAL ECONOMIC AND SOCIAL DEVELOPMENT PLAN	4- 1
4.1.1	Objectives and Target of the Sixth Plan	4- 1
4.1.2	Development Guidelines in the Sixth Plan	4- 1
4.1.3	Main Programs	4- 2
4.1.4	Regional Development Plan	4- 2
4.2	EASTERN AND SOUTHERN SEABOARD DEVELOPMENT PROGRAMS	4- 5
4.2.1	Eastern Seaboard Development Program	4- 5
4.2.2	Southern Seaboard Development Program	4- 8
4.3	ESTABLISHMENT OF SOCIO-ECONOMIC FRAMEWORK	4- 9
4.3.1	Population	4-11
4.3.2	Economic Indicators	4-13
CHAPTER 5 TRANSPORTATION DEVELOPMENT PLAN		5- 1
5.1	FUTURE PLAN OF TRANSPORTATION SECTORS	5- 1
5.1.1	Land Transport	5- 1
5.1.2	Water Transport	5- 3
5.1.3	Air Transport	5- 4
5.2	CONCEPT OF THE SEVENTH HIGHWAY DEVELOPMENT PLAN	5- 6
5.3	FUTURE PLANS OF THE NATIONAL HIGHWAYS	5- 7

CHAPTER 6 TRAFFIC SURVEY, ANALYSIS

AND FORECAST.....	6- 1
6.1 INTRODUCTION	6- 1
6.1.1 General	6- 1
6.1.2 Definition of Regions and Divisions	6- 1
6.2 TRAFFIC SURVEYS AND RESULTS	6- 2
6.2.1 Mobilization	6- 5
6.2.2 Methodology	6- 6
6.2.3 Results of Traffic Surveys	6-10
6.3 ESTABLISHMENT OF PRESENT AND FUTURE OD TABLES	6-22
6.3.1 Methodology of Present OD Tables	6-22
6.3.2 Methodology of Future OD Tables	6-27
6.3.3 Development of Trip Generation Model	6-28
6.3.4 Trips of Future Development Plans	6-33
6.3.5 Trip Distribution Analysis	6-37
6.4 PRESENT AND FUTURE TRIP PATTERN	6-38
6.4.1 Present OD Tables and Desire Line Charts	6-39
6.4.2 Future Trip Pattern	6-48
6.4.3 Growth of Trip Generation and Attraction	6-57
6.4.4 Trip Length Distribution	6-65
6.5 ASSIGNED TRAFFIC VOLUMES	6-67
6.5.1 Methodology	6-67
6.5.2 Traffic Volumes on Present and Future National Highway Networks — Case of "Without Project"	6-81
6.5.3 Traffic Volumes on Future National Highway and Toll Motorway Networks — Case of "With Project"	6-86
CHAPTER 7 MOTORWAY NETWORK MASTER PLAN ...	7- 1
7.1 MOTORWAYS DEVELOPMENT POLICY	7- 1
7.2 PROCEDURE FOR ESTABLISHMENT OF MASTER PLAN ..	7- 3
7.3 TARGET LENGTH OF MOTORWAYS	7- 5
7.4 ESTABLISHMENT OF TENTATIVE MOTORWAY NETWORK...	7- 6
7.4.1 Basic Idea for Planning	7- 6
7.4.2 Tentative Motorway Network	7-11
7.5 ESTABLISHMENT OF PROPOSED MOTORWAY NETWORK ...	7-13
7.5.1 Assessment of the Tentative Motorway Network	7-13
7.5.2 Proposed Motorway Network — 4,300 km —	7-15

7.6	CHARACTERISTICS OF 4,300 KM MOTORWAY NETWORK	7-21
7.6.1	Traffic	7-21
7.6.2	Coverage	7-22
7.7	BASIC FACTORS OF DESIGN AND PLANNING	7-26
7.7.1	Basic Factors of Design	7-26
7.7.2	Planning of Motorway Facilities	7-30
7.8	ROUTING	7-31
7.9	ROUTES INSIDE OBRR TO CONNECT WITH PROPOSED MOTORWAYS	7-47
CHAPTER 8 ENVIRONMENTAL CONSIDERATIONS		8- 1
8.1	OUTLINE OF MOTORWAY ENVIRONMENTAL PROBLEMS	8- 1
8.2	ENVIRONMENTAL IMPACT ASSESSMENT AND FORECAST	8- 4
8.2.1	Environmental Impact Assessment	8- 4
8.2.2	Forecasting Methodology	8- 5
8.3	ENVIRONMENTAL PROTECTION MEASURES	8-10
8.3.1	General	8-10
8.3.2	Environmental Protection Goals	8-11
8.3.3	Measures Incorporated in Highway Planning	8-13
8.3.4	Measures Embodied in Highway Construction	8-14
8.3.5	Measures Taken for Roadside Areas and Vicinity	8-16
8.4	IMPROVEMENT OF MOTORWAY ENVIRONMENT	8-17
8.5	MAIN ENVIRONMENTAL CONSIDERATIONS BY ROUTE	8-17
CHAPTER 9 SYSTEM AND ORGANIZATION		9- 1
9.1	FINANCIAL SYSTEM	9- 1
9.1.1	Special Fund System (Earmarked Tax Revenue System)	9- 3
9.1.2	Toll Road System	9- 5
9.2	MANAGEMENT SYSTEM	9-13
9.2.1	Proposed Execution Bodies	9-13
9.2.2	Organization of DOH in the Preparatory Period	9-16
9.2.3	Proposed Public Corporation	9-18
9.2.4	Maintenance and Traffic Operation	9-28
9.2.5	Traffic Control and Management System	9-30

CHAPTER 10 ECONOMIC EVALUATION	10- 1
10.1 CONSTRUCTION COSTS	10- 1
10.1.1 Quantities of Major Work Items	10- 1
10.1.2 Unit Costs	10- 2
10.1.3 Construction Cost	10- 4
10.2 MAINTENANCE AND OPERATION COST	10- 6
10.3 BENEFIT	10-13
10.3.1 Classification of Benefit of Motorways	10-13
10.3.2 Direct Benefit	10-13
10.3.3 Regional Development Effects (Indirect Benefits)	10-36
10.4 ECONOMIC ANALYSIS	10-45
10.4.1 Economic Costs	10-45
10.4.2 Conditions for Economic Analysis	10-45
10.4.3 Results of Economic Analysis	10-46
10.4.4 Economic Sensitivity Analysis	10-47
CHAPTER 11 FINANCIAL EVALUATION	11- 1
11.1 FINANCIAL COST	11- 1
11.1.1 Financial Construction Cost	11- 1
11.1.2 Financial Maintenance and Operation Costs	11- 1
11.2 TOLL RATE	11- 2
11.2.1 Criteria for Toll Rate Determination	11- 2
11.2.2 Generalized Costs of Toll Motorways and Railways	11- 2
11.3 FINANCIAL ANALYSIS	11- 4
11.3.1 Toll Rate and Revenues	11- 4
11.3.2 Financial Returns	11- 5
11.3.3 Repayment Schedule	11- 5
11.3.4 Financial Sensitivity Analysis	11- 7
11.4 TREATMENT OF TOLL ROAD SYSTEM AFTER COMPLETION OF REPAYMENT	11 16
11.4.1 Repayment Principle and Toll Road System	11 16
11.4.2 Toll Road System after Completion of Repayment	11 17
11.5 VALUE CAPTURE	11 18
11.5.1 Concept and Definition of Value Capture	11 18
11.5.2 Methods for Value Capture Policy	11 19

CHAPTER 12 IMPLEMENTATION SCHEDULE 12- 1

12.1 IMPLEMENTATION SCHEDULE 12- 1

12.2 INVESTMENT PROGRAM 12- 4

12.3 FUTURE STUDY 12- 4

APPENDICES

	Page
Appendix 3. 1	ADMINISTRATION BOUNDARY BY REGION AND CHANGWAT 1
Appendix 3. 2	POPULATION BY CHANGWAT 2
Appendix 3. 3	URBAN POPULATION BY MUNICIPALITY 5
Appendix 3. 4	GROSS PROVINCIAL PRODUCT AT CURRENT MARKET PRICES 7
Appendix 3. 5	GROSS PROVINCIAL PRODUCT AT 1972 CONSTANT PRICES 8
Appendix 3. 6	PER CAPITA GPP AT CURRENT MARKET PRICES ... 9
Appendix 3. 7	PER CAPITA GPP AT 1972 CONSTANT PRICES 10
Appendix 3. 8	NUMBER OF FACTORIES BY CHANGWAT 11
Appendix 3. 9	RAILWAY NETWORK 12
Appendix 3. 10	MAIN COASTAL PORTS 12
Appendix 3. 11	MAIN INLAND WATER PORTS 13
Appendix 3. 12	AIRPORTS 13
Appendix 3. 13	DESIGN STANDARDS FOR PRIMARY HIGHWAY 14
Appendix 4. 1	FUTURE POPULATION BY CHANGWAT 15
Appendix 4. 2	REGRESSION FORMULA AND PARAMETERS BY REGION 16
Appendix 4. 3	FUTURE GPP BY CHANGWAT AT 1972 CONSTANT PRICES 17
Appendix 6. 1	TRAFFIC SURVEY FORMS 18
Appendix 6. 2	LIST OF TRAFFIC SURVEY STATIONS 20
Appendix 6. 3	SPEED SURVEY STATIONS 21
Appendix 6. 4	EXPANSION FACTORS 22
Appendix 6. 5	NUMBER OF EFFECTIVE SAMPLES 26
Appendix 6. 6	INTER-CHANGWAT TRAFFIC BY SURVEY STATION — 1990 30
Appendix 6. 7	AVERAGE CAPACITY OF TRUCKS — 1990 33
Appendix 6. 8	AVERAGE ESTIMATED PAYLOAD OF TRUCKS — 1990 37
Appendix 6. 9	EMPTY VEHICLE RATIO OF TRUCKS — 1990 41
Appendix 6. 10	AVERAGE NUMBER OF ASSISTANTS — 1990 45
Appendix 6. 11	ESTIMATED COMMODITY FLOW — 1990 49
Appendix 6. 12	AVERAGE CAPACITY OF PASSENGER VEHICLES — 1990 56

Appendix 6.13	AVERAGE OCCUPANCY OF PASSENGER VEHICLES — 1990	60
Appendix 6.14	PERCENTAGE OF TRIP PURPOSE — 1990	64
Appendix 6.15	SOCIO-ECONOMIC INDICATORS AND TRIP GENERATION AND ATTRACTION BY CHANGWAT — 1990	68
Appendix 6.16	INTER-CHANGWAT OD TABLE — 1990	69
Appendix 6.17	GENERATION AND ATTRACTION OF INTER-CHANGWAT TRIPS — 1990	71
Appendix 6.18	DIVISIONAL OD TABLES — 1990	72
Appendix 6.19	REGIONAL OD TABLES — 1990	73
Appendix 6.20	GENERATED AND ATTRACTED REGIONAL TRIPS — 1990	73
Appendix 6.21	GENERATED AND ATTRACTED REGIONAL TRIPS BY COMMODITY GROUP — 1990	74
Appendix 6.22	GENERATED AND ATTRACTED REGIONAL TRIPS BY PURPOSE — 1990	74
Appendix 6.23	COMMODITY FLOW FROM/TO BMR — 1990	75
Appendix 6.24	COMMODITY FLOW COMPOSITION FROM/TO BMR — 1990	76
Appendix 6.25	INTER-CHANGWAT OD TABLE — 2000	77
Appendix 6.26	INTER-CHANGWAT OD TABLE — 2010	79
Appendix 6.27	PRESENT AND FUTURE INTER-CHANGWAT DESIRE LINE CHARTS	81
Appendix 6.28	GENERATED AND ATTRACTED INTER-CHANGWAT TRIPS — 2000	83
Appendix 6.29	GENERATED AND ATTRACTED INTER-CHANGWAT TRIPS — 2010	84
Appendix 6.30	DIVISIONAL OD TABLES — 2000	85
Appendix 6.31	DIVISIONAL OD TABLES — 2010	86
Appendix 6.32	PRESENT AND FUTURE INTER-DIVISION DESIRE LINE CHARTS	87
Appendix 6.33	REGIONAL OD TABLES — 2000	88
Appendix 6.34	REGIONAL OD TABLES — 2010	88
Appendix 6.35	PRESENT AND FUTURE INTER-REGION DESIRE LINE CHARTS	89
Appendix 6.36	GENERATED AND ATTRACTED REGIONAL TRIPS — 2000	90
Appendix 6.37	GENERATED AND ATTRACTED REGIONAL TRIPS — 2010	90
Appendix 6.38	GROWTH RATES OF INTER-CHANGWAT TRIP-ENDS	91
Appendix 6.39	GROWTH RATES OF DIVISIONAL TRIP-ENDS	92

Appendix 6. 40	GROWTH RATES OF INTER- AND INTRA-REGION TRIP-ENDS	92
Appendix 6. 41	GROWTH RATES OF REGIONAL GENERATED AND ATTRACTED TRIPS	92
Appendix 6. 42	TRIP LENGTH DISTRIBUTION BY VEHICLE CATEGORY — 1990	93
Appendix 6. 43	TRIP LENGTH DISTRIBUTION OF PASSENGER VEHICLES BY TRIP PURPOSE — 1990	93
Appendix 6. 44	TRIP LENGTH DISTRIBUTION OF COMMODITY VEHICLES BY COMMODITY GROUP — 1990	94
Appendix 6. 45	TRIP LENGTH DISTRIBUTION BY VEHICLE CATEGORY — 2000	94
Appendix 6. 46	TRIP LENGTH DISTRIBUTION BY VEHICLE CATEGORY — 2010	95
Appendix 6. 47	PRESENT AND FUTURE TRIP LENGTH DISTRIBUTION BY VEHICLE GROUP	95
Appendix 6. 48	NUMBER OF SUB-ZONES FOR TRAFFIC ASSIGNMENT BY CHANGWAT	96
Appendix 6. 49	SUB-ZONING SYSTEM OF THE STUDY AREA	96
Appendix 6. 50	LINK CLASSIFICATION AND Q-V EQUATION PARAMETERS	98
Appendix 6. 51	AASHTO DIVERSION CURVE	99
Appendix 6. 52	NIHON DORO KODAN DIVERSION CURVES	99
Appendix 6. 53	TRAFFIC ASSIGNMENT CASES	101
Appendix 6. 54	TRAFFIC VOLUME MATCHING RATES ON REGION BOUNDARIES — 1990	101
Appendix 6. 55	TRAFFIC VOLUME MATCHING RATES ON DIVISION BOUNDARIES — 1990	101
Appendix 6. 56	PRESENT AND FUTURE NATIONAL HIGHWAY NETWORKS	102
Appendix 6. 57	DESIGN ADT AND TRAFFIC VOLUMES — 1990	103
Appendix 6. 58	ASSIGNED TRAFFIC VOLUMES ON TENTATIVE TOLL MOTORWAY NETWORK — 2010	104
Appendix 6. 59	ASSIGNED TRAFFIC VOLUMES ON NATIONAL HIGHWAY NETWORK (WITH TENTATIVE NETWORK) — 2010	105
Appendix 6. 60	ASSIGNED TRAFFIC VOLUMES ON NATIONAL HIGHWAY NETWORK (WITH PROPOSED NETWORK) — 2010	106
Appendix 6. 61	TRIP LENGTH DISTRIBUTION OF INDUCED TRIPS ..	107
Appendix 6. 62	ASSIGNED TRAFFIC VOLUMES OF IMPLEMENTATION PLANS	107
Appendix 7. 1	LENGTH OF MOTORWAYS AND INDICES IN VARIOUS COUNTRIES	108
Appendix 7. 2	RELATIONSHIP BETWEEN K AND G	108

Appendix 7. 3	DETAILS OF MAJOR POINTS BY CHANGWAT	109
Appendix 7. 4	TENTATIVE TOLL MOTORWAY NETWORK	112
Appendix 7. 5	SUMMARY OF RESULTS OF TENTATIVE TOLL MOTORWAY ROUTING	112
Appendix 7. 6	BASIC FACTORS OF DESIGN	115
Appendix 7. 7	MOTORWAY FACILITIES	123
Appendix 10. 1	TYPICAL CROSS SECTION	125
Appendix 10. 2	UNIT COSTS	132
Appendix 10. 3	STANDARD COSTS OF TYPICAL SECTIONS	134
Appendix 10. 4	ECONOMIC CONSTRUCTION COSTS FOR EACH LINK	135
Appendix 10. 5	ECONOMIC VALUES FOR ESTIMATING VOC	140
Appendix 10. 6	CREW SALARIES AND ALLOWANCES	142
Appendix 10. 7	COST BENEFIT CASH FLOW (CASE 1 — CASE 5) ...	143
Appendix 11. 1	FINANCIAL CASH FLOW (CASE 1 — CASE 5)	146
Appendix 11. 2	FINANCIAL REPAYMENT SCHEDULE (CASE 1)	149
Appendix 11. 3	FINANCIAL REPAYMENT SCHEDULE (CASE 1)	151

LIST OF FIGURES

	Page
Figure 1. 1	STUDY FLOW DIAGRAM 1- 5
Figure 1. 2	ORGANIZATION FOR THE STUDY 1- 7
Figure 2. 1	COMPARISON OF CASUALTY RATE IN JAPAN 2- 2
Figure 2. 2	INDUSTRIAL PLANTS LOCATION 2- 5
Figure 2. 3	CHANGE IN THE AMOUNT OF VEGETABLE SALES .. 2- 6
Figure 3. 1	POPULATION GROWTH BY REGION 3- 3
Figure 3. 2	POPULATION DISTRIBUTION — 1988 3- 3
Figure 3. 3	POPULATION DENSITY BY CHANGWAT — 1988 3- 5
Figure 3. 4	URBAN POPULATION BY MUNICIPALITY — 1988 3- 6
Figure 3. 5	GDP BY SECTOR 3- 8
Figure 3. 6	GRP AT CURRENT MARKET PRICES 3- 9
Figure 3. 7	GRP BY SECTOR — 1987 3-10
Figure 3. 8	PER CAPITA GRP AT CURRENT MARKET PRICES ... 3-12
Figure 3. 9	SHARE OF TRANSPORT MODES — 1987 3-17
Figure 3.10	FREIGHT TRAFFIC FLOW TO/FROM BANGKOK BY MODE — 1987 3-18
Figure 3.11	RAILWAY PASSENGER FLOW TO/FROM BANGKOK — 1987 3-21
Figure 3.12	RAILWAY FREIGHT FLOW TO/FROM BANGKOK — 1987 3-22
Figure 3.13	COAST FREIGHT FLOW TO/FROM BANGKOK — 1987 3-23
Figure 3.14	INLAND WATER FREIGHT FLOW BY COMMODITY IN CHAOPHRAYA RIVER — 1987 3-25
Figure 3.15	AIR PASSENGER TRAFFIC — 1987 3-26
Figure 3.16	NATIONAL HIGHWAY NETWORK 3-29
Figure 3.17	CUMULATIVE NO OF SECTIONS AND ADT OF ALL NATIONAL HIGHWAYS — 1989 3-30
Figure 3.18	TREND OF DOH BUDGET 3-30
Figure 3.19	ORGANIZATION OF TOLL HIGHWAY OFFICE 3-32
Figure 3.20	TOLL REVENUE AND NUMBER OF VEHICLES 3-33
Figure 3.21	TOLL REVENUE AND TOLL HIGHWAYS OFFICE EXPENSES 3-34
Figure 3.22	TYPICAL CROSS SECTION OF DIVIDED PRIMARY HIGHWAY 3-35
Figure 3.23	EXPRESSWAY NETWORK IN BANGKOK 3-38
Figure 3.24	ORGANIZATION OF ETA 3-39
Figure 3.25	SCHEMATIC DIAGRAM OF THE TRAFFIC CONTROL SYSTEM 3-40

Figure	4. 1	REGIONAL URBAN GROWTH CENTERS	4- 4
Figure	4. 2	EASTERN SEABOARD DEVELOPMENT PROGRAM ...	4- 6
Figure	4. 3	LAEM CHABANG INDUSTRIAL COMPLEX	4- 7
Figure	4. 4	MAP TA PHUT INDUSTRIAL COMPLEX	4- 8
Figure	4. 5	SOUTHERN SEABOARD DEVELOPMENT PROGRAM ..	4-10
Figure	4. 6	ESTIMATED POPULATION GROWTH RATES BY NESDB	4-11
Figure	4. 7	FUTURE POPULATION	4-12
Figure	4. 8	FUTURE POPULATION PER REGION	4-13
Figure	4. 9	FUTURE GDP AT 1972 CONSTANT PRICES	4-15
Figure	4.10	FUTURE GRP AT 1972 CONSTANT PRICES	4-16
Figure	6. 1	ZONING SYSTEM OF STUDY AREA	6- 4
Figure	6. 2	STATIONS OF OD AND CLASSIFIED COUNTING SURVEYS	6- 8
Figure	6. 3	SORTED SHARE OF HEAVY VEHICLES BY CATEGORY	6-11
Figure	6. 4	SHARE OF NIGHTTIME TRAFFIC	6-12
Figure	6. 5	RELATIONSHIP BETWEEN ADT AND NUMBER OF SAMPLES	6-14
Figure	6. 6	RELATIONSHIP BETWEEN SPEED AND TRAFFIC VOLUME ON TWO-LANE HIGHWAYS	6-21
Figure	6. 7	RELATIONSHIP BETWEEN SPEED AND TRAFFIC VOLUME ON MULTI-LANE HIGHWAYS	6-21
Figure	6. 8	ESTABLISHMENT OF PRESENT OD TABLES	6-23
Figure	6. 9	DAY AND NIGHT COMMODITY FLOW — 1988	6-26
Figure	6.10	DAY AND NIGHT PASSENGER MOVEMENT — 1988 ..	6-26
Figure	6.11	ESTABLISHMENT OF FUTURE OD TABLES	6-28
Figure	6.12	POPULATION AND PRESENT TRIP GENERATION AND ATTRACTION	6-30
Figure	6.13	GPP AND PRESENT TRIP GENERATION AND ATTRACTION	6-31
Figure	6.14	NUMBER OF REGISTERED VEHICLES AND PRESENT TRIP GENERATION AND ATTRACTION	6-31
Figure	6.15	INTER-CHANGWAT DESIRE LINE CHART — 1990	6-40
Figure	6.16	INTER-DIVISION DESIRE LINE CHART FOR ALL VEHICLES — 1990	6-42
Figure	6.17	INTER-REGION DESIRE LINE CHART — 1990	6-44
Figure	6.18	REGIONAL TRIP-END COMPOSITION BY VEHICLE GROUP — 1990	6-45
Figure	6.19	COMMODITY GROUP COMPOSITION FOR TRIP GENERATION AND ATTRACTION — 1990	6-46
Figure	6.20	TRIP PURPOSE COMPOSITION — 1990	6-47
Figure	6.21	TRIP PATTERN FROM/TO BMR — 1990	6-49
Figure	6.22	COMMODITY FLOW PATTERN FROM/TO BMR — 1990	6-50

Figure	6. 23	INTER-CHANGWAT DESIRE LINE CHARTS — 2010	6-52
Figure	6. 24	INTER-DIVISION DESIRE LINE CHART — 2010	6-54
Figure	6. 25	INTER-REGION DESIRE LINE CHART — 2010	6-55
Figure	6. 26	FUTURE REGIONAL TRIP-END COMPOSITION — 2010	6-56
Figure	6. 27	FUTURE TRIP PATTERN FROM/TO BMR — 2010 ...	6-56
Figure	6. 28	PRESENT AND FUTURE TRIP GENERATION AND ATTRACTION BY DIVISION	6-59
Figure	6. 29	GROWTH RATES OF REGIONAL TRIP-ENDS	6-62
Figure	6. 30	TRANSITION OF REGIONAL TRIP-ENDS	6-62
Figure	6. 31	GROWTH RATES OF PASSENGER VEHICLE TRIP-ENDS	6-63
Figure	6. 32	GROWTH RATES OF COMMODITY VEHICLE TRIP-ENDS	6-63
Figure	6. 33	TRANSITION OF TRIP-ENDS BY VEHICLE CATEGORY	6-64
Figure	6. 34	TOTAL TRIP-LENGTH DISTRIBUTION — 1990	6-65
Figure	6. 35	PRESENT AND FUTURE TRIP LENGTH DISTRIBUTION	6-66
Figure	6. 36	FORECAST OF TRAFFIC VOLUMES ON NATIONAL HIGHWAY AND TOLL MOTORWAY NETWORKS ...	6-68
Figure	6. 37	GROWTH OF RAILWAY FREIGHT AND PASSENGER TRANSPORT	6-69
Figure	6. 38	TRAFFIC ASSIGNMENT FOR NATIONAL HIGHWAY AND TOLL MOTORWAY NETWORKS	6-70
Figure	6. 39	SPEED - FLOW RELATIONSHIP	6-72
Figure	6. 40	EFFECT OF TOLL RATE ON VEHICLE-KILOMETER ..	6-77
Figure	6. 41	METHODOLOGY OF ESTIMATING INDUCED TRAFFIC	6-79
Figure	6. 42	ASSIGNED TRAFFIC VOLUMES ON NATIONAL HIGHWAY NETWORK — 1990	6-84
Figure	6. 43	ASSIGNED TRAFFIC VOLUMES ON NATIONAL HIGHWAY NETWORK ("WITHOUT PROJECT" CASE) — 2010	6-85
Figure	6. 44	ASSIGNED TRAFFIC VOLUMES ON PROPOSED MOTORWAY NETWORK — 2010	6-92
Figure	6. 45	TRIP LENGTH DISTRIBUTION FOR TREND, INDUCED AND TOTAL INTER-CHANGWAT TRIPS — 2010	6-94
Figure	6. 46	ALTERNATIVE STAGING PLANS FOR IMPLEMENTATION	6-97
Figure	7. 1	PROCEDURES FOR ESTABLISHMENT OF MASTER PLAN OF THE MOTORWAY NETWORK	7- 4
Figure	7. 2	LOCATIONAL MAP OF MAJOR POINTS	7- 9
Figure	7. 3	PROPOSED MOTORWAY NETWORK	7-19

Figure 7. 4	SHARE IN TRIPS BETWEEN NATIONAL HIGHWAY AND TOLL MOTORWAY NETWORKS — 2010	7-22
Figure 7. 5	BOUNDARIES OF AREA COVERED WITHIN 60 MINUTES	7-23
Figure 7. 6	CROSS SECTION ELEMENTS	7-28
Figure 7. 7	PROPOSED URBAN MOTORWAY NETWORK INSIDE OBRR	7-49
Figure 8. 1	ENVIRONMENTAL IMPACT ASSESSMENT PROCEDURE	8- 5
Figure 8. 2	NITROGEN DIOXIDE (NO ₂) CALCULATION PROCEDURE	8- 6
Figure 8. 3	WATER QUALITY FORECASTING PROCEDURE ..	8- 7
Figure 8. 4	MEASURES FOR NOISE IN HIGHWAY STRUCTURE	8-15
Figure 9. 1	PAST TRENDS OF ROAD INVESTMENT AS RATIO TO GNP	9- 2
Figure 9. 2	ROAD WORK FINANCIAL SYSTEM IN JAPAN — 1989	9- 2
Figure 9. 3	STRUCTURE OF ROAD USERS TAX	9- 3
Figure 9. 4	TOLL RATES AND GNP PER CAPITA	9- 8
Figure 9. 5	REPAYMENT OF TOLL MOTORWAY INVESTMENTS	9- 9
Figure 9. 6	EXAMPLE FOR TOLL COLLECTION SYSTEM ...	9-11
Figure 9. 7	GENERAL ORGANIZATION OF DOH	9-16
Figure 9. 8	ORGANIZATIONAL STRUCTURE OF PUBLIC CORPORATION	9-20
Figure 9. 9	ASSUMED ORGANIZATION OF HEADQUARTER ..	9-21
Figure 9. 10	ORGANIZATION OF DIVISION BUREAU IN CONSTRUCTION STAGE	9-23
Figure 9. 11	ORGANIZATION OF DIVISION BUREAU IN OPERATION STAGE	9-24
Figure 9. 12	ORGANIZATION OF CONSTRUCTION OFFICE	9-26
Figure 9. 13	ORGANIZATION OF OPERATION OFFICE	9-26
Figure 9. 14	ORGANIZATION OF TOLL COLLECTION OFFICE ...	9-27
Figure 9. 15	TRAFFIC MANAGEMENT SYSTEM STRUCTURE ..	9-31
Figure 9. 16	CONCEPT OF TRAFFIC CONTROL AND MANAGEMENT SYSTEM	9-32
Figure 9. 17	AN EXAMPLE OF TRAFFIC CONTROL AND MANAGEMENT PLAN	9-35
Figure 10. 1	ALTERNATIVE STAGING CASES FOR IMPLEMENTATION	10-33
Figure 10. 2	BETTERMENT OF NATION WIDE DEVELOPMENT	10-38
Figure 10. 3	LOCATION OF INDUSTRIAL ESTATES	10-39

Figure 10. 4	RANGES OF ONE DAY ROUND TRIP FROM MAJOR CITIES	10-40
Figure 10. 5	LOCATION OF AGRICULTURAL AND FISHERY PRODUCTS	10-41
Figure 10. 6	COMPARISON OF INTERNATIONAL TRAVELING TIME	10-42
Figure 10. 7	CHANGE OF INCOME AFTER CONSTRUCTION ...	10-43
Figure 10. 8	DIFFERENCE IN TRIPS TO VISIT HOSPITAL ..	10-43
Figure 10. 9	TRAVELING TIME FROM BMA BY MODE	10-44
Figure 12. 1	STAGING PLAN OF SCENARIO-1, CASE 1	12- 3

LIST OF TABLES

	Page
Table 3. 1	POPULATION BY REGION 3- 2
Table 3. 2	URBAN POPULATION BY REGION 3- 4
Table 3. 3	GROSS DOMESTIC PRODUCT 3- 7
Table 3. 4	GDP BY SECTOR 3- 7
Table 3. 5	GRP AT CURRENT MARKET PRICES 3- 8
Table 3. 6	GRP AT 1972 CONSTANT PRICES 3- 9
Table 3. 7	PER CAPITA GDP AND GRP AT CURRENT MARKET PRICES 3-11
Table 3. 8	PER CAPITA GDP AND GRP AT 1972 CONSTANT PRICES 3-12
Table 3. 9	NUMBER OF FACTORIES BY REGION 3-13
Table 3.10	INTERNATIONAL TOURIST ARRIVAL 3-14
Table 3.11	NUMBER OF GUEST ARRIVAL 3-14
Table 3.12	NUMBER OF REGISTERED VEHICLES (1973 — 1985) 3-15
Table 3.13	NUMBER OF REGISTERED VEHICLES — 1988 3-15
Table 3.14	REGISTERED VEHICLES BY REGION UNDER MOTOR VEHICLE ACT — 1988 3-16
Table 3.15	LENGTH OF ALL ROADS (1981 — 1988) 3-19
Table 3.16	LENGTH OF HIGHWAYS UNDER DOH RESPONSIBILITY — 1988 (KM) 3-27
Table 3.17	EXISTING TOLL HIGHWAYS — 1990 3-28
Table 3.18	TARGETS OF THE 6TH NATIONAL HIGHWAY DEVELOPMENT PLAN (1987 — 1991) 3-31
Table 3.19	NUMBER OF TRAFFIC ACCIDENTS AND CASUALTIES ON DOH HIGHWAYS — 1988 3-35
Table 3.20	NUMBER OF ACCIDENTS AND CASUALTIES ON DOH HIGHWAYS BY ACCIDENT TYPE — 1988 3-36
Table 3.21	EXISTING EXPRESSWAYS AND FUTURE PLAN OF EXPRESSWAY IN BANGKOK 3-37
Table 3.22	TREND OF EXPRESSWAY OPERATIONS IN BANGKOK 3-41
Table 4. 1	ESTIMATED POPULATION GROWTH RATE (1970—1988) 4-11
Table 4. 2	ESTIMATED POPULATION GROWTH RATE 4-12
Table 4. 3	ESTIMATED POPULATION GROWTH RATE BY REGION 4-13
Table 4. 4	TARGET AND REVISED GDP GROWTH RATE 4-14
Table 5. 1	COMMITTED ROUTES FOR WIDENING — 1990 .. 5- 8
Table 5. 2	COMMITTED ROUTES FOR NEW CONSTRUCTION —1990 5- 8
Table 5. 3	FUTURE DOH PLAN OF TOLL HIGHWAYS 5- 9

Table 6. 1	DEFINITION OF REGIONS AND DIVISIONS	6- 3
Table 6. 2	REGIONAL FLUCTUATION MULTIPLYING FACTORS ..	6-13
Table 6. 3	AVERAGE CAPACITY OF TRUCKS BY REGION	6-15
Table 6. 4	AVERAGE ESTIMATED PAYLOAD OF TRUCKS BY REGION	6-15
Table 6. 5	EMPTY VEHICLE RATIO OF TRUCKS BY REGION ..	6-16
Table 6. 6	AVERAGE NUMBER OF ASSISTANTS BY REGION ..	6-16
Table 6. 7	ESTIMATED COMMODITY FLOW BY REGION BOUNDARY	6-17
Table 6. 8	AVERAGE CAPACITY OF PASSENGER VEHICLES BY REGION	6-18
Table 6. 9	AVERAGE OCCUPANCY OF PASSENGER VEHICLES BY REGION	6-18
Table 6.10	TRIP PURPOSE OF PASSENGER VEHICLES BY REGION	6-19
Table 6.11	ADJUSTED GENERATED AND ATTRACTED TRAFFIC OF LAEM CHABANG INDUSTRIAL COMPLEX	6-34
Table 6.12	ADJUSTED GENERATED AND ATTRACTED TRAFFIC OF MAP TA PHUT INDUSTRIAL COMPLEX	6-34
Table 6.13	TRIP DISTRIBUTION FROM/TO EASTERN SEABOARD DEVELOPMENT AREA	6-36
Table 6.14	GENERATED AND ATTRACTED TRIPS OF SOUTHERN SEABOARD DEVELOPMENT AREA — 2010	6-37
Table 6.15	GROWTH RATE OF TRIPS FROM/TO BMR BY DIVISION	6-64
Table 6.16	PASSENGER-CAR UNITS	6-73
Table 6.17	ESTABLISHMENT OF TOLL RATE	6-76
Table 6.18	PRESENT AND FUTURE LENGTH OF ASSIGNED ROAD NETWORK	6-83
Table 6.19	LENGTH OF FUTURE WIDENED LINKS	6-83
Table 6.20	LENGTH OF NEWLY CONSTRUCTED LINKS — 2000	6-83
Table 6.21	PRESENT AND FUTURE ASSIGNED TRAFFIC VOLUMES ON REGION BOUNDARY	6-86
Table 6.22	GROWTH OF ASSIGNED TRAFFIC VOLUMES ON REGION BOUNDARIES	6-86
Table 6.23	PRESENT AND FUTURE TRIP LENGTH DISTRIBUTION OF INTRA- AND INTER-CHANGWAT TRIPS	6-87
Table 6.24	REGIONAL INDUCED TRIP-ENDS BY VEHICLE CATEGORY	6-88
Table 6.25	VEHICLE-KILOMETER AND AVERAGE TRAFFIC VOLUMES OF TENTATIVE NETWORK BY ROUTE — 2010	6-89
Table 6.26	VEHICLE-KILOMETER AND VEHICLE-HOUR OF TENTATIVE TOLL MOTORWAY AND NATIONAL HIGHWAY NETWORKS — 2010	6-89

Table 6. 27	TRIP LENGTH DISTRIBUTION OF INTRA- AND INTER-CHANGWAT TRIPS WITH TENTATIVE NETWORK — 2010	6-90
Table 6. 28	REGIONAL INDUCED TRIP-ENDS BY VEHICLE CATEGORY — 2010	6-91
Table 6. 29	VEHICLE-KILOMETER AND AVERAGE TRAFFIC VOLUMES OF PROPOSED NETWORK BY ROUTE — 2010	6-91
Table 6. 30	VEHICLE-KILOMETER AND VEHICLE-HOUR OF PROPOSED TOLL MOTORWAY AND NATIONAL HIGHWAY NETWORKS — 2010	6-93
Table 6. 31	TRIP LENGTH DISTRIBUTION OF INTRA- AND INTER-CHANGWAT TRIPS WITH PROPOSED NETWORK — 2010	6-95
Table 6. 32	ASSIGNMENT RESULTS FOR IMPLEMENTATION PLANS	6-99
Table 6. 33	NUMBER AND LENGTH OF TRIPS FOR IMPLEMENTATION PLANS	6-99
Table 7. 1	TARGET LENGTH OF MOTORWAYS IN THAILAND ...	7- 6
Table 7. 2	MAJOR POINTS	7- 8
Table 7. 3	TENTATIVE MOTORWAYS BY STEP	7-12
Table 7. 4	ASSESSMENT OF TENTATIVE NETWORK BY ROUTE ..	7-14
Table 7. 5	SELECTED ROUTES	7-16
Table 7. 6	4,300 KM MOTORWAY NETWORK	7-17
Table 7. 7	TRAFFIC CHARACTERISTICS OF TOLL MOTORWAY AND NATIONAL HIGHWAY NETWORKS — 2010	7-21
Table 7. 8	POPULATION AND AREA COVERAGE RATES — 2010 ..	7-22
Table 7. 9	COVERED MAJOR POINTS BY 4,300 KM NETWORKS	7-24
Table 7. 10	MOTORWAY CLASSIFICATION	7-26
Table 7. 11	MINIMUM LENGTH OF ONE DESIGN UNIT	7-27
Table 7. 12	DESIGN SPEED	7-27
Table 7. 13	WIDTH OF CROSS SECTION ELEMENTS	7-28
Table 7. 14	MINIMUM RADIUS	7-28
Table 7. 15	MAXIMUM GRADE	7-29
Table 7. 16	DESIGN STANDARD TRAFFIC VOLUME	7-29
Table 7. 17	CONTROL POINTS	7-32
Table 7. 18	CONNECTED ROUTES INSIDE OBRR	7-48
Table 8. 1	ENVIRONMENTAL QUALITY STANDARDS FOR NOISE	8-12
Table 8. 2	EMERGENCY PROCEDURE FOR STANDARDS FOR ROAD TRAFFIC VIBRATION	8-12
Table 8. 3	ENVIRONMENTAL PROTECTION TARGET FOR NATURAL ENVIRONMENT	8-13

Table 9. 1	SYSTEMS OF MOTORWAYS IN SELECTED COUNTRIES	9- 5
Table 9. 2	EXECUTING BODIES OF MOTORWAYS	9-13
Table 9. 3	EXPECTED DIVISION BUREAU	9-22
Table 9. 4	REQUIRED NUMBER OF STAFF	9-27
Table 10. 1	TYPICAL SECTIONS FOR COST ESTIMATION	10- 2
Table 10. 2	QUANTITY OF MAJOR WORK ITEMS	10- 3
Table 10. 3	UNIT COSTS OF MAJOR WORK ITEMS	10- 4
Table 10. 4	TOTAL CONSTRUCTION COST BY ROUTE	10- 5
Table 10. 5	UNIT COSTS OF MAINTENANCE WORK	10- 7
Table 10. 6	OPERATION COSTS OF ETA	10- 8
Table 10. 7	PERCENTAGE OF MAINTENANCE COST TO TOTAL PROJECT COST	10- 9
Table 10. 8	COST OF ONE OPERATION OFFICE	10-10
Table 10. 9	COST OF ONE TOLL COLLECTION OFFICE	10-11
Table 10.10	UNIT COST OF TRAFFIC CONTROL WORK	10-11
Table 10.11	PERCENTAGE OF TOLL OPERATION COST TO TOTAL PROJECT COST	10-12
Table 10.12	CHARACTERISTICS OF TYPICAL VEHICLES ...	10-15
Table 10.13	FUEL COST	10-16
Table 10.14	AVERAGE COST OF FUEL	10-16
Table 10.15	ECONOMIC AND FINANCIAL COSTS OF FUEL ..	10-17
Table 10.16	FUEL COST BY VEHICLE TYPE	10-17
Table 10.17	USAGE OF FUEL BY VEHICLE TYPE	10-17
Table 10.18	VARIATION IN FUEL CONSUMPTION	10-18
Table 10.19	ECONOMIC FUEL COST BY SPEED	10-18
Table 10.20	OIL COST	10-19
Table 10.21	OIL COST BY VEHICLE TYPE	10-19
Table 10.22	OIL CONSUMPTION BY ROAD TYPE	10-19
Table 10.23	ECONOMIC OIL COST BY ROAD TYPE	10-20
Table 10.24	COST OF TIRES	10-20
Table 10.25	TYRE CONSUMPTION BY ROAD TYPE	10-21
Table 10.26	ECONOMIC TYRE COST BY ROAD TYPE	10-21
Table 10.27	MONTHLY MAINTENANCE COSTS	10-21
Table 10.28	ANNUAL KILOMETRAGE AND AVERAGE SPEED BY ROAD TYPE	10-22
Table 10.29	ECONOMIC MAINTENANCE COST BY ROAD TYPE	10-22
Table 10.30	VARIATION IN ECONOMIC CAPITAL COST AT DIFFERENT SPEEDS	10-23
Table 10.31	ANNUAL OVERHEAD COST	10-24
Table 10.32	VARIATION IN OVERHEAD COST AT DIFFERENT SPEEDS	10-24
Table 10.33	VARIATION IN ECONOMIC CREW COSTS	10-25
Table 10.34	ECONOMIC VEHICLE OPERATING COST	10-26

Table 10. 35	TIME VALUES OF PASSENGERS FOR BUSINESS TRIPS	10-29
Table 10. 36	AVERAGE OCCUPANCY AND SHARE OF BUSINESS TRIP	10-29
Table 10. 37	TIME VALUES OF PASSENGERS	10-29
Table 10. 38	VEHICLE OPERATING COST BY ALTERNATIVE CASE	10-35
Table 10. 39	VOC SAVING BENEFIT	10-35
Table 10. 40	TIME COST BY ALTERNATIVE CASE	10-35
Table 10. 41	TIME COST SAVING BENEFIT	10-35
Table 10. 42	BENEFIT OF INDUCED TRAFFIC	10-35
Table 10. 43	TOTAL BENEFIT	10-36
Table 10. 44	ADJUSTED TOTAL BENEFIT	10-36
Table 10. 45	ECONOMIC CONSTRUCTION COST	10-45
Table 10. 46	SUMMARY OF ECONOMIC EVALUATION	10-46
Table 10. 47	RESULTS OF ECONOMIC SENSITIVITY ANALYSIS	10-47
Table 11. 1	FINANCIAL CONSTRUCTION COST	11- 1
Table 11. 2	TIME AND COST BETWEEN RAILWAY AND MOTORWAY	11- 3
Table 11. 3	TOLL REVENUES	11- 4
Table 11. 4	FINANCIAL EVALUATION	11- 5
Table 11. 5	AMOUNTS OF INTEREST CHANGES	11- 7
Table 11. 6	EFFECTS ON FINANCIAL RETURN	11- 8
Table 11. 7	CHANGES OF THE YEAR OF BREAK EVEN POINT (STAGING CASE I)	11- 9
Table 11. 8	CHANGES IN MAXIMUM DEFICITS	11- 9
Table 11. 9	EFFECTS OF CHANGES IN PRICE ESCALATION RATE ON FIRR	11-10
Table 11.10	EFFECTS OF CHANGES IN PRICE ESCALATION RATE ON BREAK EVEN POINT	11-11
Table 11.11	EFFECTS OF CHANGES IN PRICE ESCALATION RATE ON MAXIMUM ACCUMULATED DEFICIT	11-11
Table 11.12	EFFECTS OF CHANGES IN PRICE ESCALATION RATE ON INVESTMENT COST	11-12
Table 11.13	EFFECTS OF CHANGES IN RATES OF INTEREST ON BREAK EVEN POINT	11-12
Table 11.14	EFFECTS OF CHANGES IN RATES OF INTEREST ON MAXIMUM ACCUMULATED DEFICIT	11-13
Table 11.15	EFFECTS OF CHANGES IN RATES OF INTEREST ON AMOUNTS OF INTEREST CHARGES	11-13
Table 11.16	TOLL STRUCTURE AND TRAFFIC DEMANDS ON TOLL MOTORWAYS (ALL VEHICLES)	11-14
Table 11.17	TOLL STRUCTURE AND TOLL REVENUE	11-15
Table 11.18	FIRR BY TOLL STRUCTURE	11-15

Table 11. 19	CHANGES IN BREAK EVEN POINT YEAR BY TOLL STRUCTURE	11-16
Table 11. 20	CHANGES IN MAXIMUM DEFICITS BY TOLL STRUCTURE	11-16
Table 12. 1	IMPLEMENTATION SCHEDULE	12- 2
Table 12. 2	INVESTMENT AMOUNT BY STAGE	12- 4
Table 12. 3	PROPOSED ROUTES FOR FEASIBILITY STUDY ..	12- 5

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 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.

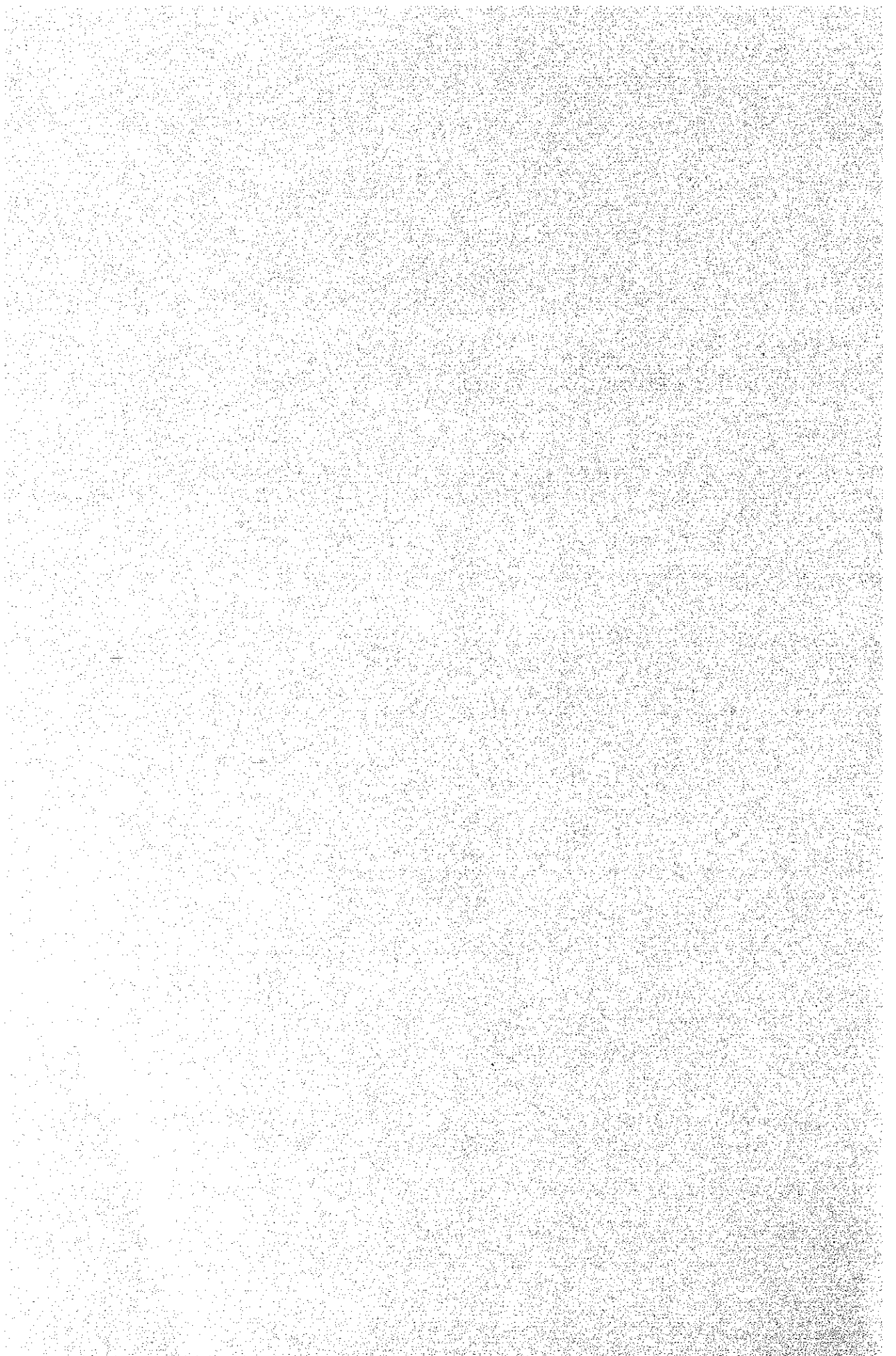
Financial evaluation carried out for the same staging plans as in EIRR shows 13% to 14% in FIRR (financial internal rate of return).

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 implementation 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 construction.
- 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

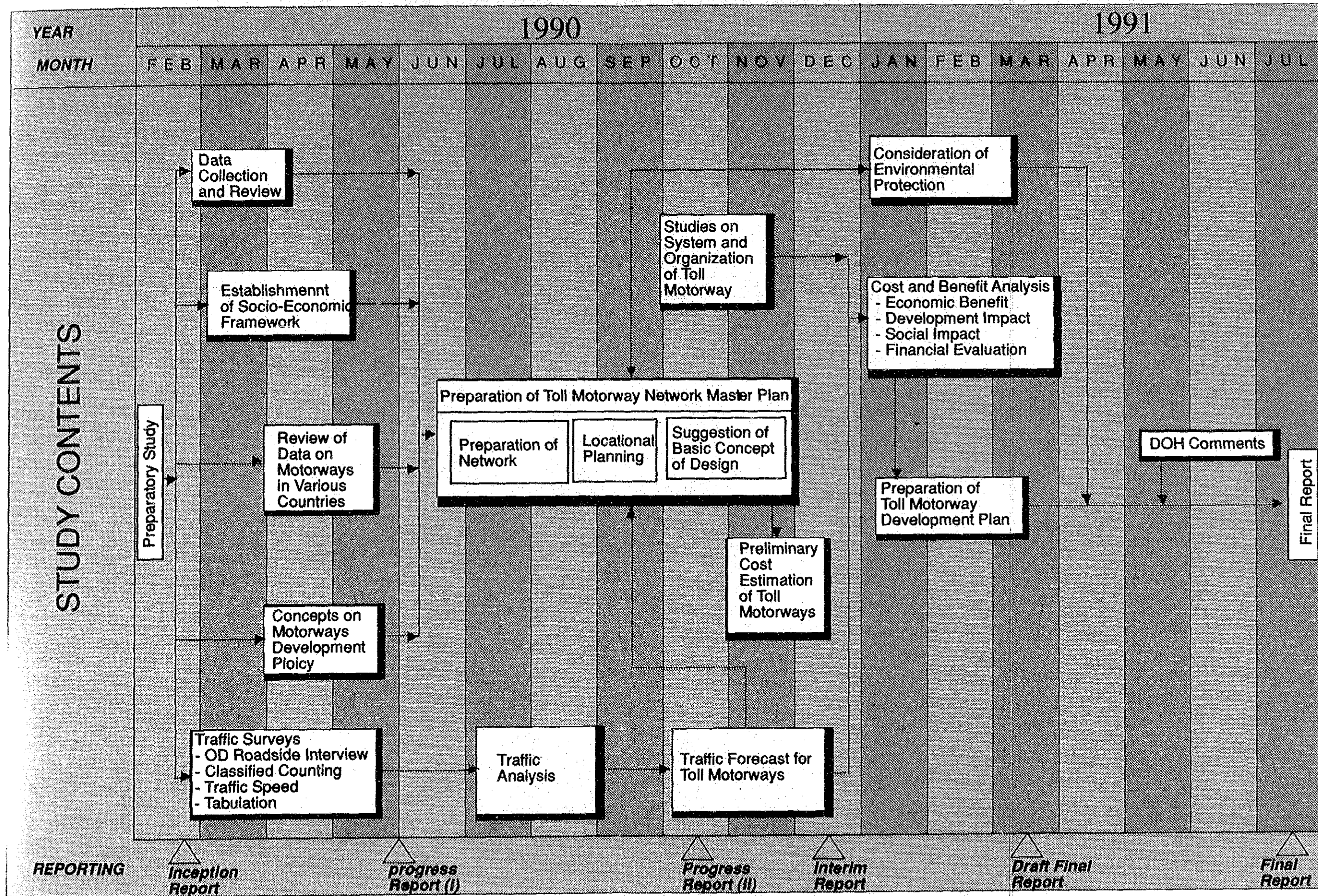
During the course of the Study, the following reports were prepared by the Study Team and submitted to DOH in accordance with the schedule of the Study.

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



REPORTING

Inception Report

Progress Report (I)

Progress Report (II)

Interim Report

Draft Final Report

Final Report

Figure 1.1 STUDY FLOW DIAGRAM

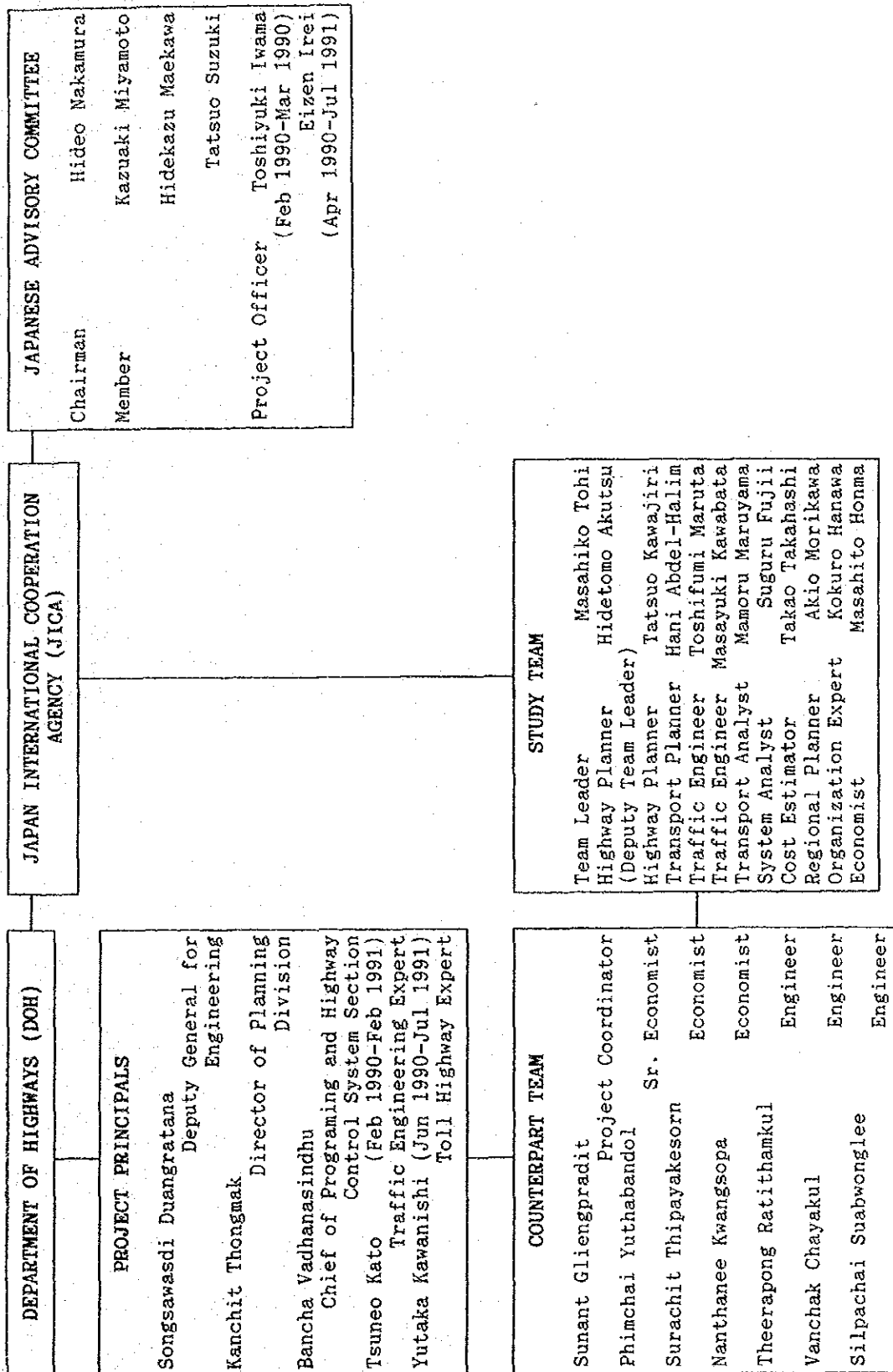
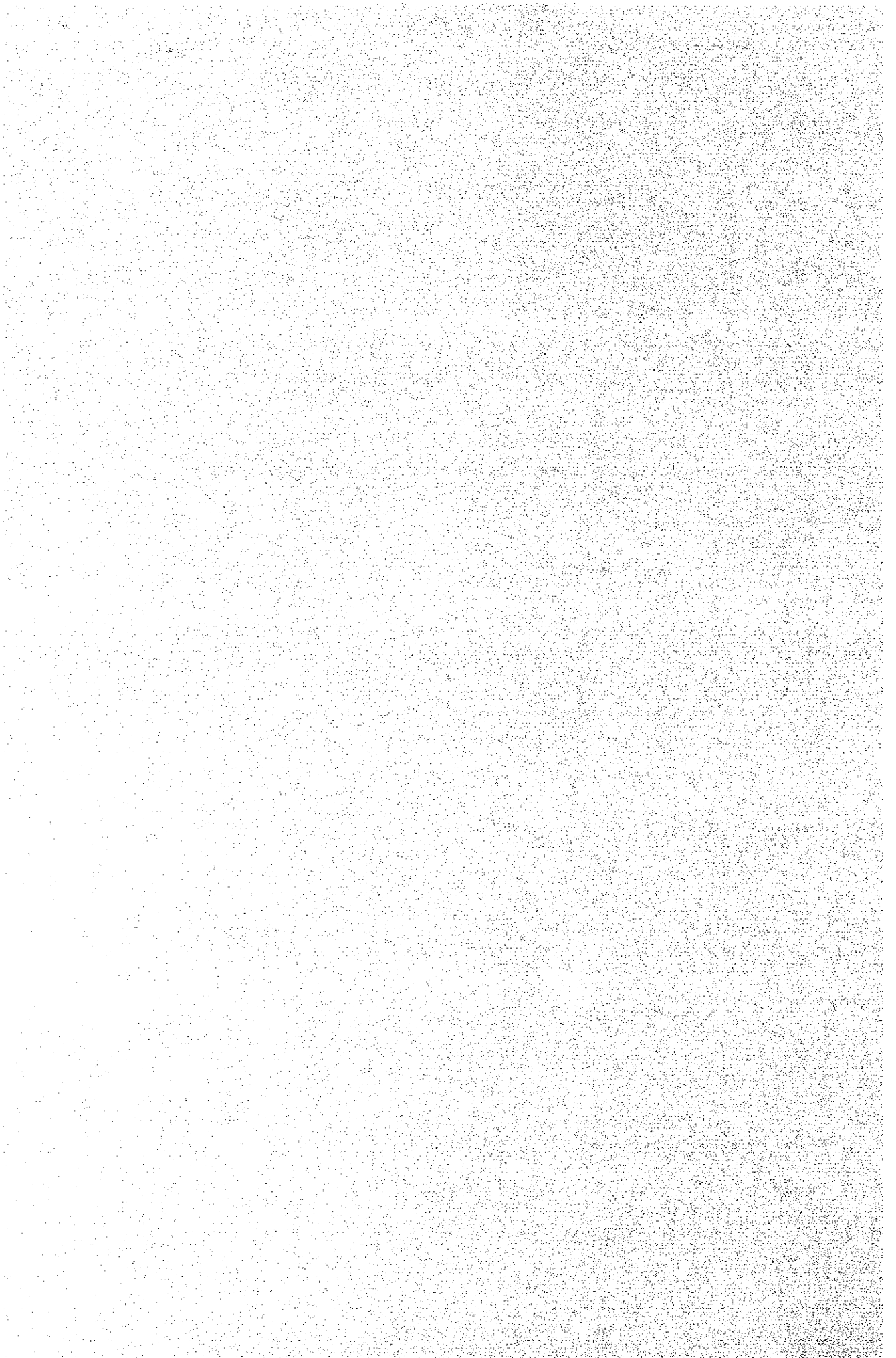


Figure 1.2 ORGANIZATION FOR THE STUDY

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:

$$\text{Value of Saved Time} = \text{Value of Time} \times \text{Saved Time}$$

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-

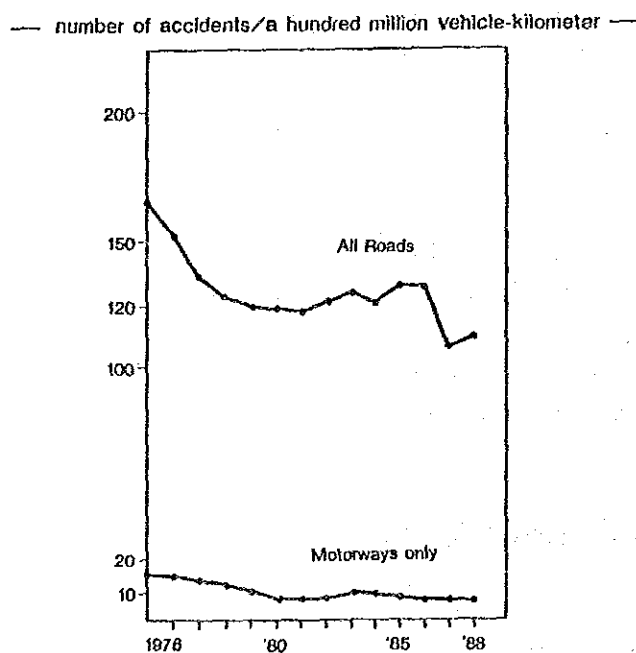


Figure 2.1 COMPARISON OF CASUALTY RATE IN JAPAN

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.