KINGDOM OF THAILAND

FEASIBILITY STUDY ON NEW KRUNGTHEP BRIDGE CONSTRUCTION AND THONBURI ROAD EXTENSION

FINAL REPORT

APPENDICES

JUNE 1987

JAPAN INTERNATIONAL COOPERATION AGENCY

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87-053(3/4)

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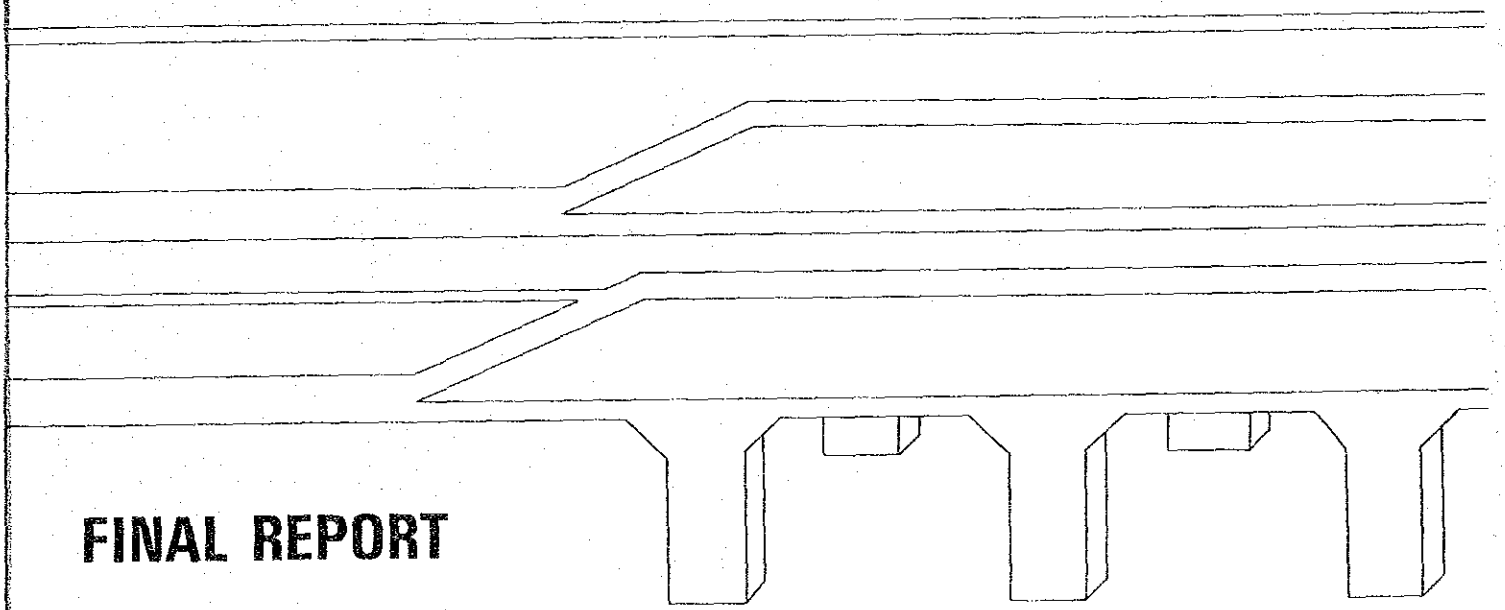

FINAL REPORT

APPENDICES

JUNE 1987

JAPAN INTERNATIONAL COOPERATION AGENCY

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Appendix 1.2.1 Scope of Work for the Project

SCOPE OF WORK

FOR

THE FEASIBILITY STUDY

ON

THE NEW KRUNG THEP BRIDGE CONSTRUCTION

AND

THE THONBURI ROAD EXTENSION

AGREED UPON BETWEEN

THE PUBLIC WORKS DEPARTMENT

AND

THE JAPAN INTERNATIONAL COOPERATION AGENCY

NOVEMBER 6, 1985

BANGKOK, THAILAND

P. Kantamala

Pojana KANTAMALA
Director General,
The Public Works Department

Fumihiro TAJIRI
Leader,
The Preliminary Study Team,
The Japan International
Cooperation Agency (JICA)

I. INTRODUCTION

In response to the request of the Government of the Kingdom of Thailand, the Government of Japan decided to implement the feasibility study on the New Krung Thep Bridge Construction and the Thonburi Road Extension (hereinafter referred to as "the Study"), within the general framework of technical cooperation between Japan and the Kingdom of Thailand, which is set forth in the Agreement on Technical Cooperation between the Government of Japan and the Government of the Kingdom of Thailand signed on 5 November, 1981.

The Japan International Cooperation Agency (hereinafter referred to as "JICA"), the official agency responsible for the implementation of the technical cooperation programs of the Government of Japan, will undertake the Study, in accordance with the relevant laws and regulations in force in Japan and in close cooperation with the authorities of the Government of the Kingdom of Thailand.

The Public Works Department under the jurisdiction of Minister of Interior, the Kingdom of Thailand (hereinafter referred to as "PWD"), shall act as counterpart agency to the Japanese study team and also as coordinating body to other relevant organizations for smooth implementation of the Study.

The present document sets forth the Scope of Work for the Study.

II. OBJECTIVE OF THE STUDY

The objectives of the study is;

To carry out the feasibility study on the enlargement of traffic capacity of the Krung Thep Bridge (by new construction or widening) and the extension of the Thonburi Road, which are necessary to meet the traffic demand in the Thonburi area of the Central Business District of Bangkok.

III. SCOPE OF THE STUDY

A. Study Area

The Study areas are the area surrounding the Krung Thep Bridge, the Thonburi area and other related area.

B. Study Phase

The Study shall consist of the following three phases:

1) Phase I

The fundamental information and data shall be collected and analyzed in this phase. The study items in this phase are as follows;

a) Review of the feasibility study report on the Thonburi Road extension prepared in 1976,

b) Review of existing data and studies on the traffic and road conditions, and other related projects in the Study Area,

c) Execution of the supplementary traffic survey and analysis in the Study Area,

d) Forecast of the future traffic demand in the Study Area,

e) Traffic assignment for the entire road network in the Study Area,

f) Collection and analysis of technical information on the Krung Thep Bridge.

2) Phase II

Following the Phase I, the detailed study on the extension of the Thonburi Road shall be made in this phase. The study items in this phase are as follows:-

a) Preparation of alternative plans of route alignment,

b) Establishment of the Thonburi Road route alignment,

c) Preparation of the design standards and the preliminary design,

- establishment of design standards
- selection of construction method
- field survey necessary for the preliminary design
- preliminary design

d) Cost estimation

- right-of-way acquisition cost
- construction cost (local and foreign portions, and taxes)
- maintenance and administration cost

e) Project Evaluation

- economic feasibility
- social and economic impacts of the project

f) Recommendations on implementation strategy and action programme.

3) Phase III

Following the Phase I, and also in parallel with the Phase II, the detailed study on the enlargement of traffic capacity of the Krung Thep Bridge (by new construction or widening) shall be studied in this phase. The study items in this phase are as follows;

a) preparation of alternative traffic capacity enlargement methods of the Krung Thep Bridge,

b) selection of traffic capacity enlargement method of the Krung Thep Bridge,

c) same as III. B. 2) c),

d) same as III. B. 2) d),

e) same as III. B. 2) e),

f) same as III. B. 2) f),

IV. WORK SCHEDULE

The whole work will be carried out in accordance with the attached tentative schedule (See Appendix I).

V. REPORTS

JICA shall prepare and submit the following reports to the Government of the Kingdom of Thailand:

1.	Inception Report	Thirty (30) copies in English at the beginning of the Study
2.	Progress I Report	Thirty (30) copies in English within three (3) months after the commencement of the Study
3.	Progress II Report	Thirty (30) copies in English within eight (8) months after the commencement of the Study
4.	Interim Report	Thirty (30) copies in English within eleven (11) months after the commencement of the Study
5.	Draft Final Report	Fifty (50) copies in English within fourteen (14) months after the commencement of the Study

The Government of the Kingdom of Thailand shall provide JICA with its comments on the Draft Final Report through JICA office in Bangkok within one (1) month after the receipt of Draft Final Report.

6.	Final Report	One hundred (100) copies in English within two (2) months after the receipt of Thai Government's comments on the Draft Final Report.

VI. UNDERTAKING OF THE GOVERNMENT OF THE KINGDOM OF THAILAND

1. In accordance with the Agreement on Technical Cooperation between the Government of Japan and the Government of the Kingdom of Thailand dated November 5, 1981, the Government of the Kingdom of Thailand shall accord benefits to the Japanese study team as follows:

   (1) to permit the members of the Japanese study team to enter, leave and sojourn in Thailand for the duration of their assignment therein and exempt them from alien registration requirements and consular fees,

   (2) to exempt the members of the Japanese study team from taxes, duties and any other charges on equipment, machinery and other materials brought into Thailand for the conduct of the Study,

   (3) to exempt the members of the Japanese study team from income taxes and charges of any kind imposed on or in connection with any emolument or allowance paid to the members of the Japanese study team for their services in connection with the implementation of the Study,

(4) to bear claims, if any arises against the members of the Japanese study team resulting from, occuring in the course of, or otherwise connected with the discharge of their duties in the implementation of the Study, except when such claims arise from gross negligence or willful misconduct on the part of the members of the Japanese study team.

2. To facilitate smooth conduct of the Study, PWD shall take necessary measures in cooperation with other relevant organization;

(1) to secure permission for entry into private properties or restricted areas for the conduct of the Study,

(2) to secure permission for the study team to take all data and documents (including photographs) related to the Study out of Thailand to Japan,

(3) to provide the medical services as needed (Its expenses will be chargeable on members of the Japanese study team.),

(4) to ensure the safety of the members of the Japanese study team when and as it is required in the course of the Study.

3. PWD shall, at its own expense, provide the Japanese study team with the followings;

(1) available data and information related to the Study,

(2) counterpart personnel,

(3) suitable office space with necessary equipment,

(4) credentials or identification cards.

VII. UNDERTAKING OF JICA

For the implementation of the study, JICA shall take the following measures;

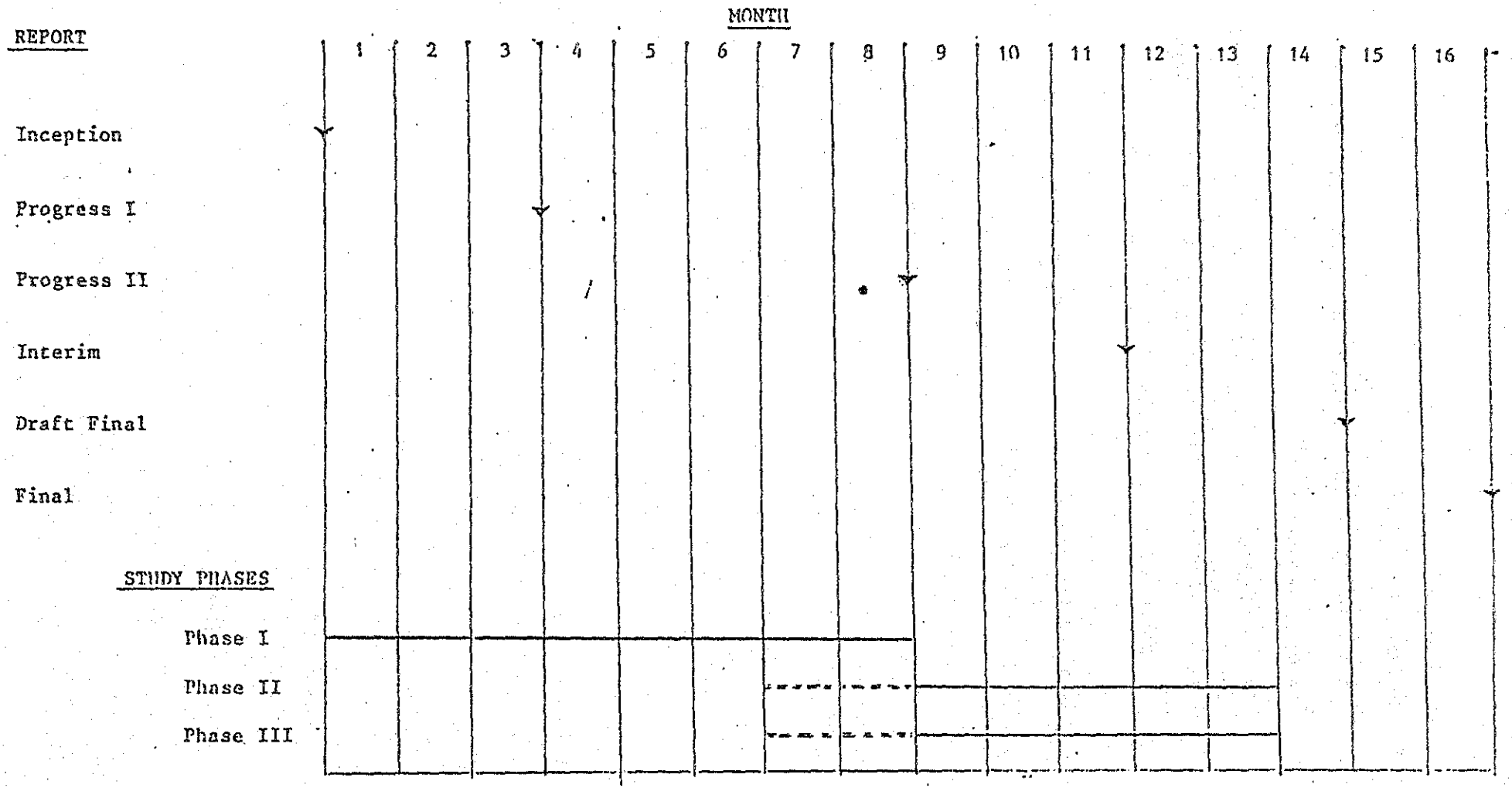
(1) to dispatch, at its own expense, study teams to Thailand,

(2) to pursue technology transfer to the Thai counterpart personnel in the course of the Study.

VIII. JICA and PWD shall consult with each other in respect of any matter that may arise from or in connection with the Study.

APPENDIX I

TENTATIVE SCHEDULE



MEMBER OF JICA TEAM

Team Leader	Fumihiro TAJIRI
Member	Kazuo YOSHINAGA
Member	Michio KANAI
Member	Hiromi KOSAKA
Member	Masanori YAMAUCHI

MEMBER OF PWD

Director General	Pojana Kantamala
Deputy Director General	Chinda Kulwatto
Project Director	Voravit Lertlaksana
Project Engineer	Dhongchai Tejasen
Civil Engineer	Surapol Srisaovajati
Civil Engineer	Somchai Sirivichayakul

JICA BANGKOK OFFICE

Assistant Resident Representative	Hideaki KASAHARA

EMBASSY OF JAPAN

First Secretary	Naofumi TAKEUCHI

THE MINUTES OF DISCUSSION

FOR

THE FEASIBILITY STUDY

ON

THE NEW KRUNG THEP BRIDGE CONSTRUCTION

AND

THONBURI ROAD EXTENSION

NOVEMBER 6, 1985

BANGKOK

P. Kantamala

Pojana KANTAMALA
Director General,
The Public Works Department

Fumihiro TAJIRI
Leader,
The Preliminary Study Team,
The Japan International
Cooperation Agency (JICA)

The Japan International Cooperation Agency (JICA) sent a mission headed by Mr. Fumihiro TAJIRI, to the Kingdom of Thailand from October 29 to November 7, 1985, and had a series of discussions with the officials of the Public Works Department (PWD) in connection with the Feasibility Study on the New Krung Thep Bridge Construction and Thonburi Road Extension (hereinafter referred to as "the Study"). Both parties concluded the Scope of Work as well as agreed upon the following matters:-

1. The Study on the Krung Thep Bridge will lay stress on the construction of a new bridge rather than the widening of the existing bridge;

2. The JICA Study Team will proceed the study on the Thonburi Road Extension in cooperation with PWD officials and Thai consulting firm(s) employed by PWD for the construction of Taksin Road - Middle Ring Road portion of the Thonburi Road. The main purpose of JICA Study will be the planning of Thonburi Road to be lined between the Middle Ring Road and the Outer Ring Road; however, it will also examine the off-routes to the Petch Kasem Road, etc. as possible;

3. PWD will make every effort to collect the necessary, existing data and information available in the Kingdom of Thailand;

4. PWD will establish the steering committee consisting of Thai Government authorities concerned, as soon as the JICA Study Team starts working in Thailand.
   This steering committee will coordinate the opinions within Thai Government authorities;

5. PWD requested the followings, and the mission agreed to deliver them to the Japanese Government:-

   1) To provide the Thai counterpart(s) with technical training opportunities in Japan;

   2) To start the Study at the earliest time of 1986; and

   3) To provide with the following equipment:-

      a) Electronic distance measuring device complete with theodolite;

      b) 16-bit Micro Computer with hard disk, printer, CRT (color) and floppy-disk; and

      c) Echo sounder;

6. The articles of "VI Undertaking of the Government of the Kingdom of Thailand" in the Scope of Work shall be interpreted as follows:-

   1) Article VI. 2 (1)

      PWD shall, upon request of the JICA Study Team, make every effort to obtain the permission to enter the private properties or restricted areas within the limitation of Thai Government's regulations and laws;

   2) Article VI. 2 (2)

      PWD shall give a proper advice to the JICA Study Team on the Thai regulations and laws concerning the handling of data and materials, and make every effort to let the JICA Study Team take unrestricted data and materials out of Thailand smoothly;

   3) Article VI. 2 (3)

      PWD shall, upon request of the members of JICA Study Team, introduce the hospitals where they can receive the best medical services in Thailand;

4) Article VI. 2 (4)

PWD shall consistently consider the safety of the members of the JICA Study Team, and give a proper advice to them when necessary; and

5) Article VI. 3 (3)

PWD shall make efforts to provide the JICA Study Team with a working space in PWD. If a suitable space is not available in PWD, PWD will assist the JICA Study Team to find a space outside PWD. (In this case, the rent and the cost of equipment will be borne by the JICA Study Team.)

Appendix 1.2.2 The Minutes of Discussion, March 10, 1986

THE MINUTES OF DISCUSSION

FOR

THE FEASIBILITY STUDY

ON

THE NEW KRUNG THEP BRIDGE CONSTRUCTION

AND

THONBURI ROAD EXTENSION

MARCH 10, 1986

BANGKOK

Pojana KANTAMALA
Director General,
The Public Works Department

Hisashi OHSHIMA
Leader,
The Study Team,
The Japan International
Cooperation Agency (JICA)

The Japan International Cooperation Agency (JICA) sent two members of the supervisory committee and a Study Team headed by Mr. Hisashi OHSHIMA, to the Kingdom of Thailand from March 5 to March 11, 1986, and had a series of discussions with the officials of the Public Works Department (PWD) in connection with the Feasibility Study on the New Krung Thep Bridge Construction and Thouburi Road Extension (hereinafter referred to as "the Study").

Both parties agreed upon the following matters:-

1. The main subject of the Study will be the New Krung Thep Bridge Construction and Thonburi Road to be lined between the Middle Ring Road and the Outer Ring Road.

2. The connecting road between the new road from Rama VI Bridge to the Bangkok Noi-Nakon Chaisri Highway and the off-route of the Thonburi Road to the Phetkasem Highway will be examined provided that the cost estimates be based on existing data including aerial photos and that its alignment be determined by PWD.

3. JICA will provide one echo sounder, one electronic distance meter with theodolite, and one set of 16-bit Micro Computer System as specified in the Minutes of Discussion, signed on November 6, 1985 between PWD and JICA. The shcedule of acquisition, utilization and transfer of the above equipment will be shown in the Progress Report I.

4. PWD will assign counterparts as follows:

Counterpart Team

1.)	Dr. Voravit Lertlaksana	Chief of Counterpart Team
2.)	Mr. Dhongchai Tejasen	Bridge Planner
3.)	Mr. U-tra Amatayakul	Highway Planner
4.)	Mr. Vitoon Janviriyakul	Transport Planner
5.)	To be named	Highway Engineer
6.)	To be named	Bridge Engineer

A.O.

5. The steering committee will be established comprising members as follows:

Steering Committee

1.)	Mr. Chinda Kulwatto Deputy Director General, PWD	Chairman
2.)	Representative Bangkok Metropolitan Administration	Member
3.)	Representative Expressway and Rapid Transit Authority of Thailand.	Member
4.)	Representative Department of Highways	Member
5.)	Representative Office of the National Economic and Social Development Board	Member
6.)	Representative Office of the Committee for the Management of Road Traffic	Member
7.)	Representative Department of Town and Country Planning	Member
8.)	Representative Harbour Department	Member
9.)	Dr. Voravit Lertlaksana Project Director, PWD	Member & Secretary

6. PWD requested the following and the mission agreed to deliver it to the Japanese Government:

To provide two Thai counterparts with technical training opportunities in Japan.

7. PWD will make available to the Study Team data files and other data generated by STTR Study and submitted to NESDB.

8. PWD will provide records concerning previous repair work on the Krung Thep Bridge.

9. BSHS45 criteria will be used for the live load evaluation during the preliminary design stage.

10. The Harbor Department will be the agency for directing the Study Team for matters concerning navigation clearance including the possible relocation of the Bangkok Dockyard.

11. The Study will not limit itself to at-grade intersections.

Appendix 1.2.3 Preliminary Engineering and Economic Examination of Connection with Rama VI Bridge.

Preliminary Engineering and Economic Examination of Connection Road with Rama VI Bridge

1. Introduction

The existing Rama VI bridge has its western approach connected only with the northern tip of Middle Ring Road in the Thonburi side of the river. It is envisaged by PWD that the addition of the new Rama VI bridge would necessitate additional approach. A direct approach to Bangkok Noi - Nakorn Chaisri Highway is therefore being planned and is included in the detailed design work of the new Rama VI bridge project. Aside from Outer Ring Road which is generally located far away from the river and the built-up area along it, Middle Ring Road is the only north-south through route serving the Thonburi side and linking the bridges over the river. The proposed Thonburi Road Extension will be directly connected with the Sathorn (Taksin) bridge and well placed to serve traffic using other bridges or those traffic generated in the southern part of the west bank. It was felt therefore that the feasibility of a road connecting Thonburi Road Extension and the new Rama VI Bridge through the planned approach to Bangkok Noi - Nakorn Chaisri Highway should be examined.

Fig. A.1.2.3.1 shows a tentative location of the subject.

This brief report describes the Study Team's preliminary findings concerning the following factors:

- Design standards
- Traffic forecasts
- Cross section
- Route Location
- Structures
- Construction costs
- Economic evaluation
- Other considerations

2. Design Requirements

1) Design Standards

Design standards for urban trunk roads with a design speed of 80 km/h was adopted considering the position of this road in the road network. Design speeds of existing roads in the vicinity are:

* Middle Ring Road 60-80 km/h
* Bangkok Noi - Nakorn Chaisri Highway 80 km/h
* New Rama VI Bridge 80 km/h
* Thonburi Road Extension 80 km/h

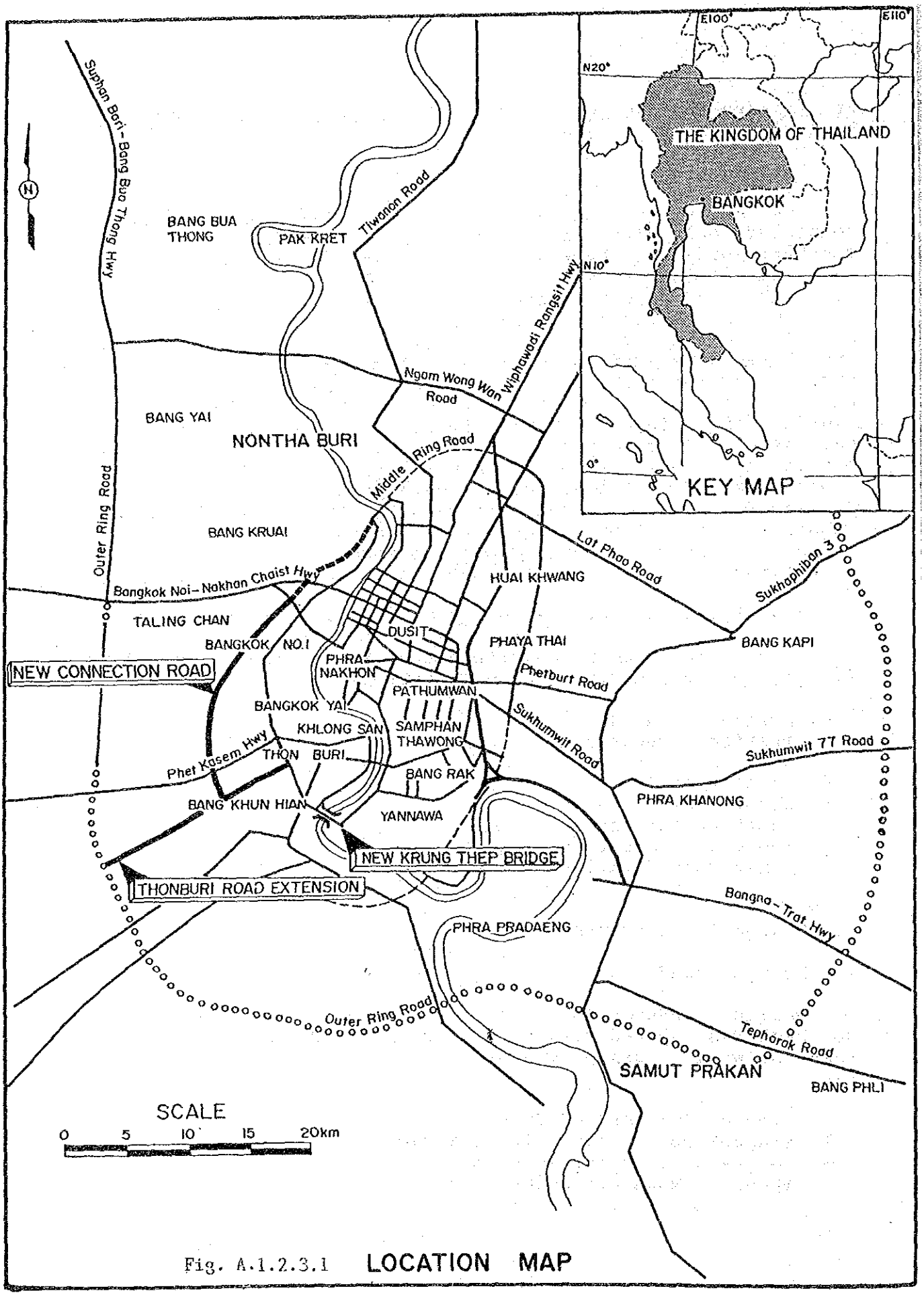


Fig. A.1.2.3.1 **LOCATION MAP**

2) Traffic Volume

Future traffic volumes on this road were forecasted for 2001 and 2011 by means of the method described in the Main Volume Chapter 4. Forecasted volumes are shown in Fig. A.1.2.3.2.

3) Cross Section

Lane capacity was determined at 1800 pcu/h, the same as for Thonburi Road Extension. As shown in Fig. A.1.2.3.2 traffic volumes in one direction varies from 2400 pcu/h to 3600 pcu/h in the year 2011. It was determined therefore that the road required 4 lanes. Forecasted volumes for 2011, however, are close to the capacity* Further widening will be inevitable. It was assumed therefore that a right of way width of 70 m be adopted.

3. Route Location

The route location work was carried out by means of aerial photographs with a scale of 1 to 6,000 and topographic maps with a scale of 1 to 20,000 basically following the location policies applied to Thonburi Road Extension. The results of the work are shown in Fig. A.1.2.3.3 and summarized below:

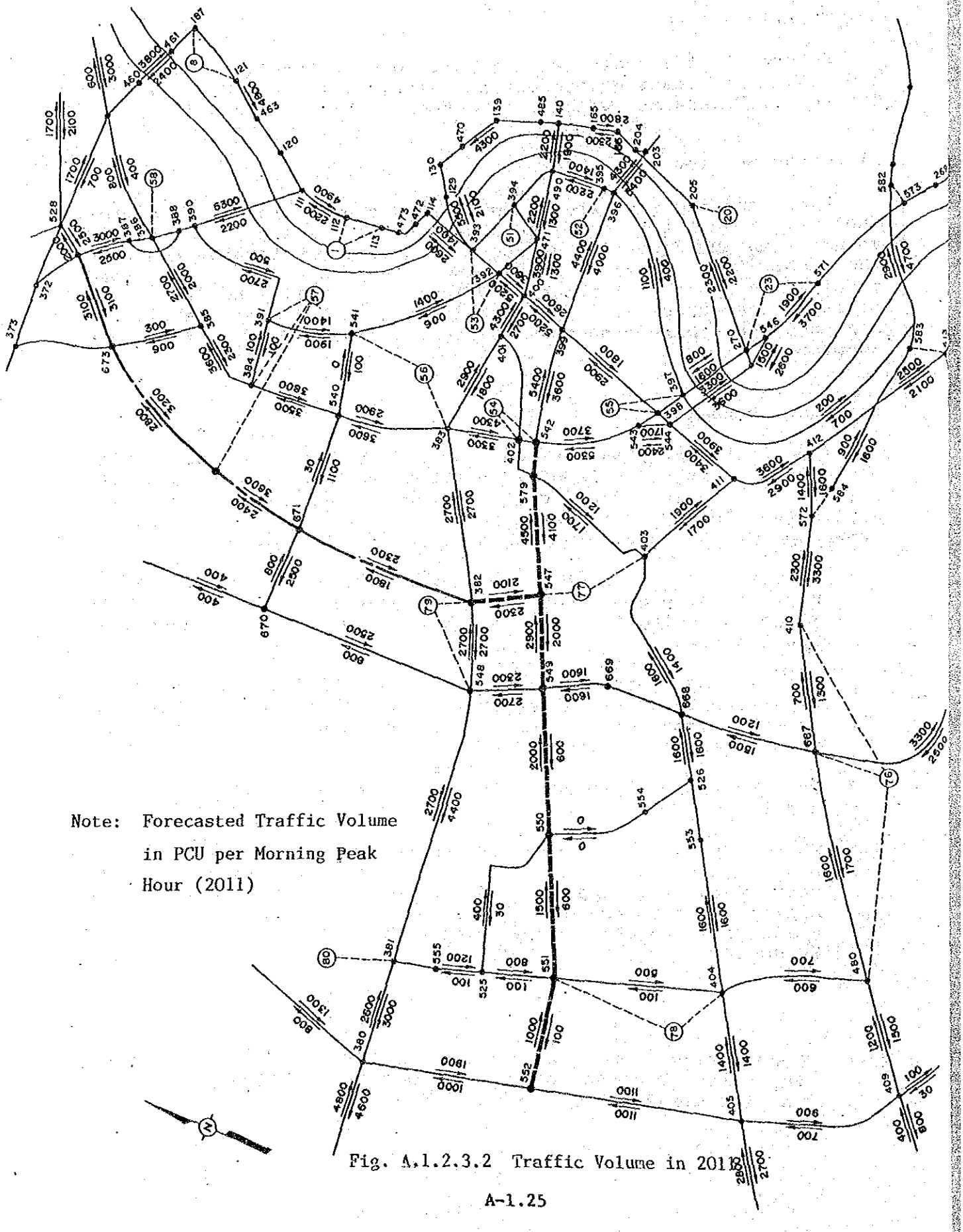
* Starting from an at grade intersection with Phet Kasem Highway at end of Segment C of Thonburi Rad Extension, the alignment slightly shifts westward to avoid a developed housing area.

* From khlong Bangkok Noi the alignment shift to the northeast direction to cross khlong Chak Phra. This section should be suitably located to minimize disturbance to the communities in both sides of Soi Wat Mali.

* The vertical clearance of khlong Chak Phra should be set at about 3.5 m.

* The section from the Southern Railway to Bangkok Noi - Nakorn Charisri highway lies in a housing area and there are many wats and schools. The alignment should be the one minimizing disturbance to them and also ensuring a smooth connection to the proposed approach road to the new Rama VI bridge.

Note: Considering the development after 2011, the grate separated intersection on the Phet Kasem Highway is shown in Fig. A.1.2.3.5 of page A-1.39.



Note: Forecasted Traffic Volume in PCU per Morning Peak Hour (2011)

Fig. A.1.2.3.2 Traffic Volume in 2011

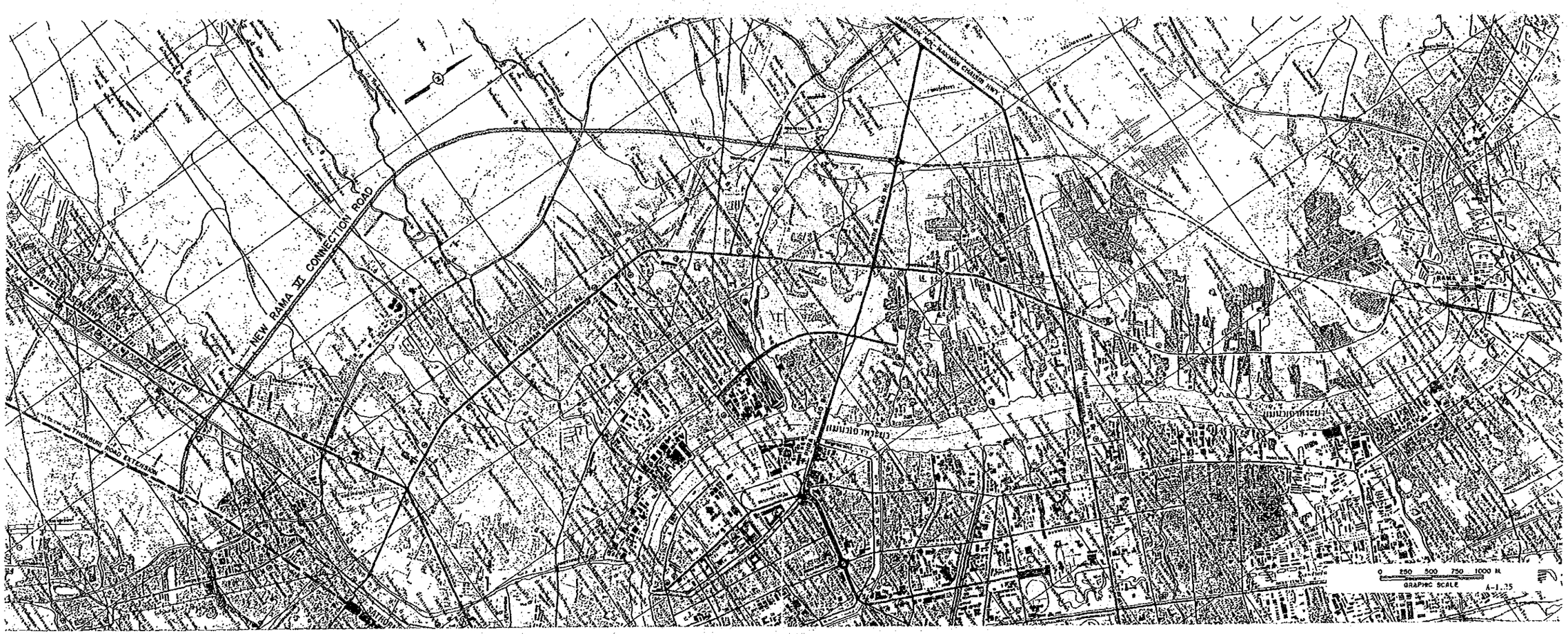


Fig. A.1.2.3.3 LOCATION MAP OF ROAD

4. Structures

There are many small khlongs and relatively wide khlongs in this area.

Following structures are needed for the road.

* Khlong Bang Jhak : bridge
* Khlong Wat Yang : box culvert
* Khlong Bang Wak : bridge
* Khlong Bang Chuak Nang : bridge
* Khlong Bang Noi : bridge
* Khlong Chak Phra : bridge
* Khlong Cheong Lane : box culvert

Southern Railway, Bang Khun Non-Taling Chan Road and Khlong Bangkok Noi are all closely located each other.

A flyover bridge is needed to cross the three.

5. Construction Cost Estimates

Construction costs were estimated using the same unit costs developed for Thonburi Road Extension.

The total construction costs are shown below:

* Construction Cost	:	1,518,000,000
* Land Acquisition cost	:	711,000,000
* Compensation cost	:	152,000,000
Total	Baht	2,381,000,000

The breakdown of construction cost is shown in Table A.1.2.3.1 and Table A.1.2.3.2.

Table A 1.2.3.1 New Connection Road (to Rama VI Bridge)

(Unit: 1,000 Baht, October 1986 prices)

Items	Financial Cost	Component (%) F	L	Tax	Economic Cost
a) Construction Cost					
Segment H, (7.41 km) from Phet Kasem Highway to Phra Pin Klao Road	875,000	35.1	64.9	10.5	778,158
Temporary Works (10%)	87,500	42.0	58.0	15.0	65,625
Direct Cost Total	962,500	35.7	64.3	12.3	843,783
Over Head (30%)	288,750	38.0	62.0	35.0	187,687
Total Construction Cost	1,251,250	36.3	63.7	17.6	1,031,470
Physical Constingency(10%)	128,750	36.3	63.7	17.6	106,090
Total	1,380,000	36.3	63.7	17.6	1,137,560
b) Engineering Service (10%)					
Detail Design Cost (3%)	41,400	48.1	51.9	11.7	36,544
Supervision Cost (7%)	96,600	40.6	59.4	11.4	85,570
Total	138,000	42.9	57.1	11.5	122,114
c) Land Acquisition					
Land Acquisition	711,000	-	100.0	3.7	685,000
Compensation Cost	152,000	-	100.0	3.7	146,000
Total	863,000	-	100.0	3.7	831,000
Capital Cost Total	2,381,000	36.4	63.6	12.2	2,090,674

Maintenance Cost for New Connection Road(to Rama VI Bridge)

(Unit: Baht, October 1986 prices)

Items	Financial Cost	Component (%) F	L	Tax	Economic Cost
a) Annual Maintenance Cost of Viaduct&Bridge(1.30km)	260,060	27.7	72.3	8.1	239,117
b) Annual Maintenance Cost of Road (6.11 km)	158,908	20.0	80.0	6.0	149,438
Total	418,968	24.8	75.2	7.3	388,555

Table A 1.2.3.2 New Connection Road (to Rama VI Bridge) Project

Financial/Economic Construction Cost Table

(Segment H)

Item No.	Work Item	Unit	Quantity	Financial Unit Price	Component (%) F	L	Tax	Financial Amount	Economic Amount
	From Phet Kasem Highway to Phra Pin Klao Road	km	7.41						
R-1	Clearing & Grubbing	sq.m	508,400	48.0	38.8	61.2	12.3	24,403,200	21,401,000
R-2	Removal of Existing Structure	cu.m	2,500	824	44.2	55.8	17.3	2,060,000	1,703,000
R-3	Embankment, Sand	cu.m	572,530	283	46.8	53.2	12.0	162,025,990	142,582,000
R-4	Side Ditch Excavation	cu.m	32,900	54.4	46.1	53.9	16.2	1,789,760	1,499,000
R-14	Drainage, Box 3.0 x 3.0 x 2	m	80	37,767	20.8	79.2	4.7	3,021,360	2,879,000
R-21	Drainage, U 0.3 x 0.5	m	13,550	1,614	7.3	92.7	1.7	21,869,700	21,497,000
R-5	Topsoil & Sodding	sq.m	81,100	17.5	0.0	100.0	0.6	1,419,250	1,410,000
R-6	Main carriageway Pavement	sq.m	119,130	564	15.6	84.4	4.1	67,189,320	64,434,000
R-9	Side Walk Block	sq.m	16,560	201	12.9	87.1	10.0	3,328,560	2,995,000
R-11	Curb & Gutter	m	27,200	409	21.3	78.7	7.6	11,124,800	1,027,000
Q-1	Bridge for Khlong (Short)	sq.m	4,350	8,201	35.5	64.5	10.3	35,674,350	31,999,000
Q-2	Bridge for Flyover (Long)	sq.m	33,800	10,252	35.5	64.5	10.3	346,517,600	310,826,000
Q-3	Abutment Structure & Transition Slab	sq.m	18,300	5,965	35.8	64.2	11.1	109,159,500	97,042,000
R-23	Traffic Signs	Each	60	33,354	28.0	72.0	2.9	2,001,240	1,943,000
R-25	Traffic Signals	Each	8	208,535	27.8	72.2	2.9	1,668,280	1,619,000
R-26	Bridge Lighting Pole	Each	45	28,806	30.8	69.2	5.3	1,296,270	1,227,000
R-27	Road Lighting Pole	Each	50	27,993	29.9	70.1	5.3	1,399,650	1,325,000
	Other Miscelloneous (10 %)	L.S	1	-	35.1	64.9	10.5	79,051,170	70,750,000
	Subtotal				35.1	64.9	10.5	875,000,000	778,158,000
	Temporary Works (10 %)	L.S	1		42.0	58.0	15.0	87,500,000	65,625,000
	Direct Cost Total				35.7	64.3	12.3	962,500,000	843,783,000
	Over Head (30 %)	L.S	1	-	38.0	62.0	35.0	288,750,000	187,687,000
	Total Construction Cost		about		36.3	63.7	17.6	1,251,250,000	1,031,470,000
	Physical Contingency	%	10.0		36.3	63.7	17.6	128,750,000	106,090,000
	Total				36.3	63.7	17.6	1,380,000,000	1,137,560,000

6. Economic Evaluation

The benefit of the proposed road is defined as the difference in the total generalized traffic cost on the entire network with and without the road but including Thonburi Road Extension and the New Krungthep Bridge. The method is decribed in Chapter 4 of the Main Text Volume. Network assignments were carried out for the year 2001 and 2011 to obtain annual benefit values for the respective years. For the year 1991, the annual benefit value was obtained by means of applying the ratio of benefits in 2001 and 1991 in other cases. Values for intermediate years were obtained by interpolation.

The project was evaluated in two ways. The first was to considered a project including Thonburi Road Extension and the Segment H as one package. The second was to evaluate Segment H alone by taking marginal benefit by it.

Necessary costs for each year for construction and maintenance were estimated. Benefits were calculated as shown in Table A.1.2.3.3. Standard economic evaluation indicators were calculated as shown in Table A.1.2.3.4. For the opening year of 1991 the connection road alone would yield an internal rate of return of 30%. If the construction is differred by 8 years and the benefit remain constant after 2011, then the rate takes a maximum value of 33%. The project would be feasible with the opening year of 1991.

Taken as a whole together with Thonburi Road Extension, the project would yeild an IRR of 41% for 2001 opening year and 32% for 1991 opening year.

No consideration was taken in the above concerning the very high possibility of intensive development along the new road. The above estimates should be taken as very conservative.

7. Other Considerations and Recommendations

1) Development Pattern and the Necessity of the Road

The urbanized area of Bangkok have been rapidly expanding. It was 67 sq.km in 1953, 96 sq.km in 1958, 184 sq.km in 1971 and 254 sq.km in 1981. This development, however, has been skewed to the northern and eastern direction from the center on the shore of the Chao Phraya River. The development of western part, that is, Thonburi side, has been slow due largely to the shortage of roads in this side. To increase the development potential in Thonburi side, the expansion of road network is required. For that purpose, New Connection Road is well suited. There have already been sporadic housing development west of MRR. However,

there is no north-south trunk road in this area. New Connection Road can serve these existing inhabitants and induce more. Obviously the new road would attract a large portion of traffic from MRR, enabling MRR function properly, as shown in Fig. A.1.3.2.2.

2) Timing of Construction

Optimum construction schedule can not be decided, at this stage without a proper study. However, a part of Thonburi Road Extension (Route C) and New Rama VI Bridge and its approach road will likely be open by year 1991. General speaking, the construction project period including feasibility study, detailed design, land acquisition and construction of road takes for at least 5-6 years.

The feasibility study of New Connection Road should be commenced as soon as possible for the formulation of the proper trunk road network in Bangkok.

3) Extension of New Connection Road

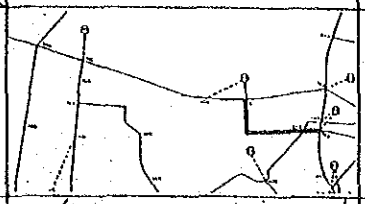
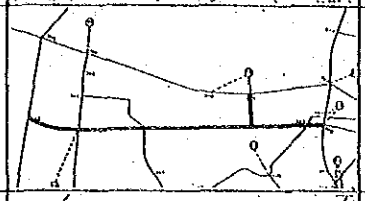
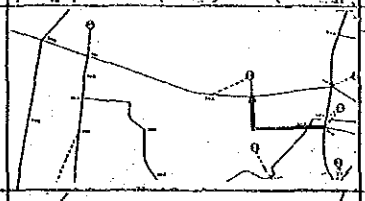
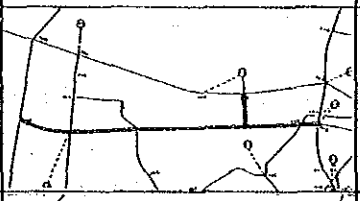
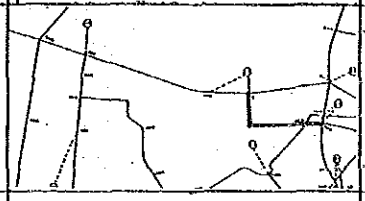
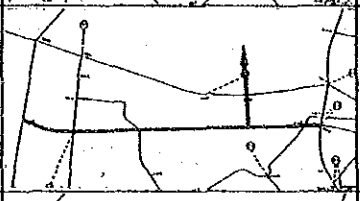
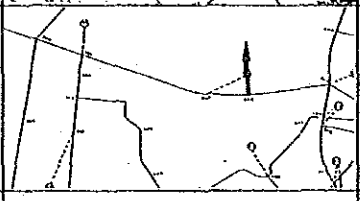
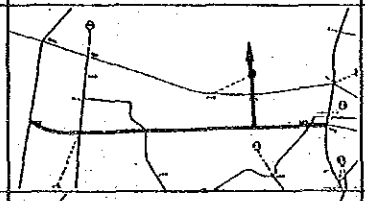
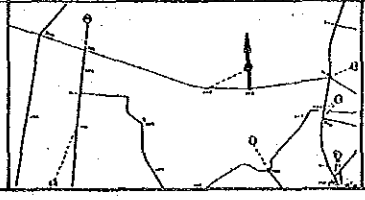
In this study, New Connection Road is linked to Thonburi Road Extension and New Rama VI Bridge approach road. However, it is likely that the extension of this road to the Wat Sai Bridge approach road or southern part of Krungthep Bridge on the existing Taksin Road would result in much higher benefit considering the traffic demand pattern and network configuration in Bangkok metropolitan area.

Table A 1.2.3.3 Rama VI Bridge Connection Road
Economic Benefit

Item	1991	2001	2011
Case 4 total benefit (million Baht)	1091	2780	1290
Case 3 total benefit (million Baht)	1091	1494	127
Difference (million Baht)	-	1286	1163
Case 5 total benefit (million Baht)	2105	2780	1290
Case 2 total benefit (million Baht)	1131	1494	127
Difference (million Baht)	974	1286	1163

Table A 1.2.3.4 Rama VI Bridge Connection Road
Economic Evaluation

Case 4 Overall	NPV	5122	million Baht
	B/C	4.02	
	IRR	41.08 %	
Case 4 Marginal	NPV	1030	million Baht
	B/C	3.17	
	IRR	32.72 %	
Case 5 Overall	NPV	7915	million Baht
	B/C	3.46	
	IRR	31.77 %	
Case 5 Marginal	NPV	3797	million Baht
	B/C	3.36	
	IRR	30.01 %	

Year / Case	Implementation Schedule		
	1991	2001	2011
Case 1		—	—
Case 2		—	—
Case 3			—
Case 4 (Over all)			—
Case 4 (Marginal)	—		—
Case 5 (Over all)		—	—
Case 5 (Marginal)		—	—

Notes :

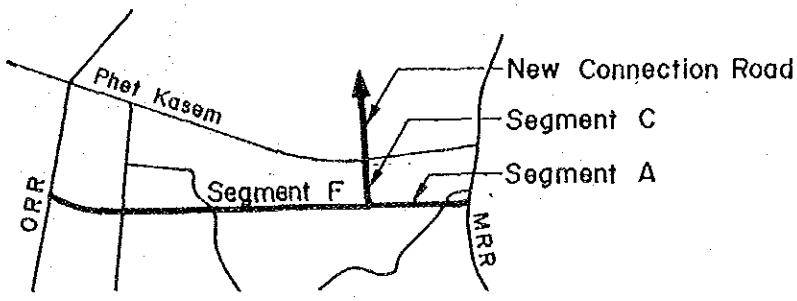


Fig. A.1.2.3.4 Presentation of Each Case

ECONOMIC EVALUATION

Thonburi Road Extension Project : Case 4

Discount Rate (%) = 12.0

UNIT : million Baht

			DISCOUNTED	
YEAR	COST	BENEFIT	COST	BENEFIT
0	0.	0.	0.	0.
1	413.	0.	369.	0.
2	262.	0.	209.	0.
3	547.	0.	389.	0.
4	213.	0.	135.	0.
5	0.	1091.	0.	619.
6	0.	1108.	0.	561.
7	0.	1126.	0.	509.
8	0.	1144.	0.	462.
9	0.	1162.	0.	419.
10	0.	1179.	0.	380.
11	1117.	1197.	321.	344.
12	465.	1215.	119.	312.
13	830.	1233.	190.	283.
14	401.	1250.	82.	256.
15	1.	2780.	0.	508.
16	1.	2631.	0.	429.
17	1.	2482.	0.	361.
18	1.	2333.	0.	303.
19	1.	2184.	0.	254.
20	1.	2035.	0.	211.
21	1.	1886.	0.	175.
22	1.	1737.	0.	144.
23	1.	1588.	0.	117.
24	1.	1439.	0.	95.
25	-2068.	1290.	-122.	76.

NET PRESENT VALUE = 5122.
B/C RATIO = 4.02

IRR= 41.08

ECONOMIC EVALUATION

TRE Case 4 (Marginal)

Discount Rate (%) = 12.0

UNIT : million Baht

			DISCOUNTED	
YEAR	COST	BENEFIT	COST	BENEFIT
0	0.	0.	0.	0.
1	0.	0.	0.	0.
2	0.	0.	0.	0.
3	0.	0.	0.	0.
4	0.	0.	0.	0.
5	0.	0.	0.	0.
6	0.	0.	0.	0.
7	0.	0.	0.	0.
8	0.	0.	0.	0.
9	0.	0.	0.	0.
10	0.	0.	0.	0.
11	868.	0.	250.	0.
12	329.	0.	84.	0.
13	623.	0.	143.	0.
14	271.	0.	55.	0.
15	0.	1286.	0.	235.
16	0.	1274.	0.	208.
17	0.	1261.	0.	184.
18	0.	1249.	0.	162.
19	0.	1237.	0.	144.
20	0.	1225.	0.	127.
21	0.	1212.	0.	112.
22	0.	1200.	0.	99.
23	0.	1188.	0.	88.
24	0.	1175.	0.	77.
25	-984.	1163.	-58.	68.

NET PRESENT VALUE = 1030.
B/C RATIO = 3.17

IRR= 32.72

ECONOMIC EVALUATION

Thonburi Road Extension Project : Case 5

Discount Rate (%) = 12.0

UNIT : million Baht

			DISCOUNTED	
YEAR	COST	BENEFIT	COST	BENEFIT
0	0.	0.	0.	0.
1	1530.	0.	1366.	0.
2	727.	0.	580.	0.
3	1377.	0.	980.	0.
4	614.	0.	390.	0.
5	1.	2150.	1.	1220.
6	1.	2173.	0.	1101.
7	1.	2240.	0.	1013.
8	1.	2308.	0.	932.
9	1.	2375.	0.	856.
10	1.	2443.	0.	787.
11	1.	2510.	0.	722.
12	1.	2578.	0.	662.
13	1.	2645.	0.	606.
14	1.	2713.	0.	555.
15	1.	2780.	0.	508.
16	1.	2631.	0.	429.
17	1.	2482.	0.	361.
18	1.	2333.	0.	303.
19	1.	2184.	0.	254.
20	1.	2035.	0.	211.
21	1.	1886.	0.	175.
22	1.	1737.	0.	144.
23	1.	1588.	0.	117.
24	1.	1439.	0.	95.
25	-1853.	1290.	-109.	76.

NET PRESENT VALUE = 7915.
B/C RATIO = 3.46

IRR= 31.77

ECONOMIC EVALUATION

TRE case 5 (Marginal)

Discount Rate (%) = 12.0

UNIT : million Baht

			DISCOUNTED	
YEAR	COST	BENEFIT	COST	BENEFIT
0	0.	0.	0.	0.
1	868.	0.	775.	0.
2	329.	0.	262.	0.
3	623.	0.	443.	0.
4	271.	0.	172.	0.
5	0.	974.	0.	553.
6	0.	1005.	0.	509.
7	0.	1036.	0.	469.
8	0.	1068.	0.	431.
9	0.	1099.	0.	396.
10	0.	1130.	0.	364.
11	0.	1161.	0.	334.
12	0.	1192.	0.	306.
13	0.	1224.	0.	281.
14	0.	1255.	0.	257.
15	0.	1286.	0.	235.
16	0.	1274.	0.	208.
17	0.	1261.	0.	184.
18	0.	1249.	0.	162.
19	0.	1237.	0.	144.
20	0.	1225.	0.	127.
21	0.	1212.	0.	112.
22	0.	1200.	0.	99.
23	0.	1188.	0.	88.
24	0.	1175.	0.	77.
25	-830.	1163.	-49.	68.

NET PRESENT VALUE = 3797.
B/C RATIO = 3.36

IRR= 30.01

ECONOMIC EVALUATION

Marginal of Segment H (Opening Year = 1999)

Discount Rate (%) = 12.0

UNIT : million Baht

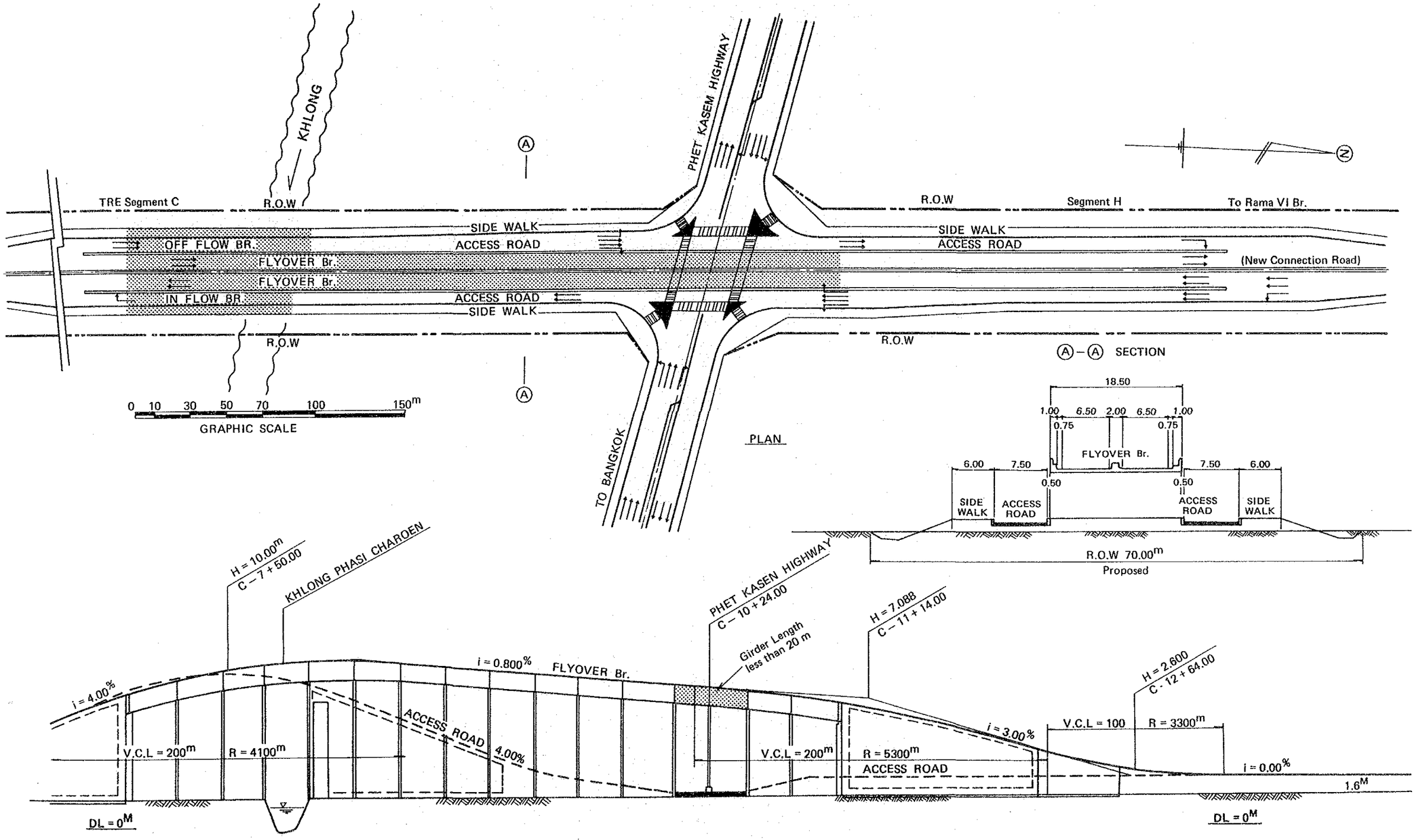
			DISCOUNTED	
YEAR	COST	BENEFIT	COST	BENEFIT
0	0.	0.	0.	0.
1	868.	0.	775.	0.
2	329.	0.	262.	0.
3	623.	0.	443.	0.
4	271.	0.	172.	0.
5	0.	1224.	0.	695.
6	0.	1255.	0.	636.
7	0.	1286.	0.	582.
8	0.	1274.	0.	515.
9	0.	1261.	0.	455.
10	0.	1249.	0.	402.
11	0.	1237.	0.	356.
12	0.	1225.	0.	314.
13	0.	1212.	0.	278.
14	0.	1200.	0.	246.
15	0.	1188.	0.	217.
16	0.	1175.	0.	192.
17	0.	1163.	0.	169.
18	0.	1163.	0.	151.
19	0.	1163.	0.	135.
20	0.	1163.	0.	121.
21	0.	1163.	0.	108.
22	0.	1163.	0.	96.
23	0.	1163.	0.	86.
24	0.	1163.	0.	77.
25	-830.	1163.	-49.	68.

NET PRESENT VALUE = 4290.
B/C RATIO = 3.67

IRR= 33.24

Fig. A.1.2.3.5 "G" INTERSECTION – GRADE SEPARATION TYPE

(See "G" Intersection of At-Grade Type in 37/47 of Drawings)



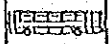
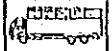
PROFILE

Appendix 3.2.1 Sample Survey Sheets and Questionnairs

การนับปริมาณการจราจรแยกประเภท
CLASSIFIED TRAFFIC COUNT SUMMARY SHEET

NEW KRUNG THEP
BRIDGE CONSTRUCTION

SURVEY STATION	DIRECTION OF TRAVEL	DAY	MONTH	YEAR
	No.			

Hours	 Passenger Car	 Taxi, samlor and sitor	 Minibus (BMTA) factory bus	 Heavy bus (BMTA) school bus, sightseeing bus and factory bus	 Pick-up station wagon, van light van and 4 wheel truck	 6 wheel truck	 Truck 10 wheel and trailers	 Motorcycle and motor scooter	Total	Remarks
06:00 - 06:15										
06:15 - 06:30										
06:30 - 06:45										
06:45 - 07:00										
07:00 - 07:15										
07:15 - 07:30										
07:30 - 07:45										
07:45 - 08:00										
08:00 - 08:15										
08:15 - 08:30										
08:30 - 08:45										
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12:45 - 13:00										
13:00 - 13:15										
13:15 - 13:30										
13:30 - 13:45										
13:45 - 14:00										

แบบสอบถามผู้ใช้รถบนท้องถนน

ROADSIDE OD SURVEY QUESTIONNAIRE

NEW KRUNG THEP
BRIDGE CONSTRUCTION

① Sheet No.	② Station No.	③ Direction	④ Survey Data Time	Interviewer	Supervisor	Pick-up and Truck only ⑤ Vehicle Types [2], [3], [4], [5]

⑤ Vehicle Types	⑥ Origin	⑦ Destination	⑧ Trip Purpose	⑨	⑩ Trip Route At RI-1	⑩ Trip Route At RI-2,3,4	⑪ Commodity-Types (Multiple Choices)	⑫
[1] Passenger Car [2] Pick-up, [3] Light Truck (4 wheels) [4] 6 wheels truck [5] 10 wheels truck [6] Taxi, Samlor, Silor [7] Mini Bus (Excluding Regular Route Bus) [8] Bus (Excluding Regular Route Bus) [9] Motorcycle (At RI-1)	Name and address of the place where you start this trip. (Soi, Road or Nearby wellknown Location)	Name and address of the place where you stop this trip. (Soi, Road or Nearby wellknown Location)	[1] To work [2] To school [3] Business [4] Private Matter [5] Go home [6] To school & To work	Number of Passengers including driver	[1] Taksin-Krung Thep - Ratchada Phisek [2] Taksin-Krung Thep - Charoen Krung [3] Charoen Nakon - Krung Thep-Ratchada Phisek [4] Charoen Nakon - Krung Thep-Charoen Krung	Do you take Krung Thep Bridge in this Trip? [1] Yes [2] No	[1] Vacant [2] Agriculture or Fishery [3] Timber or Wood Product [4] Minerals (Sand, Laterite, etc.) [5] Metal Product & Machinery [6] Consumer Goods [7] Chemical Producted (Gas, Oil, etc.) [8] Miscellaneous	[1] Full [2] 3/4 [3] 1/2 [4] 1/4
[1] [2] [3] [4] [5] [6] [7] [8] [9]	Zone No.	Zone No.	[1] [2] [3] [4] [5] [6]		[1] [2] [3] [4]	[1] [2]	[1] [2] [3] [4] [5] [6] [7] [8]	[1] [2] [3] [4]
[1] [2] [3] [4] [5] [6] [7] [8] [9]	Zone No.	Zone No.	[1] [2] [3] [4] [5] [6]		[1] [2] [3] [4]	[1] [2]	[1] [2] [3] [4] [5] [6] [7] [8]	[1] [2] [3] [4]
[1] [2] [3] [4] [5] [6] [7] [8] [9]	Zone No.	Zone No.	[1] [2] [3] [4] [5] [6]		[1] [2] [3] [4]	[1] [2]	[1] [2] [3] [4] [5] [6] [7] [8]	[1] [2] [3] [4]
[1] [2] [3] [4] [5] [6] [7] [8] [9]	Zone No.	Zone No.	[1] [2] [3] [4] [5] [6]		[1] [2] [3] [4]	[1] [2]	[1] [2] [3] [4] [5] [6] [7] [8]	[1] [2] [3] [4]
[1] [2] [3] [4] [5] [6] [7] [8] [9]	Zone No.	Zone No.	[1] [2] [3] [4] [5] [6]		[1] [2] [3] [4]	[1] [2]	[1] [2] [3] [4] [5] [6] [7] [8]	[1] [2] [3] [4]
[1] [2] [3] [4] [5] [6] [7] [8] [9]	Zone No.	Zone No.	[1] [2] [3] [4] [5] [6]		[1] [2] [3] [4]	[1] [2]	[1] [2] [3] [4] [5] [6] [7] [8]	[1] [2] [3] [4]

แบบสอบถามผู้ครอบครองรถ
HOME INTERVIEW QUESTIONNAIRE

NEW KRUNG THEP
BRIDGE CONSTRUCTION

① Sheet No.

② Vehicle Registered No.

③ Date of Trip (Working Day)

Survey Date

Interviewer

Supervisor

Truck only

④ Address — Zone No.

Trips made by owned vehicle during the last 24 hours

⑤ Form of Ownership
- [1] Individual
- [3] Company
- [2] Government, State Enterprise

⑥ Occupation
- [1] Government Officer
- [2] Managers, Professionals
- [3] Shop Owner
- [4] Service & Sales Workers
- [5] Factory, Construction Workers, Laborers
- [6] Agricultural Workers
- [8] Housewife
- [7] Student
- [9] Others (.....)

⑦ Type of Vehicle
- [1] Passenger Car
- [2] Pick-up
- [3] 4 Wheel Truck
- [4] 6 Wheel Truck
- [5] 10 Wheel Truck
- [6] Trailor

⑧ Period of Ownership
- [1] Less than 1 year
- [2] 1 - 2 years
- [3] 3 - 4 years
- [4] 5 years or more

⑨ Frequency of Vehicle Use per week
- [1] No Use
- [2] 1 - 2 days
- [3] 3 - 4 days
- [4] 5 - 6 days
- [5] Everyday

Trip No.	⑫ Name and address of the place where you start this trip. (Soi, Road or Nearby wellknown Location)	Departure Time	⑬ Name and address of the place where you stop this trip. (Soi, Road or Nearby wellknown Location)	Arrival Time	⑭ Trip Purpose	⑮ Parking Place	⑯	⑰ Number of Passengers including driver	⑱ Commodity Types (Multiple Choices)	⑲ Loading
1	Zone No.		Zone No.		[1] [2] [3] [4] [5]	[1] [2] [3] [4] [5]	[1] Parking Fee [2] Free		[1] [2] [3] [4] [5] [6] [7] [8]	[1] Full [2] 3/4 [3] 1/2 [4] 1/4
2	Zone No.		Zone No.		[1] [2] [3] [4] [5]	[1] [2] [3] [4] [5]	[1] [2]		[1] [2] [3] [4] [5] [6] [7] [8]	[1] [2] [3] [4]
3	Zone No.		Zone No.		[1] [2] [3] [4] [5]	[1] [2] [3] [4] [5]	[1] [2]		[1] [2] [3] [4] [5] [6] [7] [8]	[1] [2] [3] [4]
4	Zone No.		Zone No.		[1] [2] [3] [4] [5]	[1] [2] [3] [4] [5]	[1] [2]		[1] [2] [3] [4] [5] [6] [7] [8]	[1] [2] [3] [4]
5	Zone No.		Zone No.		[1] [2] [3] [4] [5]	[1] [2] [3] [4] [5]	[1] [2]		[1] [2] [3] [4] [5] [6] [7] [8]	[1] [2] [3] [4]

For Zone No. 74, 76, 77, 78, 86

⑩ When the Dao Kanong - Port Expressway which includes the Wat Sai Bridge is completed, will you divert your normal trip to this expressway?

[1] Yes (and go to ⑪) [2] No

⑪ If the tolls are ฿ 20 for small vehicles and ฿ 40 for heavy vehicles, are you still willing to use this expressway section?

[1] Yes [2] No

⑳ Frequency of Vehicle Use per day
- [1] 1 trip
- [3] 3 trips
- [2] 2 trips
- [4] 4 trips or more

㉑ Brand Name.....
Model .....
Maximum Capacity ..... tons

㉒ If you want to buy a new truck, you will buy
- [1] 4 wheel truck
- [3] 10 wheel truck
- [2] 6 wheel truck
- [4] trailor

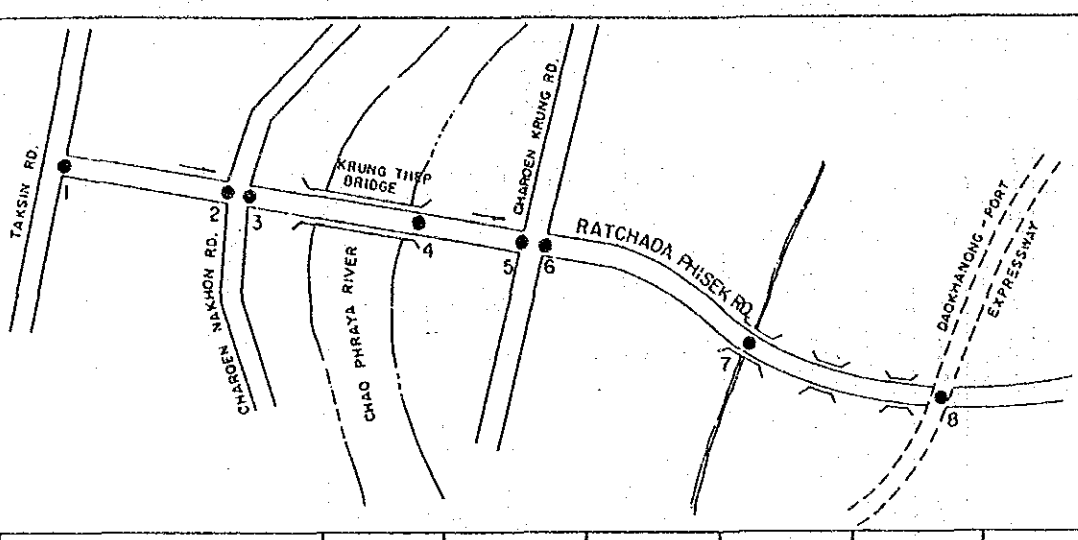
A-3.4

แบบสำรวจความเร็วของยานพาหนะ
VEHICLE SPEED SURVEY

NEW KRUNG THEP
BRIDGE CONSTRUCTION

ROAD NAME	RATCHADA PISEK RD.	DIRECTION	1 TO 8	DATE	
VEHICLE TYPE		MODEL		TIME	
SURVEYOR NAME				WEATHER	

LOCATION SKETCH

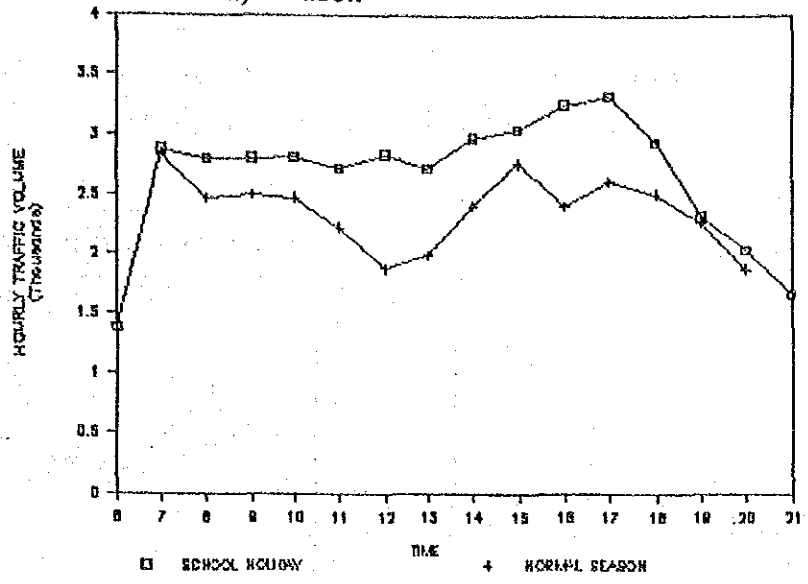


NO.	LOCATIONS	TRAFFIC SIGNAL Ⓡ .R.G	TIME H	TIME M	TIME S	DISTANCE (km)	TRAVEL TIME (S)	TRAVEL SPEED (km/h)	REMARKS
1.	TAKSIN RD.					0.31			
2.	FIRST STOP BEFORE SIGNAL								
2.	CHAROEN NAKON RD. (WEST					0.06			
3.	CHAROEN NAKON RD. (EAST					0.75			
4.	KRUNG THEP BRIDGE					0.37			
5.1	FIRST STOP BEFORE SIGNAL								
5.	CHAROEN KRUNG RD. (WEST					0.04			
6.	CHAROEN KRUNG RD. (EAST					1.68			
7.	FIRST BRIDGE					1.35			
8.	EXPRESSWAY								
TOTAL (AVERAGE)									

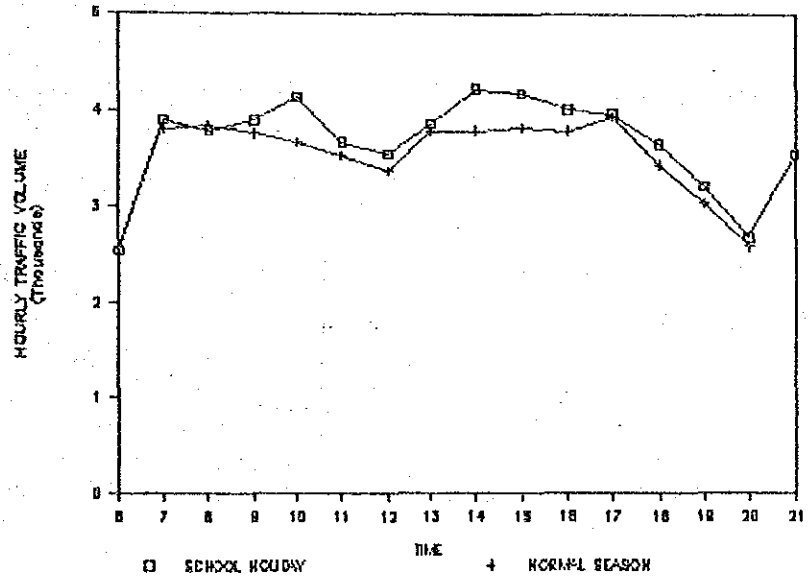
TRAFFIC SIGNAL Ⓡ = RED (FIRST CAR TO STOP) R = RED (STOP BEHIND OTHERS)
G = GREEN

Appendix 3.2.2 Existing Traffic Volume

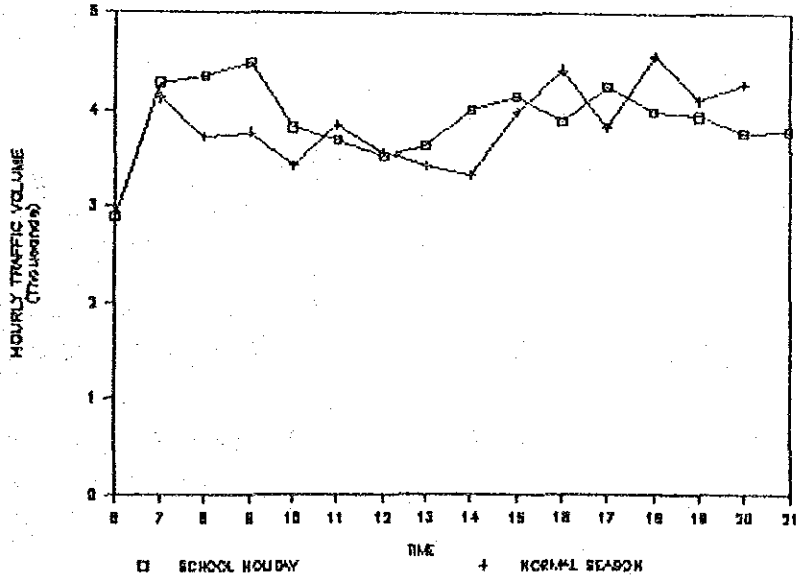
Comparison of Traffic Volume between Normal Season and School Holiday Season



Krungthep Bridge



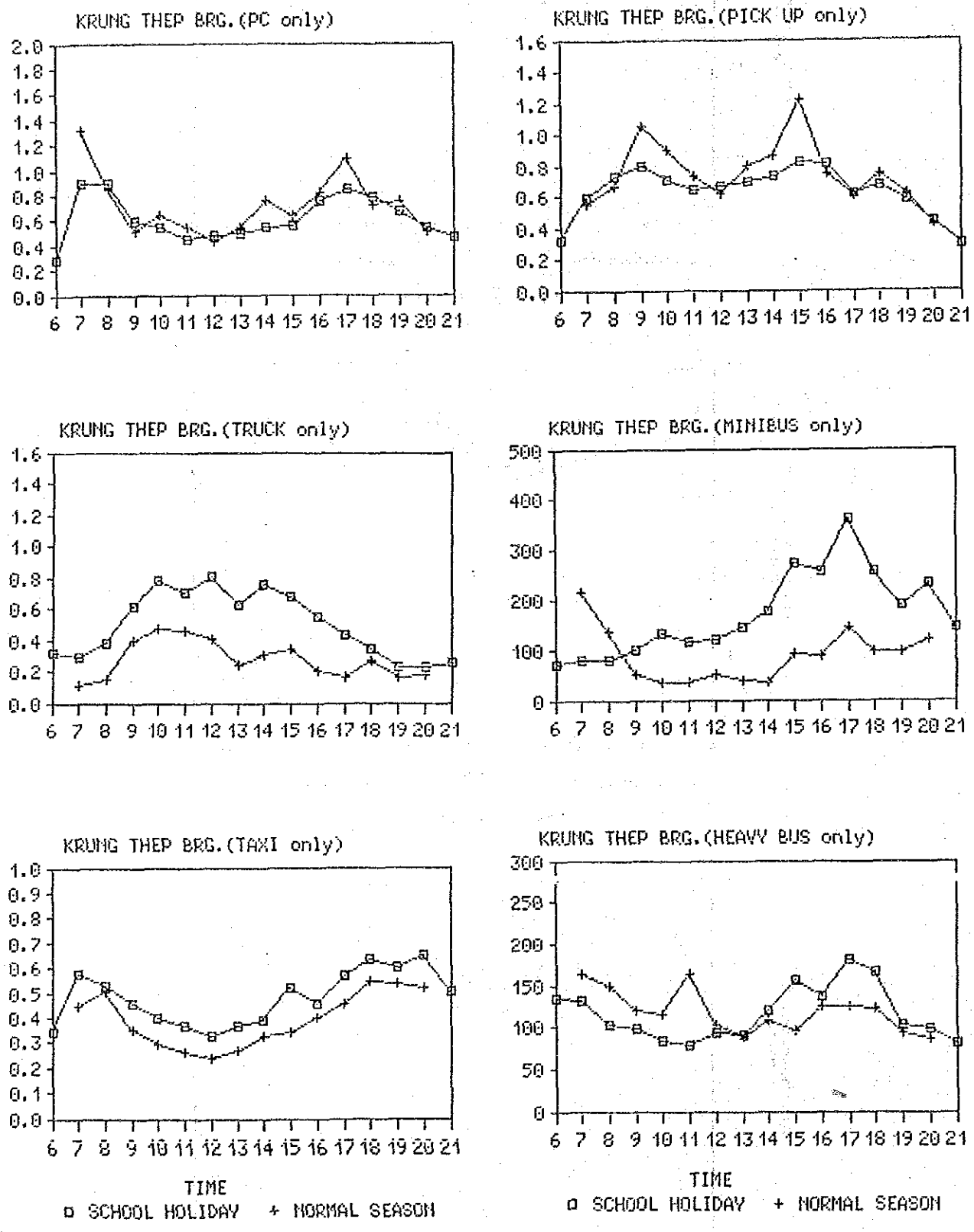
Taksin Road



Intharaphitak Road

Comparison of Traffic Volume between Normal Season
and School Holiday Season by Vehicle Type

KRUNGTHEP BRIDGE

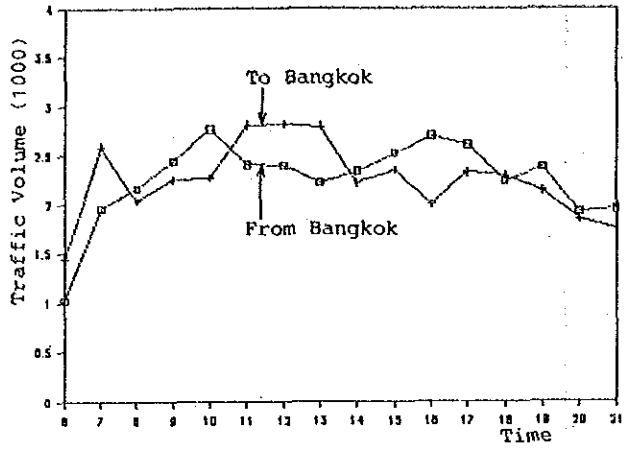


Trend of Traffic Volume on Bridges

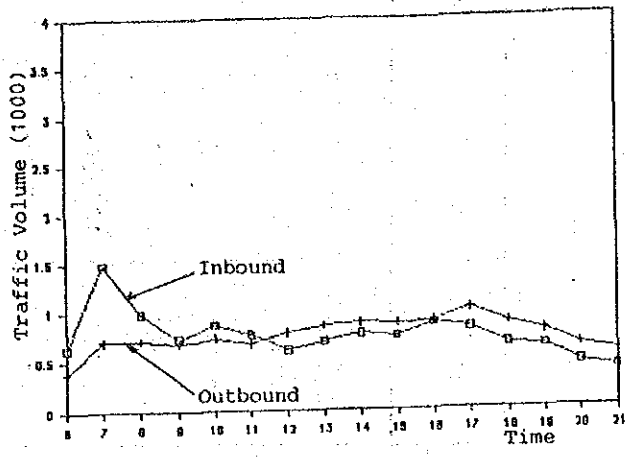
Name of Bridge	Year of Completion	1973[1]	1975[1]	1978[1]	1981[1]	1982[1]	1984[2]	1985[1]	1986[1]
Rama VI	1951	14,566	17,831	20,494	25,520	26,282	*	33,000	-
Krungthon	1955	40,875	37,344	52,404	48,490	49,947	51,632	61,600	-
Pinklao	1972	*	56,144	83,833	87,440	88,654	118,579	113,169	-
Memorial	1933	143,108	106,194	98,188	117,150	115,933	123,054	152,149	-
Taksin	1982	-	-	-	-	65,048	111,907	107,564	-
Krungthep	1955	39,626	41,799	53,180	63,850	46,217	*	54,978	65,302
Total		238,175	259,312	308,099	342,450	392,081	405,172	522,460	

Source: (1) JICA
(2) AEC
(3) PWD
* No Record

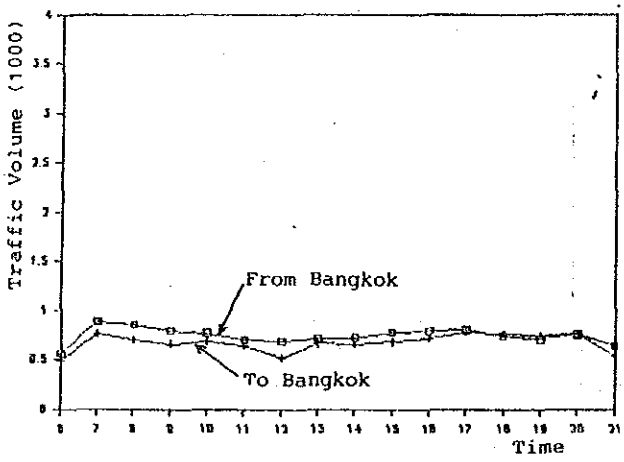
Hourly Fluctuation of Traffic Volume



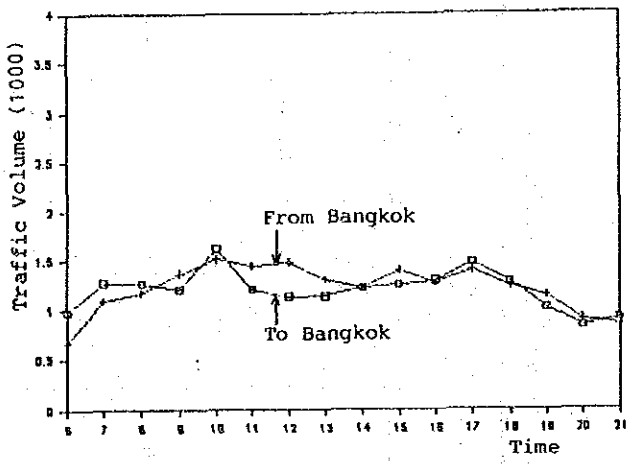
Taksin Road



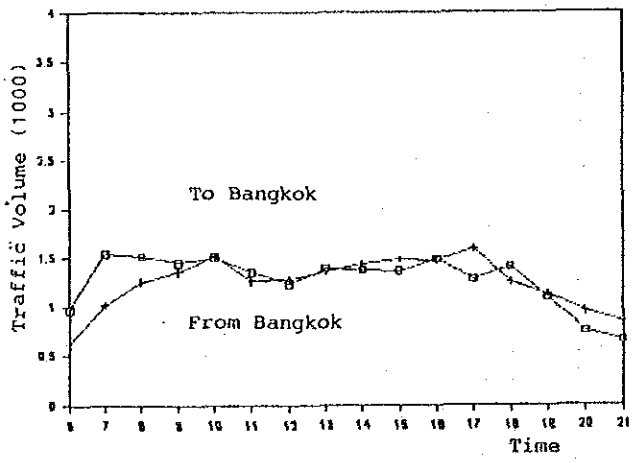
Charoen Nakhon Road



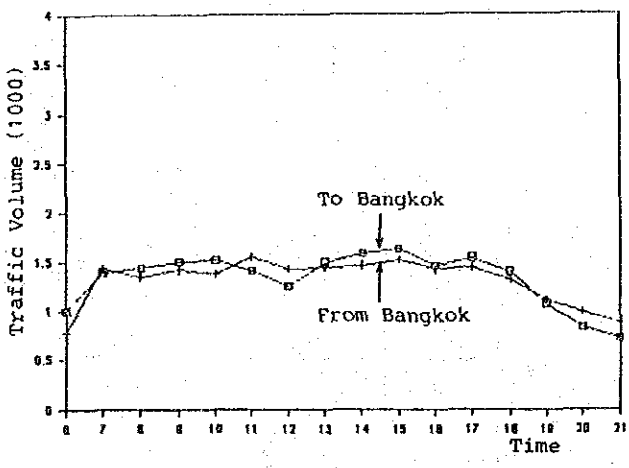
Charoen krung Road



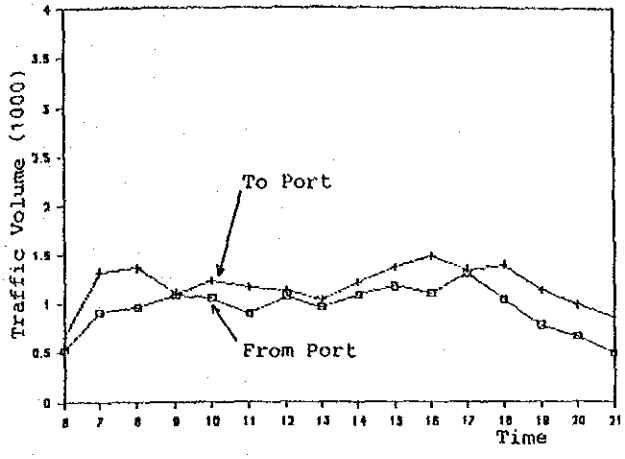
Petkasem Road



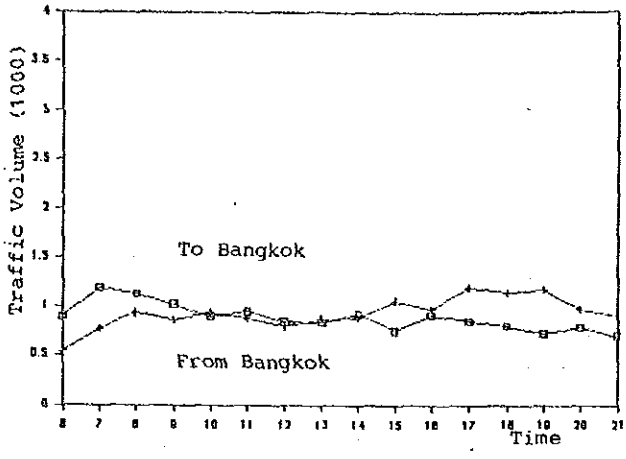
Thonburi - Paktho Highway



Suksawat Road

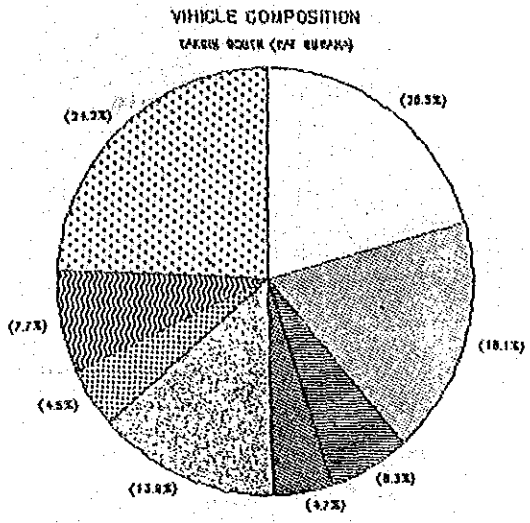


Riau Maenam Road
(Middle Ring Road)

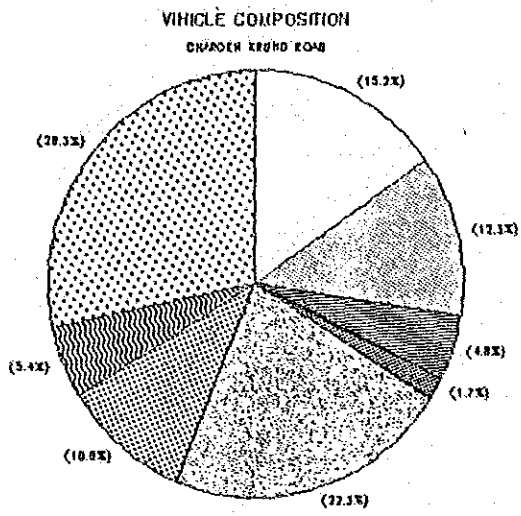


Thoed Thai Road

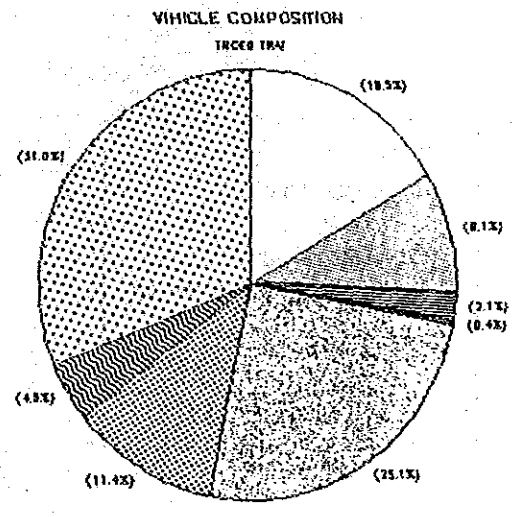
Appendix 3.2.3 Existing Traffic Composition



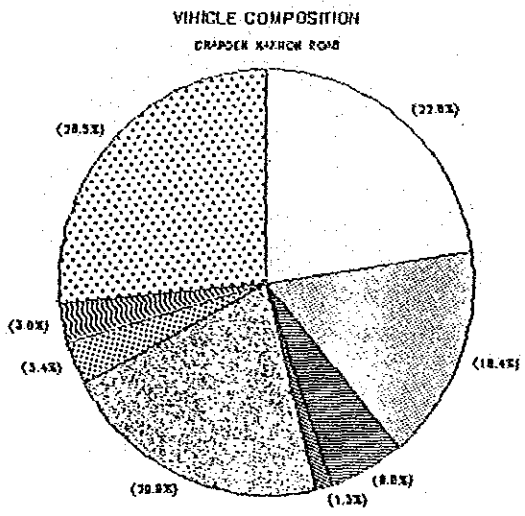
Taksin Road



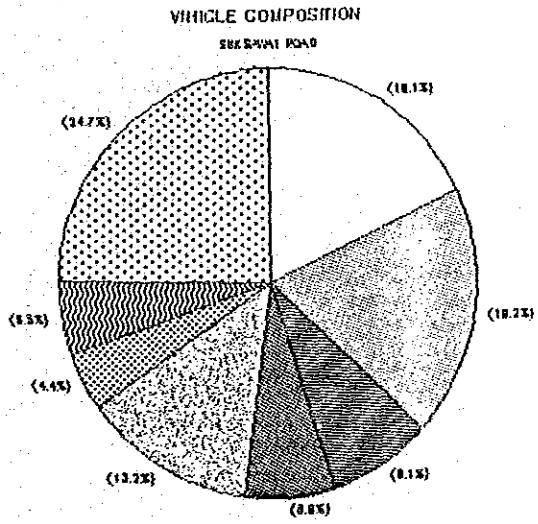
Charoen Krung Road



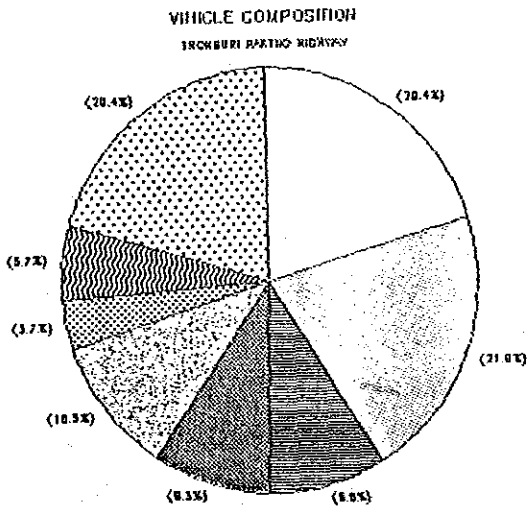
Thoed Thai Road



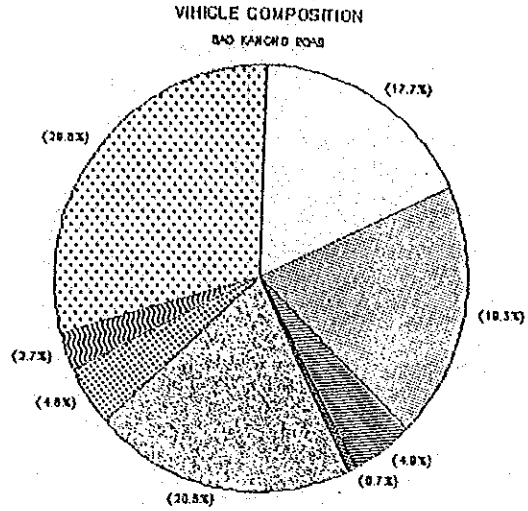
Charoen Nakhon Road



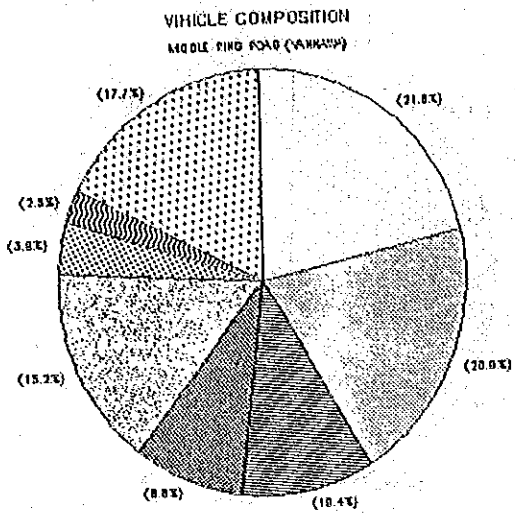
Suksawat Road



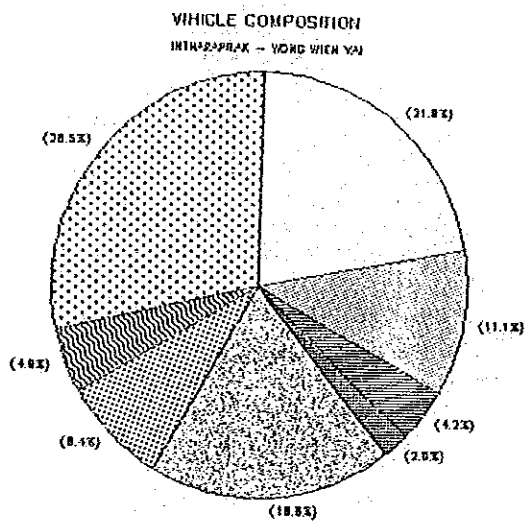
Thonburi - Paktho Highway



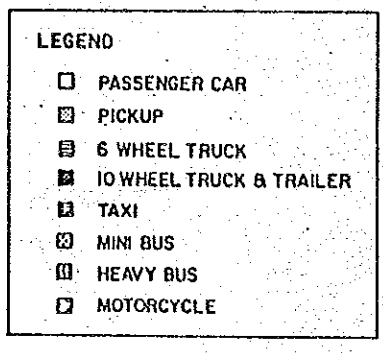
Dao Kanong Road



Riau Mae Nam Road
(Middle Ring Road)

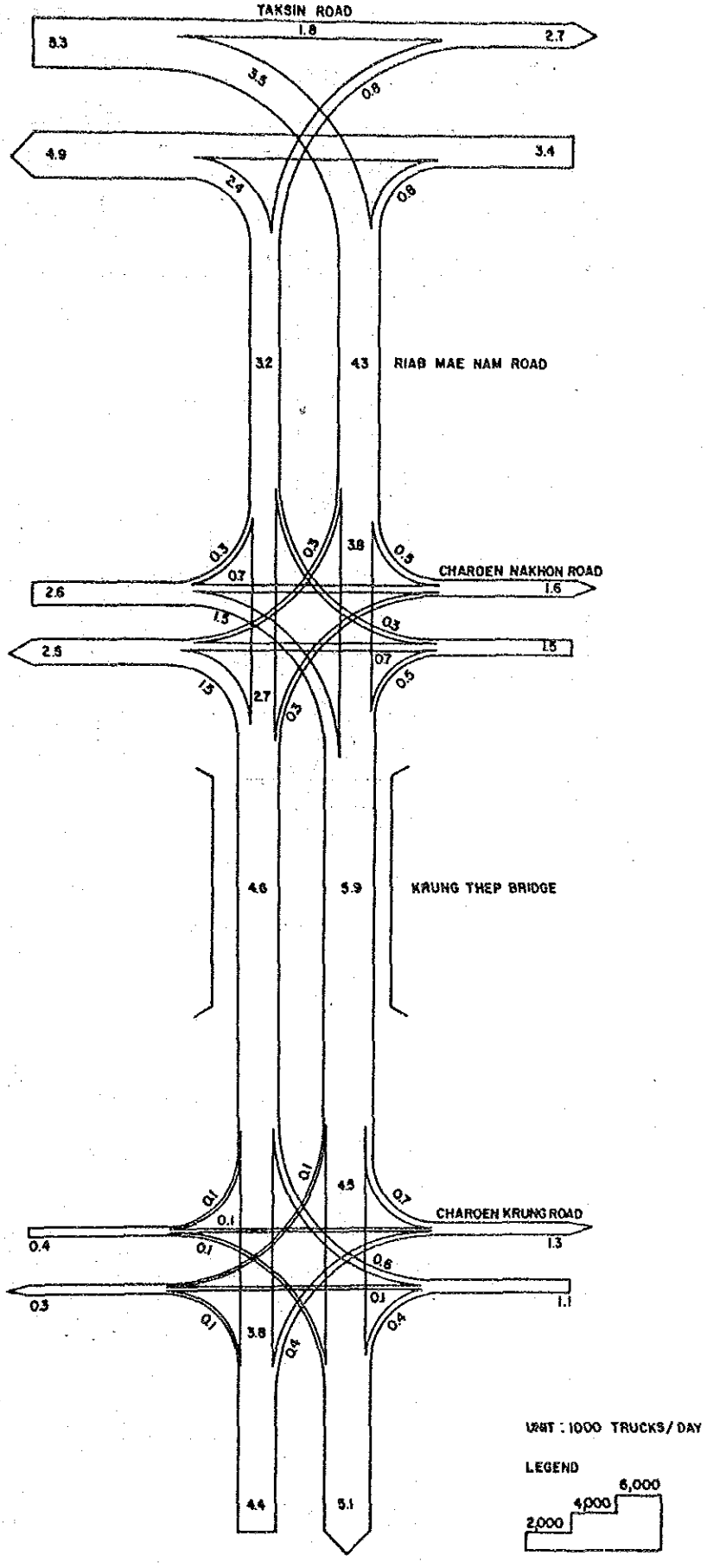


Intharapitak Road

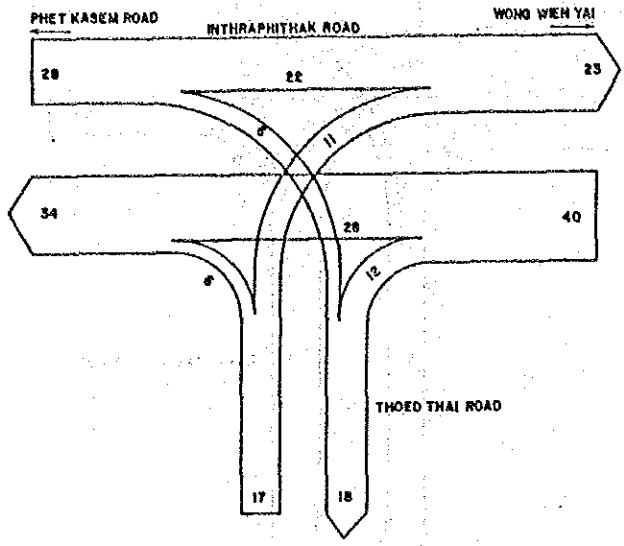


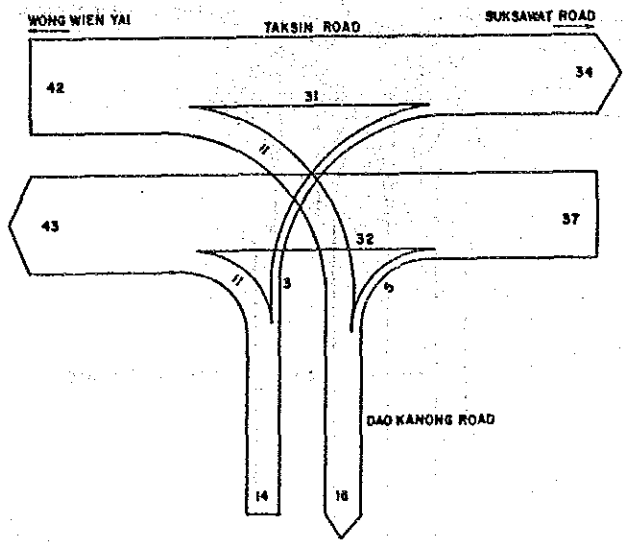
Appendix 3.2.4 Existing Turning Movements

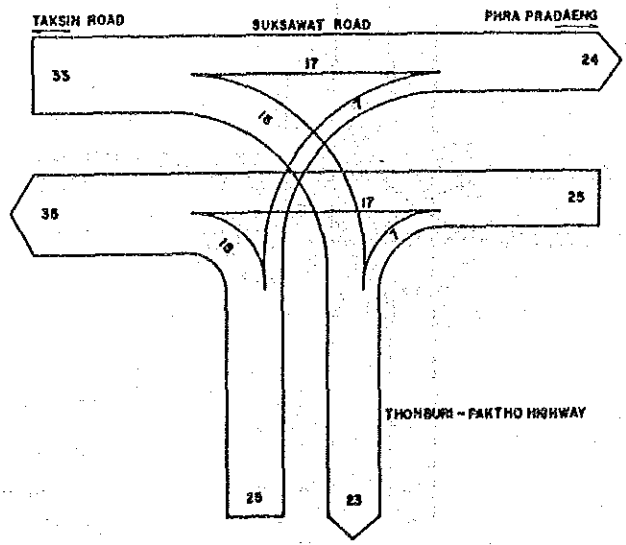
Turning Movements of Trucks at Intersections
Related to the Krungthep Bridge

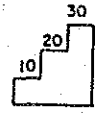


Turning Movements of Vehicles at Major Intersections
(Excluding motorcycle)

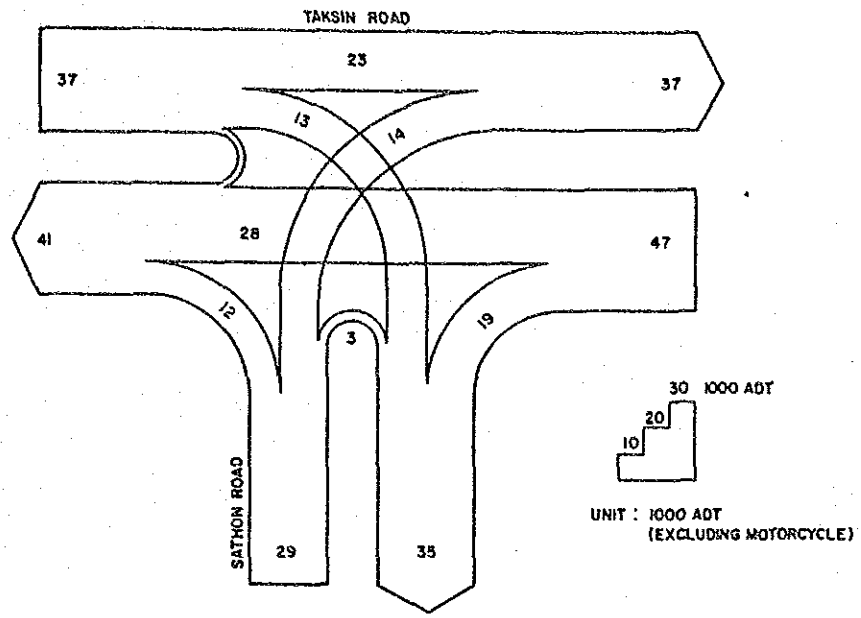








UNIT : 1000 ADT
(EXCLUDING MOTORCYCLE)


TAKSIN ROAD
37
23
37
13
14
41
28
47
12
19
3
SATHON ROAD
29
35
30 1000 ADT
20
10
UNIT : 1000 ADT
(EXCLUDING MOTORCYCLE)

Appendix 3.2.5 Expansion Factors

Expansion Factor for Roadside OD Survey

	Passenger Car	Pick-up	Truck	Taxi	Bus	Motorcycle
RI 1	19.4	19.9	44.1	71.2	58.5	70.2
RI 2	12.2	13.2	11.0	73.2	39.3	-
RI 3	18.8	17.1	23.7	50.9	30.3	-
RI 4	17.3	16.5	46.1	78.1	271.7	-

Expansion Factor for Home Interview Survey

Zone No.	Passenger Car			Pickup			Truck		
	Car Ownership	No. of Samples	Expansion Factors	Car Ownership	No. of Samples	Expansion Factors	Car Ownership	No. of Samples	Expansion Factors
74	3726	166	22.4	972	166	5.9	378	101	3.7
76	2898	175	16.6	765	76	9.9	294	56	5.3
77	5175	154	33.6	1350	78	17.3	300	44	6.8
78	966	99	9.7	252	88	2.9	98	39	2.5
79	3243	164	19.8	846	50	16.9	329	28	11.8
80	966	99	9.8	252	51	4.9	98	21	4.7
83	1311	122	10.7	342	39	8.8	76	16	4.8
86	1035	124	8.3	270	116	2.3	105	64	1.6
23	-	-	-	-	-	-	301	72	4.2

Appendix 3.3.1 Zonal Socio-Economic Indicator, Population

POPULATION BY ZONE : 1980-2001

(1000 Person)

zone	1980	1986	1991	1996	2001
1	11.7	11.2	11.4	11.8	12.1
2	28.3	27.0	27.0	27.8	23.1
3	51.7	48.3	47.9	48.6	48.4
4	17.8	17.0	17.0	17.4	17.5
5	159.9	155.0	158.3	164.9	168.7
6	23.1	21.6	21.4	21.7	21.6
7	72.5	69.9	71.0	73.6	74.7
8	132.3	163.6	190.6	213.4	234.8
9	72.6	84.8	94.6	103.5	111.9
10	55.7	65.2	74.5	86.3	98.3
11	37.1	43.5	49.7	57.5	65.5
12	238.0	270.8	292.2	309.1	325.1
13	45.1	51.0	53.9	56.3	57.8
14	85.1	77.3	76.0	80.0	82.6
15	105.3	102.4	108.0	115.0	120.2
16	25.1	27.2	31.6	35.1	37.6
17	54.0	56.2	57.6	60.2	62.3
18	34.8	43.5	50.2	54.6	58.9
19	32.9	41.4	47.8	52.0	56.0
20	127.6	145.9	161.3	175.7	192.9
21	37.4	43.1	48.2	52.9	58.7
22	32.6	38.0	42.3	47.0	52.8
23	73.0	89.7	104.8	120.3	137.7
24	41.7	56.1	69.1	79.9	89.6
25	30.0	38.0	45.0	50.8	56.6
26	20.0	25.3	30.0	33.9	37.7
27	23.1	26.8	29.1	31.5	32.8
28	27.8	32.2	35.0	37.8	39.4
29	41.1	44.6	45.4	46.3	47.6
30	16.4	17.8	18.2	18.5	19.0
31	24.6	26.7	27.2	27.8	28.5
32	41.7	48.3	52.5	56.8	59.1
33	70.1	74.1	75.2	76.4	79.4
34	25.0	27.7	29.3	30.5	31.1
35	5.2	6.2	6.9	7.5	8.1
36	12.0	14.5	16.1	17.4	18.8
37	43.4	47.2	48.7	49.3	49.5
38	34.7	37.8	39.0	39.5	39.6
39	43.4	47.2	48.7	49.3	49.5
40	43.4	47.2	48.7	49.3	49.5

POPULATION BY ZONE : 1980-2001

(1000 Person)

zone	1980	1986	1991	1996	2001
41	76.8	94.9	108.9	122.2	136.9
42	38.4	48.4	56.3	64.0	72.7
43	38.8	49.4	58.1	66.6	76.4
44	29.5	38.4	46.2	54.2	63.4
45	81.7	87.2	90.0	93.5	99.7
46	66.8	71.4	73.6	76.5	81.6
47	23.2	29.8	32.0	34.1	35.6
48	38.7	49.6	53.3	56.8	59.4
49	38.7	49.6	53.3	56.8	59.4
50	54.2	69.5	74.6	79.5	83.1
51	55.3	57.1	57.4	59.2	59.6
52	78.4	84.0	87.5	88.6	90.2
53	42.1	42.1	40.2	38.5	37.4
54	131.9	142.1	147.0	151.3	154.6
55	74.6	88.3	99.8	108.7	117.0
56	96.1	105.8	112.4	118.3	124.0
57	226.3	248.4	263.4	279.5	293.9
58	128.0	146.1	161.1	175.7	189.9
59	105.9	161.5	204.4	239.8	275.6
60	96.8	150.1	176.9	195.8	214.7
61	48.1	87.0	118.0	146.7	182.3
62	57.6	100.2	128.1	155.1	186.0
63	106.7	157.0	195.4	236.2	279.1
64	31.8	51.3	62.1	69.1	76.3
65	9.7	16.5	21.2	24.9	30.4
66	74.9	98.0	115.5	123.6	131.7
67	33.3	50.3	68.3	88.3	110.5
68	59.4	75.3	89.2	103.5	118.3
69	62.3	79.3	94.5	112.1	127.4
70	23.7	32.4	41.0	50.2	60.3
71	40.7	49.4	56.7	65.0	75.0
72	52.8	63.8	73.1	83.8	96.1
73	47.9	53.3	56.9	60.9	65.5
74	100.6	124.5	140.9	154.6	168.1
75	8.3	12.2	16.1	20.2	25.0
76	59.1	78.4	97.1	118.1	139.6
77	120.2	141.7	155.8	171.2	186.9
78	21.1	26.1	30.2	33.4	37.2
79	72.0	89.1	102.3	114.0	126.0
80	21.1	26.2	29.9	33.2	36.9

POPULATION BY ZONE : 1980-2001

(1000 Person)

zone	1980	1986	1991	1996	2001
81	42.0	55.1	67.6	79.5	93.7
82	75.5	100.2	122.6	146.7	173.6
83	40.9	53.8	66.6	81.8	100.4
84	23.1	27.5	30.9	34.9	39.6
85	52.0	66.3	79.2	92.9	108.5
86	44.6	56.8	67.9	79.6	93.0
87	141.6	179.1	212.7	247.5	286.4
88	52.0	66.3	79.2	92.9	108.5
89	94.4	119.4	141.8	165.0	190.9
90	57.5	68.5	80.5	95.3	113.2
91	14.4	17.1	20.1	23.8	28.3
92	46.4	51.8	57.3	64.2	73.1
93	6.7	8.0	8.9	10.1	11.2
94	20.2	23.9	26.8	30.2	33.6
95	17.9	21.3	23.8	26.8	29.9
96	93.4	120.5	146.3	179.1	220.3
97	46.8	59.2	71.1	85.9	103.1
98	107.6	138.1	167.1	203.8	249.0
99	90.1	101.9	112.0	122.0	134.4
100	49.9	57.4	63.4	70.4	78.5
101	208.4	257.7	307.3	369.7	448.5
102	73.7	90.6	107.3	128.2	154.5
Total	6070.1	7277.5	8250.0	9241.2	10310.1

Note
Source : BMR Study, Population Working Paper
Draft Final Report, NESDB, December 1985
Allocated to zones by JICA KBTR Study Mission

Appendix 3.3.2 Zonal Socio-Economic Indicator, Employment

EMPLOYMENT BY ZONE : 1986-2001

(1000 Person)

zone	1986	1991	2001
1	17.0	19.6	27.0
2	30.8	35.7	44.1
3	55.0	63.4	92.3
4	6.9	7.8	10.3
5	63.5	73.0	99.9
6	20.7	23.5	31.3
7	67.1	77.9	108.3
8	23.2	27.3	38.0
9	12.1	13.6	18.1
10	24.1	27.9	38.3
11	16.1	18.6	25.6
12	52.3	60.5	83.3
13	43.0	49.8	68.8
14	50.1	57.6	78.6
15	24.9	28.6	39.1
16	63.2	72.7	99.2
17	39.1	41.9	54.3
18	30.3	36.5	51.3
19	28.8	34.7	48.8
20	39.3	45.4	61.2
21	11.6	13.5	18.6
22	18.4	21.3	28.9
23	17.8	20.6	27.9
24	24.7	29.2	40.1
25	16.7	19.0	25.4
26	11.1	12.7	16.9
27	18.0	20.7	27.9
28	21.5	24.8	33.5
29	15.5	17.8	24.1
30	14.6	16.8	22.7
31	9.3	10.7	14.5
32	54.6	62.8	84.9
33	37.7	43.4	58.6
34	20.3	23.5	32.1
35	15.5	17.9	24.5
36	36.3	41.8	57.1
37	16.1	18.6	25.6
38	12.8	14.9	20.5
39	16.1	18.6	25.6
40	16.1	18.6	25.6

EMPLOYMENT BY ZONE : 1986-2001

(1000 Person)

zone	1986	1991	2001
41	5.1	5.7	7.6
42	2.6	3.0	4.0
43	2.6	3.1	4.2
44	2.0	2.4	3.5
45	28.9	33.5	46.0
46	23.7	27.4	37.6
47	16.0	18.3	24.8
48	26.7	30.6	41.3
49	26.7	30.6	41.3
50	37.3	42.8	57.8
51	22.3	25.7	34.9
52	20.1	23.2	31.5
53	17.2	19.8	26.6
54	35.7	41.1	55.3
55	28.1	32.3	43.5
56	25.1	28.9	38.8
57	31.9	36.7	50.0
58	61.4	70.6	96.2
59	22.5	25.8	34.8
60	55.8	63.8	85.9
61	20.6	23.6	31.7
62	13.2	15.1	20.3
63	21.7	24.9	33.6
64	44.0	50.3	67.8
65	2.9	3.3	4.5
66	5.6	6.4	8.7
67	3.5	4.0	5.4
68	31.0	35.6	47.6
69	32.6	37.6	51.3
70	8.9	10.2	13.8
71	39.6	44.1	56.8
72	65.9	71.9	89.3
73	19.9	17.6	14.4
74	83.0	94.1	122.3
75	8.1	10.7	18.1
76	38.8	45.1	62.3
77	70.1	72.4	83.4
78	12.9	14.0	16.6
79	44.1	47.5	56.2
80	13.0	13.9	16.4

EMPLOYMENT BY ZONE : 1986-2001

(1000 Person)

zone	1986	1991	2001
81	27.3	31.4	41.8
82	49.6	57.0	77.5
83	10.1	9.5	8.8
84	5.1	4.4	3.5
85	10.4	12.1	16.4
86	8.9	10.4	14.1
87	32.1	37.5	50.8
88	26.9	31.4	42.6
89	92.7	108.3	146.7
90	27.1	31.7	42.9
91	9.9	11.6	15.7
92	29.4	34.3	46.5
93	7.9	8.8	10.8
94	3.7	4.1	5.0
95	3.2	3.6	4.4
96	51.2	57.2	70.0
97	27.2	30.4	37.2
98	15.9	17.8	21.8
99	66.5	74.2	91.0
100	30.3	29.2	30.5
101	136.0	141.8	173.9
102	47.8	49.5	59.9
Total	2902.4	3286.9	4350.7

Note
Source : Projection of Economic Activities and Employment in the BMR
Chulalongkorn University/NESDB, Dec 1985
Allocated to zones by JICA KBTR Study Mission

Appendix 3.3.3 Zonal Socio-Economic Indicator, Car Ownership

CAR OWNERSHIP BY ZONE : 1986-2001

(1000 Vehicle)

zone	1986	1991	2001
1	0.8	0.8	0.9
2	2.6	2.7	2.8
3	4.6	4.8	5.8
4	1.5	1.5	1.8
5	13.5	14.3	17.4
6	1.5	1.5	1.7
7	4.8	5.1	5.9
8	6.1	7.4	12.5
9	3.1	3.7	5.9
10	5.6	6.2	8.5
11	3.8	4.1	5.6
12	19.1	21.2	29.8
13	5.2	6.7	12.7
14	4.5	5.3	8.3
15	20.6	25.8	46.5
16	1.8	2.2	3.8
17	5.4	6.0	9.2
18	4.2	5.2	8.7
19	4.0	4.9	8.3
20	8.9	12.6	27.5
21	2.6	3.8	8.3
22	5.4	9.2	24.2
23	4.3	5.0	7.8
24	3.1	4.5	10.1
25	2.1	2.9	6.4
26	1.4	2.0	4.3
27	3.5	3.8	5.3
28	4.1	4.6	6.3
29	2.3	2.6	3.8
30	1.2	1.3	1.8
31	1.3	1.5	2.2
32	0.9	1.1	2.0
33	9.0	10.4	16.1
34	2.3	2.9	5.3
35	1.0	1.7	4.4
36	2.2	3.9	10.2
37	4.9	5.8	9.6
38	3.9	4.7	7.6
39	4.9	5.8	9.6
40	4.9	5.8	9.6

CAR OWNERSHIP BY ZONE : 1986-2001

(1000 Vehicle)

zone	1986	1991	2001
41	7.1	8.2	12.8
42	3.6	4.3	6.8
43	3.7	4.4	7.1
44	2.9	3.5	5.9
45	5.6	6.3	9.5
46	4.5	5.2	7.7
47	2.2	2.7	5.0
48	3.7	4.6	8.3
49	3.7	4.6	8.3
50	5.1	6.4	11.6
51	3.5	3.8	4.8
52	4.0	4.3	5.3
53	3.6	3.9	5.0
54	3.3	3.9	6.2
55	4.8	5.4	7.8
56	8.8	9.8	14.0
57	14.0	17.7	32.3
58	8.0	9.8	17.1
59	7.2	9.3	17.9
60	17.5	23.4	46.9
61	5.6	7.0	12.5
62	6.2	7.8	14.3
63	13.6	16.7	29.2
64	4.6	7.9	20.9
65	1.0	1.4	3.2
66	8.8	11.4	21.8
67	2.1	2.4	3.5
68	6.0	6.5	8.5
69	6.3	6.9	9.1
70	1.7	1.9	2.9
71	0.9	1.1	2.1
72	1.1	1.4	2.6
73	0.3	0.6	1.7
74	5.4	6.4	10.4
75	0.5	0.7	1.6
76	4.2	5.2	9.2
77	7.5	8.3	12.3
78	1.4	1.6	2.4
79	4.7	5.5	8.3
80	1.4	1.6	2.4

CAR OWNERSHIP BY ZONE : 1986-2001

(1000 Vehicle)

zone	1986	1991	2001
81	2.9	3.6	6.1
82	5.3	6.6	11.4
83	1.9	2.3	3.9
84	1.0	1.1	1.5
85	1.8	2.2	4.0
86	1.5	1.9	3.4
87	3.0	3.5	5.5
88	2.3	2.8	4.8
89	15.2	16.9	23.6
90	4.0	4.6	6.9
91	0.3	0.4	0.9
92	1.2	1.9	4.7
93	1.5	2.7	7.4
94	0.5	0.6	1.0
95	0.5	0.6	0.8
96	8.7	10.6	18.1
97	0.9	1.5	4.1
98	1.1	1.5	3.3
99	1.5	1.8	2.9
100	0.7	1.2	3.3
101	1.5	2.8	9.7
102	1.0	1.9	6.2
Total	445.1	541.9	930.9

Note

Source : Incomes and Vehicle Ownership
STTR Internal Working Paper No.7
May 1985

Updated by JICA KBTR Study Mission

Appendix 3.3.4 Zonal Socio-Economic Indicator, No. of Students

NUMBER OF STUDENTS BY ZONE : 1986

(1000 Person)

Zone	Kinder-garten	Primary School	Secondary School	Higher Education	Total
1	0.4	2.1	1.0	13.4	16.9
2	0.8	4.1	2.9	0.0	7.8
3	0.7	4.7	13.0	0.0	18.4
4	0.5	2.9	0.5	0.0	3.9
5	0.6	4.8	8.8	0.2	14.3
6	0.2	0.2	4.1	0.0	4.5
7	0.1	5.2	2.5	0.0	7.8
8	1.3	10.3	9.1	0.0	20.8
9	0.6	7.9	3.3	0.0	11.7
10	1.6	5.5	1.6	0.0	8.7
11	0.5	2.9	3.0	0.0	6.4
12	2.6	7.9	7.3	0.0	17.8
13	0.8	3.2	3.7	0.0	7.7
14	0.4	7.0	1.9	0.0	9.3
15	0.1	1.0	4.2	18.0	23.4
16	1.1	5.3	1.8	0.0	8.2
17	2.0	4.8	6.6	0.0	13.4
18	0.9	5.5	5.2	0.1	11.7
19	0.1	3.4	3.3	0.0	6.8
20	1.8	13.1	10.8	0.0	25.7
21	1.4	6.7	0.2	0.0	8.5
22	0.8	2.0	0.4	0.0	3.2
23	1.5	11.5	1.1	0.0	14.2
24	0.1	3.2	2.1	0.0	5.3
25	0.6	4.5	4.6	0.0	9.6
26	0.3	3.2	0.6	0.0	4.1
27	0.4	1.2	0.4	23.3	25.3
28	0.5	1.2	3.2	0.0	5.0
29	0.5	2.1	0.0	0.0	2.6
30	0.9	2.7	4.0	0.0	7.6
31	0.4	2.0	0.1	0.0	2.4
32	0.5	7.2	1.0	0.0	8.8
33	3.5	19.6	12.4	0.0	35.5
34	0.1	1.5	3.9	0.0	5.5
35	0.0	2.2	0.0	0.0	2.2
36	0.2	1.0	0.4	0.0	1.6
37	0.2	1.0	3.5	7.7	12.4
38	1.1	3.1	0.2	2.4	6.9
39	0.1	0.0	0.0	0.0	0.2
40	1.2	4.8	0.6	0.0	6.6

NUMBER OF STUDENTS BY ZONE : 1986

(1000 Person)

Zone	Kinder-garten	Primary School	Secondary School	Higher Education	Total
41	1.3	12.3	2.9	0.0	16.6
42	1.2	5.3	6.2	6.5	19.2
43	0.0	0.0	2.0	0.0	2.0
44	0.7	3.6	2.9	0.0	7.2
45	2.1	11.7	4.5	0.0	18.2
46	0.4	2.8	2.0	8.2	13.4
47	0.0	0.0	0.0	0.0	0.0
48	2.2	6.4	5.1	0.0	13.8
49	0.9	4.4	1.3	0.0	6.5
50	1.9	5.4	3.8	10.6	21.7
51	1.5	6.1	0.6	0.0	8.1
52	1.2	6.4	0.7	0.0	8.3
53	1.4	7.4	4.7	0.0	13.5
54	0.9	9.6	3.1	0.0	13.6
55	0.5	8.1	2.0	0.0	10.6
56	2.0	13.3	8.2	4.2	27.6
57	3.5	13.1	10.3	7.4	34.3
58	3.8	19.2	11.4	0.0	34.4
59	4.2	11.6	11.9	0.0	27.7
60	2.3	11.9	10.0	0.0	24.2
61	3.2	8.1	0.9	1.4	13.7
62	0.9	5.9	5.9	0.0	12.7
63	2.9	13.1	3.9	5.4	25.3
64	0.5	4.3	3.6	34.2	42.5
65	0.2	1.3	0.0	0.0	1.5
66	0.6	2.5	2.6	0.0	5.7
67	0.0	0.0	0.0	0.0	0.0
68	2.0	12.6	9.6	0.0	24.1
69	1.3	8.5	1.0	0.0	10.8
70	0.6	7.1	11.3	10.0	29.0
71	0.6	6.9	0.1	0.0	7.6
72	1.1	10.5	1.7	0.0	13.3
73	0.3	7.8	0.4	0.0	8.6
74	2.4	16.7	10.3	0.0	29.3
75	0.0	0.8	0.0	0.0	0.8
76	0.7	9.4	4.7	0.0	14.8
77	1.9	18.5	11.1	0.0	31.5
78	0.2	0.9	0.0	0.0	1.1
79	1.8	13.5	6.3	0.0	21.6
80	0.7	3.3	0.0	0.0	4.0

NUMBER OF STUDENTS BY ZONE : 1986

(1000 Person)

Zone	Kinder-garten	Primary School	Secondary School	Higher Education	Total
81	0.0	4.5	0.0	0.0	4.6
82	1.4	12.1	5.6	2.3	21.4
83	0.7	7.5	7.8	0.0	16.0
84	0.0	1.8	0.4	0.0	2.2
85	1.0	5.0	4.1	0.0	10.1
86	0.8	1.5	0.0	0.0	2.3
87	0.0	0.0	1.9	0.0	1.9
88	0.5	0.8	1.5	0.0	2.7
89	5.1	17.8	14.4	0.0	37.3
90	0.0	0.0	7.7	0.0	7.7
91	0.3	0.9	0.0	0.0	1.2
92	0.3	0.0	3.0	0.0	3.3
93	0.1	0.0	1.0	0.0	1.1
94	0.0	0.0	0.4	0.0	0.4
95	0.0	0.0	0.0	0.0	0.0
96	4.0	5.8	14.5	0.0	24.4
97	1.9	4.9	1.7	0.0	8.4
98	0.4	1.4	0.1	0.0	1.9
99	0.0	0.0	2.5	0.0	2.5
100	0.4	1.0	1.1	0.0	2.4
101	0.2	0.1	15.6	0.0	15.9
102	2.8	6.1	1.4	0.0	10.4
Total	104.9	564.2	385.3	155.3	1209.6

NUMBER OF STUDENTS BY ZONE : 1991

(1000 Person)

Zone	Kinder-garten	Primary School	Secondary School	Higher Education	Total
1	0.4	2.3	1.0	12.8	16.5
2	0.7	4.6	3.0	0.0	8.2
3	0.7	5.2	13.1	0.0	19.1
4	0.5	3.2	0.5	0.0	4.3
5	0.5	5.3	8.9	0.2	14.9
6	0.2	0.2	4.2	0.0	4.6
7	0.1	5.8	2.6	0.0	8.4
8	1.4	12.3	9.9	0.0	23.6
9	0.6	9.4	3.6	0.0	13.6
10	1.7	6.5	1.8	0.0	10.0
11	0.5	3.4	3.3	0.0	7.2
12	2.7	9.5	7.9	0.0	20.1
13	0.8	3.8	4.1	0.0	8.7
14	0.4	7.8	1.9	0.0	10.1
15	0.1	1.1	4.3	17.2	22.7
16	1.1	5.9	1.9	0.0	8.8
17	2.1	5.7	7.1	0.0	15.0
18	0.9	6.6	5.6	0.1	13.2
19	0.1	4.0	3.6	0.0	7.7
20	1.9	15.7	11.7	0.0	29.3
21	1.5	8.1	0.3	0.0	9.9
22	0.9	2.4	0.4	0.0	3.7
23	1.6	13.8	1.2	0.0	16.6
24	0.1	3.8	2.2	0.0	6.2
25	0.6	5.4	5.0	0.0	11.0
26	0.4	3.8	0.7	0.0	4.8
27	0.4	1.5	0.4	22.2	24.5
28	0.5	1.5	3.5	0.0	5.5
29	0.6	2.5	0.0	0.0	3.1
30	0.9	3.3	4.4	0.0	8.5
31	0.4	2.3	0.1	0.0	2.9
32	0.5	8.7	1.1	0.0	10.3
33	3.7	23.5	13.5	0.0	40.7
34	0.1	1.8	4.2	0.0	6.2
35	0.0	2.7	0.0	0.0	2.7
36	0.2	1.3	0.4	0.0	1.9
37	0.2	1.2	3.8	7.3	12.6
38	1.2	3.7	0.2	2.3	7.4
39	0.2	0.0	0.0	0.0	0.2
40	1.2	5.7	0.7	0.0	7.6

NUMBER OF STUDENTS BY ZONE : 1991

(1000 Person)

Zone	Kinder-garten	Primary School	Secondary School	Higher Education	Total
41	1.4	14.7	3.2	0.0	19.3
42	1.3	6.3	6.7	6.2	20.5
43	0.0	0.0	2.2	0.0	2.2
44	0.7	4.3	3.1	0.0	8.2
45	2.2	13.9	4.9	0.0	20.9
46	0.5	3.4	2.1	7.8	13.8
47	0.0	0.0	0.0	0.0	0.0
48	2.3	7.7	5.6	0.0	15.6
49	0.9	5.2	1.4	0.0	7.6
50	2.0	6.5	4.2	10.0	22.7
51	1.6	7.2	0.6	0.0	9.4
52	1.2	7.7	0.8	0.0	9.7
53	1.4	8.9	5.1	0.0	15.4
54	1.0	11.4	3.4	0.0	15.8
55	0.5	9.7	2.2	0.0	12.4
56	2.0	15.9	8.9	4.0	30.8
57	3.6	15.7	11.2	7.0	37.5
58	4.0	23.0	12.3	0.0	39.3
59	4.4	13.9	12.9	0.0	31.2
60	2.4	14.3	10.9	0.0	27.5
61	3.4	9.7	1.0	1.3	15.4
62	0.9	7.1	6.4	0.0	14.4
63	3.1	15.7	4.2	5.1	28.1
64	0.5	5.1	3.9	32.5	42.0
65	0.2	1.6	0.0	0.0	1.8
66	0.6	3.0	2.9	0.0	6.4
67	0.0	0.0	0.0	0.0	0.0
68	2.1	15.1	10.4	0.0	27.6
69	1.4	10.1	1.1	0.0	12.6
70	0.6	8.5	12.3	9.5	30.9
71	0.6	7.9	0.1	0.0	8.6
72	1.1	11.9	1.7	0.0	14.8
73	0.3	8.9	0.5	0.0	9.7
74	2.5	19.9	11.2	0.0	33.6
75	0.0	0.9	0.0	0.0	0.9
76	0.7	11.3	5.1	0.0	17.1
77	2.0	22.1	12.1	0.0	36.2
78	0.2	1.1	0.0	0.0	1.2
79	1.8	16.2	6.9	0.0	24.9
80	0.7	4.0	0.0	0.0	4.7

NUMBER OF STUDENTS BY ZONE : 1991

(1000 Person)

Zone	Kinder-garten	Primary School	Secondary School	Higher Education	Total
81	0.0	5.4	0.0	0.0	5.5
82	1.4	14.5	6.1	2.2	24.3
83	0.8	9.0	8.5	0.0	18.3
84	0.0	2.2	0.4	0.0	2.6
85	1.1	5.7	4.7	0.0	11.5
86	0.9	1.8	0.0	0.0	2.6
87	0.0	0.0	2.1	0.0	2.1
88	0.5	0.9	1.7	0.0	3.1
89	5.6	20.4	16.1	0.0	42.1
90	0.0	0.0	8.6	0.0	8.6
91	0.3	1.0	0.0	0.0	1.3
92	0.3	0.0	3.2	0.0	3.4
93	0.1	0.0	1.0	0.0	1.1
94	0.0	0.0	0.4	0.0	0.4
95	0.0	0.0	0.0	0.0	0.0
96	4.3	6.7	15.9	0.0	26.9
97	2.0	5.5	1.8	0.0	9.3
98	0.4	1.6	0.1	0.0	2.1
99	0.0	0.0	2.4	0.0	2.4
100	0.4	1.0	1.1	0.0	2.5
101	0.2	0.1	16.9	0.0	17.2
102	3.1	6.8	1.5	0.0	11.4
Total	110.3	667.8	416.1	147.7	1341.9

NUMBER OF STUDENTS BY ZONE : 1996

(1000 Person)

Zone	Kinder-garten	Primary School	Secondary School	Higher Education	Total
1	0.4	2.1	1.1	13.2	16.8
2	0.6	4.1	3.3	0.0	8.0
3	0.6	4.7	14.5	0.0	19.9
4	0.4	2.9	0.6	0.0	3.9
5	0.5	4.8	9.8	0.2	15.2
6	0.2	0.2	4.6	0.0	5.0
7	0.1	5.2	2.8	0.0	8.1
8	1.3	12.1	11.8	0.0	25.2
9	0.5	9.2	4.3	0.0	14.1
10	1.6	6.4	2.1	0.0	10.1
11	0.5	3.4	3.9	0.0	7.8
12	2.5	9.3	9.5	0.0	21.3
13	0.8	3.7	4.9	0.0	9.3
14	0.4	7.1	2.1	0.0	9.5
15	0.1	1.0	4.7	17.8	23.6
16	0.9	5.3	2.0	0.0	8.3
17	2.0	5.6	8.5	0.0	16.2
18	0.9	6.5	6.8	0.1	14.2
19	0.1	4.0	4.3	0.0	8.3
20	1.8	15.5	14.1	0.0	31.4
21	1.4	7.9	0.3	0.0	9.7
22	0.8	2.4	0.5	0.0	3.7
23	1.5	13.6	1.5	0.0	16.6
24	0.1	3.8	2.7	0.0	6.5
25	0.6	5.3	6.0	0.0	11.9
26	0.3	3.7	0.8	0.0	4.9
27	0.4	1.4	0.5	23.0	25.3
28	0.5	1.5	4.3	0.0	6.2
29	0.5	2.5	0.0	0.0	3.0
30	0.8	3.2	5.2	0.0	9.3
31	0.4	2.3	0.1	0.0	2.8
32	0.5	8.5	1.3	0.0	10.4
33	3.4	23.2	16.2	0.0	42.9
34	0.1	1.8	5.0	0.0	7.0
35	0.0	2.6	0.0	0.0	2.6
36	0.2	1.2	0.5	0.0	1.9
37	0.2	1.2	4.5	7.6	13.5
38	1.1	3.6	0.3	2.4	7.4
39	0.1	0.0	0.0	0.0	0.2
40	1.1	5.6	0.8	0.0	7.5

NUMBER OF STUDENTS BY ZONE : 1996

(1000 Person)

Zone	Kinder-garten	Primary School	Secondary School	Higher Education	Total
41	1.3	14.5	3.9	0.0	19.7
42	1.2	6.2	8.1	6.4	22.0
43	0.0	0.0	2.6	0.0	2.6
44	0.7	4.3	3.8	0.0	8.7
45	2.0	13.7	5.8	0.0	21.5
46	0.4	3.3	2.6	8.1	14.4
47	0.0	0.0	0.0	0.0	0.0
48	2.2	7.6	6.7	0.0	16.5
49	0.9	5.2	1.7	0.0	7.7
50	1.9	6.4	5.0	10.4	23.7
51	1.5	7.1	0.8	0.0	9.3
52	1.2	7.5	0.9	0.0	9.6
53	1.3	8.7	6.1	0.0	16.2
54	0.9	11.2	4.1	0.0	16.2
55	0.5	9.5	2.6	0.0	12.6
56	1.9	15.6	10.7	4.1	32.3
57	3.4	15.4	13.4	7.2	39.4
58	3.7	22.5	14.8	0.0	41.1
59	4.1	13.7	15.5	0.0	33.4
60	2.2	14.1	13.1	0.0	29.4
61	3.1	9.6	1.2	1.4	15.3
62	0.9	7.0	7.7	0.0	15.5
63	2.9	15.4	5.1	5.3	28.8
64	0.5	5.0	4.7	33.7	43.8
65	0.2	1.6	0.0	0.0	1.8
66	0.6	2.9	3.4	0.0	6.9
67	0.0	0.0	0.0	0.0	0.0
68	1.9	14.9	12.6	0.0	29.3
69	1.3	10.0	1.3	0.0	12.6
70	0.6	8.3	14.8	9.8	33.6
71	0.5	7.5	0.1	0.0	8.0
72	1.0	11.2	2.0	0.0	14.3
73	0.3	8.4	0.5	0.0	9.2
74	2.3	19.6	13.4	0.0	35.4
75	0.0	0.9	0.0	0.0	0.9
76	0.7	10.9	6.1	0.0	17.6
77	1.9	21.6	14.4	0.0	37.9
78	0.2	1.0	0.0	0.0	1.2
79	1.7	15.9	8.3	0.0	25.9
80	0.7	3.9	0.0	0.0	4.6

NUMBER OF STUDENTS BY ZONE : 1996

(1000 Person)

Zone	Kinder-garten	Primary School	Secondary School	Higher Education	Total
81	0.0	5.3	0.0	0.0	5.3
82	1.3	14.2	7.3	2.3	25.1
83	0.7	8.7	10.1	0.0	19.5
84	0.0	2.1	0.5	0.0	2.6
85	1.2	6.2	5.4	0.0	12.8
86	0.9	1.9	0.0	0.0	2.8
87	0.0	0.0	2.4	0.0	2.4
88	0.5	1.0	1.9	0.0	3.4
89	5.8	21.9	18.4	0.0	46.2
90	0.0	0.0	10.0	0.0	10.0
91	0.3	1.1	0.0	0.0	1.5
92	0.3	0.0	3.5	0.0	3.8
93	0.1	0.0	1.1	0.0	1.2
94	0.0	0.0	0.5	0.0	0.5
95	0.0	0.0	0.0	0.0	0.0
96	4.6	7.0	18.9	0.0	30.4
97	2.1	5.7	2.1	0.0	9.9
98	0.4	1.7	0.2	0.0	2.2
99	0.0	0.0	2.6	0.0	2.6
100	0.4	1.0	1.2	0.0	2.6
101	0.2	0.1	19.3	0.0	19.7
102	3.4	7.5	1.7	0.0	12.6
Total	105.1	656.2	491.3	152.9	1405.5

NUMBER OF STUDENTS BY ZONE : 2001

(1000 Person)

Zone	Kinder-garten	Primary School	Secondary School	Higher Education	Total
1	0.3	1.8	1.0	15.3	18.4
2	0.6	3.5	3.1	0.0	7.2
3	0.6	4.0	13.9	0.0	18.5
4	0.4	2.5	0.6	0.0	3.5
5	0.4	4.1	9.4	0.2	14.1
6	0.1	0.1	4.4	0.0	4.7
7	0.1	4.5	2.7	0.0	7.2
8	1.3	11.3	12.4	0.0	25.0
9	0.5	8.6	4.5	0.0	13.7
10	1.6	6.0	2.2	0.0	9.8
11	0.5	3.1	4.1	0.0	7.7
12	2.5	8.7	10.0	0.0	21.1
13	0.7	3.5	5.1	0.0	9.3
14	0.3	6.0	2.0	0.0	8.4
15	0.1	0.8	4.5	20.5	26.0
16	0.8	4.5	2.0	0.0	7.3
17	2.0	5.3	8.9	0.0	16.2
18	0.9	6.1	7.1	0.1	14.1
19	0.1	3.7	4.5	0.0	8.3
20	1.8	14.6	14.9	0.0	31.3
21	1.4	7.5	0.3	0.0	9.3
22	0.8	2.3	0.5	0.0	3.6
23	1.5	12.8	1.6	0.0	15.9
24	0.1	3.6	2.9	0.0	6.5
25	0.5	5.0	6.4	0.0	11.9
26	0.3	3.5	0.9	0.0	4.7
27	0.4	1.4	0.6	26.5	28.8
28	0.5	1.4	4.5	0.0	6.4
29	0.5	2.3	0.0	0.0	2.8
30	0.8	3.1	5.5	0.0	9.4
31	0.4	2.2	0.1	0.0	2.7
32	0.5	8.1	1.4	0.0	10.0
33	3.4	21.9	17.2	0.0	42.5
34	0.1	1.7	5.3	0.0	7.1
35	0.0	2.5	0.0	0.0	2.5
36	0.2	1.2	0.5	0.0	1.9
37	0.2	1.1	4.8	8.7	14.8
38	1.1	3.4	0.3	2.8	7.5
39	0.1	0.0	0.0	0.0	0.2
40	1.1	5.2	0.8	0.0	7.2

NUMBER OF STUDENTS BY ZONE : 2001

(1000 Person)

Zone	Kinder-garten	Primary School	Secondary School	Higher Education	Total
41	1.3	13.7	4.1	0.0	19.1
42	1.2	5.9	8.6	7.4	23.0
43	0.0	0.0	2.7	0.0	2.7
44	0.7	4.0	4.0	0.0	8.7
45	2.0	12.8	6.1	0.0	20.9
46	0.4	3.1	2.7	9.3	15.5
47	0.0	0.0	0.0	0.0	0.0
48	2.2	7.2	7.1	0.0	16.4
49	0.9	4.9	1.8	0.0	7.5
50	1.9	6.0	5.3	12.0	25.2
51	1.4	6.6	0.8	0.0	8.9
52	1.1	7.1	1.0	0.0	9.1
53	1.3	8.2	6.4	0.0	15.9
54	0.9	10.5	4.3	0.0	15.6
55	0.5	8.9	2.7	0.0	12.1
56	1.9	14.6	11.2	4.8	32.4
57	3.3	14.4	14.1	8.4	40.1
58	3.7	21.1	15.5	0.0	40.2
59	4.1	12.9	16.4	0.0	33.5
60	2.2	13.3	13.9	0.0	29.3
61	3.1	9.1	1.3	1.6	15.1
62	0.9	6.6	8.1	0.0	15.6
63	2.9	14.6	5.4	6.1	29.0
64	0.5	4.8	4.9	38.8	49.0
65	0.2	1.5	0.0	0.0	1.7
66	0.6	2.7	3.6	0.0	6.9
67	0.0	0.0	0.0	0.0	0.0
68	1.9	14.0	13.3	0.0	29.2
69	1.3	9.4	1.4	0.0	12.1
70	0.6	7.9	15.7	11.4	35.5
71	0.5	6.7	0.1	0.0	7.3
72	1.0	10.1	2.0	0.0	13.1
73	0.3	7.6	0.5	0.0	8.4
74	2.3	18.6	14.2	0.0	35.1
75	0.0	0.8	0.0	0.0	0.8
76	0.6	10.0	6.2	0.0	16.9
77	1.8	20.1	15.0	0.0	36.9
78	0.2	1.0	0.0	0.0	1.1
79	1.7	15.0	8.7	0.0	25.5
80	0.7	3.7	0.0	0.0	4.4

NUMBER OF STUDENTS BY ZONE : 2001

(1000 Person)

Zone	Kinder-garten	Primary School	Secondary School	Higher Education	Total
81	0.0	4.8	0.0	0.0	4.9
82	1.3	13.2	7.6	2.6	24.7
83	0.7	8.0	10.3	0.0	19.0
84	0.0	1.9	0.5	0.0	2.4
85	1.2	6.4	6.0	0.0	13.6
86	0.9	2.0	0.0	0.0	2.9
87	0.0	0.0	2.6	0.0	2.6
88	0.6	1.0	2.2	0.0	3.7
89	6.1	22.3	20.4	0.0	48.8
90	0.0	0.0	11.3	0.0	11.3
91	0.3	1.2	0.0	0.0	1.5
92	0.3	0.0	3.8	0.0	4.1
93	0.1	0.0	1.2	0.0	1.2
94	0.0	0.0	0.5	0.0	0.5
95	0.0	0.0	0.0	0.0	0.0
96	5.1	7.6	21.2	0.0	33.9
97	2.3	6.1	2.3	0.0	10.7
98	0.4	1.8	0.2	0.0	2.4
99	0.0	0.0	2.6	0.0	2.6
100	0.4	1.1	1.2	0.0	2.7
101	0.2	0.1	22.4	0.0	22.8
102	3.7	8.3	2.0	0.0	13.9
Total	105.1	617.8	518.3	176.4	1417.6

Note
Source : Ministry of Education, Bangkok Metropolitan Administration
Department of General Education (MOE)
Vocational Education Department (MOE)
Office of University Affair
Allocated to zones by JICA KBTR Study Mission
Future figures were estimated based on the growth rate from
'BMA Study, Population Working Paper, Draft Final Report
NESDB December 1985'

Appendix 3.4.1 Summary of Intersection Signal Timing Survey

Table 2.2.1 Summary of Intersection Signal Timing Survey

No.	Intersection	Completion Time	Signal Auto/ Manual	Average Cycle Time (min.)	Direction From	Approach Lanes	Flow Major (J) Minor (N)	Average Red Tim (%)
1	Silom and	1106 am	A	1.90	Rama IV	2	J	34
					New Road	2	J	47
	Dejo				Suriwongse	2	N	59
2	Silom and	1115 am	M	4.83	New Road	4	N	79
	Rajadamri				Pleonchit	4	N	85
	Rama IV				Wireless	6	J	70
					Phayathai	6	J	60
3	Rama IV and	1126 am	M	3.17	Silom	6	J	54
					Phayathai	6	J	71
	Suriwongse				New Road	2	N	79
	Henri Dunan				Rama I	4	N	86
4	Pleonchit and	1135 am	A	1.67	Rajadamri	5	J	30
	Henri Dunan				Rama V	5	N	70
5	Rama I and	1144 am	A	2.42	Rajadamri	8	J	61
	Phayathai				Petchburi	9	J	53
					Rama IV	5	N	85
6	Yawarat and	1210 pm	M	2.33	Siphaya	5	J	42
	Rachawong				New Road	3	N	58
					River	2	N	58
7	Yawarat and	1230 pm	M	1.70	Rachawong	5	J	43
	Triphet				New Road	5	N	57
8	Rajadamneon	1325 pm	M	1.70	Pinklao Brdg.	4	J	31
					Charansanit-wong	4	J	31
	and Arun							
	Amarin					4	N	69

Summary of Intersection Signal Timing Survey (Continued)

No.	Intersection	Completion Time	Signal Auto/ Manual	Average Cycle Time	Direction From	Approach Lanes	Flow Major (J) Minor (N)	Average Red Time
9	Petchburi and Rama VI	1340 pm	A	2.45	Pitsanulok	4	J	52
					Rama 1	4	J	48
10	Rama VI and	1355 pm	M	2.83	Si Ayuthiya	5	J	65
					North	3	N	75
	Ratchawithi				Victory Manu	4	N	78
					Krungthon Brdg.	4	N	79
11	Phayathia and Si Ayuthaya	1410 pm	M	2.07	Victory Monu.	8	J	57
					Rajadamri	4	N	76
					Rama VI	4	N	55
12	Phayathia and Petchburi	1420 pm	A	1.15	Victory Mon.	8	J	41
					Rama VI	2	N	59
13	Rama IV and	820 am	M	4.83	Klong Toey	6	J	62
					Silom	6	J	76
	Sathorn				New Road	6	N	71
	Wireless				Pleonchit	5	N	87
14	Charoenkrung	935 am	M	3.08	Sathorn	2	N	69
	Tanon Tok				River	2	N	84
	and Rachapisak				Yanawa	5	J	68
	Mahaissawan				Krungthep Br.	5	J	68
15	Manaissawan	1035 am	M	4.42	Krungthep Br.	5	J	54
					Daokanong	4	J	75
	and Charoen				Prapradaeng	4	N	79
	Nakorn				Taksin	5	N	85
16	New Petchburi	700 pm	M	2.68	Asoke	3	J	40
					Ekamai	3	J	53
	and Sunvichai				Sunvichai	1	N	80

Appendix 3.5.1 Motorcycle Ownership (1984)

Mototrcycle Ownership (1984)

(1000 Vehicle)

Zone	Number	Zone	Number	Zone	Number	Zone	Number
1	400	27	1100	53	2400	79	3819
2	1327	28	900	54	4800	80	1123
3	2373	29	2900	55	6900	81	6700
4	7000	30	2300	56	4600	82	5800
5	2831	31	1200	57	9400	83	2300
6	394	32	1400	58	8800	84	1000
7	1275	33	4600	59	7300	85	600
8	7000	34	1200	60	7900	86	4300
9	4700	35	400	61	2900	87	3100
10	3200	36	1000	62	3200	88	3100
11	2200	37	2700	63	7200	89	10300
12	13200	38	2800	64	2100	90	4000
13	2500	39	1200	65	1000	91	500
14	5700	40	2800	66	3800	92	2000
15	4900	41	2100	67	2200	93	1600
16	1000	42	3400	68	2800	94	900
17	3400	43	1100	69	1700	95	300
18	2409	44	2100	70	3300	96	8800
19	2291	45	6700	71	1400	97	1600
20	6300	46	2800	72	1600	98	1500
21	2800	47	800	73	500	99	2600
22	2200	48	1400	74	5800	100	1400
23	6200	49	1200	75	1900	101	3600
24	700	50	4100	76	3361	102	2000
25	500	51	3600	77	6075		
26	2500	52	4000	78	1121		

Source : STTR Internal Working Paper No.7

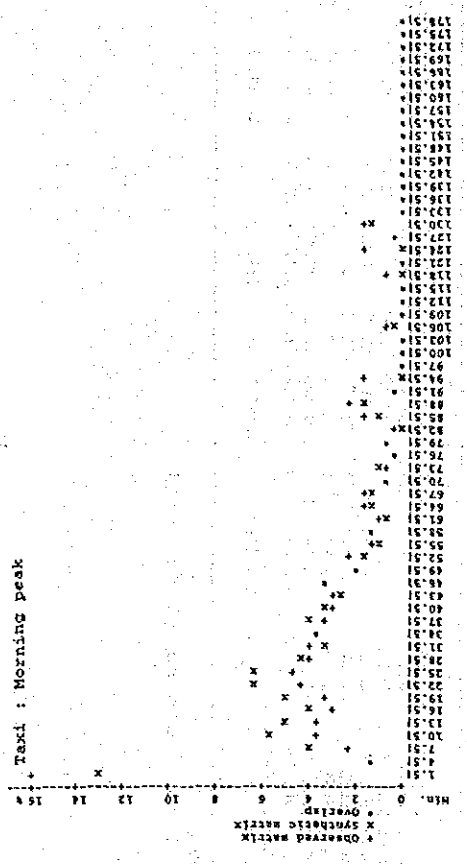
Appendix 3.5.2 Comparision between Assigned Volumes and Actual Counts

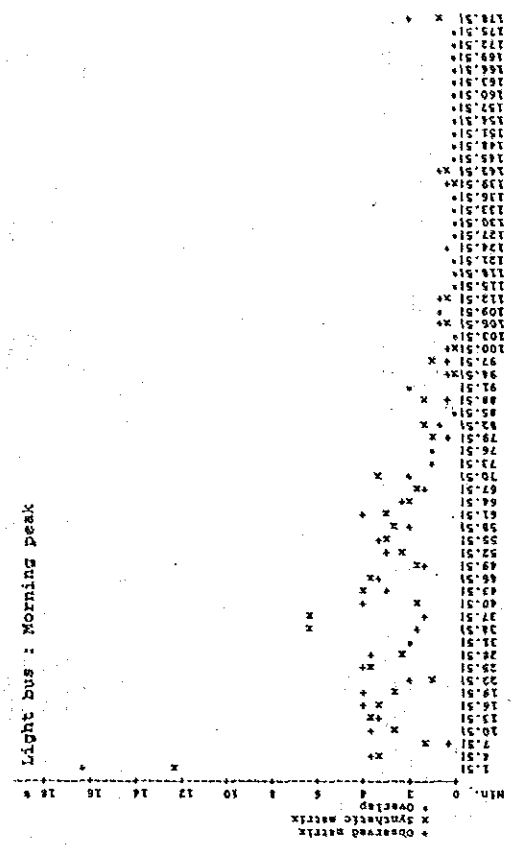
Passenger car		Motorcycle		Taxi		Light bus		Light truck		Heavy bus		Heavy truck	
Count	Assign	Count	Assign	Count	Assign	Count	Assign	Count	Assign	Count	Assign	Count	Assign
1494	1440	630	645	396	362	68	64	138	93	110	101	0	28
244	288	245	283	266	224	2	4	70	46	2	0	0	6
1787	1790	635	653	314	307	0	0	287	278	48	0	0	0
1850	1798	969	901	769	759	37	37	297	269	243	102	10	10
705	770	927	1029	405	338	0	165	174	103	222	269	2	2
671	843	628	610	410	387	0	9	91	50	70	72	0	18
1805	1687	1236	1326	685	604	0	163	227	142	50	137	0	30
1409	1294	1154	1084	760	648	9	9	269	169	47	93	0	20
1665	1686	1125	1186	769	754	21	20	288	257	178	143	0	9
1261	1326	512	775	419	455	0	16	237	172	99	97	11	12
1705	1585	681	750	601	585	4	3	229	175	83	97	6	8
3106	3153	1668	1684	1207	1145	26	32	327	253	285	266	17	16
1501	1345	909	984	260	249	4	4	75	53	221	219	0	64
977	953	759	834	430	422	27	28	164	136	124	121	4	0
924	874	673	847	407	403	23	29	179	142	106	103	0	2
1832	1898	1088	1150	576	536	7	7	309	216	250	223	0	4
422	396	123	121	117	117	17	0	64	0	110	0	0	0
1386	1183	821	1128	1040	928	63	61	215	155	386	288	1	0
841	769	555	566	703	708	37	34	92	50	104	113	0	3
550	555	235	248	192	187	40	28	47	43	157	38	0	0
353	351	132	169	103	101	6	0	42	40	65	0	3	0
1033	1040	326	305	355	357	14	0	86	83	213	0	0	0
966	951	689	733	286	271	20	18	115	96	43	52	1	0
1554	1542	1358	1500	426	423	14	15	227	215	120	119	0	12
1359	1268	1375	1253	401	366	20	24	259	205	66	103	1	0
1746	1637	966	1055	452	411	78	71	336	283	62	68	6	3
825	788	895	902	363	334	0	27	259	233	26	26	0	2
846	842	-	-	116	115	27	27	268	240	2	0	108	0
316	252	-	-	46	38	1	0	103	53	10	0	4	0
3954	3727	2070	2202	1284	1222	45	37	444	348	254	185	0	4
426	241	-	-	42	23	0	0	48	35	2	0	0	0
1985	2171	1623	1720	501	424	18	13	391	310	23	63	9	17
4075	3549	2375	1762	1270	1184	33	32	499	398	253	268	0	18
1421	1402	421	159	292	272	25	26	238	209	16	18	0	2
1402	1359	942	1037	379	364	30	28	248	228	21	22	3	1
670	662	444	406	220	216	8	8	168	155	28	0	3	0
1179	1176	621	623	184	185	63	0	160	159	43	0	3	0
989	1139	368	730	256	304	0	11	209	263	28	77	1	6
1329	1212	405	805	452	410	29	36	285	221	238	77	0	0
1516	1776	568	629	593	577	69	63	161	194	296	113	0	10
710	753	283	300	155	135	39	49	170	129	98	65	6	9
888	896	270	133	168	147	29	27	146	143	53	53	0	3
1212	1282	474	600	316	307	15	15	164	138	120	117	0	65
62	61	-	-	11	11	6	5	42	40	7	0	11	0
236	233	-	-	15	13	2	0	22	16	4	0	4	0
699	669	577	564	282	260	130	135	181	152	67	66	65	68
574	533	688	781	279	253	114	117	270	242	107	87	3	0

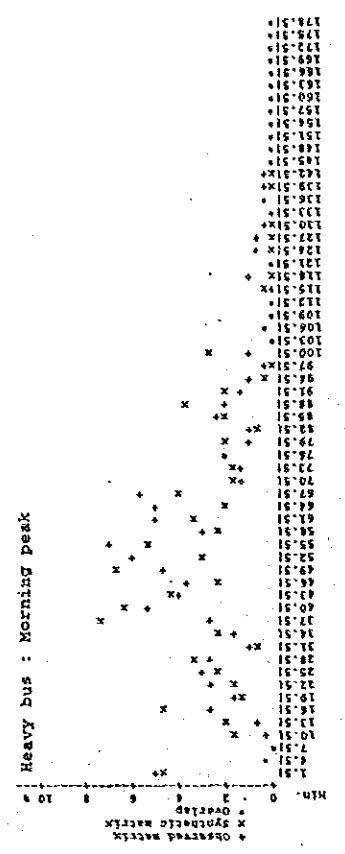
Passenger car		Motorcycle		Taxi		Light bus		Light truck		Heavy bus		Heavy truck	
Count	Assign	Count	Assign	Count	Assign	Count	Assign	Count	Assign	Count	Assign	Count	Assign
679	642	228	318	271	250	9	7	95	88	82	32	0	2
359	381	547	719	185	176	92	93	125	111	85	53	4	3
889	919	959	903	249	269	8	6	186	170	180	180	2	4
569	537	563	645	306	289	85	88	283	224	169	177	0	1
1641	1575	811	963	185	208	37	30	144	122	135	113	1	2
994	911	1520	1452	379	340	148	144	165	120	106	151	0	0
1211	1206	-	-	47	48	22	22	198	196	22	0	5	0
2319	2289	-	-	82	81	40	39	396	381	59	0	19	8
642	647	626	601	163	167	79	78	177	158	165	170	2	2
669	655	280	70	143	133	84	42	165	160	101	103	5	0
1247	1118	702	689	172	170	55	54	205	132	206	109	3	0
743	744	508	414	118	119	34	35	152	149	32	32	20	0
223	223	177	177	111	111	45	0	68	68	22	0	0	0
656	627	625	519	97	86	48	57	213	191	198	186	64	64
323	292	268	276	135	111	63	65	327	321	128	127	127	125
1131	1051	615	1008	229	199	39	47	235	195	198	219	0	45
426	492	284	415	183	186	25	31	244	231	150	173	0	126
712	701	430	454	361	342	31	36	156	141	238	230	0	22
559	549	632	657	358	336	27	28	173	163	226	206	0	124
650	749	652	625	353	361	76	77	225	192	93	97	23	22
1475	1423	751	752	272	263	102	98	339	313	102	108	0	4
3338	3365	1252	1435	397	372	64	58	316	281	152	152	0	13
1132	1061	966	1327	460	420	1	54	156	111	46	55	0	20
1490	1441	3128	3074	929	885	2	2	203	161	188	207	0	5
760	678	887	581	419	372	31	27	283	262	28	29	2	1
1567	1544	3075	3075	569	545	2	16	661	386	27	44	1	0
922	933	922	949	300	275	138	134	270	211	86	81	87	83
1355	1268	2461	2036	522	475	76	72	432	374	200	191	0	16
1259	1095	2406	2142	808	751	65	16	629	353	31	32	2	0
956	978	1309	981	569	508	83	84	264	183	215	196	0	13
685	654	772	725	508	472	259	259	205	177	194	203	2	1
1525	1504	1868	2612	428	383	296	302	280	212	280	290	1	1
732	796	725	280	259	252	107	113	413	343	138	127	67	66
973	906	1164	706	337	305	114	106	406	336	212	208	46	54
2972	2285	-	-	144	143	127	42	296	184	41	0	191	0
1654	1601	473	266	389	391	14	16	86	73	274	56	0	0
564	514	334	763	225	240	10	13	153	129	42	61	3	9
1431	1243	533	550	329	335	22	32	165	144	79	81	22	22
660	757	376	483	265	259	22	22	135	126	78	76	3	5
365	352	261	240	157	161	10	0	64	56	56	61	0	1
880	879	338	337	283	288	0	0	72	70	55	0	0	0
3494	3639	2264	2416	1046	1019	108	109	291	214	278	278	0	109
1308	1359	1720	1816	367	333	57	54	307	259	54	40	1	0
397	351	-	-	72	62	32	23	57	43	16	0	3	0
2674	2643	1347	557	571	566	32	0	360	353	191	167	5	4
1972	1980	713	591	358	340	0	19	264	170	25	113	8	9
489	493	272	0	193	192	2	0	52	54	190	0	0	0

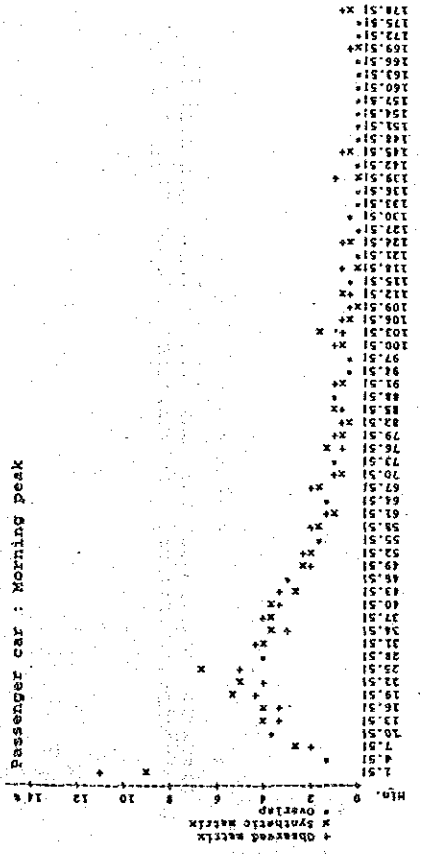
Appendix 3.5.3 Trip Length Distribution

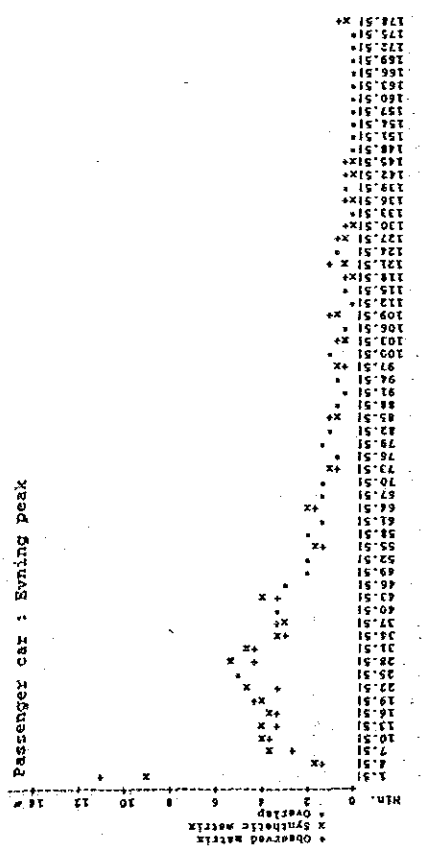
Trip Length Distribution of O&D Matrixes

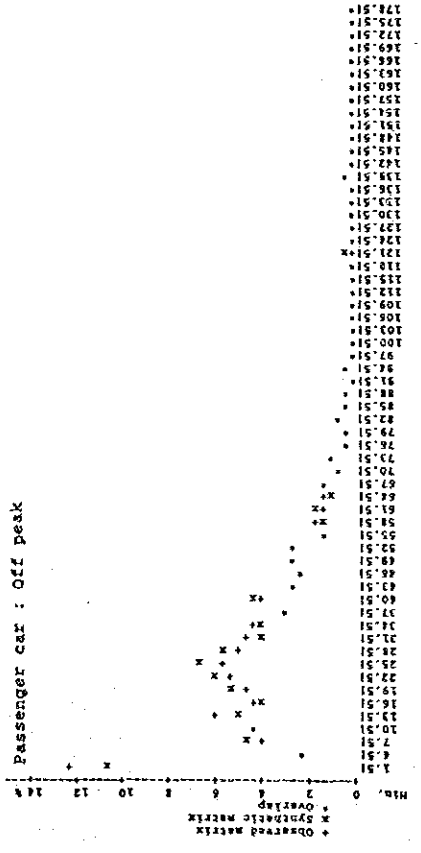


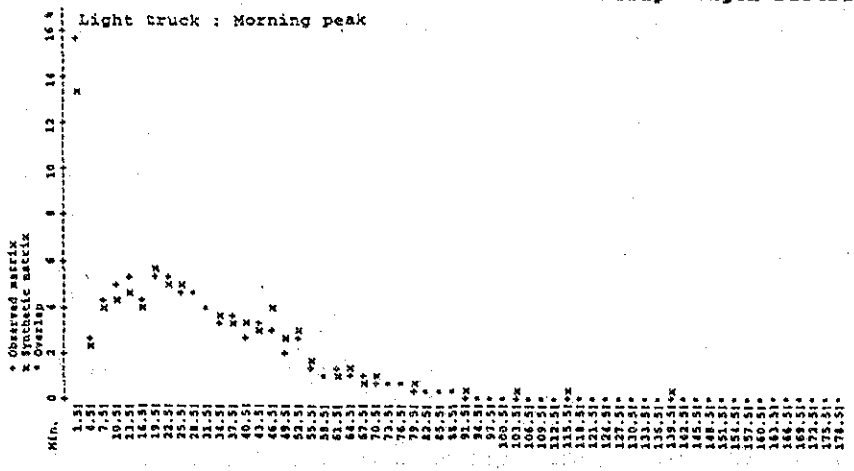


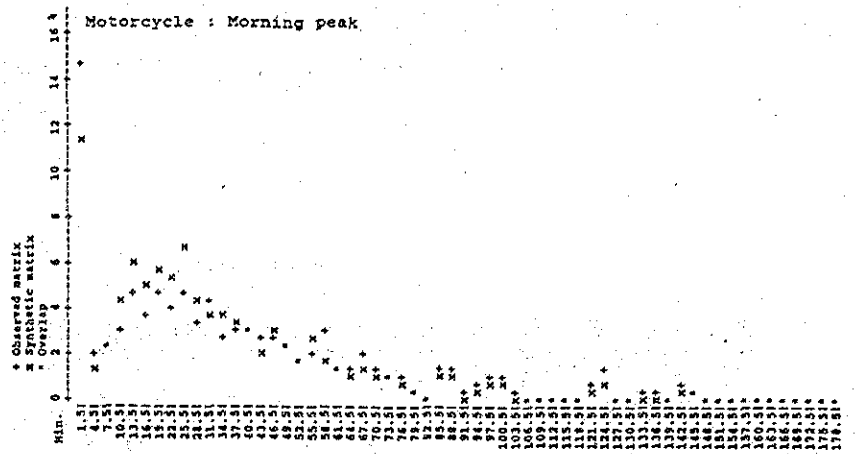












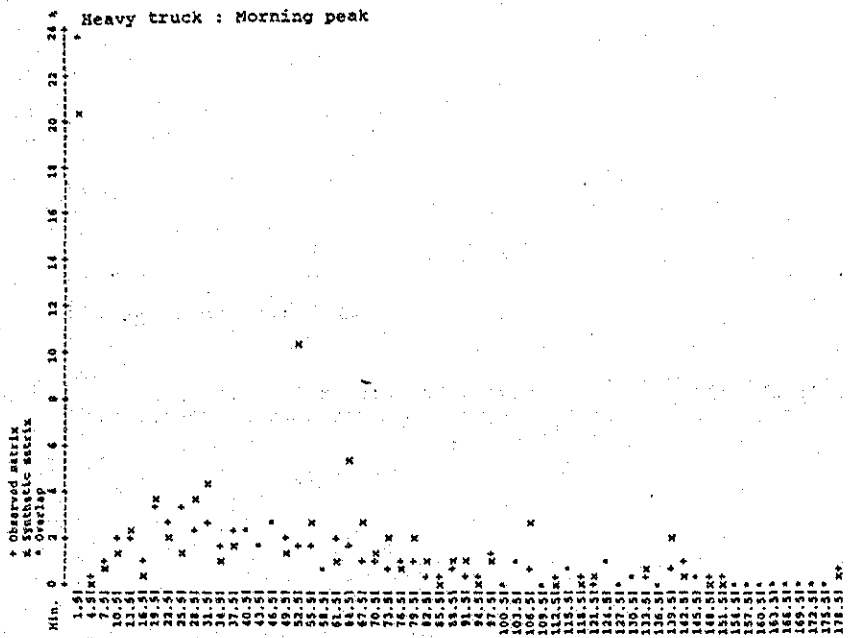


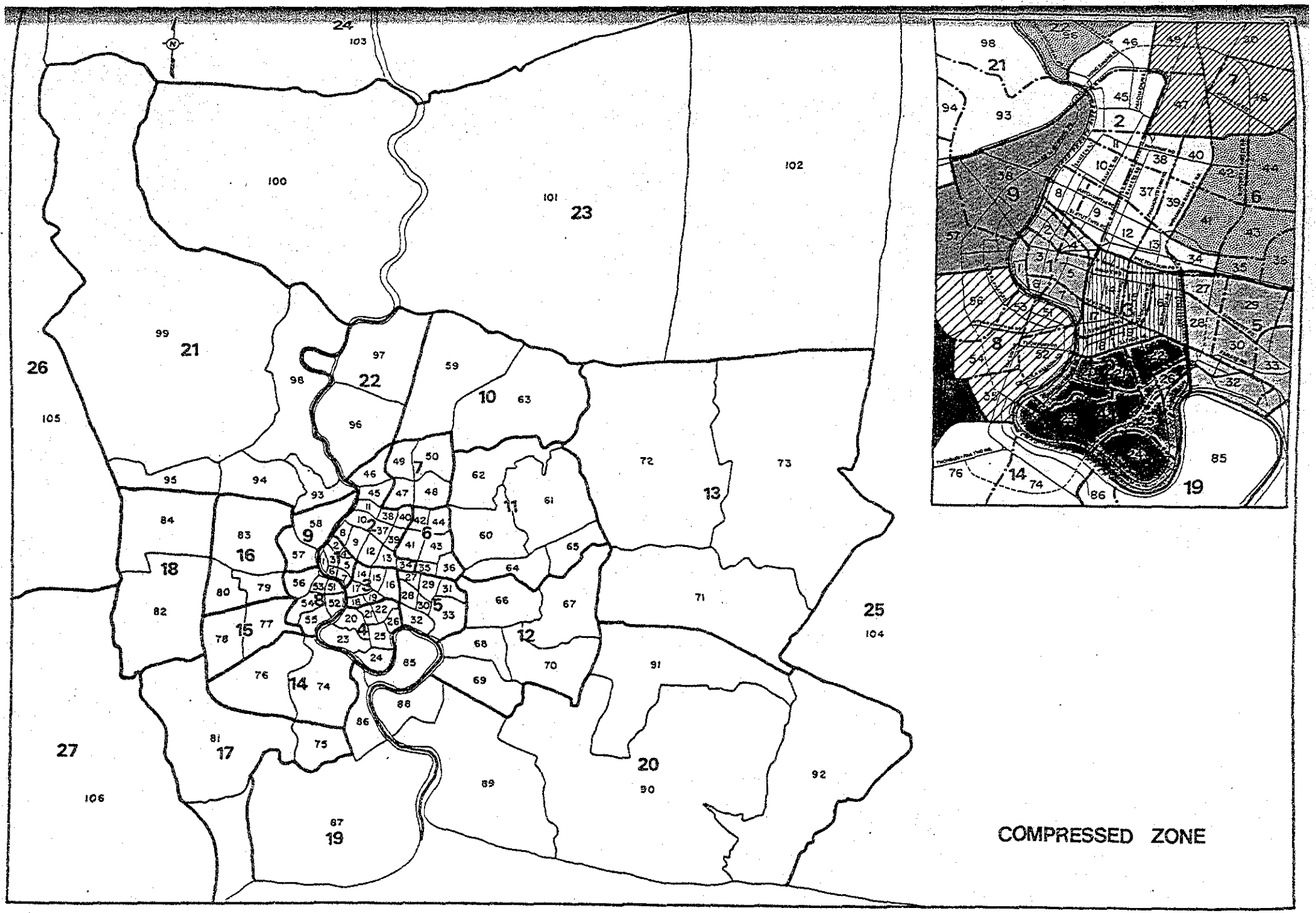
Table 2.3.4 Total Number of Trips by Vehicle Type in Base Year

(Vehicles)

Type of Vehicle	Passenger Car Equivalent Factor	Morning Peak Hour		Evening Peak Hour		Off Peak Hour		Daily	
Passenger Car	1.000	91,391	(44.7)	78,187	(43.0)	50,797	(37.2)	1,123,467	(35.5)
Taxi, Samlor	0.930	30,401	(14.9)	29,537	(16.3)	31,833	(20.2)	688,825	(21.8)
Light Bus	1.500	4,214	(2.1)	3,777	(2.1)	2,693	(1.7)	60,789	(1.9)
Heavy Bus	2.100	5,803	(2.8)	5,290	(2.9)	4,141	(2.6)	84,618	(2.7)
Light Truck	1.000	17,409	(8.5)	21,279	(11.7)	24,897	(15.8)	427,316	(13.5)
Heavy Truck	2.500	1,190	(0.6)	1,554	(0.9)	4,710	(3.0)	69,910	(2.2)
Motorcycle	0.175	54,246	(26.5)	42,005	(23.1)	38,800	(24.6)	707,943	(22.4)
Total Vehicles	-	204,654	(100)	181,629	(100)	157,871	(100)	3,162,868	(100)
Passenger Car Equivalent	-	168,229		155,107		136,969		2,758,937	

Note
( ) : Traffic composition in percent

Appendix 3.5.4 Compressed Zone



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