GOVERNMENT OF MALAYSIA

THE FEASIBILITY STUDY ON
TRANSPORTATION FACILITIES PROJECTS
IN KLANG VALLEY

FINAL REPORT

MAIN VOLUME

JUNE 1989

JAPAN INTERNATIONAL COOPERATION AGENCY

GOVERNMENT OF MALAYSIA

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PREFACE

In response to a request from the Government of Malaysia, the Japanese Government decided to conduct the Feasibility Study on Transportation Facilities Project in Klang Valley and entrusted the study to the Japan International Cooperation Agency (JICA).

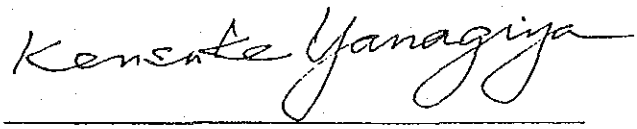
JICA sent to Malaysia several times a survey team headed by Mr. Toshio Kimura, Fukuyama Consultants International Co. Ltd., comprising members from Fukuyama Consultants International Co. Ltd., Pacific Consultants International Co. Ltd. and Aero Asahi Corporation from October 1987 to March 1989.

The team held discussions with officials concerned of the Government of Malaysia and conducted field surveys. 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 sincerest appreciation to the officials concerned of the Government of Malaysia for their close cooperation extended to the team.

June 1989



KENSUKE YANAGIYA
President
Japan International Cooperation Agency

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PART II: TRAFFIC CONTROL AND SURVEILLANCE SYSTEM PROJECT

1. INTRODUCTION

1.1 Background

Japan International Cooperation Agency (hereinafter referred to as "JICA"), the official agency responsible for the implementation of technical cooperation programs of the Government of Japan has conducted jointly with the Government of Malaysia the "Klang Valley Transportation Study" (hereinafter referred to as the "KVTS") from December 1985 to May 1987. The KVTS has proposed a list of priority transportation facility development projects, that of public transportation system project, road improvement and construction projects, traffic control and surveillance projects and freight terminal projects.

The Government of Malaysia has accepted the proposals and consequently requested the Government of Japan to conduct the Feasibility Study on Transportation Facilities Projects in Klang Valley which include highways, the area traffic control and surveillance system and freight terminals (hereinafter referred to as the "Study").

In response to the request by the Government of Malaysia to conduct the Study, JICA dispatched a Scope of Work Mission to Malaysia in setting the Scope of Work for the Study to commence in 1987. Following the agreed Scope of Work, the Government of Japan despatched a team of Japanese experts (hereinafter referred as the "Study Team") in late October 1987 to Malaysia to conduct the feasibility study jointly with the Government of Malaysia.

The Study officially commenced on the 29th day of October, 1987 after the contents of the Inception Report was accepted by the Government of Malaysia at the First Steering Committee Meeting.

Progress Report I of the Study, consisting of a Main Volume and three supplementary volumes were submitted to the Government of Malaysia in February 1988, reporting on all the works done between October 1987 to February 1988.

With the completion of Phase I of the Study in September 1988, an Interim Report containing the draft conclusion and recommendations for the Traffic Control and Surveillance System (TCS) and

the Freight Terminal Projects as well as the progress of the Highway Project was submitted to the Government of Malaysia.

Progress Report II of the Study was submitted to the Government of Malaysia in January 1989 reporting on all the works done between September 1988 to January 1989.

With the completion of work in Malaysia, a Draft Final Report was submitted in March 1989, presenting the Study Team's conclusion and recommendation for the Study.

This report forms the MAIN VOLUME of the Final Report which is prepared based on the Draft Final Report and incorporating comments from the Malaysian Government on the Draft.

1.2 Objectives of the Study

This Study has the following objectives:-

(1) To examine the technical, economic and financial feasibility of the transportation facility projects;

(2) To prepare the preliminary engineering design for these transportation facilities in the Klang Valley following their technical, economic and financial analyses;

(3) To prepare a suitable implementation program for these projects; and

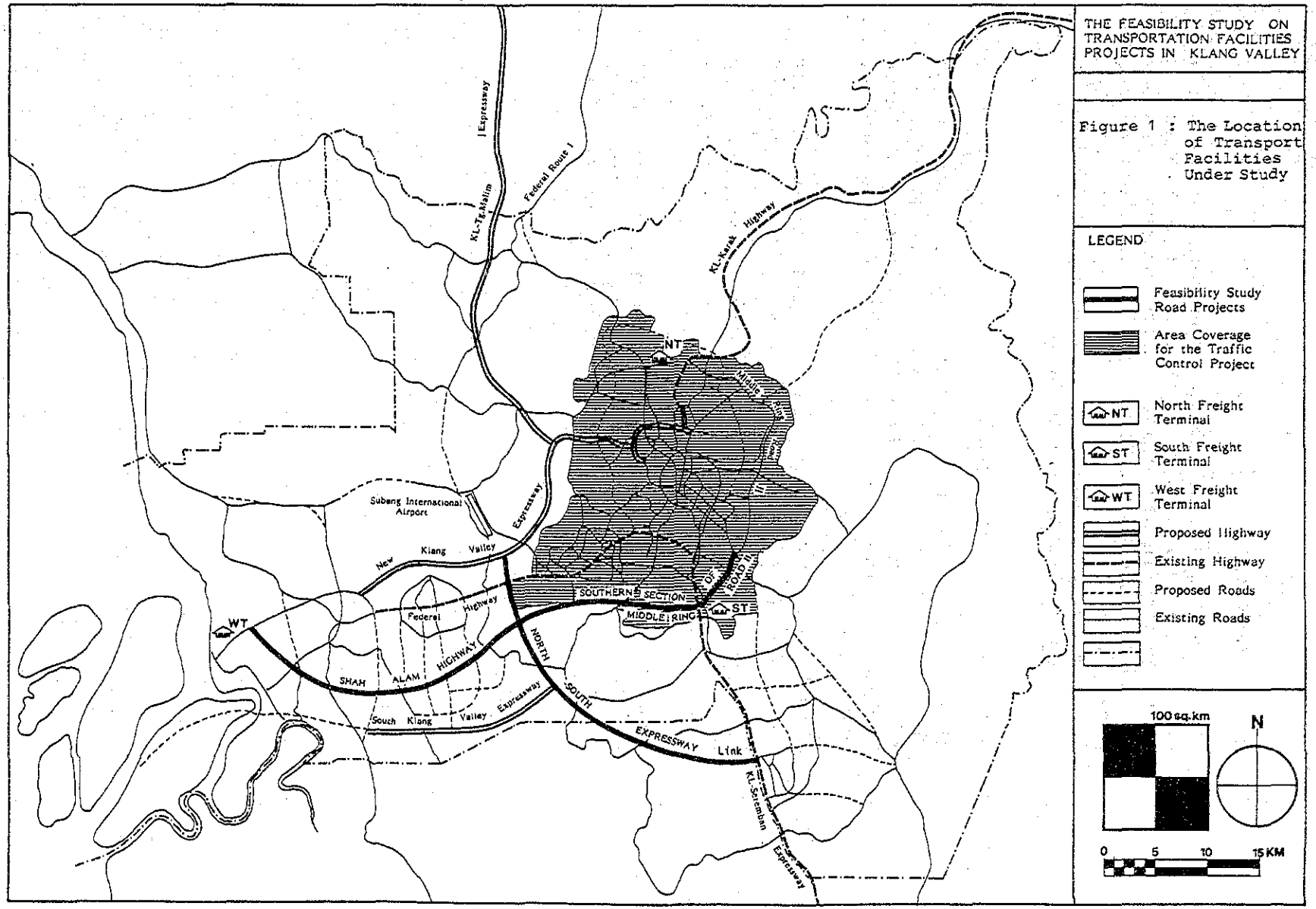
(4) To transfer the necessary technical know-how and methodologies on the feasibility study to the Malaysian counterparts in the course of the Study.

1.3 The Study Components

The Study examined three transportation facility component projects in the Klang Valley. These are:-

(a) Highway Project
(b) Area Traffic Control and Surveillance System Project
(c) Freight Terminal Project

Figure 1 shows the location of these facilities in Klang Valley as proposed by KVTS.


THE FEASIBILITY STUDY ON TRANSPORTATION FACILITIES PROJECTS IN KLANG VALLEY
Figure 1 : The Location of Transport Facilities Under Study
LEGEND
Feasibility Study Road Projects
Area Coverage for the Traffic Control Project
NT North Freight Terminal
ST South Freight Terminal
WT West Freight Terminal
Proposed Highway
Existing Highway
Proposed Roads
Existing Roads
100 sq.km
N
0 5 10 15 KM
I Expressway
Federal Route 1
KL-Tg.Malim
KL-Karak Highway
Middle Ring Road II
Subang International Airport
Expressway
New Klang Valley
SOUTHERN SECTION OF MIDDLE RING ROAD II
Federal Highway
SHAH ALAM HIGHWAY
South Klang Valley Expressway
NORTH SOUTH EXPRESSWAY Link
KL-Seremban Expressway

1.4 Study Approach

This Feasibility Study was conducted in two (2) phases and organized into five (5) stages as illustrated in Figure 2. The highway project extended throughout the entire period while the other two (2) projects were completed at the Interim Report Stage. This Final Report presents the final outcomes of the Study.

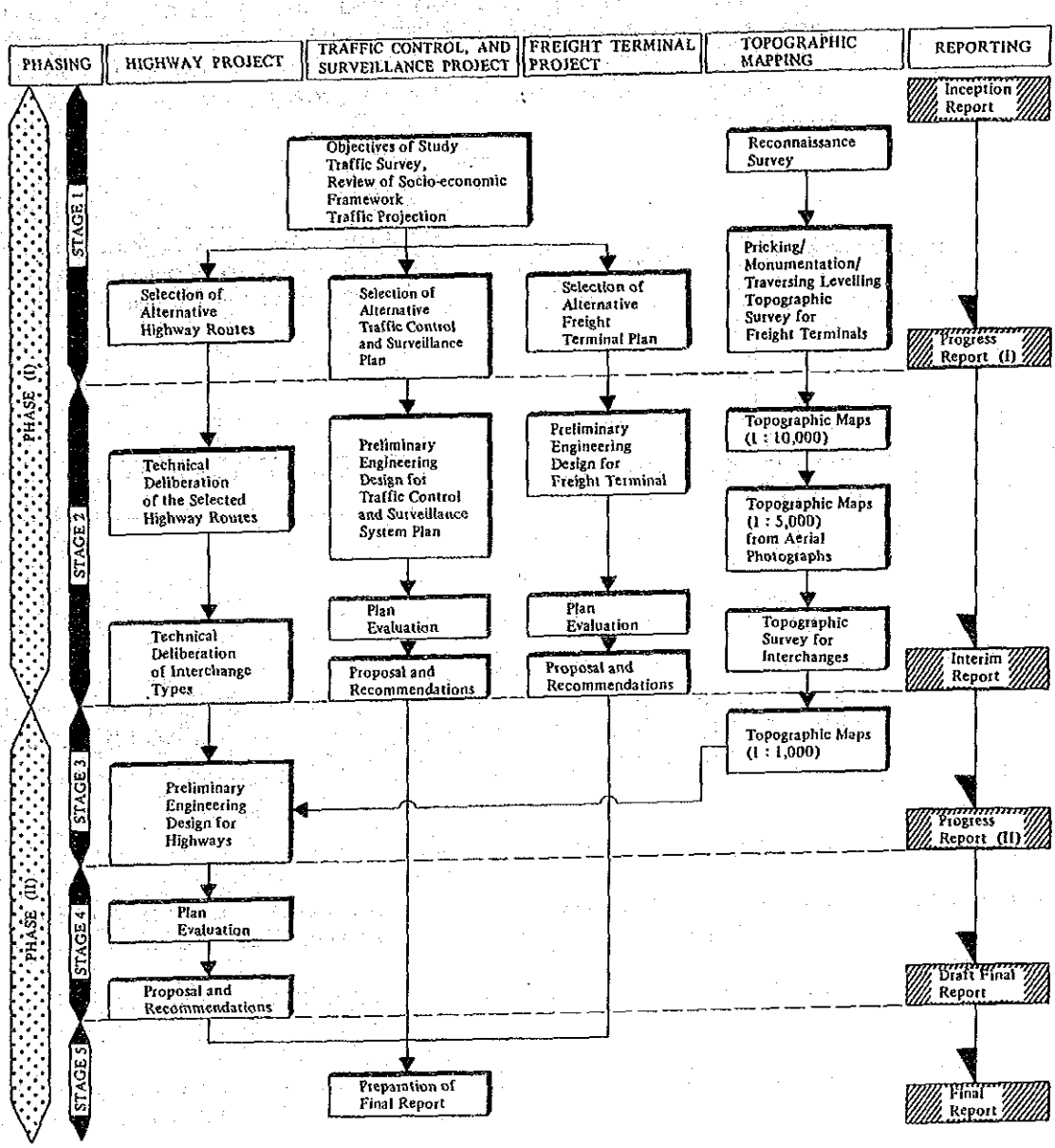
1.5 Structure of this Report

This report is the MAIN VOLUME of the Final Report. Besides this volume there are one EXECUTIVE SUMMARY, three TEXT volumes and three DRAWINGS volumes for each of the three component projects.

This MAIN VOLUME comprises an introduction chapter and summaries of the three component projects presented in three parts, namely, PART I: HIGHWAY PROJECT; PART II: TRAFFIC CONTROL AND SURVEILLANCE SYSTEM PROJECT and PART III: FREIGHT TERMINAL PROJECT.

Each of these three parts comprises ten (10) chapters which summarize the work done for each study component described in detail in the TEXT volumes.

Figure 2: The Study Flowchart



1.6 Organization of this Study

The project is being carried out jointly by JICA and the Government of Malaysia in coordination with other related agencies. The organization for the project and the lists of committee members are as follows:-

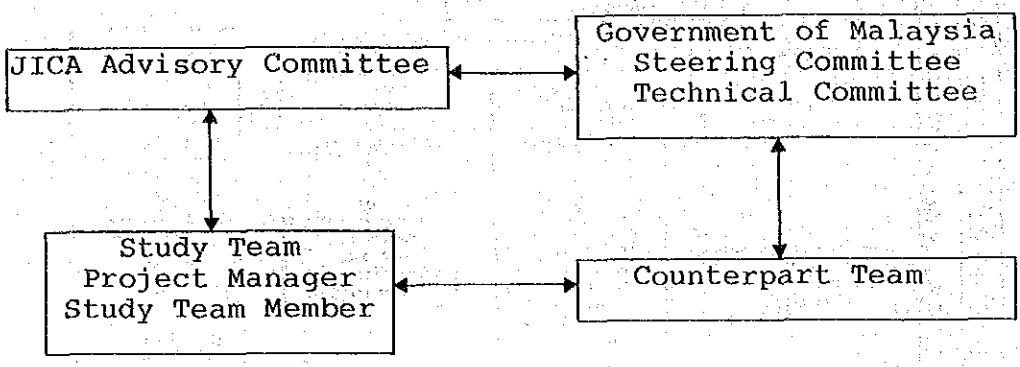


Figure 3: Organization of the Study

JICA has set up an Advisory Committee to assist the Study Team by providing the latter with advice and suggestions from time to time.

Steering Committee, Government of Malaysia

Chairman	Dr. Mohd. Noor bin Haji Harun	Economic Planning Unit, Prime Minister's Department
	Mrs. Rosmah bte Jentra	Economic Planning Unit, Prime Minister's Department
	Mr. Ismail bin Mohamed	Economic Planning Unit, Prime Minister's Department
Secretary	Mrs. Farida bte Mohd. Ali	Economic Planning Unit, Prime Minister's Department
	Datuk Yaacob bin Abd. Hamid	Klang Valley Planning Secretariat, Prime Minister's Department
	Mr. Ahmad Kamaruddin bin Abd.Rashid	Klang Valley Planning Secretariat, Prime Minister's Department
	Mrs. Norasiah Yahya	Klang Valley Planning

	Mrs. Norasiah Yahya	Klang Valley Planning Secretariat, Prime Minister's Department
	Mr. Amir bin Kassim	Highway Planning Unit, Ministry of Works
	Mr. Heng Aik Koon	Highway Planning Unit, Ministry of Works
	Mr. Taichi Seki	Highway Planning Unit, Ministry of Works
	Mr. Han Joke Kwang	Public Works Department, Ministry of Works
	Mr. Kamarul Baharim bin Dato Haji Abdul Raof	Federal Territory Development Unit
	Mrs. Hew Kuan Wai	Ministry of Transport
	Mr. Mahfix bin Omar	Kuala Lumpur City Hall
	Mr. Jabbari bin Ahmad	Development and Planning Unit, Selangor State

Technical Committee, Government of Malaysia

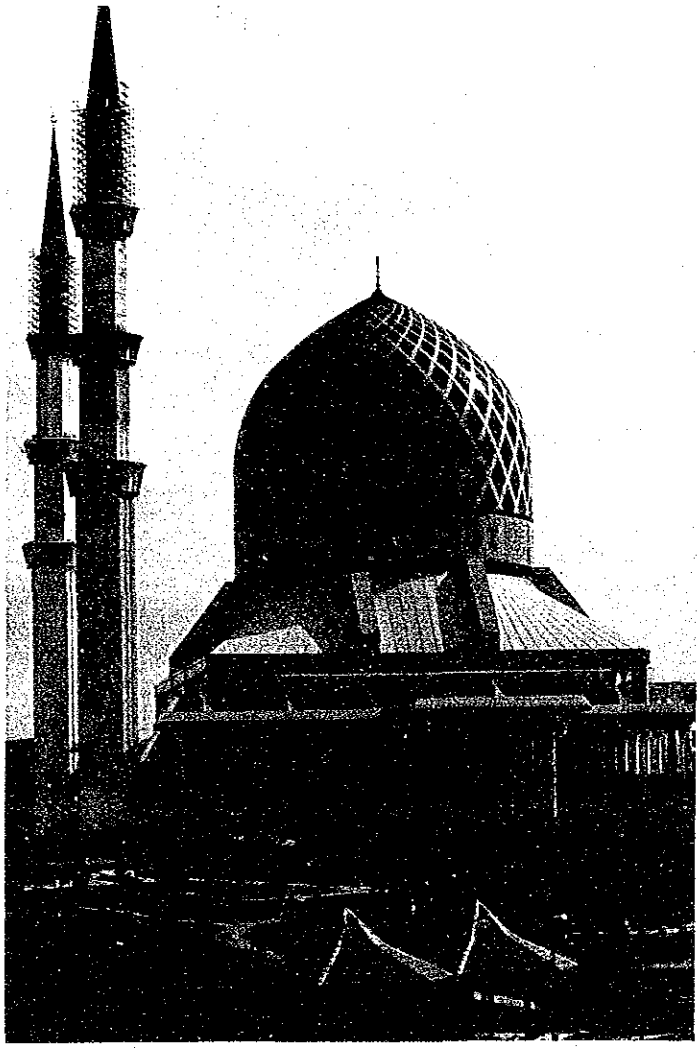
Chairman	Datuk Yaacob bin Abdul Hamid	Klang Valley Planning Secretariat, Prime Minister's Department
Secretary	Mr. Awangku Hidup bin Awangku Hossain	Klang Valley Planning Secretariat, Prime Minister's Department
	Mr. Ahmad Kamaruddin bin Abdul Rashid	Klang Valley Planning Secretariat, Prime Minister's Department
	Mrs. Norasiah Yahya	Klang Valley Planning Secretariat, Prime Minister's Department
	Mrs. Farida bte Mohd. Ali	Economic Planning Unit, Prime Minister's Department
	Mr. Amir bin Kasim	Highway Planning Unit, Prime Minister's Department
	Mr. Heng Aik Koon	Highway Planning Unit, Prime Minister's Department

	Mr. Taichi Seki	Highway Planning Unit, Prime Minister's Department
	Mr. Han Joke Kwang	Public Works Department, Prime Minister's Department
	Mr. Ibrahim bin Ahmad	Public Works Department, Prime Minister's Department
	Mr. Kamarul Baharim bin Dato Haji Abdul Raof	Federal Territory Development Unit
	Mr. Prem Kumar	Federal Territory Development Unit
	Mr. Shamsuddin Che' Mat	Ministry of Transport
	Mrs. Hew Kuan Wai	Ministry of Transport
	Mr. Mahfix bin Omar	Kuala Lumpur City Hall
	Mr. Ooi Goan Lee	Kuala Lumpur City Hall
	Mr. Lee Then Hong	Kuala Lumpur City Hall
	Mr. Jabbari bin Ahmad	Development and Planning Unit, Selangor State
	Mr. Mohammad Khusrin bin Haji Munawi	Development and Planning Unit, Selangor State
	Mr. Ghazali Md. Noor	Malaysian Highway Authority
	Mr. Ahmad Rahimi bin Jaafar	Malayan Railway Administration
	Mr. Sabini bin Tijan	Malayan Railway Administration

Advisory Committee, Government of Japan

Chairman	Dr. Kazuo Yoda	Housing and Urban Development Corporation
	Mr. Koji Hasekura	Housing and Urban Development Corporation
	Mr. Toshio Takeuchi	Ministry of Construction
	Mr. Kazuhiro Watanabe	Ministry of Transport
	Mr. Saiji Noma	Ministry of Transport

CONCLUSION AND RECOMMENDATIONS



2. CONCLUSION AND RECOMMENDATIONS

2.1 Highway Project

(1) Scheme of the Project Roads

Through the Feasibility Study, the scheme of the Project Roads has been identified as follows:-

Design Element	Shah Alam Highway/ MRR-II	N-S Link
Design Standard	Arterial (U5)	Expressway (R-6)
Design Speed (km/h)	80	120
Number of Lanes	Divided 6-lane or 4-lane	Divided 6-lane or 4-lane
Right-of-Way (m)	40 - 80	60 - 80
Length of Project Road (km)	47.7	33.7

(2) Economic Evaluation

(a) Both the Project Roads, namely, Shah Alam Highway/MRR-II and N-S Link are found to be economically feasible if they are implemented during the years from 1991 to 2000 according to the implementation schedule described in the forthcoming paragraph (7).

(b) Results of the economic evaluation indicate that the following sections of the Project Roads are the highest priority sections:-

* Shah Alam Highway/MRR-II:
  KL-Seremban Expressway - HICOM

* N-S Link
  New Klang Valley Expressway (NKVE) - Shah Alam Highway

(3) Implementation Concept

The existing and committed highways running parallel to Shah Alam Highway/MRR-II, namely Federal Route 2 and New Klang Valley Expressway (NKVE) have already been determined by the Government as tollways under a privatization scheme.

To provide an alternative route to road users, therefore, Shah Alam Highway/MRR-II should ideally be toll free and implemented by JKR.

However, if the Government prefers to privatize the project as a matter of national policy, then it should be implemented and operated by the private sector as a tollway under the BOT (Build, Operate, Transfer) scheme.

(4) Toll System

If the Project Roads are to be tollways, then it is recommended that the toll levy system on N-S Link be a closed system with distance proportional tariff while that on Shah Alam Highway/MRR-II be an open system with zone tariff to be collected at three (3) toll barriers.

In the event that only the connecting road between NKVE and Shah Alam Highway, i.e. the short section of N-S Link between NKVE and Shah Alam Highway is constructed, it is recommended that this connecting road be tentatively toll free.

(5) Government's Contribution

Land acquisition cost is preferably to be borne by the Government irrespective of whether the project roads are to be privatized or not. Land acquisition at an early stage is recommended and sufficient right-of-way for the ultimate scheme should be obtained at the first stage.

(6) Concession and Other Conditions

If the implementation of the Project Roads is privatized, the following options can be considered:-

(a) Minimum Package Option

This option consists of privatizing the highest priority sections of the Project Roads identified as follows:-

* Shah Alam Highway/MRR-II : Construction of the section from KL - Seremban Expressway to HICOM as a 4-lane highway.

* N-S Link : Construction of the connecting road from Jalan TUDM-Shah Alam to Subang West IC to form the section of N-S Link between NKVE to Shah Alam Highway as a 4-lane road.

A twenty (20) year concession period to be granted to the private business entity in undertaking the project is recommended for this option which will cost about M$210 million at 1988 prices.

(b) Medium Package Option

This option consists of privatizing the Minimum Package plus other higher priority sections of the Project Roads identified as follows:-

* Minimum Package
* Shah Alam Highway/MRR-II : Widening the 4-lane MRR-II section of Shah Alam Highway in Minimum Package into 6-lane highway

: Construction of Shah Alam Highway between HICOM and South Klang Straits By-pass (SKSB) as a 6-lane highway

: Construction of Shah Alam Highway between SKSB to Jalan Langat as a 4-lane highway

A twenty-five (25) year concession period to the business entity is recommended for this option which will cost about M$385 million at 1988 prices.

(c) Maximum Package Option

This option calls for the privatization of all the Project Roads except the section of MRR-II from Jalan Cheras to KL-Seremban Expressway

A thirty-five (35) year concession period to the business entity is recommended for this option which will cost about M$874 million at 1988 prices.

(7) Implementation Program

Technical, economic and financial studies carried out in this Study reveal that the Project Roads should preferably be implemented according to the following schedule:-

Phase 1: 1991-1994

(a) Shah Alam Highway/ MRR-II	:	Construction of the section from KL-Seremban Expressway to HICOM as a 4-lane highway.
(b) N-S Link	:	Construction of the connecting road from Jalan TUDM-Shah Alam to Subang West IC to complete the section of N-S Link from NKVE to Shah Alam Highway as a 4-lane road.

Phase 2: 1994-1997

(a) Shah Alam Highway/ MRR-II	:	Widening of the section between KL-Seremban Expressway and HICOM to a 6-lane highway.
	:	Construction of the section from HICOM to SKSB as a 6-lane highway.

: Construction of the section from SKSB to Jalan Langat as a 4-lane highway.

Phase 3: 1997-2000

(a) Shah Alam Highway/ MRR-II : Construction of the section of MRR-II from Jalan Cheras to KL-Seremban Expressway as a 6-lane arterial.

: Construction of the section of Shah Alam Highway from Jalan Langat to NKSB as a 4-lane highway.

(b) N-S Link : Construction of the section between NKVE and Shah Alam Highway as a 6-lane expressway.

: Construction of the section from Shah Alam Highway to KL-Seremban Expressway as a 4-lane expressway.

(8) Investment Requirement

The project costs for the recommended plans are given below:-

(a) The project cost for Phase 1 is estimated at M$210 million of which the foreign currency component will amount to M$91 million and the local currency component, M$119 million.

(b) The project cost for Phase 2 is estimated at M$175 million, of which the foreign currency portion will amount to M$58 million and local currency portion, M$117 million.

(c) The construction cost for Phase 3 is estimated at M$647 of which the foreign currency portion will amount to M$261 million and local currency portion, M$386 million.

(9) Further Areas of Investigation

This Study has evaluated the feasibility of three of the projects identified by the Klang Valley Transportation Study in response to the request from the Government of Malaysia. Further areas which need to be investigated as they are not covered in this Study are on the public transport system and intra-urban road network in Kuala Lumpur. These are deemed to be necessary as simultaneous improvements of the private and public transport systems in Klang Valley are very important for promoting a balanced transport system and to ensure the achievement of the planned mode shares in future.

2.2 Traffic Control and Surveillance (TCS) System Project

(1) The TCS System should be introduced and/or upgraded in the areas of Kuala Lumpur, Petaling Jaya and on major highways under JKR in order to achieve the objectives of alleviating traffic congestion, ensuring an effective control of all traffic, reinforcing the traffic surveillance function, enhancing driver information function and introducing statistical data collection function to these areas.

(2) Results of the economic and technical studies indicate that the following three (3) TCS Systems should be implemented as soon as possible.

(a) Kuala Lumpur Area Traffic Control (ATC) System
(b) Petaling Jaya Area Traffic Control (ATC) System
(c) JKR Highway Traffic Surveillance (HTS) System

(3) It is concluded from the technical analysis that:-

(a) The Kuala Lumpur ATC System should be an integrated system consisting of area-wide traffic responsive signal control, traffic surveillance and driver information systems.

(b) The Petaling Jaya ATC System whose coverage is the entire Petaling Jaya area should also comprise of area-wide traffic responsive signal control and traffic surveillance systems.

(c) The JKR System whose coverage routes are Federal Route 2 (from Kuala Lumpur city boundary to the junction with NKSB) and Airport Highway, should be an advanced form of real-time traffic surveillance and control system including traffic responsive signal control at interchanges on Federal Route 2 in Petaling Jaya.

(4) As for the central control function, the center-subcenter formation is the most preferable. Under this proposed formation, the main center of the TCS System should be set up in Kuala Lumpur to be called the Klang Valley Traffic Intelligence Center. Linked to this main center are the three (3) subcenters, i.e. Kuala Lumpur Subcenter, Petaling Jaya Subcenter and JKR Subcenter.

(5) The project costs for the TCS System are as follows:-

System	Project Costs (M$mil at 1988 Constant Prices)		
	Phase 1	Phase 2	Total
KL ATC System	39.8	20.3	60.1
PJ ATC System	11.3	2.5	13.8
JKR HTS System	13.6	28.8	42.4
TOTAL	64.7	51.6	116.3

(6) To facilitate the implementation of the proposed TCS System, it is most appropriate that a task force be established under the Klang Valley Planning Secretariat. Members of the task force would include DBKL, MPPJ, JKR, HPU, Royal Police Department and other relevant agencies.

Since the TCS Systems in the Klang Valley Region are recommended to be implemented as an integrated system, it is necessary to carry out the detailed engineering design work as one package.

(7) Implementation Program

The TCS System should preferably be implemented according to the following schedule:-

	Installation Period	Start of Operation
Phase 1 ..	1991 - 1994	1995
Phase 2 ..	1996 - 1999	2005

The disbursement schedule for the TCS System will be as follows:-

	Federal Fund Requirement (at 1988 Constant Prices)
Sixth Malaysia Plan	M$ 64.70 million
Seventh Malaysia Plan	M$ 51.60 million
TOTAL	M$116.30 million

2.3 Freight Terminal Project

(1) Freight terminals should be established not only in Klang Valley but also in Peninsular Malaysia as soon as possible in achieving the objectives of rationalizing freight transport system, modernizing freight transport industry and reducing the freight transport cost through the increase in transportation efficiency.

(2) Results of the economic and financial studies indicate that the North and South Terminals should be constructed at the earliest possible time. However, construction of the Multi-modal (West) Terminal should be delayed until such time as when the existing Inland Clearance Depot of Kontena Nasional and Container Depot of Shapadu have reached their full capacity at around the year 1997 or earlier.

Therefore, works on the detailed engineering design for the North and South Terminals should be started immediately.

(3) It is concluded from the financial analysis that:-

(a) the Freight Terminals are financially viable for a business entity to implement and operate;

(b) the business entity which will implement and operate the Freight Terminals can expect to receive appropriate level of profits;

(c) investors in the Freight Terminals can also expect to receive appropriate levels of Return on Investment (ROI), though not a high return due to the fact that such a project is a non-risky project involving the construction of one of the public infrastructures for the transport industry;

(d) transporters who are willing to relocate to the Freight Terminals can expect to receive sufficient net financial benefit even though the berth rental charges of the terminals are higher than the cost of existing facilities borne by the transporters.

(4) Nevertheless, the abovementioned financial viability is based on the following conditions:-

(a) The project costs for the Freight Terminals are as follows:-

	Project Cost (at 1988 constant prices)
North Terminal	M$11,116,000
South Terminal	M$ 9,217,000
Multi-modal (West) Terminal	M$10,489,000
Total	M$30,822,000

(b) The equity share of the capital costs shall be 20% and a public body shall take up at least 20% of the equity share.

(c) It is recommended that the Government arrange for the utilization of a lower interest long-term loan from Bank Pembangunan Malaysia (BPM) or a two-step loan from World Bank or OECF (Japan).

(d) The berth rental at the terminals is recommended as follows:-

	Annual Berth Rental (At 1988 constant prices)
North Terminal	M$20,000
South Terminal	M$18,000
Multi-modal (West) Terminal	M$20,000

(e) The expected berth utilization rate is as follows:-

	North Terminal	South Terminal	Multi-modal (West) Terminal
1995	57 (65%)	51 (64%)	-
2000	71 (81%)	64 (80%)	-
2005	88 (100%)	80 (100%)	84 (100%)

Note: Figures in parenthesis are utilization rate to the total berth capacity

(5) In order to implement the Freight Terminal Project successfully, the Study Team recommends that the organization identified as the promoters of the Project, and related agencies should earnestly carry out the following main activities at each stage:-

Stage	Promoters/Related Agencies	Main Objectives and Activities
Preparatory Stage of the Projects	* Selangor State Government * Kuala Lumpur City Hall * Ministry of Transport	* To induce the candidate promoters to sit at the same table after arrangement of interest among the members
Establishment of the Business Entity	* Selangor State Government * Kuala Lumpur City Hall * Ministry of Transport * Representatives of Lorry Transportation Industry * Loan-Supplier/s * Entrepreneur/s	* To establish the business entity * Clarification and getting concensus on the conditions to determine the responsibility and role of each member * To arrange for sources of implementation fund * Preparation of Project Proposal

(6) Considering that the Freight Terminals are public infrastructures for the lorry transportation system, a public body should jointly invest with the business entity to be set up for the Freight Terminals and contribute at least 20% of the total equity share in order to realize a desirable policy on the establishment of national-wide freight terminal network, to monitor and control freight cost set by the Government, to enhance the qualification of the business entity in receiving long-term loan from development banks and achieving a financially stable management.

(7) The Freight Terminals should preferably be implemented according to the following schedules:-

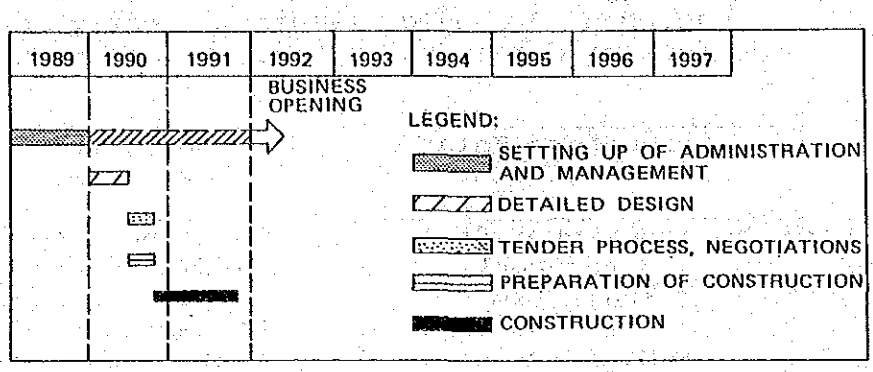


Figure 3: Recommended Implementation Schedule for North and South Terminals

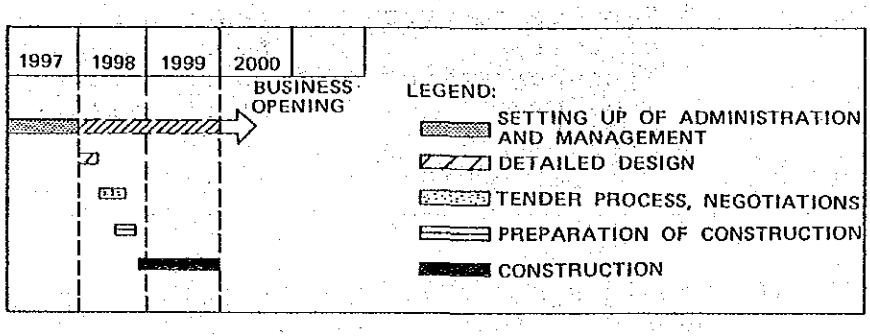


Figure 4: Recommended Implementation Schedule for Multi-modal (West) Terminal

(8) Based on the result of the location study for the Freight Terminals, the following locations are recommended:-

(a) North Terminal on Lot No. 10903 (near Batu Caves)
(b) South Terminal on Lot Nos. 3050 and 3051 (part of former Sungei Besi Tin Mines)
(c) Multi-modal (West) Terminal on vacant reclaimed land at the North Port area in Klang.

(9) The required area for the Freight Terminals are:-

(a) North Terminal	..	10.1 ha
(b) South Terminal	..	7.9 ha
(c) Multi-modal (West) Terminal	..	10.1 ha

(10) The Freight Terminal management companies shall lease the terminal berth spaces to lorry transporters or forwarders at a tariff rate agreeable to all parties. Auxiliary facilities such as warehouses, petrol station are also to be contracted out to private operators. Parking facility is provided for all the line-haul and distribution lorries to avoid the present haphazard parking by lorries along street shoulders.

(11) Regulations on restructuring and control of freight charges (between line-haul operators and distribution transporters); leasing procedure of berth spaces to transporters; terminal operations and usage need to be enacted. The Land and Marine Transport Divisions in the Ministry of Transport are recommended to play an active role in regulating the planning, construction and operation of all terminals in the country.

(12) A "National Freight Terminal Study" to undertake a feasibility study on the establishment of Freight Terminals at each regional center in Peninsular Malaysia is recommended in order to increase the overall efficiency of the lorry transport industry.

PART I

HIGHWAY PROJECT

CONTENTS

1. INTRODUCTION

Rapid economic growth in the Klang Valley Region has brought about a concentration of population creating a vast increase in urbanized area and an expansion of manufacturing and commercial activities. In proportion to the increases in these activities, transportation demand has expanded tremendously. The growth of vehicular traffic volume on the roads in Klang Valley has created further traffic congestion, especially in the Kuala Lumpur-Klang Corridor.

In order to mitigate these transport problems, the Klang Valley Transportation Study (KVTS) has established a transportation masterplan towards the year 2005 and has proposed a list of priority transportation development projects, that of public transportation development project, road construction and improvement project, traffic control and surveillance system project and freight terminal project.

The Government of Malaysia has accepted the proposals and consequently requested the Government of Japan to conduct a Feasibility Study on the transportation facilities which includes highways, traffic control and surveillance system and freight terminals.

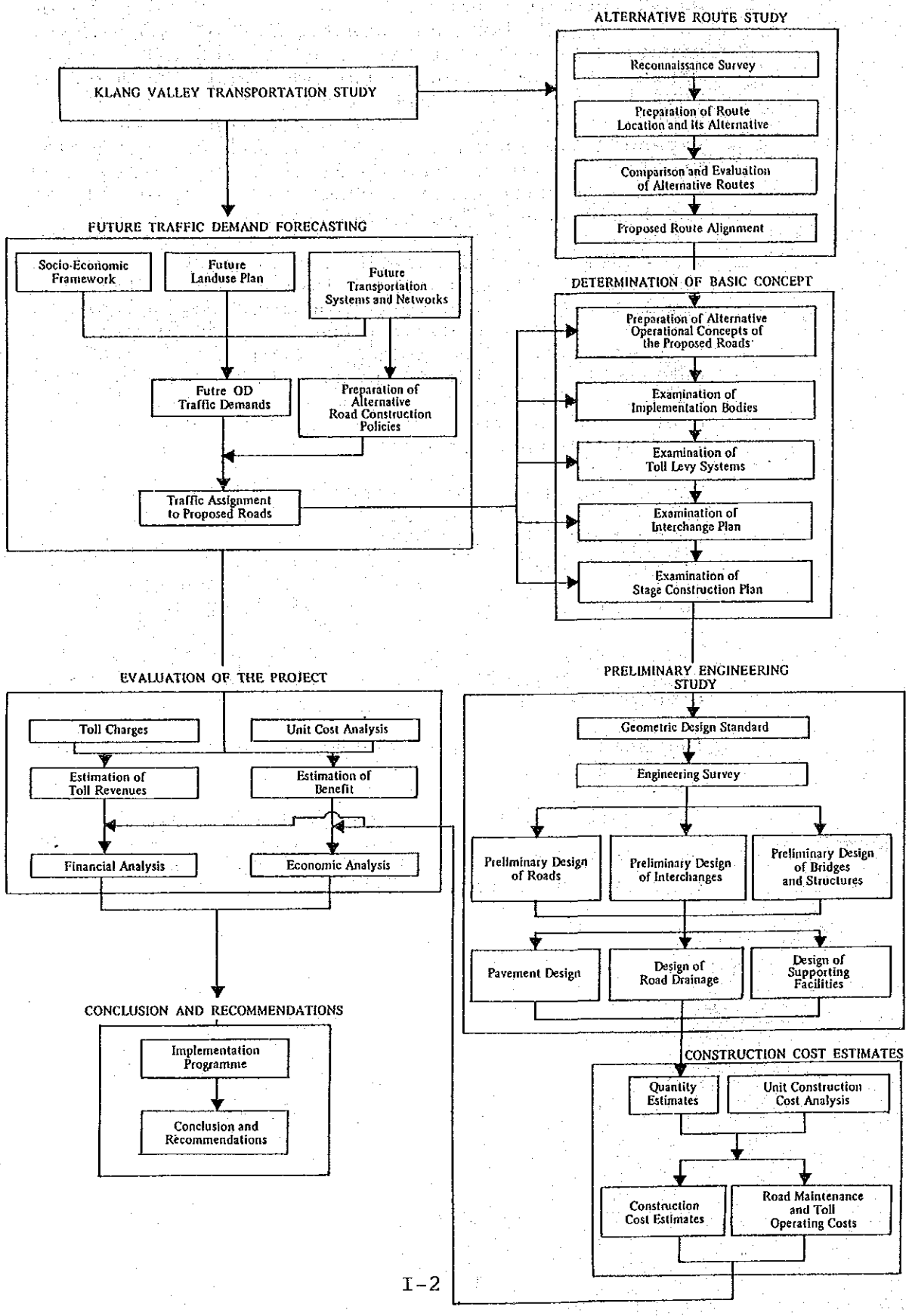
Among these transportation facilities, the highway project deals with the following highways:-

(a) Shah Alam Highway/Southern part of Middle Ring Road II (MRR-II);

(b) North-South Expressway Link (N-S Link).

The Study Approach for the highway project is illustrated in Figure I-1.

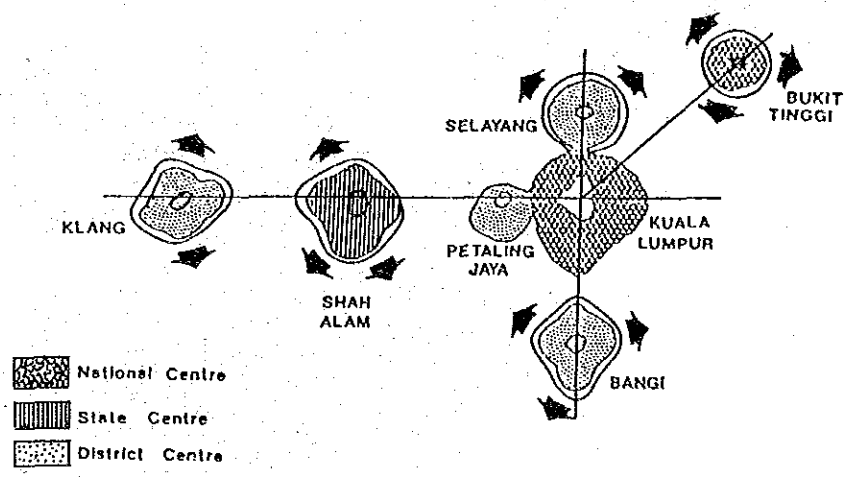
Figure I-1: Study Approach for the Highway Project



2. PROJECT CHARACTERISTICS

2.1 Future Road Network System

The planned urban development pattern in Klang Valley is to produce an urban hierarchy structure with six (6) growth centers as shown in Figure I-2. The roads connecting these growth centers will form the inter-urban road network while those directly serving these growth centers will form the intra-urban road network so that the future road network system in Klang Valley will consist of a clearly defined inter-urban network and an intra-urban network.



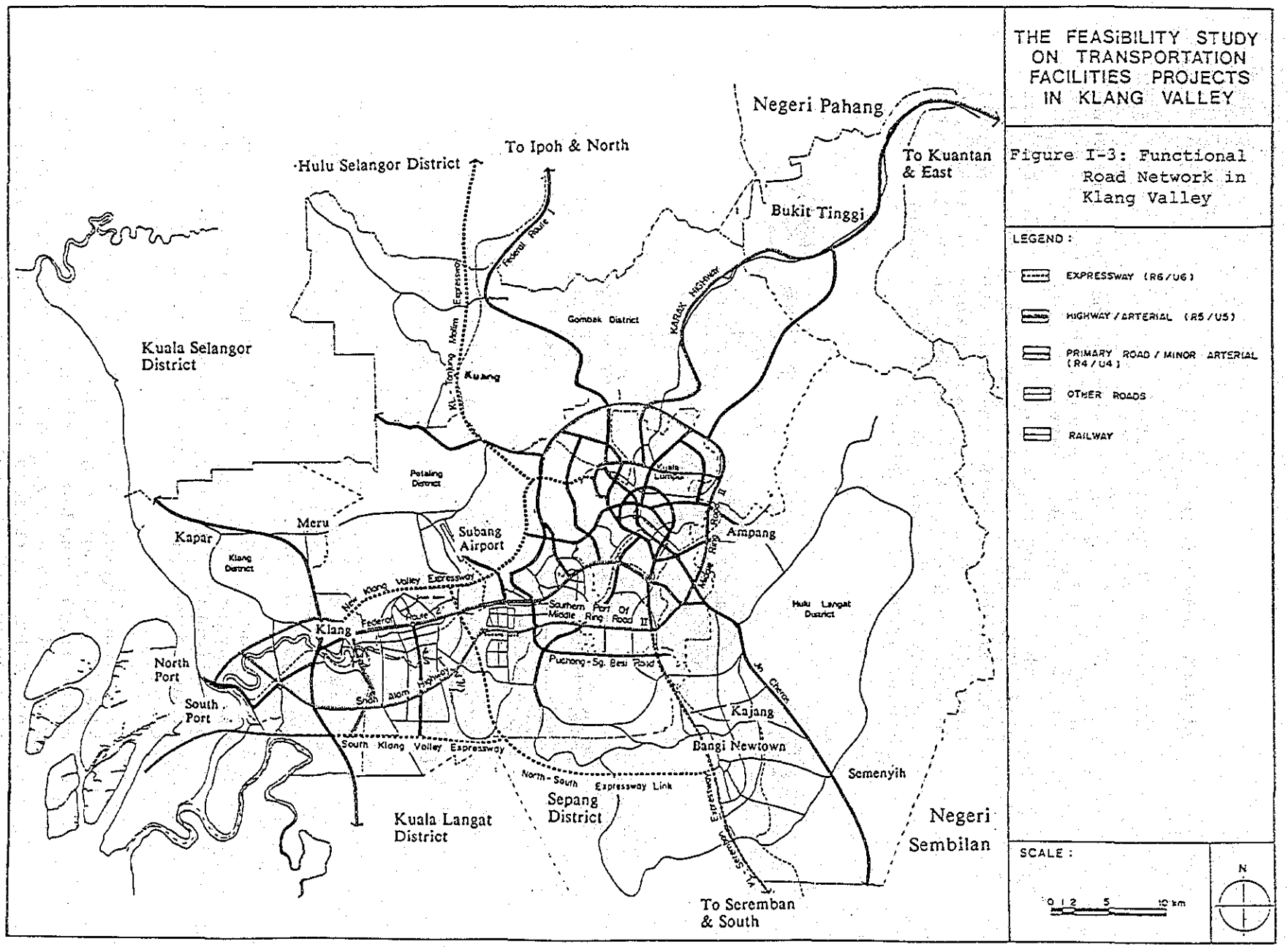
Source: Klang Valley Transportation Study, 1987

Figure I-2 : Future Regional Development Pattern

The future inter-urban road network within Klang Valley is shown in Figure I-3. The proposed six (6) urban centers will be interlinked by expressways and/or highways.

The road network proposed for the Kuala Lumpur Conurbation shall be fully developed as a radial and circumferential road network in line with the urban development structure of a polycentric city.

The road network proposed for the Kuala Lumpur-Klang Corridor shall be developed into a multilinear ladder pattern following the east-west axis urban development concept and that for the other corridors in Klang Valley shall be developed as simple or multilinear ladder pattern.



THE FEASIBILITY STUDY ON TRANSPORTATION FACILITIES PROJECTS IN KLANG VALLEY

Figure I-3: Functional Road Network in Klang Valley

LEGEND :

- EXPRESSWAY (R6/U6)
- HIGHWAY / ARTERIAL (R5/U5)
- PRIMARY ROAD / MINOR ARTERIAL (R4/U4)
- OTHER ROADS
- RAILWAY

SCALE : 0 1 2 5 10 km

N

2.2 Shah Alam Highway/MRR-II

MRR-II in Kuala Lumpur is aimed at dispersing traffic converging to Kuala Lumpur as well as promoting sub-centers development at Wangsa Maju, Bukit Jalil and Segambut-Penchala.

The feasibility study for the northern section of MRR-II starting from Kepong to Batu Caves and down to Jalan Cheras has already been undertaken in 1986 by the Malaysian Government in view of its urgency.

The southern part of MRR-II examined in this Study starts from Jalan Cheras and ends in Petaling Jaya.

Shah Alam Highway was planned as an important inter-urban arterial linking Shah Alam southern town center to Kuala Lumpur in the Shah Alam Expansion Plan and reconfirmed by the then KVTS where it is planned to link up with MRR-II so that arterial traffic from Shah Alam to Kuala Lumpur will be dispersed by the ring road.

The planning of Shah Alam Highway is given priority as it will help to promote further industrial expansion in Shah Alam and relieve traffic congestion presently faced along Federal Route 2 at peak hours.

2.3 N-S Link

N-S Link is planned to serve as a connecting link between the committed NKVE and KL-Tanjung Malim Expressway with KL-Seremban Expressway thus forming part of the Peninsular Expressway Network. When this national grid is completed, traffic from the north or south will be able to travel on the expressway network bypassing Kuala Lumpur and Petaling Jaya hence relieving traffic congestion on the local roads at these urban centers. Goods from the production centers of Bangi, Shah Alam, Petaling Jaya and Klang will be able to be transported swiftly on the expressway network for distribution within the Klang Valley Region and beyond.

The routing for this expressway link starts from New Klang Valley Expressway near Subang to KL-Seremban Expressway near Bangi Newtown Center.

3. FUTURE TRAFFIC DEMAND

3.1 Methodology

The methodology for forecasting future traffic demand is basically similar as in the KVTS. Data inputs for the demand forecasting however have to be adjusted to take into account the economy growth rate since 1985 when data used in the KVTS was collected. The unexpected slow economy growth between 1985-87 for example has affected household income level which in turn affected vehicle ownership and hence travel demand.

This feasibility study on the Project Roads also calls for a further sub-division of traffic zones along the highway corridors. This is necessary in view of the fact that detail trip generation and attraction along the highway corridors are needed to forecast accurate traffic volume on the highways.

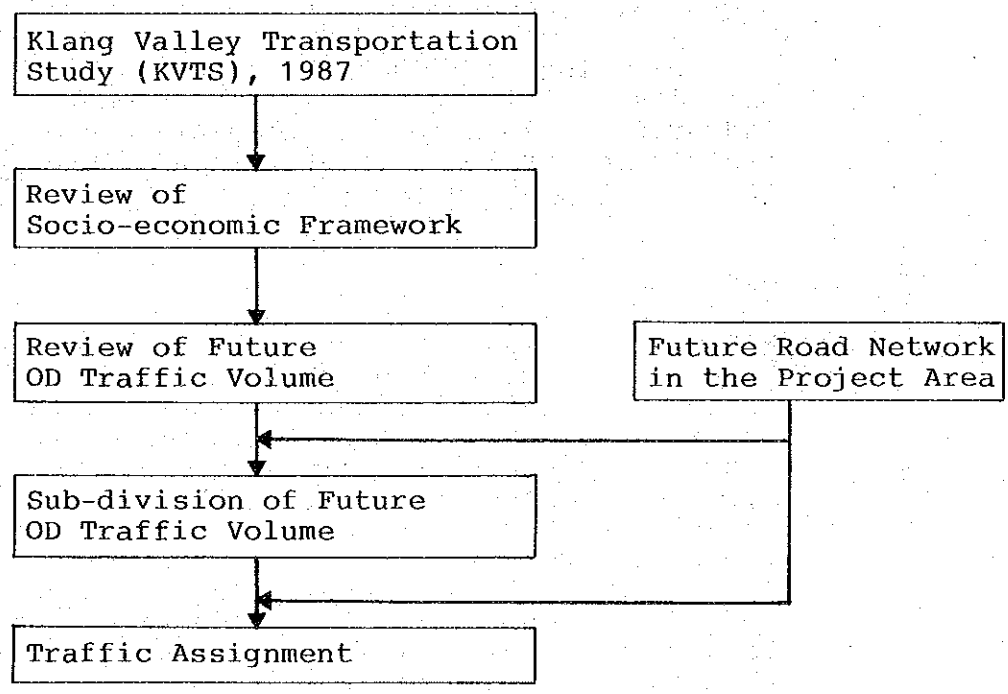


Figure I-4: Estimation of Future Traffic Demand

3.2 Socio-Economic Framework

The future socio-economic framework as a result of the increase in future population, size and distribution, economic performance hence household income level is an important determinant in forecasting future traffic demand.

The Malaysian economy has undergone an unexpected low economic growth during the 1985-86 period that warrants the re-examination of the 1985 base year socio-economic framework used in the KVTS.

(1) Population Framework

In the Klang Valley Region, the population is expected to increase from 2.5 million in 1985 to 3.9 million in 1995 and 5.5 million in 2005 with an average annual growth rate of 4.5% between 1985 and 1995, and 3.5% between 1995 and 2005.

Table I-1: Future Population Framework, Klang Valley, 1985-2005

Region	Year				Average Annual Growth Rate (%)	
	1980	1985	1995	2005	1985-1995	1995-2005
Kuala Lumpur	977	1,215	1,770	2,240	3.8	2.4
Other Areas in Klang Valley	1,043	1,319	2,170	3,310	5.1	4.0
Klang Valley	2,020	2,534	3,940	5,550	4.5	3.5

Source: Klang Valley Transportation Study, 1987

(2) Economic Framework

The Malaysian economy in 1985 recorded a negative growth of 1.0% but recovered to a positive rate of 1.2% in 1986 and 2.0% in 1987. Consequently, the total GDP for 1985 reported in the Fifth Malaysia Plan was revised based on the Economic Report 1987/88. With the 1985 Base Year GDP figures being revised and the growth rate for the low estimated adjusted to 3%, the future GDP for 1990, 1995 and 2005 with three (3) forecasting scenarios are shown below:-

Table I-2: Gross Domestic Product and Gross Regional Product in Klang Valley, 1985-2005

	Forecast	Year			Average Annual Growth Rate (%)	
		1985	1995	2005	1985-1995	1995-2005
GDP in Malaysia	Low		75,465	101,419	2.8	3.0
	Medium	57,150	86,339	140,637	4.2	5.0
	High		92,263	165,229	4.9	6.0
GRP in Klang Valley	Low		23,172	32,628	3.9	3.5
	Medium	15,867	26,511	45,244	5.3	5.5
	High		28,330	53,155	6.0	6.5

Source: 1) Economic Report 1987/88
2) Estimated by Study Team

(3) Employment Framework

With the revision on economic projection, employment figures by industry are also revised accordingly. The total employment in the Study Area is expected to grow from 1,010,000 in 1985 to 1,583,700 in 1995 and 2,223,800 in 2005 at an average annual growth rate of 4.6% during 1985-1995 and 3.5% during 1995-2005.

Table I-3: Employment by Industry in Klang Valley 1985-2005

	Employment ('000)			Average Annual Growth Rate (%)	
	1) 1985	2) 1995	2) 2005	1985-1995	1995-2005
Primary	81.3	99.2	114.7	2.0	1.5
Secondary	295.4	424.2	574.4	3.7	3.1
Tertiary	633.3	1,060.3	1,534.7	5.3	3.8
TOTAL	1,010.0	1,583.7	2,223.8	4.6	3.5

Source: 1) Based on HIS Data, 1985
2) Klang Valley Transportation Study, 1987

(4) Landuse Plan

A dispersal to selected growth centers scenario in the Klang Valley Region appears to be the most likely future development pattern. This is to be in line with the national and regional development policy.

Based on the regional development pattern, the landuse plan in the Project Roads' corridor is examined and illustrated in Figure I-5.

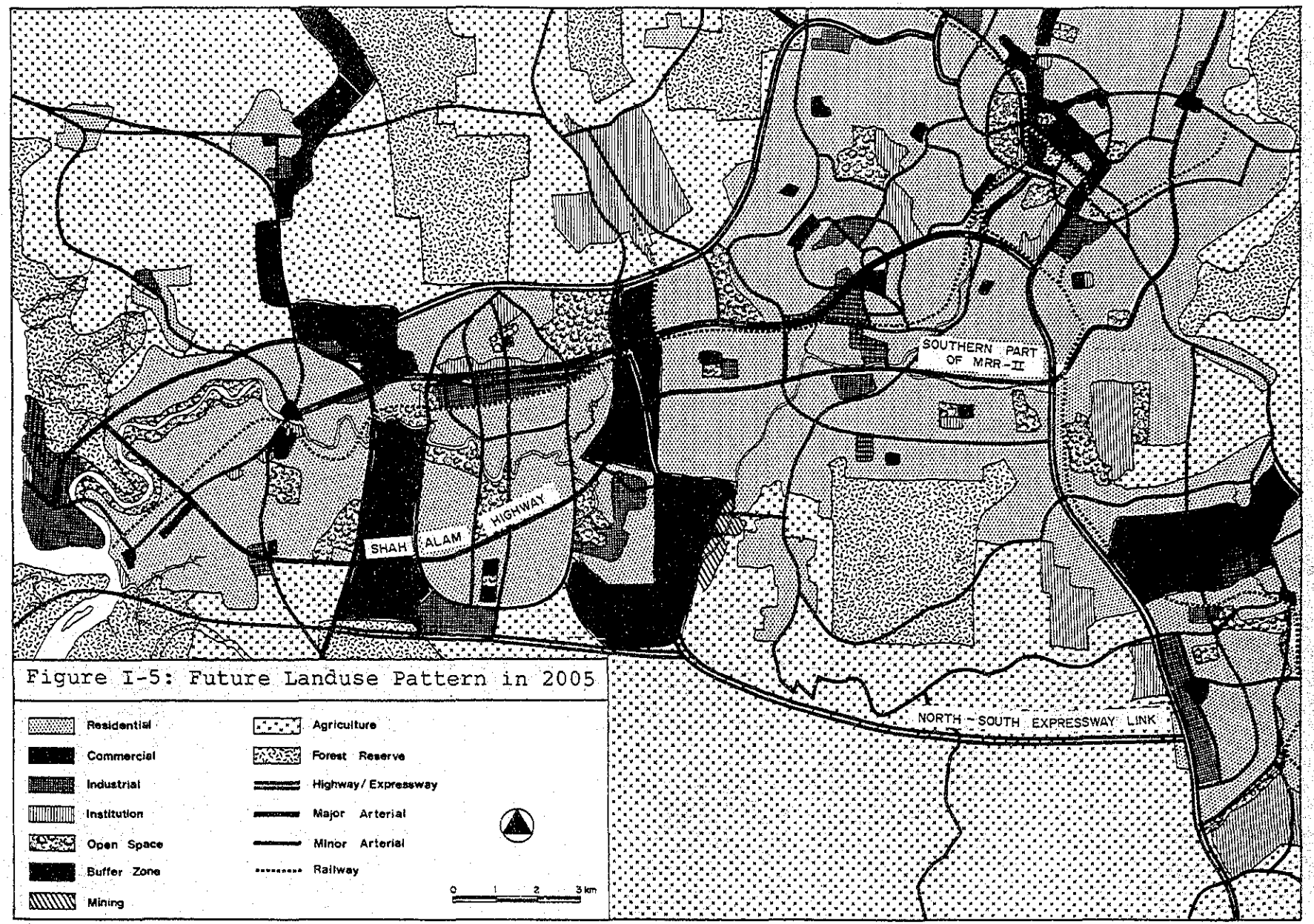


Figure I-5: Future Landuse Pattern in 2005

3.3 Assigned Traffic Volume on the Project Roads

Over fifteen (15) alternative cases of the traffic assignment to the Project Roads were carried out in this Study.

(1) Toll Free Case

Traffic was assigned to the Project Roads with a "Toll Free System" and Table I-4 shows the total vehicular traffic volume on the Project Roads by vehicle type. In terms of total vehicle trips, there will be some 433,000 vehicle per day on the Project Roads by 1995 and the vehicle volume is estimated to increase by 4.0% per annum to some 640,000 vehicle per day by 2005.

Table I-4: Daily Traffic Volume on the Project Roads by Vehicle Type (Toll Free System), 1995 & 2005

(Unit: Veh/Day)

Vehicle Type	Daily Traffic Volume in the year		Average Annual Growth Rate
	1995	2005	1995-2005
Motor-car	311,866	459,124	3.9 %
Lorry	140,965	160,087	4.3 %
Bus	15,699	20,906	2.9 %
Total	432,530	640,117	4.0 %

(2) With Toll Case

When the toll levy system is applied on the Project Roads, the assigned traffic volume is estimated and shown in Table I-5. Accordingly, the total daily traffic volume in 1995 amounts to some 300,000 vehicles and is expected to increase by 4.8% per annum to 481,000 vehicles in 2005.

The assigned traffic volume by section on the Project Roads in case of "With Toll System" for 1995 and 2005 are shown in Figures I-6 and I-7.

Table I-5: Daily Traffic Volume on the Project Roads by Vehicle Type (With Toll System), 1995 & 2005

(Unit: Veh/Day)

Vehicle Type	Daily Traffic Volume in the year		Average Annual Growth Rate
	1995	2005	1995-2005
Motor-car	218,319	349,123	4.8 %
Lorry	72,501	119,897	5.2 %
Bus	8,822	11,807	3.0 %
Total	299,642	480,827	4.8 %

(3) Comparison of Assigned Traffic Volume With and Without Toll System

In terms of total traffic volume, when toll is levied, the Project Roads are estimated to carry only 69% and 75% in 1995 and 2005 respectively of the corresponding traffic volume if the Project Roads are operated as toll free highways (Table I-6).

By individual highway, Table I-7 shows that when toll is levied, Shah Alam Highway/MRR-II is estimated to carry only 63% and 75% in 1995 and 2005 respectively of the corresponding traffic volume if this highway is toll free. Traffic volume on N-S Link as tollway is estimated to be 42% and 51% in 1995 and 2005 respectively of the toll free cases.

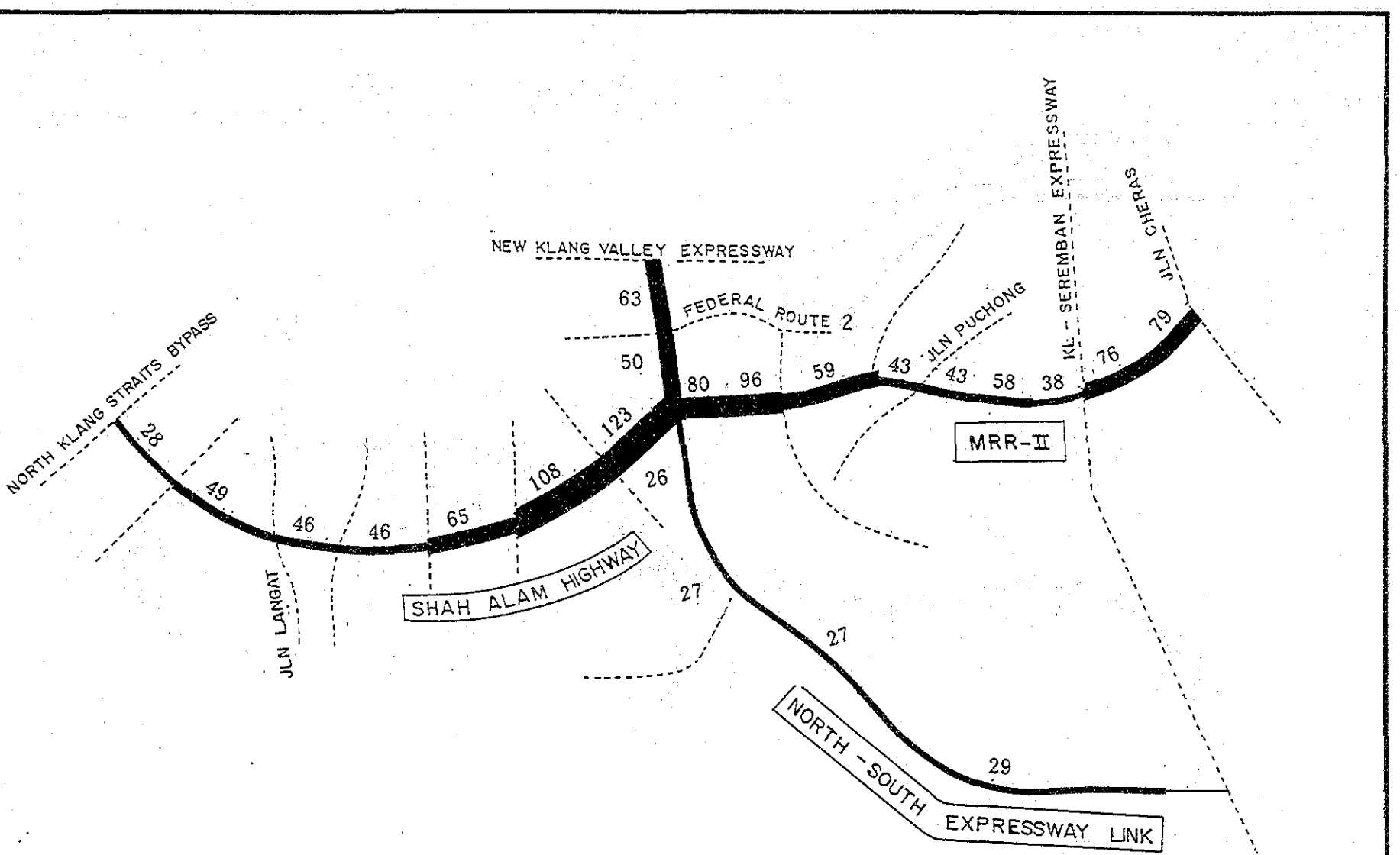


Figure I-6: Assigned Traffic Volume on the Proposed Highway in 1995 - With Toll System

(Unit: 1000 PCU/day)

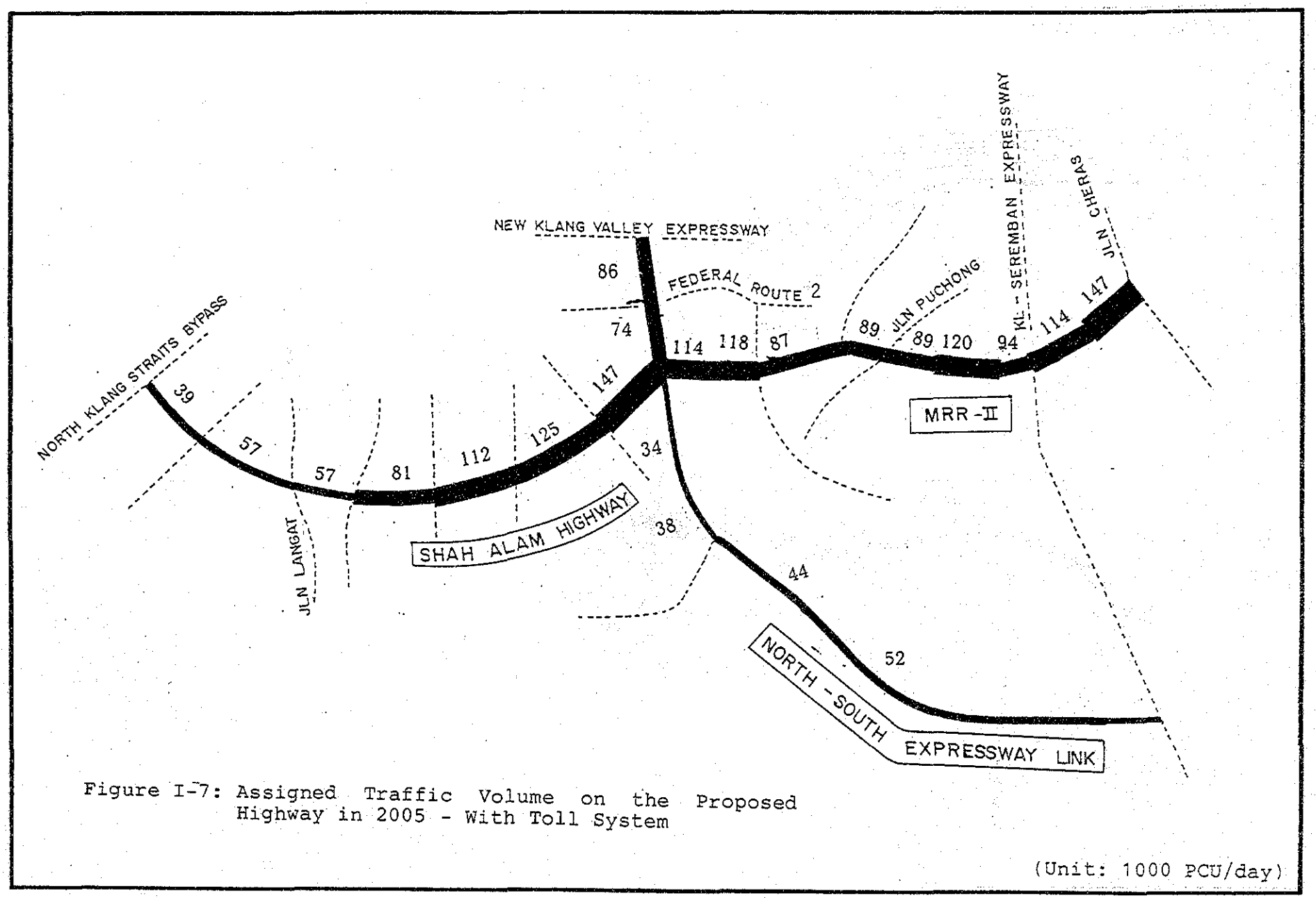


Figure I-7: Assigned Traffic Volume on the Proposed Highway in 2005 - With Toll System

Table I-6: Comparison of Daily Traffic Volume on the Project Roads With and Without Toll System, 1995 & 2005

Year	Without Toll System (A)	With Toll System (B)	Comparison (B/A)
1995	432,530 veh/day	299,642 veh/day	0.69
2005	640,117 veh/day	480,827 veh/day	0.75

Note: Traffic volume on Shah Alam Highway/MRR-II under "With Toll System" case includes both untolled and tolled vehicles

Table I-7: Comparison of Daily Traffic Volume by the Project Roads With and Without Toll System, 1995 & 2005

(Unit: Vehicles)

Project Road	Year	Without Toll System (A)	With Toll System (B)	Comparison (B/A)
Shah Alam Highway/ MRR-II	1995	195,406	123,421	0.63
	2005	281,626	211,674	0.75
N-S Link	1995	169,818	71,989	0.42
	2005	220,834	112,426	0.51

Note: Traffic volume on Shah Alam Highway/MRR-II is counted on the three (3) toll barriers

Next, in order to study the effects on traffic flow in the Kuala Lumpur-Klang Corridor when the Project Roads are implemented, the following four (4) cases are compared:-

(a) The Project Roads are not implemented (Without Project Roads)

(b) The entire length of the Project Roads with toll free system is implemented (Whole Project, Toll Free system)

(c) The entire length of the Project Roads with toll system is implemented (Whole Project, With Toll System)

(d) A minimum package of the Project Roads with toll system is implemented, namely Shah Alam Highway/MRR-II from KL-Seremban Expressway to HICOM: 4-lane and N-S Link from NKVE to Shah Alam Highway: 4-lane (Minimum Package With Toll System).

Tables I-8 and I-9 show the comparison of traffic volume on the Klang-Shah Alam and Shah Alam-Petaling Jaya Screenlines respectively.

For the Klang-Shah Alam Screenlines, when the Project Roads are implemented as toll free roads, 37% (or 78,700 pcu) of traffic volume on NKVE and Federal Route 2 is expected to be diverted to Shah Alam Highway. On the other hand, when the Project Roads are tollways, only 20% (or 45,900 pcu) of traffic volume on these two roads is expected to be diverted to Shah Alam Highway.

For the Shah Alam-Petaling Jaya Screenline, when the Project Roads are implemented as toll free roads, 41% (or 148,000 pcu) of traffic volume on NKVE and Federal Route 2 is expected to be diverted to Shah Alam Highway while when the Project Roads are implemented as tollways then 31% (or 101,500 pcu) of the traffic volume on both roads is expected to be diverted to Shah Alam Highway/MRR-II.

Comparing the "Minimum Package, With Toll System" case against the "Without Project Roads" case it is found that traffic variation on NKVE and Federal Route 2 is negligible across the Shah Alam-Klang Screenline. However, diversion to Shah Alam Highway is only 12% across the Shah Alam-Petaling Jaya Screenline.

Taking into account the effects to NKVE and Federal Route 2 where toll concession has been given to PLUS, it is found that in the early stage, Shah Alam Highway/MRR-II should be constructed up to HICOM only and then the highway should be extended stagewise in proportion to increases in traffic volume.

Table I-8: Traffic Volume on Shah Alam-Klang Screenline in 1995

(Unit: '000 PCU)

	Without Project Roads (A)	Whole Project, Toll Free System (B)	Whole Project, With Toll System (C)	Minimum Package, With Toll System (D)	Comparison (B/A)	Comparison (C/A)	Comparison (D/A)
NKVE	95.2	36.0	56.2	83.4	0.38	0.59	0.88
Federal Route 2	131.7	107.6	124.4	143.4	0.82	0.94	1.09
Shah Alam Highway	-	78.7	45.9	-	-	-	-
Jalan Kebun	6.2	3.5	3.9	6.2	0.56	0.63	1.00
Total	233.1	225.8	230.5	233.0	0.97	0.99	1.00

Table I-9: Traffic Volume on Shah Alam-Petaling Jaya Screenline in 1995

(Unit: '000 PCU)

	Without Project Roads (A)	Whole Project, Toll Free System (B)	Whole Project, With Toll System (C)	Minimum Package, With Toll System (D)	Comparison (B/A)	Comparison (C/A)	Comparison (D/A)
NKVE	95.2	36.0	56.2	83.4	0.38	0.59	0.88
Federal Route 2	229.1	160.4	166.6	201.7	0.70	0.73	0.88
Shah Alam Highway	-	148.0	122.5	63.8	-	-	-
Batu Tiga-Jalan Puchong	40.2	17.8	19.7	20.2	0.44	0.49	0.50
Total	364.5	367.2	365.0	369.1	1.01	1.00	1.01

(5) Stage Implementation Plans

Three cases of the traffic assignment are examined for the stage implementation plans illustrated in Figure I-8.

Alt.1 consists of implementing the 4-lane sections of Shah Alam Highway/MRR-II from KL-Seremban Expressway to HICOM and N-S Link from NKVE to Shah Alam Highway.

Alt.2 consists of implementing a 6-lane section of Shah Alam Highway/MRR-II from KL-Seremban Expressway to SKSB and a 4-lane section of SKSB to Jalan Langat.

Alt.3 consists of implementing a 4-lane section of Shah alam Highway/MRR-II from KL-Seremban Expressway to HICOM, a 6-lane section of N-S Link from NKVE to Shah Alam Highway and a 4-lane section from Shah Alam Highway to KL-Seremban Expressway.

Table I-10 shows the assigned traffic volume on the Project Roads by the stage implementation plans in 1995. Accordingly, Alt.1 is superior to the other plans in terms of utilization rate of the Project Roads followed by Alt.2.

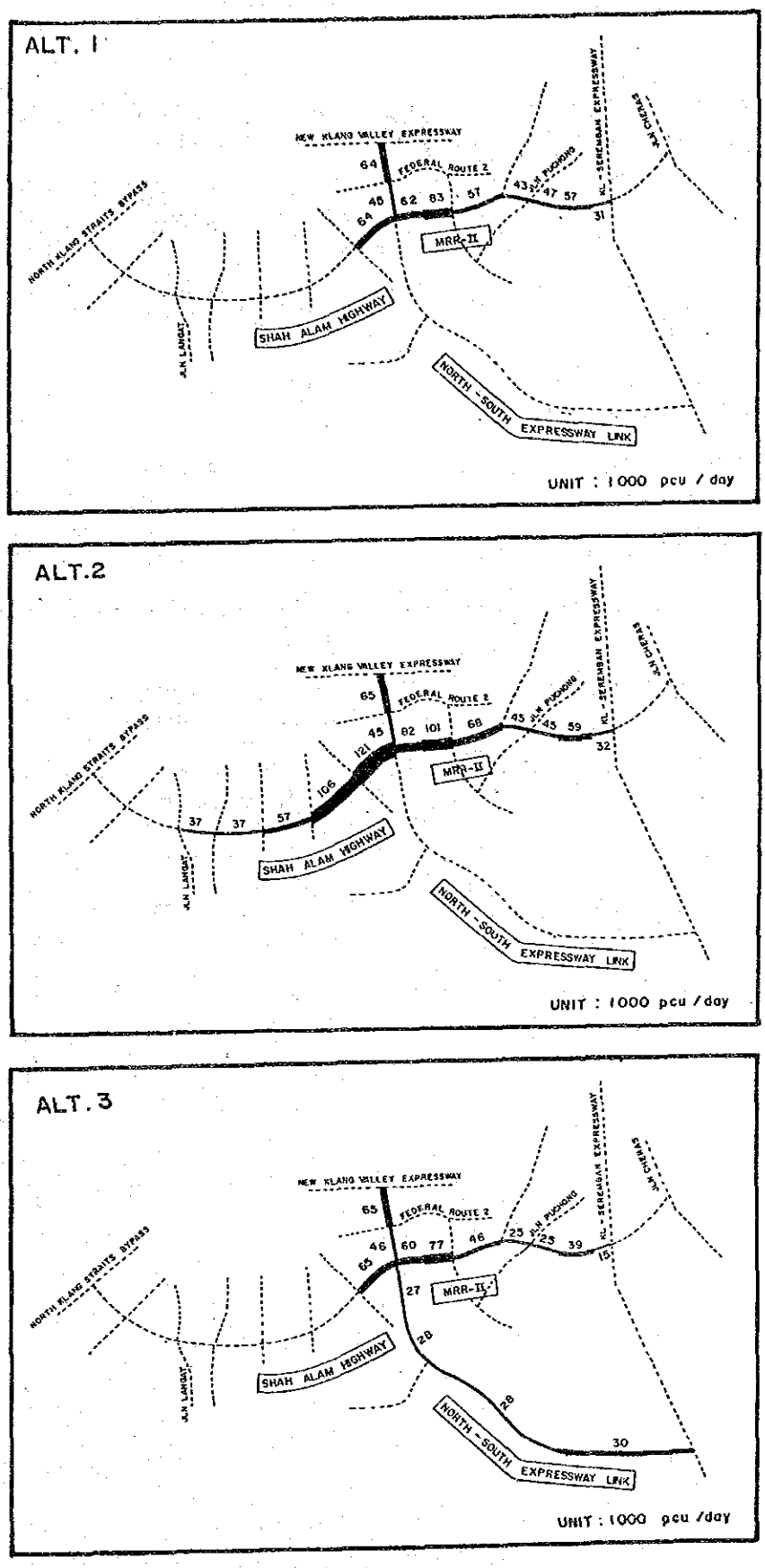


Figure I-8: Stage Implementation Plans

Table I-10: Traffic Statistics on the Project Roads by Alternative Staging Plans in 1995

	*1 Alt. 1 (A)	*2 Alt. 2 (B)	*3 Alt. 3 (C)	Comparison (B/A)	(C/A)
Traffic Volume ('000 veh)	140.7	188.7	154.6	1.34	1.10
Vehicle Kilometers ('000 veh.km)	1,159	2,338	1,921	2.02	1.66
Capacity Kilometers ('000 veh.km)	1,370	2,956	3,631	2.16	2.65
Veh.km/Capacity.km	0.85	0.79	0.53	0.93	0.62

Notes: *1 Shah Alam Highway: KL-Seremban Expressway to HICOM, 4-lane

N-S Link: New Klang Valley Expressway to Shah Alam Highway, 4-lane

*2 Shah Alam Highway: KL-Seremban Expressway to SKSB, 6-lane

SKSB to Jalan Langat, 4-lane

N-S Link: New Klang Valley Expressway to Shah Alam Highway, 4-lane

*3 Shah Alam Highway: KL-Seremban Expressway to HICOM, 4-lane

N-S Link: New Klang Valley Expressway to Shah Alam Highway, 6-lane

Shah Alam Highway to KL-Seremban Expressway, 4-lane

4. ALTERNATIVE ROUTE STUDY

This Study principally adopts the original corridors of the southern part of MRR-II, Shah Alam Highway and N-S Link as proposed by KVTS.

Aerial photographs of the Klang Valley Region taken in 1982 at a scale of 1:40,000 as well as topographic maps at scales of 1:25,000 and 1:10,000 were used in the route location study.

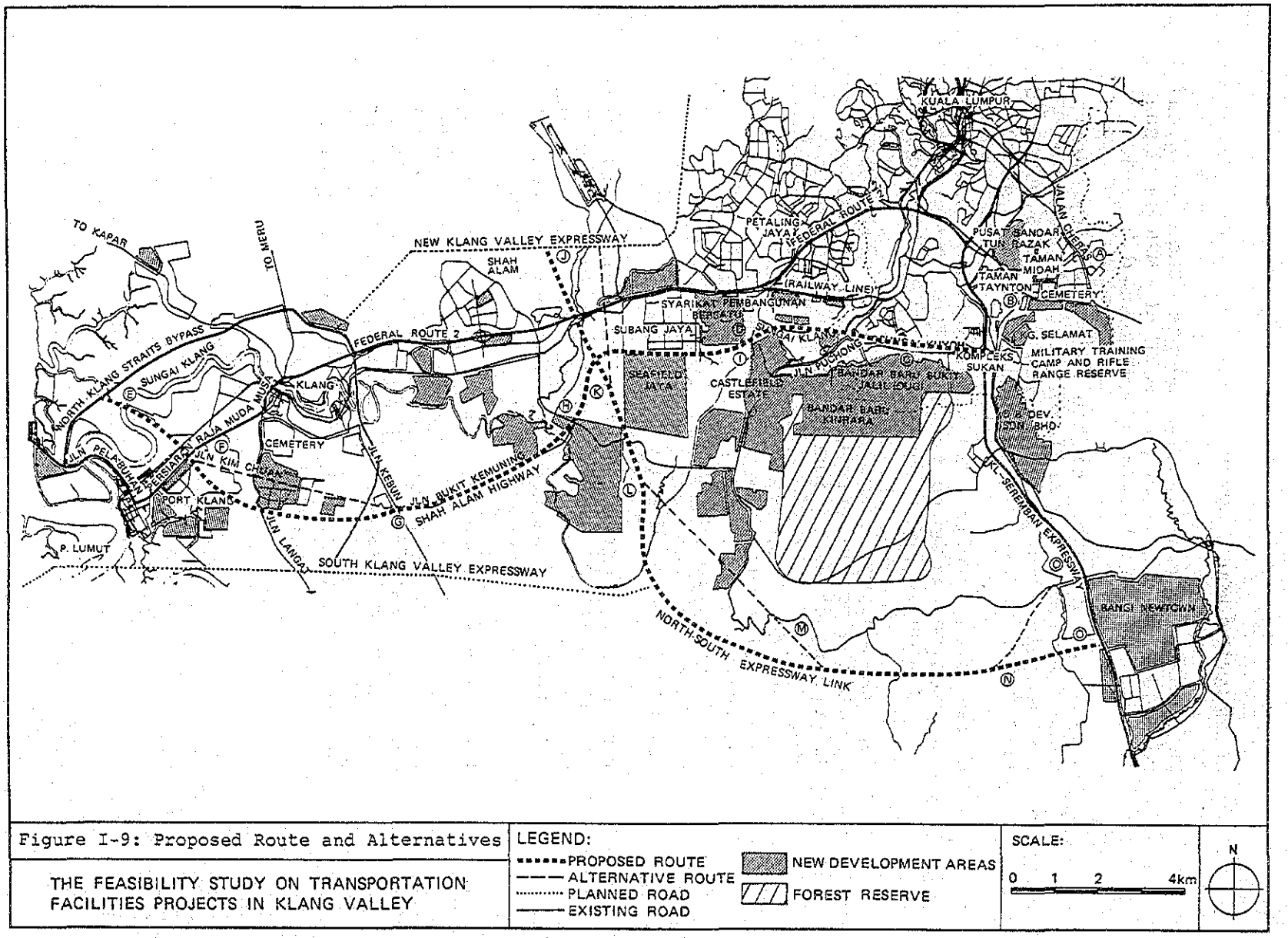
Alternative routes were explored based on information gathered through site investigation and examination of maps and aerial photographs.

For the purpose of comparing such alternative, the following criteria were taken into account in descending order of importance:-

(a) Land Availability
(b) Impact on the Social Environment
(c) Future Traffic Demand
(d) Construction Economy
(e) Road User Benefits
(f) Development Impact

The proposed optimum routes shown in Figure I-9 are a combination of segments whose technical feasibility has been deliberated on and those selected from among alternatives through the comprehensive comparison and evaluation process.

The route location was finalized through discussion on land availability with the relevant agencies, using proposed right-of-way maps shown on the standard sheets and the latest topographical maps to scales of 1:5,000 for throughway and 1 = 1,000 for major interchange locations compiled by photogrammetric plotting and field survey by the Study.


TO KAPAR
TO MERU
NEW KLANG VALLEY EXPRESSWAY
SHAH ALAM
FEDERAL ROUTE 2
SUNGAI KLANG
NORTH KLANG STRAITS BYPASS
KLANG
JLN PELABUHAN
PERSIARAN RAJA MUDA MUSA
JLN KIM CHEAH
CEMETERY
JLN KEBUN
JLN BUKIT KEMUNING
SHAH ALAM HIGHWAY
PORT KLANG
P. LUMUT
JLN LANGAT
SOUTH KLANG VALLEY EXPRESSWAY
SUBANG JAYA
SEAFIELD MAYA
CASTLEFIELD ESTATE
SYARIKAT PEMBANGUNAN BERSATU
PETALING JAYA
FEDERAL ROUTE 1
(RAILWAY LINE)
KUALA LUMPUR
JALAN CHERAS
PUSAT BANDAR TUN RAZAK
TAMAN MIDAH
TAMAN TAYNTON
CEMETERY
KG. SELAMAT
MILITARY TRAINING CAMP AND RIFLE RANGE RESERVE
KOMPLEKS SUKAN
JLN PUCHONG
BANDAR BARU KINRARA
BANDAR BARU KLIKIT
JALIL LODGE
DEV. SDN BHD
KL-SERENDAH EXPRESSWAY
BANGI NEWTOWN
NORTH-SOUTH EXPRESSWAY LINK
Figure I-9: Proposed Route and Alternatives
THE FEASIBILITY STUDY ON TRANSPORTATION FACILITIES PROJECTS IN KLANG VALLEY
LEGEND:
PROPOSED ROUTE
ALTERNATIVE ROUTE
PLANNED ROAD
EXISTING ROAD
NEW DEVELOPMENT AREAS
FOREST RESERVE
SCALE:
0 1 2 4km
N

5. BASIC DESIGN CONCEPTS OF THE PROJECT ROADS

5.1 Implementation Concept

With regard to the Project Roads, they may be implemented and hence operated by any one of the following bodies:-

(a) Government
(b) Private Sector or
(c) Third Sector (Joint-venture by Government and Private Sector)

If one of the abovementioned three (3) implementation bodies is to implement and operate the Project Roads, it would be relevant that for the case of adopting the "Toll Free System", the implementation body should be JKR, while for the case of adopting the "With Toll System", other forms of implementation body are LLM, private sector or third sector. Decision on which one of the bodies should be selected is a policy matter and its determination by the Government would naturally determine which one of the following implementation concepts should be adopted:-

(a) Toll Free System
(b) With Toll System

5.2 Toll Levy System

In the case where either the private sector or third sector would be implementing the Project Roads, the business entity set up will levy a toll on the road users.

In order to determine the most appropriate toll levy system including location of toll plaza, the alternative toll levy systems are proposed based on the following conditions:-

(a) Urban community along the Project Roads
(b) Land availability for toll plazas
(c) Traffic characteristics on the Project Roads
(d) Compatibility with other toll levy systems
(e) Equitable toll levy

The alternative toll levy systems prepared are evaluated from the following viewpoints:-

(a) Toll revenue expected
(b) Road and toll facilities construction costs
(c) Operating costs
(d) Malaysian context

Figure I-10 shows the proposed toll levy system selected based on the following findings:-

(1) Shah Alam Highway/MRR-II

The toll barrier system with three (3) toll plazas is the best alternative because of the following reasons:-

(a) Initial investment costs of this System is relatively lower than other systems. At the same time, the operating cost of this system is also relatively lower.

Therefore, cost performance of this system is comparatively better than other systems at initial stage of the Project.

(b) If this system which has a smaller estimated toll revenue is found to be financially feasible, other alternative systems which have higher toll revenue would obviously be feasible too. For the purpose of this Study, it is thus safer to assume this system for further deliberation.

(c) Taking into consideration the Malaysian context, the toll barrier system is more popular than the other systems.

(2) N-S Link

N-S Link is principally planned as a segment of the expressway traversing Peninsular Malaysia, known as North-South Expressway.

The closed system with distance proportional tariff should be adopted ultimately while at the interim stage, the open system may be applied to N-S Link because:-

(a) N-S Link being a part of North-South Expressway should therefore have a toll levy system which is compatible with toll levy system adopted or to be adopted to the whole North-South Expressway;

(b) the closed system is a more effective toll levy system than the open system in order to ensure higher mobility and safety on the expressway.

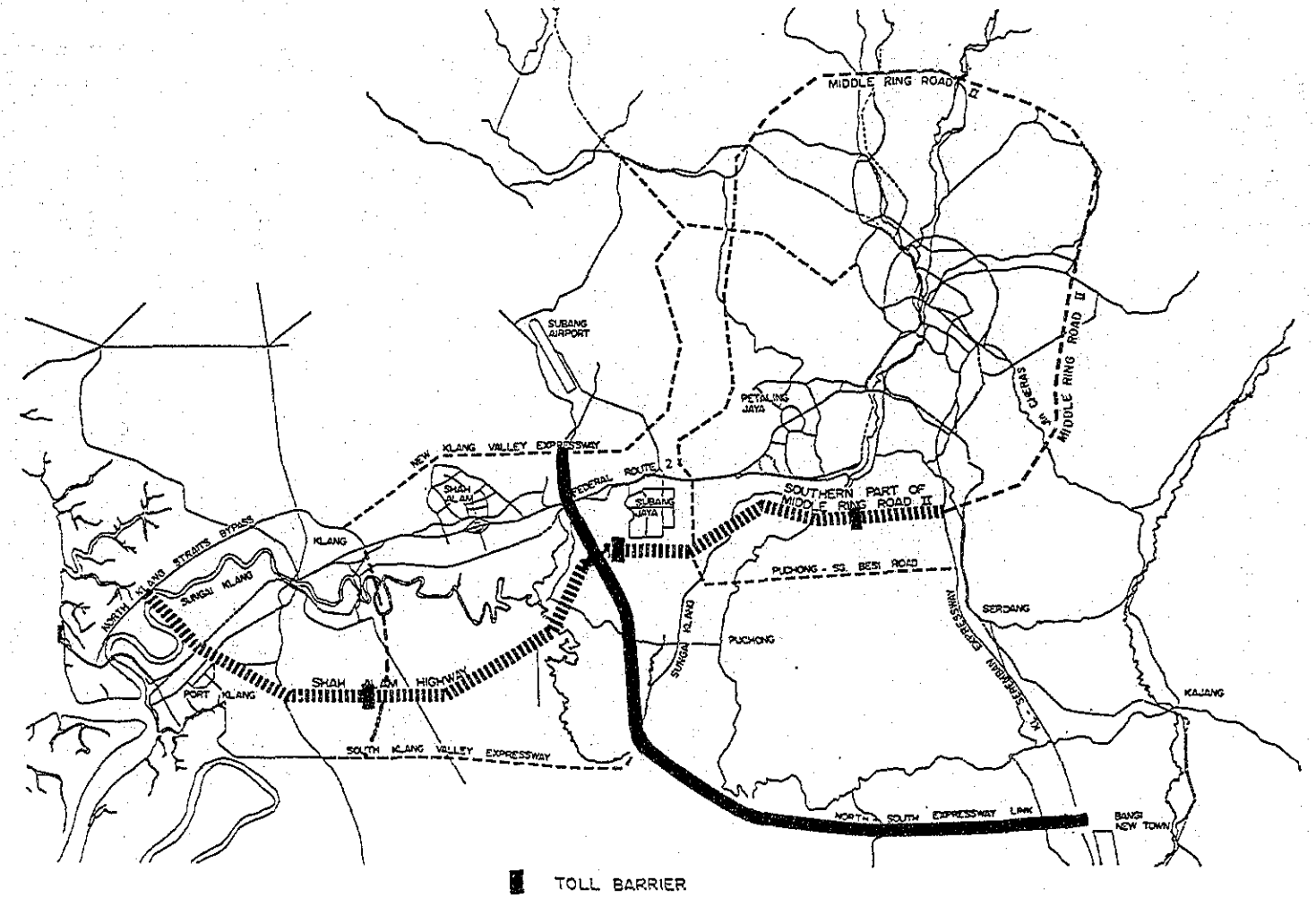


Figure I-10: Proposed Toll Levy System on Project Roads (Ultimate Scheme)

THE FEASIBILITY STUDY ON TRANSPORTATION FACILITIES PROJECTS IN KLANG VALLEY

LEGEND:

CLOSED SYSTEM BY DISTANCE PROPORTIONAL TARIFF

OPEN SYSTEM BY ZONE TARIFF

SCALE : 0 1 2 5 10 km

N

5.3 Interchange Plan

In determining the optimum number of interchanges and its location on the Project Roads, alternative interchange plans prepared based on landuse, population and employment distribution plans, functional road network in Klang Valley and consideration on traffic demand were evaluated on the following aspects:-

(a) Traffic volume at the interchanges
(b) Toll revenue expected
(c) Roadway and interchange construction costs
(d) Average interchange interval at the existing expressway and highway in Klang Valley
(e) Urban development consideration

Comparative analysis on the various interchange plans indicated that the alternative plan with twenty-two (22) interchanges on the Project Roads is the optimum one among all others because:-

(a) the cost-performance of this plan is comparatively higher than other plans;

(b) compared with the average interchange interval at existing expressway and highway in Klang Valley, the proposed interchange interval is rather modest;

(c) eventhough HICOM East IC on N-S Link has the smallest traffic volume among all the interchanges, it is still an important interchange to promote industrial development in Shah Alam especially that of the national car project (PROTON) at HICOM area; to enhance the transportation of manufactured goods from HICOM to other parts of Peninsular Malaysia, and to promote housing development around the HICOM area.

(d) without HICOM East IC, traffic into HICOM area and the neighbouring housing development area from N-S Link will have to make a longer detour by using either Shah Alam East IC or Subang South IC and the local roads.

(e) HICOM East IC is also found to be necessary from the aspect of preserving a good environment in the housing development area because heavy vehicle traffic into HICOM area will have direct access to the factories rather than making detours on local roads.

Therefore, the proposed interchange plan shown in Figure I-11 is justified in this Study.

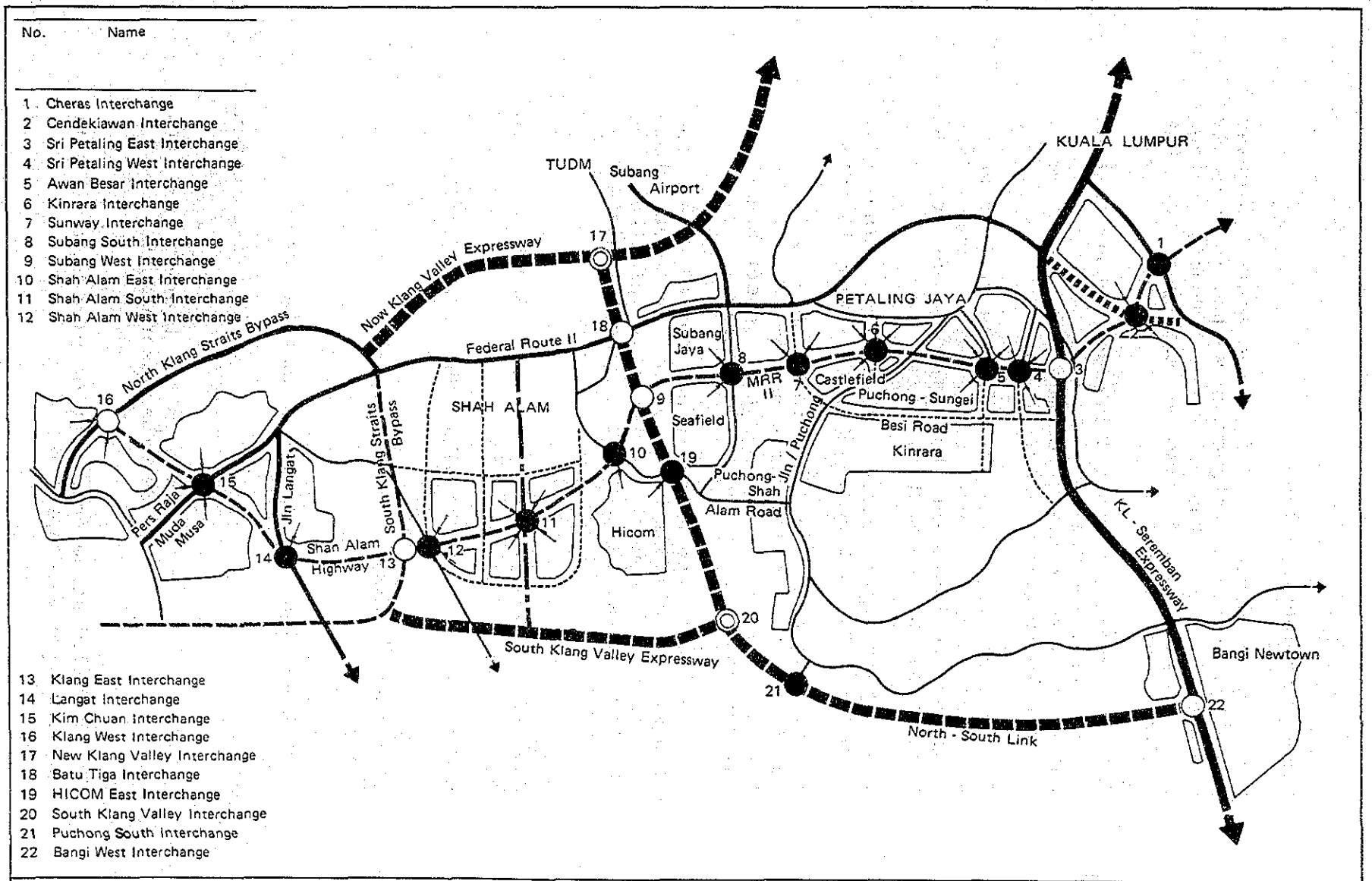


Figure I-11: Location of Interchanges on Project Roads

THE FEASIBILITY STUDY ON TRANSPORTATION FACILITIES PROJECTS IN KLANG VALLEY

5.4 Stage Construction Plan

For the construction of large-scale highway projects, stage construction method is commonly employed. For the Project Roads, stage construction should also be employed for the following reasons:-

(a) to ease the financial burden of huge initial construction cost;
(b) to utilize construction man-power, equipment, etc. more effectively.

Considering the large scale of the Project Roads and the high project cost, the Study Team proposes to implement the Project Roads by the stage construction method.

The stage construction plan is principally formulated by considering the following factors:-

(a) Traffic demand on the Project Roads,
(b) Functional road network system,
(c) Urban development along the Project Roads,
(d) Economic and financial viability.

Such a plan is principally determined after the economic and financial viability have been confirmed. However, a tentative plan based on the first three (3) factors can be formulated as follows:-

Stage 1

Shah Alam Highway/ MRR-II	:	KL-Seremban Expressway to HICOM
N-S Link	:	NKVE to Shah Alam Highway

Stage 2

Shah Alam Highway/ MRR-II	:	HICOM to Jalan Langat

Stage 3

Shah Alam Highway/ MRR-II	:	Jalan Langat to NKSB
	:	Jalan Cheras to KL-Seremban Expressway
N-S Link	:	Shah Alam Highway to KL-Seremban Expressway

The detailed stage construction plan however will be discussed in Chapter 8.

6. PRELIMINARY ENGINEERING STUDY

6.1 Right-of-Way (R.O.W.) Situation

The land availability for the project road was confirmed in principle by Selangor State Planning Department and Dewan Bandaraya Kuala Lumpur. Table I-11 presents the proposed R.O.W. for the Project Roads.

The following descriptions reveal the land condition related to the Project Roads.

Table I-11: Right-of-Way for Project Roads

Project Roads	Section	Proposed R.O.W. (m)
Shah Alam Highway	Klang West IC - CH. 0+600	50
	CH. 0+600 - CH. 6+000	40
	Ch. 6+000 - Shah Alam West IC	60
	Shah Alam West IC - Shah Alam East IC	80*1
	Shah Alam East IC - Sunway IC	60
Middle Ring Road II	Sunway IC - Sri Petaling West IC	60*3
	Sri Petaling West IC - Sri Petaling East IC	80*2
	Sri Petaling West IC - Cheras IC	40*4
North-South Expressway Link	New Klang Valley IC - CH. 3+700	80*2
	CH. 3+700 - Bangi West IC	60
	Direct Access to Bangi Town Centre	40

Notes: *1 60m wide road reserve for throughway and 20m for frontage road which is provided by developers of land fronting the existing Jalan Bukit Kemuning

*2 60m wide road reserve for throughway and 20m for frontage road which is used to maintain the function of existing roads

*3 60m road reserve includes a 10m wide frontage road wherever necessary

*4 40m wide road reserve includes a 10m wide frontage road but R.O.W. is reduced to 30m in HAR Holding, Rumah Tulin and Taman Taynton area

6.2 Geological Analysis and Soil Survey

(1) Ground Condition

Subsurface soil conditions were explored by drilling 15 boreholes at seven major structure sites. The load bearing stratum has been found to vary from 10m below ground level at Klang River Bridge site to 40m at Klang West IC site. A depth of 20m to 30m is found elsewhere.

(2) Engineering Properties of Construction Materials

A series of laboratory test were performed on soil samples collected from possible quarry site and soil pits at Subang, Bangi and Puchong to determine their engineering properties. The soil is found to be marginally suitable for roadbed embankment and the mining sand may be used for subbase course.

6.3 Geometric Design Standard

(1) Geometric Design Standard

The recommended geometric design standard for the Project Roads is derived mainly from existing standards prepared by JKR and LLM. Some necessary supplements are made and the recommended design standard is tabulated in Table I-12.

(2) Design Section of Each Road

Due consideration must be given to the provision of adequate capacity to meet traffic demand as well as attaining economic and financial viability when designing a roadway.

Each road must then be examined in various design sections where different design standards may be applied to achieve the abovementioned objective. However, for reasons of traffic safety and impact of design on actual construction, it is desirable to use the same standard on a continuous roadway as far as possible.

Table I-12 Design Control and Element of Roads

Items	Road	Throughway			Ramp		
		Southern Part of Middle Ring Road II	Shah Alam Highway	North-South Link	Semi-Direction	Loops and Diagonal	Loops and Diagonal
Design Control	Design Standard	Arterial (U5)	Arterial (U5)	Expressway (R6)	-	-	-
	Design Vehicle	Truck Combination (WB-50)	Truck Combination (WB-50)	Truck Combination (WB-50)	Truck Combination (WB-50)	Truck Combination (WB-50)	Truck Combination (WB-50)
	Design Speed (km/h)	80	80	120	60	50	40
	Design Daily Capacity (veh/day/Lane)	11,700	9,400	8,800	7,200	7,500	7,500
Element of Design	Sight Distance (m)	140	140	285	85	65	45
	Lane Width (m)	3.50	3.50	3.75	3.50	3.50	3.50
	Outer Shoulder Width (m)	3.00 (1.50)	3.00 (1.50)	3.00 (1.50)	3.00 (1 Lane) 0.75 (2 Lanes)	3.00 0.75	3.00 0.75
	Inner Shoulder Width (m)	0.75	0.75	0.75	0.75	0.75	0.75
	Crossfall of Travelled Way (%)	2.5	2.5	2.5	2.5	2.5	2.5
	Crossfall of Outer Shoulder (%)	4	4	4	4 (1 Lane) 2.5 (2 Lanes)	4 2.5	4 2.5
	Type of Pavement	Asphalt Concrete	Asphalt Concrete	Asphalt Concrete	Asphalt Concrete	Asphalt Concrete	Asphalt Concrete
	Maximum Superelevation (%)	10	10	7	7	7	10
	Minimum Radius (m) Max.Grade(%) (Desirable) (Absolute)	230 4 7	230 4 7	650 2 5	125 5 8	85 6 8	50 7 10
Remarks		( ) Value for bridge and viaduct section, of length more than 100m					

MRR-II and Shah Alam Highway will be divided into the following three design sections:-

(a) Jalan Cheras to KL-Seremban Expressway : 6-lane major arterial

(b) KL-Seremban Expressway to South Klang Straits Bypass : 6-lane highway with exclusive cycle track

(c) South Klang Straits Bypass to NKSB : 4-lane highway

N-S Link will be divided into two (2) sections:-

(a) NKVE to Shah Alam Highway : 6-lane expressway

(b) Shah Alam Highway to KL-Seremban Expressway : 4-lane expressway

(3) Typical Cross-section

The typical cross-sections shown in Figures I-12, I-13 and I-14 are proposed based on the recommended design standard and proposed right-of-way.

6.4 Interchange Plan and Design

The location of the proposed twenty-two (22) interchanges on the Project Roads is already shown in Figure I-11. According to the categorization of interchanges by service level in terms of mobility, there are three (3) system interchanges (Class A) located on N-S Link, five (5) system interchanges (Class B) and fourteen (14) service interchanges on both Project Roads. Practical-type interchange designs are adapted to suit their functionality on the Project Roads as illustrated in the interchange plan shown in Figures I-15 and I-16.

SHAH ALAM HIGHWAY

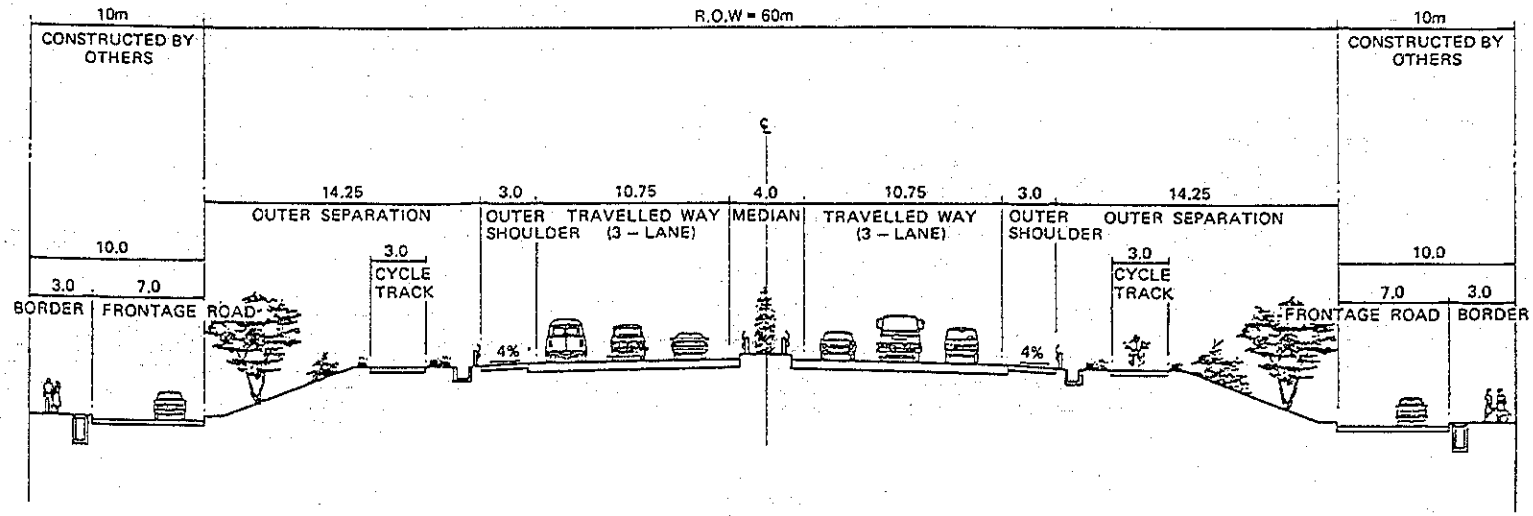


Figure I-12: Typical Cross-section for Shah Alam Highway

SCALE : 4 2 0 2 4 6 metres

DRAWING NO : DATE :

THE FEASIBILITY STUDY ON TRANSPORTATION FACILITIES PROJECTS IN KLANG VALLEY

JAPAN INTERNATIONAL COOPERATION AGENCY

MIDDLE RING ROAD II

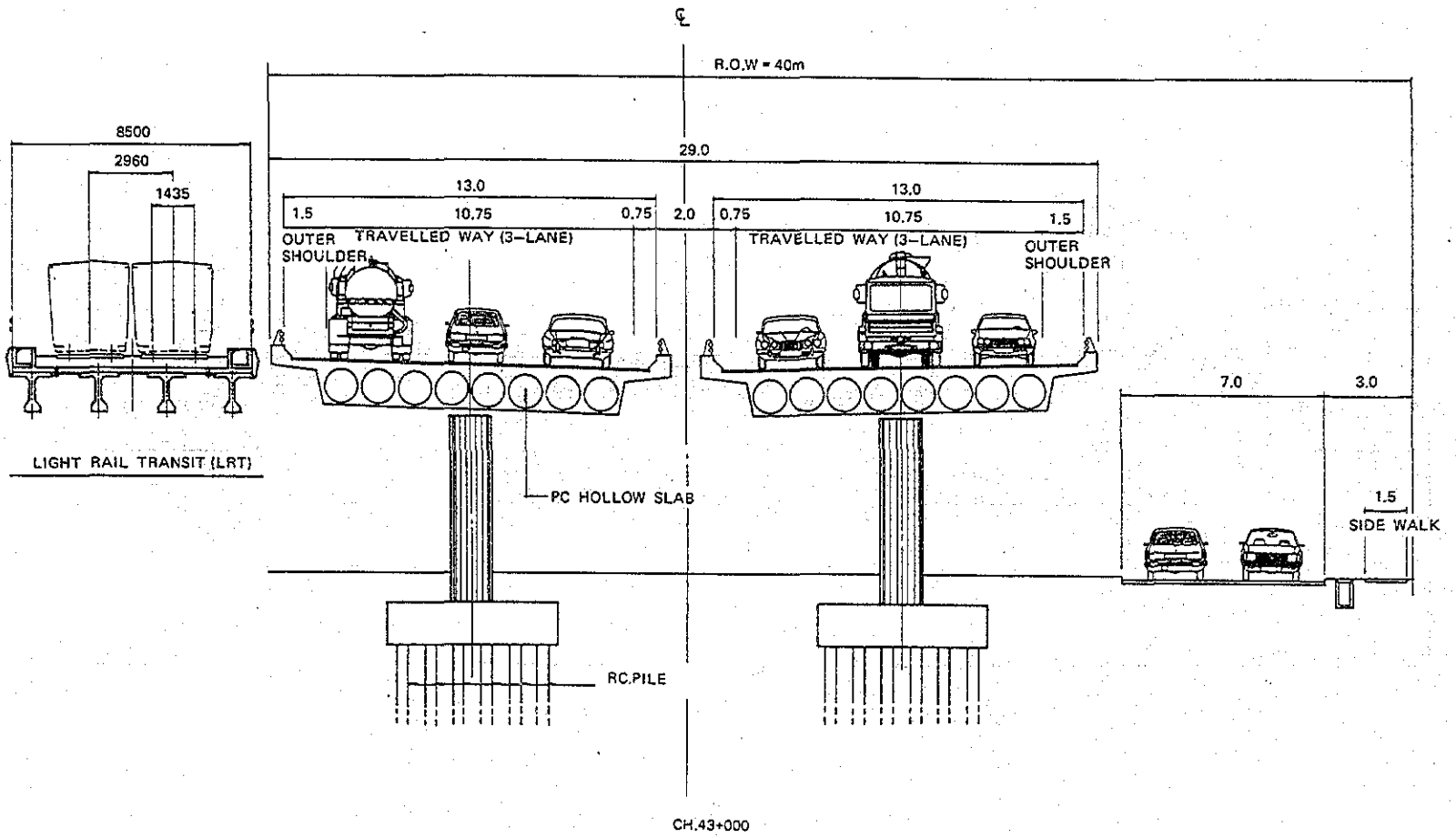


Figure I-13: Typical Cross-section for Middle Ring Road II

SCALE : 2 1 0 2 metres 4

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THE FEASIBILITY STUDY ON TRANSPORTATION FACILITIES PROJECTS IN KLANG VALLEY

JAPAN INTERNATIONAL COOPERATION AGENCY

NORTH–SOUTH LINK

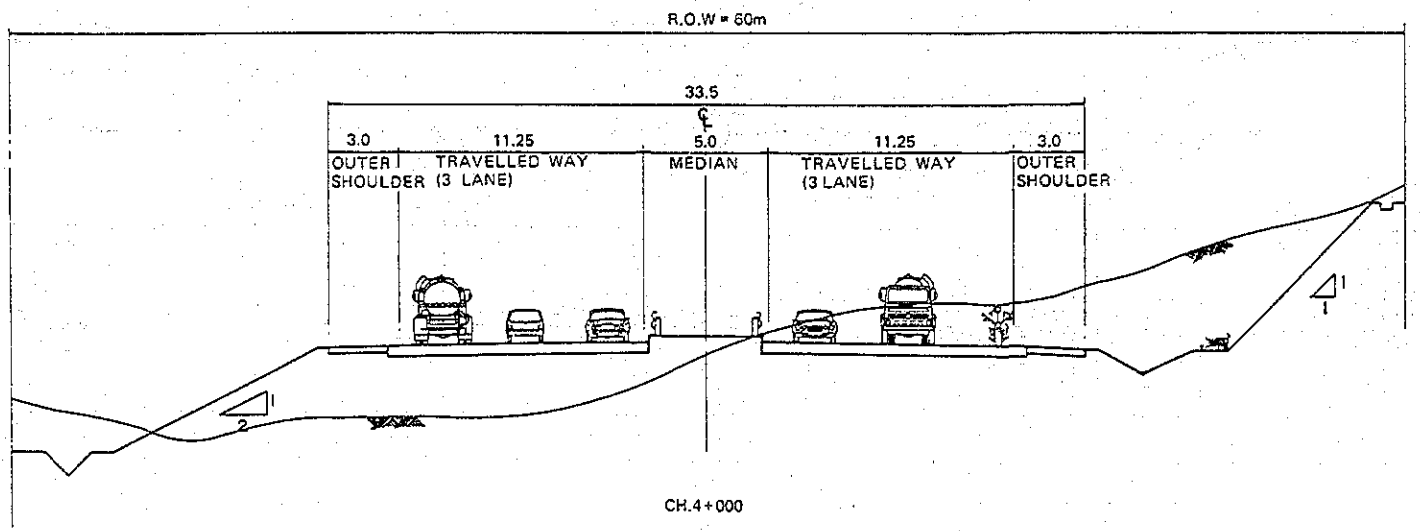

Figure I-14: Typical Cross-section for N-S Link

SCALE : 2 1 0 2 4 6 metres

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THE FEASIBILITY STUDY ON TRANSPORTATION FACILITIES PROJECTS IN KLANG VALLEY

JAPAN INTERNATIONAL COOPERATION AGENCY

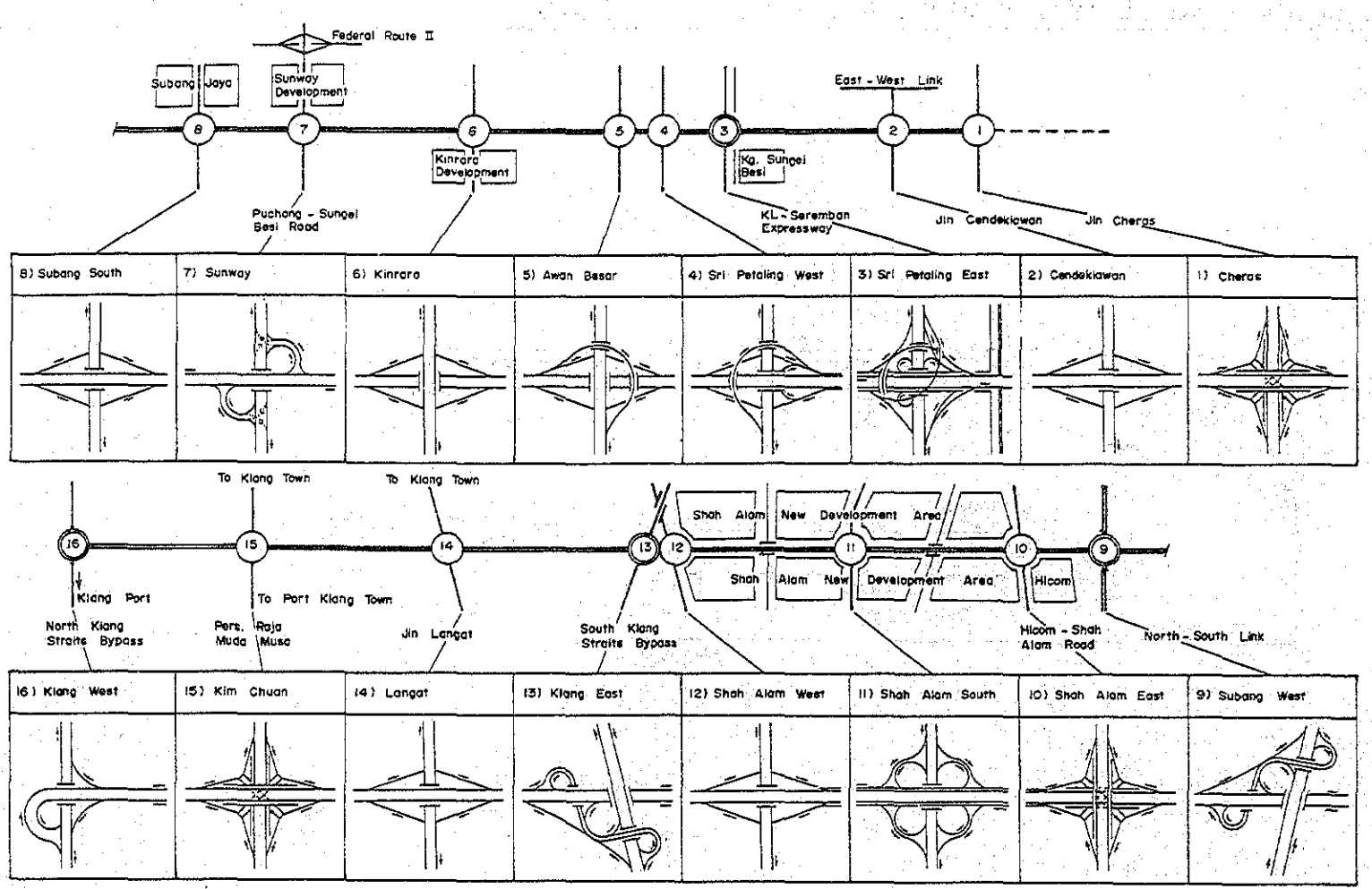


Figure I-15: Proposed Interchange Design on Shah Alam Highway/MRR-II

THE FEASIBILITY STUDY ON TRANSPORTATION FACILITIES PROJECTS IN KLANG VALLEY

LEGEND:

- SYSTEM INTERCHANGE B
- SERVICE INTERCHANGE

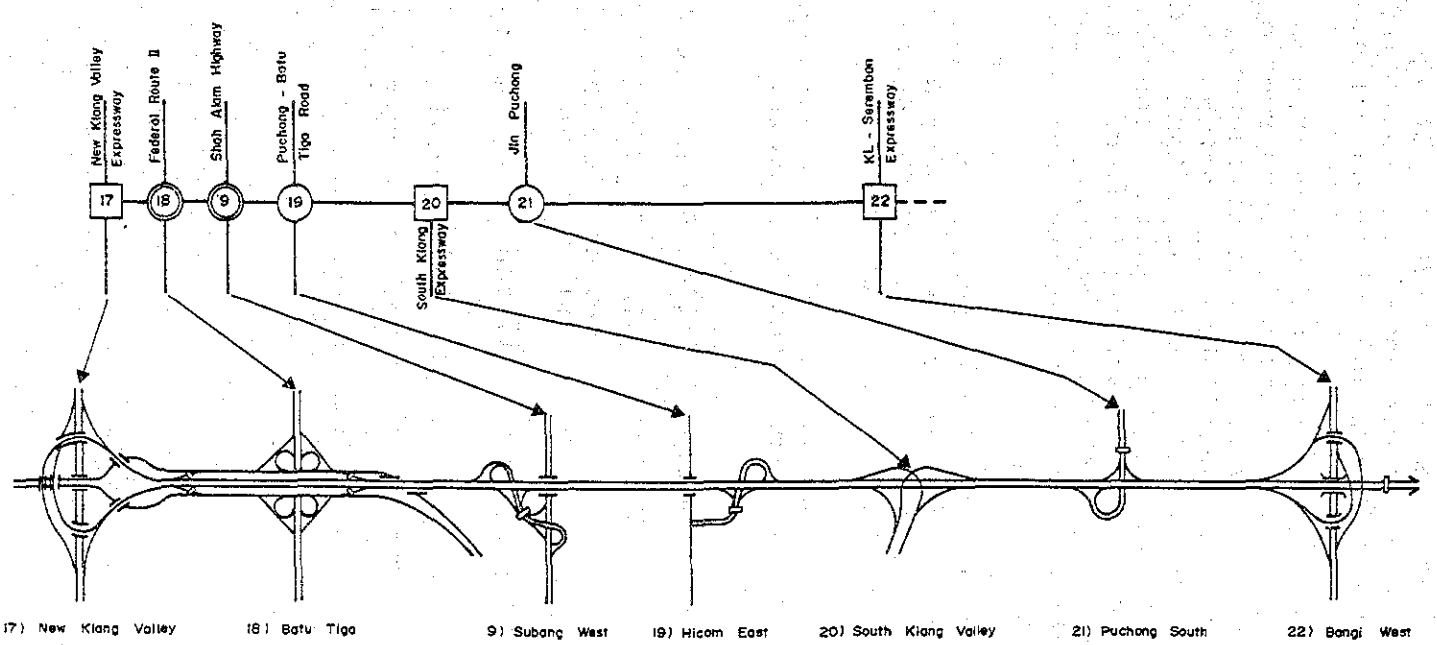


Figure I-16: Proposed Interchange Design on N-S Link

THE FEASIBILITY STUDY ON TRANSPORTATION FACILITIES PROJECTS IN KLANG VALLEY

LEGEND:

- SYSTEM INTERCHANGE A
- SYSTEM INTERCHANGE B
- SERVICE INTERCHANGE
- TOLL PLAZA

6.5 Design of Bridges and Other Structures

Major structures along the project roads include four bridges across Sungai Klang with waterways width ranging from 60m to 260m, bridges over other rivers, interchange bridges, viaducts, flyovers, box culverts and retaining walls.

Selection of bridge type and dimensions is done taking into account not only construction and maintenance economy but also other factors, some of which are unquantifiable in nature. Among these, safety is the most important. Others include durability, aesthetics, consistency, environmental quality and performance, ease of construction, rider's comfort, ease of reconstruction and dismantling and ease of widening, etc.

There are 43 bridges/viaducts on Shah Alam Highway/MRR-II and 47 bridges/ viaducts on N-S Link, i.e. a grand total of 90 bridge/viaduct structures on the Project Roads.

The total bridge length and bridge area on the Project Roads are summarized as follows:-

Table I-13: Summary of Bridge Length and Area

Project Roads	Road Length (m)	Bridge Length (m)	Bridge Area (sq.m)
Shah Alam Highway/MRR-II	47,700	9,876	190,834
N-S Link	33,700	4,704	56,678
Total	81,400	14,570	247,512

6.6 Design of Pavement

(1) General

Pavements can be broadly classified into flexible and rigid types.

In selecting the type of pavement for each road, the following features of each of the pavement types are taken into consideration:-

(a) Ease of construction and maintenance,
(b) Resistance to rotting and wearing,
(c) Stage construction,
(d) Materials used,
(e) Skid resistance,
(f) Initial investment,
(g) Difficulty in repair.

Considering the climatic and environmental conditions, physical properties and condition of the roadbed soils and the heavy traffic volume use in Klang Valley, the most reasonable design procedure was selected from procedures as described in the AASHTO Interim Guide.

(2) Optimum Design of Flexible Pavement Structure

Flexible pavement is recommended for throughway, ramps, frontage roads and bridges. The optimum design of flexible pavement structure for each road segment is as follows:-

Table I-14: Optimum Design of Flexible Pavement Structure

Segment	Design Structure Number	Total Thickness (cm)
SHAH ALAM HIGHWAY/MRR-II		
Klang West IC-Cheras IC	4.85	51
Klang East IC-Klang West IC	4.65	54
N-S LINK	4.65	54

(3) Optimum Design of Rigid Pavement Strucutre

Rigid pavement with slab thickness of 30cm is recommended in toll plaza area for all road segments.

7. PROJECT COST ESTIMATES

7.1 Bases for Cost Estimates

Construction cost of each road section is estimated on the following bases:-

(1) The direct construction cost is estimated by the quantity take-off of construction work items from the preliminary engineering plans;

(2) The unit price of each work item is determined based on the economic conditions prevailing in June 1988;

(3) The cost of each work item is found by multiplying quantity and unit price and is split into foreign currency and local currency portions, both indicated in Malaysian Ringgit;

(4) Land acquisition and compensation includes land cost and compensation for the property destroyed and the relocation of public utilities;

(5) Physical contingency is assumed to be 10% of the total of direct construction cost;

(6) Consulting and supervisory services fee is estimated to be 3% of direct construction cost;

(7) Final engineering services fee is estimated as 5% of direct construction cost; and

(8) The exchange rates used to convert Malaysian Ringgit to Japanese Yen and US Dollar are M$2.60 = US$1.00 = Yen 125.

7.2 Summary of Estimated Construction Cost

(1) Total Construction Cost of Ultimate Scheme

The total construction cost of the ultimate scheme in 1988 prices is estimated as follows:-

Table I-15: Total Construction Cost of Ultimate Scheme

Shah Alam Highway/MRR-II	.. M$	673.5 million
N-S Link	.. M$	358.6 million
Total	.. M$	1,032.1 million

(2) Total Construction Cost of High Priority Sections

Section 2 (HICOM to Jalan Langat) and Section 3 (KL-Seremban Expressway to HICOM) of Shah Alam Highway/MRR-II and Section 1 of N-S Link (NKVE to Shah Alam Highway) are regarded as high priority sections of the Project Roads.

The cost of each high priority section in 1988 prices is estimated as follows:-

Table I-16: Construction Cost of High Priority Sections
(M$ million)

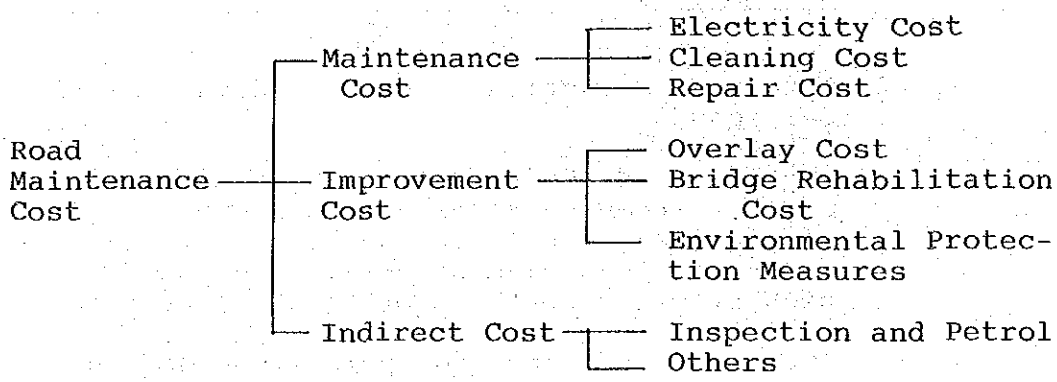
Road	Section	No.of Lane	Construction Cost	Land Acquisition Cost	Total Cost
Shah Alam Highway/ MRR-II	Section 2	2	54.1	9.1	63.2
		4	75.8	21.1	96.9
	Section 3	4	130.8	15.3	146.1
		6	164.1	22.2	186.3
N-S Link	Section 1	2	49.2	4.0	53.2
		4	60.4	4.0	64.4

7.3 Road Maintenance and Toll Operation Cost

(1) Road Maintenance

The term "road maintenance" is defined as the preserving and keeping of each type of roadway, roadside structure and facility as nearly as possible in its original condition as constructed or as subsequently improved and the operation of road facilities and services to provide satisfactory and safe transportation.

Road maintenance cost is estimated for the following items:-



(2) Toll Operation

The toll operation works mainly consist of toll management and toll levy.

The tollway management includes:-
- Supervision of tollway operations;
- Maintenance and repair of tollway facilities and equipment;
- Traffic control and provision of information; and
- Administration.

The current manpower requirement for toll operation by LLM is adopted in this Study.

(3) Cost of Road Maintenance and Toll Operation

The summary of road maintenance and toll operation costs is as follows:-

Table I-17: Road Maintenance and Toll Operation Cost

Shah Alam Highway/MRR-II	.. M$ 8,731,600/year
N-S Link	.. M$ 5,890,600/year
Total	.. M$14,622,200/year

8. PROJECT EVALUATION

8.1 Economic Evaluation

(1) Objectives and Assumptions

The economic evaluation of the Project Roads has two objectives: one is to confirm the economic feasibility of the proposed scheme and the other is to discern the priority sections in order to assume an implementation schedule for evaluations hereinafter.

Evaluation is first carried out for the whole length and by section under the condition that the project is assumed to be implemented from 1991 to 1994.

Evaluation is then made again on the whole project when it is implemented according to the implementation schedule established by the priority analysis.

The basic assumptions for the evaluation are as follows:-

(a) The life of project roads is assumed to be twenty (20) years;
(b) The discount rate is 12% per annum;
(c) Benefit flow begins from the year 1995.

(2) Evaluation of the Total Project

The economic viability of the total project is evaluated based on the assumed schedule.

The economic indicators obtained are shown in Table I-18. The results show that both Shah Alam Highwa/MRR-II and N-S Link are highly economically feasible projects.

Table I-18: Economic Evaluation Indicators for Total Project

	B/C Ratio	NPV (M$mil)	IRR (%)
Total Project	1.96	525.0	21.3
Shah Alam Highway/MRR-II	2.52	570.5	25.7
N-S Link	3.24	390.1	28.5

(3) Evaluation by Section

Table I-19 shows the economic evaluation results of the projects by road section. Except for the section from Jalan Langat to NKSB of Shah Alam Highway/MRR-II, the B/C ratios for all other sections are over 1.0

The highest B/C ratio is found for the short-stretch of N-S Link from New Klang Valley Expressway to Subang West IC, followed by the section of Shah Alam Highway/MRR-II between KL-Seremban Expressway to HICOM and between HICOM to Jalan Langat.

Accordingly, these sections should be given a higher priority than the other sections in implementation.

Table I-19: Economic Evaluation Indicators by Section

Section	B/C Ratio	NPV (M$mil)	IRR (%)
SHAH ALAM HIGHWAY/MRR-II			
Jalan Cheras to KL-Seremban Ex'way	1.6	50.6	19.0
KL-Seremban Ex'way to HICOM	4.6	425.1	37.5
HICOM to Jalan Langat	2.2	102.7	23.0
Jalan Langat to NKSB	0.8	-19.7	9.5
N-S LINK			
NKVE to Shah Alam Highway	4.8	186.3	41.0
Shah Alam Highway to KL-Seremban Ex'way	1.9	131.5	20.6

Note: Discount Rate .. 12% per year
Project Life .. 20 years

(4) Evaluation According to the Proposed Implementation Schedule

The project implementation is scheduled for the period from 1991 to 2000. The economic feasibility is thus re-examined for the total project according to the proposed implementation schedule described in Table I-29 (page I-62).

The results of the benefit cost analysis tabulated in Table I-20 show that the project as a whole is highly economically feasible if it is implemented according to the proposed schedule. The indicators show that a net present value amounting to M$593 million and a B/C ratio of 2.63 can be expected.

Table I-20: Economic Evaluation Indicators for the Whole Project Based on the Proposed Implementation Schedule

B/C Ratio	..	2.63
NPV (M$million)	..	593.0
IRR (%)	..	30.0