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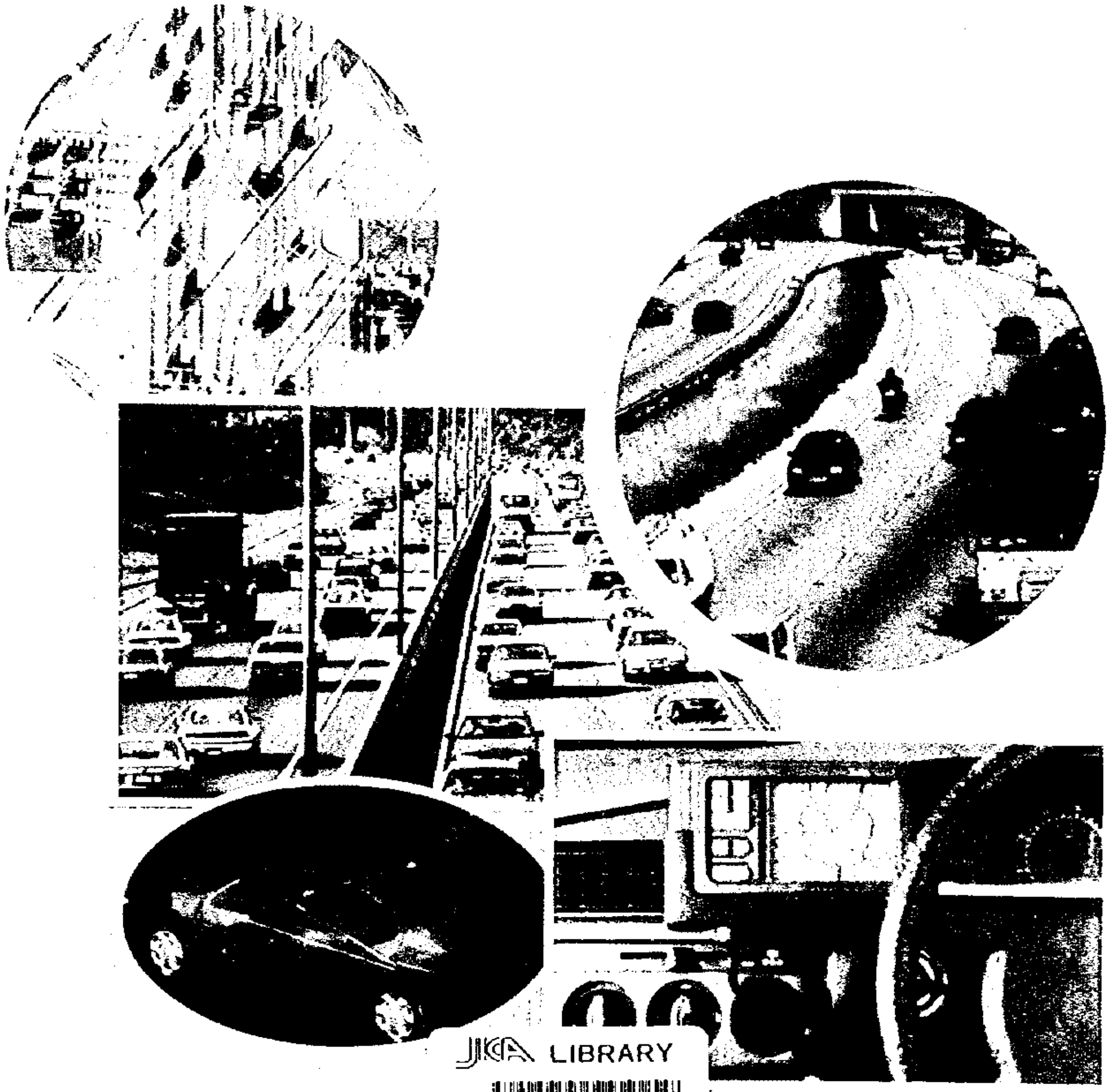
NO.: 2

Study On Integrated Transport Information Systems (ITIS) In Klang Valley And The MSC In Malaysia

Final Report October 1999



LEMBAGA LEBUHRAYA MALAYSIA

JAPAN INTERNATIONAL COOPERATION AGENCY(JICA) MALAYSIA OFFICE

SUBMITTED BY :

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Study On Integrated Transport Information Systems (ITIS) In Klang Valley And The MSC In Malaysia Final Report Octobe

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PREFACE

At the request of the Government of Malaysia, the Government of Japan decided conduct a Study on Integrated Transport Information Systems (ITIS) in Klang Valley and the MSC in Malaysia and entrusted the study to the Japan International Cooperation Agency (JICA).

JICA Malaysia Office selected and engaged a study team headed by Dr. Tai Tuck Leong of Perunding Trafik Klasik Sdn. Bhd. and consisting of an Intelligent Transport System (ITS) Expert Mr. Seiya Matsuoka from Japan and other Telecommunication & Electronics Experts from Malaysia for a period between March 1999 and September 1999.

The Coordinating Committee headed by Dato' Chua Soon Poh, Director-General of Malaysian Highway Authority (MHA), was set up to coordinate, examine and guide the study team from a technical point of view.

In addition, JICA HQ dispatched to Malaysia Mr. Tomokazu Wachi, Pacific Consultants International, and Mr. Shozo Shirasaki, Fukuyama Consultants Co., Ltd., four times between February 1999 and October 1999, who monitored and assisted in the conduct of the study.

The study team held discussions with the officials concerned of the Government of Malaysia, conducted field surveys at the study area, analyzed a lot of relevant data and prepared this final report.

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

Finally, I wish to express my sincere appreciation to the stakeholders concerned from both the private and public sectors in Malaysia for their close cooperation extended to the study.

October 1999

Kazutoshi Iwanami
Resident Representative
Japan International Cooperation Agency
Malaysia Office

October 1999

Resident Representative
Japan International Cooperation Agency
Malaysia Office

Dear Mr. Kazutoshi IWANAMI,

Letter of Transmittal

We are pleased to formally submit herewith the final report on "A Study of Integrated Transport Information Systems (ITIS) in Klang Valley and the MSC in Malaysia".

This report prepares the groundwork and basis for the introduction of an Integrated Transport Information Systems (ITIS) for the Klang Valley and the MSC. A conceptual planning and design of an ITIS is also provided. It includes deliberations on a system architecture, estimate of costs and benefits, implementation schedules and the necessary institutional arrangements.

The successful completion of this project was made possible with the efforts and contributions from many people. And hence we would like to express our sincere gratitude and appreciation to all those people for their kind assistance and co-operation to the Study Team. In particular, officials from the Malaysia Highway Authority, the counterpart agency, have provided us with invaluable assistance.

At the same time, we would also like to acknowledge the kind help from all the officials of your agency, the JICA Technical Advisory Committee and the Embassy of Japan in Malaysia.

We hope the report would be able to contribute substantially to the improvement of urban transport environment in the Klang Valley and the MSC.

Very truly yours,

Dr. Tai Tuck Leong
Team Leader
ITIS Study Team

LIST OF ABBREVIATIONS

		Chapter
MSC	Multimedia Super Corridor	1
ITS	Intelligent Transport System	1
ITIS	Integrated Transport Information System	1
BOT	Build-Operate-Transfer	1
KLCC	Kuala Lumpur City Centre	2
KLIA	Kuala Lumpur International Airport	2
MPSJ	Subang Jaya Municipality in Petaling Jaya	2
IRR	Inner Ring Road	2
MRRI	Middle Ring Road I	2
MRRII	Middle Ring Road II	2
NSCL	North South Central Link	2
LDP	Lebuhraya Damansara Puchong	2
SAE	Shah Alam Expressway	2
NKVE	North Klang Valley Expressway	2
EWL	East-West Link	2
NKBP	North Klang Bypass	2
CPA	Central Planning Area	2
KTM	Keretapi Tanah Melayu	2
STAR	Sistem Transit Aliran Ringan	2
PUTRA	Projek Usahasama Transit Automatik Sdn Bhd	2
PLUS	Projek Lebuhraya Utara Selatan	2
TCS	Traffic Control Signals	3
SCATS	Sydney Coordinated Adaptive Traffic System	3
HDD	Hard Disk Drive	3
CCTV	Closed Circuit Television	3
PTZ	Pan-Tilt-Zoom	3
VMS	Variable Message Signage	3
TMB	Telekom Malaysia Berhad	3
TP	Toll Plaza	3
HQ	Head Quarters	3
EVA	Enhanced Variable Actuation	3
LLM	Malaysian Highway Authority	3
NEP	National Enterprise Privatisation	3
NTP	National Telecommunication Policy	3
UPM	University Putra Malaysia	3
OPP	Outline Perspective Plan	4

		Chapter
HNDP	Highway Network Development Plan	4
AVI	Automatic Vehicle Identification	6
DRGS	Dynamic Route Guidance System	7
UPS	Un-interruptible Power Supply	8
TPM	Technology Park Malaysia	8
GPS	Global Positioning System	8
RM	Malaysian Ringgit	9
SMS	Short Messaging System	10
MDC	Multimedia Development Corporation	11
NITC	National Information Technology Council	11
CCC	City Command Centre	11
PDC	Putrajaya Development Corporation	11
REAM	Road Engineering Association of Malaysia	11

EXECUTIVE SUMMARY

EXECUTIVE SUMMARY

1.0 BACKGROUND

It has become increasingly obvious to urban transport planners that better management of travel demand and the optimal use of existing facilities are some of the crucial measures to take in overcoming traffic-related problems. Development in the field of Intelligent Transport Systems (ITS) in recent years has provided a powerful tool in this endeavour to mitigate traffic congestion on roads, improve transport efficiency, improve traffic safety and the general urban environment. The ability to remotely control and monitor traffic using new technology has presented a new dimension in managing traffic in highly congested and saturated road networks.

The prime objective of ITS is to create a safe, comfortable, efficient, environment-friendly and highly mobile society. ITS integrates human, road and vehicle using the leading edge information and communication technologies. It covers a wide range of systems, which gather and disseminate various road and traffic-related information to road users.

The Malaysian Government recognises the necessity of ITS, particularly the role of transport information, to achieve an effective and optimal utilisation of road infrastructure in the metropolitan area. Mid-term Review of the Seventh Malaysia Plan 1996 – 2000 endorses this recognition and stipulates that "Intelligent Transport Systems (ITS), which involve the deployment of advanced electronics, communications and IT for monitoring, tracking and real-time information on traffic flows and volumes, will be used on a wider scale." Under such circumstances, the Malaysian Government requested the Japanese Government to conduct a study on the Integrated Transport Information System (ITIS) in Klang Valley and Multimedia Super Corridor (MSC).

The Japanese Government accepted the request and Japan International Co-operation Agency (JICA) the official agency responsible for the implementation of the technical co-operation program of the Government of Japan is to undertake the study. A local consultant was subsequently engaged by JICA to carry out the work. The study officially started on 22nd of March 1999 and was completed after six (6) months on 21st September 1999.

2.0 OBJECTIVES OF THE STUDY

The objectives of the study, as stipulated in the Terms of Reference, are as follows:

- To provide assistance for Malaysia to go into the Information Technology Society in the field of transportation which is believed to ensure the betterment of quality of life;
- To obtain necessary data and information for the introduction of the Integrated Transportation Information System (hereinafter referred to as "ITIS"); and
- To formulate a guideline on the Integrated Transport Information System in Klang Valley, which will contribute to solve the traffic woes in the region.

The Study area covers the whole Klang Valley region and Multimedia Super Corridor.

3.0 INTEGRATED TRANSPORT INFORMATION SYSTEMS (ITIS) AND INTELLIGENT TRANSPORT SYSTEM (ITS)

3.1 ITS And ITIS

Intelligent Transport System (ITS) may be defined as a transport system in which human, vehicle, road and transport facilities are dynamically integrated for the purpose of achieving a safe, efficient, comfortable and environmentally sound transportation system.

Integrated Transport Information System (ITIS) is a subset of ITS. It focuses more on the use of information in road traffic. The system collects, processes and disseminates information related to road traffic for road users and road administrators in a comprehensive and timely manner to promote safe and efficient road traffic. This relationship between ITS and ITIS is shown in *Figure ES1.0*.

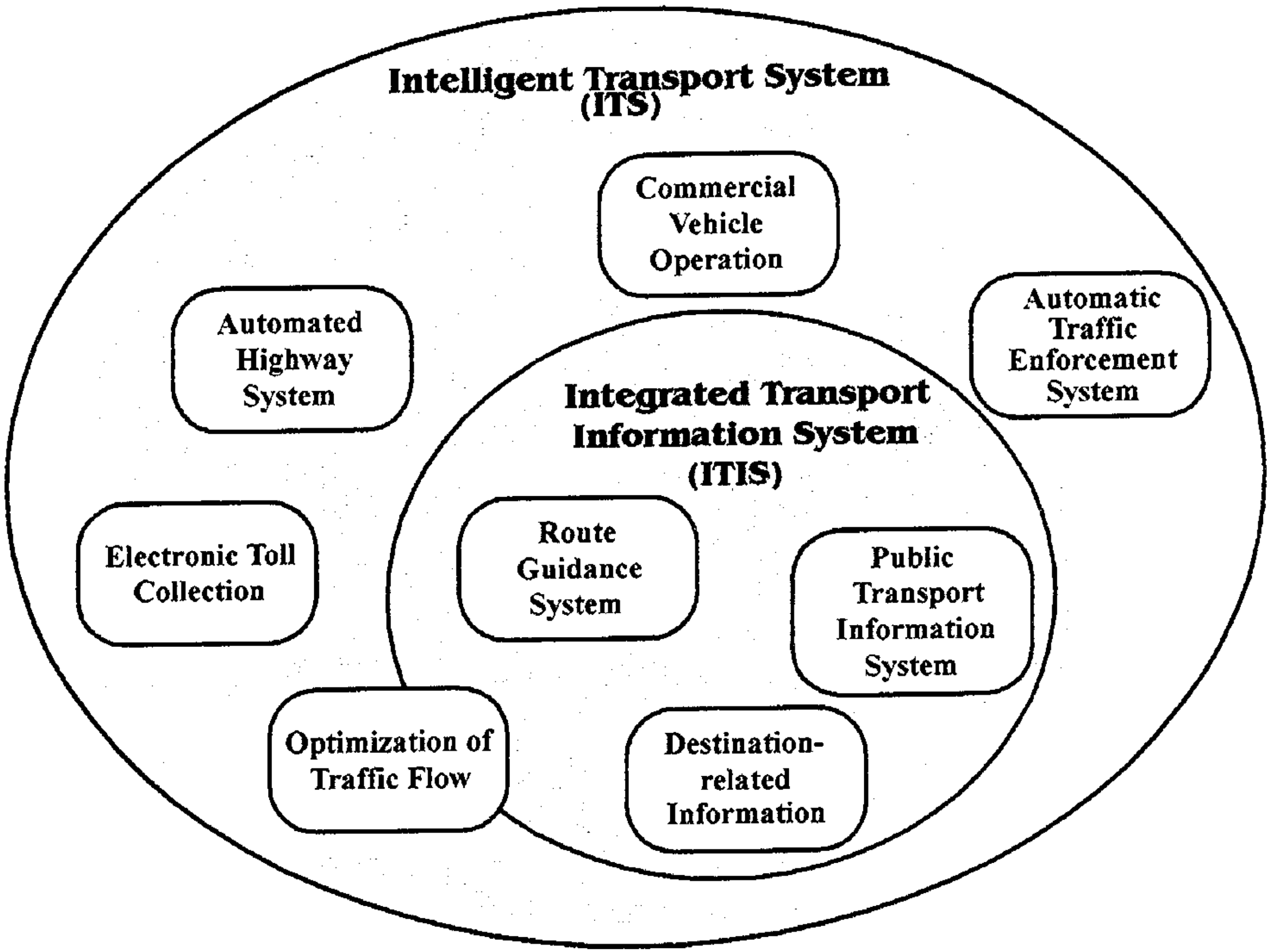


FIGURE ES1.0 : RELATIONSHIP BETWEEN ITS, ITIS AND USER SERVICE

3.2 Necessity of ITIS

The current traffic situation in the Study Area suggests great potential for the deployment of ITIS to optimise the utilisation of existing road transport infrastructure and the SMURT-KL Study conducted in 1998 lends support to its need.

According to the opinion survey conducted in this Study, more than 60% of the drivers interviewed regard various traffic information as important to them. Among the information, 'severity of congestion', 'route guidance' and 'cause of congestion' ranked highest and the percentage of respondents who consider these kinds of information very important or important, are 96%, 89% and 83%, respectively.

According to the same opinion survey, an overwhelming 94% of drivers responded that they would take alternative routes if information on traffic congestion were provided to them.

The collective loss time of all drivers could be very substantial and the nation's productivity is thus seriously affected by traffic problems. ITIS can contribute significantly in mitigating CO_2 emissions thereby preserving the environment.

3.3 Selection ITIS Services in the Study Area

Eight (8) ITIS user services were selected for further examination for purposes of introducing them to the Klang Valley and the MSC:

- Pre-trip traveller information system
- En-route driver information system
- Traveller services information system
- Route guidance system
- Parking availability information system
- Environmental monitoring system
- Emergency vehicle management system
- Public transportation information system

The factors in the prioritising of user services are as follows:

- Need for user service
- Beneficiary and potential amount of benefits
- Information availability
- Technology used
- Ease of implementation

Each user service is rated according to the evaluation criterion. The priority is finally classified into four groups, A through D, where A has the highest priority whilst D has the lowest. See Table 3.1.

Pre-trip traveller information and en-route driver information systems belong to Group A. They are highly needed, produce large benefit and are relatively simple to implement. Their immediate introduction is recommended.

Route guidance system, parking guidance system and public transport information system are rated as Group B. They have high demand and large to medium benefits. Although data collection for route guidance system is a complex task, data already collected for the pre-trip traveller information and en-route driver information systems can provide a strong foundation for establishing a route guidance system. For this reason, route guidance system is considered as an expansion of the pre-trip traveller and en-route driver systems and can be introduced one or two years later.

Table 3.1 Priority Ranking of User Services

	User Services	Needs	Benefits	Information availability	Technology	Implementation	Overall Priority
1	Pre-trip traveller information system	Large (3)	Large (3)	Moderate (2)	Moderate (2)	Simple (3)	A (13)
2	En-route driver information system	Large (3)	Large (3)	Moderate (2)	Moderate (2)	Simple (3)	A (13)
3	Traveller service information system	Small (1)	Small (1)	Moderate (2)	Moderate (2)	Moderate (2)	D (8)
4	Route guidance system	Large (3)	Large (3)	Complex (1)	Advanced (3)	Complex (1)	B (11)
5	Parking guidance system	Large (3)	Medium (2)	Simple (3)	Conventional (1)	Simple (3)	B (12)
6	Environmental monitoring system	Medium (2)	Small (1)	Simple (3)	Moderate (2)	Moderate (2)	C (10)
7	Emergency vehicle management system	Medium (2)	Small (1)	Moderate (2)	Advanced (3)	Moderate (2)	C (10)
8	Public transportation information system	Large (3)	Medium (2)	Moderate (2)	Advanced (3)	Moderate (2)	B (12)

Note : numbers in ( ) are scores

4.0 ROAD USERS AWARENESS AND OPINIONS ON ITIS

The opinion surveys were conducted at a variety of land uses at various locations. The locations selected to conduct these surveys include Kuala Lumpur city centre, Petaling Jaya, Klang, Shah Alam, Subang Jaya and Gombak.

In total, more than 800 forms were distributed, following which a return of approx. 560 forms was achieved.

For private vehicle users, the overwhelming majority of those interviewed considered congestion or route guidance information as very important or important, followed by estimated journey time and parking information.

Between 30% to 40% of those interviewed are willing to pay for the items of such traffic information. This is considered to be an encouraging response, as many of them have had little or no direct experience on the workings of this Integrated Traffic Information System.

For public transport users, it is clear that the general public in the Klang Valley area is very interested in traffic information, in particular in traffic congestion and route choice information for private vehicle users, and in bus route information for public transport users. More than 90% of those surveyed considered the above-mentioned information as important or very important.

5.0 CONCEPTUAL PLANNING AND DESIGN OF AN ITIS IN KLANG VALLEY

5.1 Pre-Trip Traveller And En-Route Driver Information Systems

The Integrated Traffic Information System, which offers pre-trip traveller information and en-route driver information, will be installed to the study area in two phases, Phase 1 system and Phase 2 system, in terms of system functions and coverage area. The functions of Phase 1 and Phase 2 system are summarised in Table 5.1. Conceptual system configuration of the traffic information system at the final stage is presented in *Figure ES2.0*.

It is expected that in Year 2003 the Phase 1 system becomes operational, while the Phase 2 system in Year 2006.

Table 5.1 System Functions

	Phase 1	Phase 2
Concept	Basic traffic information system	Advanced In-vehicle traffic information system
Information collection	**Objective** • Monitor traffic flow/condition • Detect incidents/queues • Estimate travel times along selected routes • Exchange data with other systems	**Objective (additional)** • Compute travel time • Estimate travel time for car navigation service
	Location • All toll roads and highways • Frequent congestion/queue and bottleneck road section/spots • High traffic volume road sections on arterial and major distributors	**Location (additional)** • Other arterial and distributor roads within the study area
	Equipment • Vehicle detector (ultrasonic and inductive loop) • TV camera	**Equipment** • AVI detector • Additional detector • Additional TV camera
Information processing	**Information to be processed and compiled :** • Congestion levels • Queue length • Incident • Travel time • Other information manually collected and input (accident, roadwork, regulation, events, etc.) • Processing of data obtained from other systems	**Information to be processed and compiled :** • Enhancement of coverage area and accuracy of information processed in Phase 1 • Link travel time for car navigation
Information dissemination	**Information to be disseminated :** • Congestion levels • Incident • Travel time • Manually input information	**Additional information to be disseminated :** • Travel time for car navigation
	Equipment for pre-trip • Radio broadcasting • Telephone inquiry • Internet • Cable TV	
	Equipment for en-route • Variable message sign • Graphic display panel • Travel time display • Highway radio	**Equipment for en-route** • FM sub-carrier broadcasting

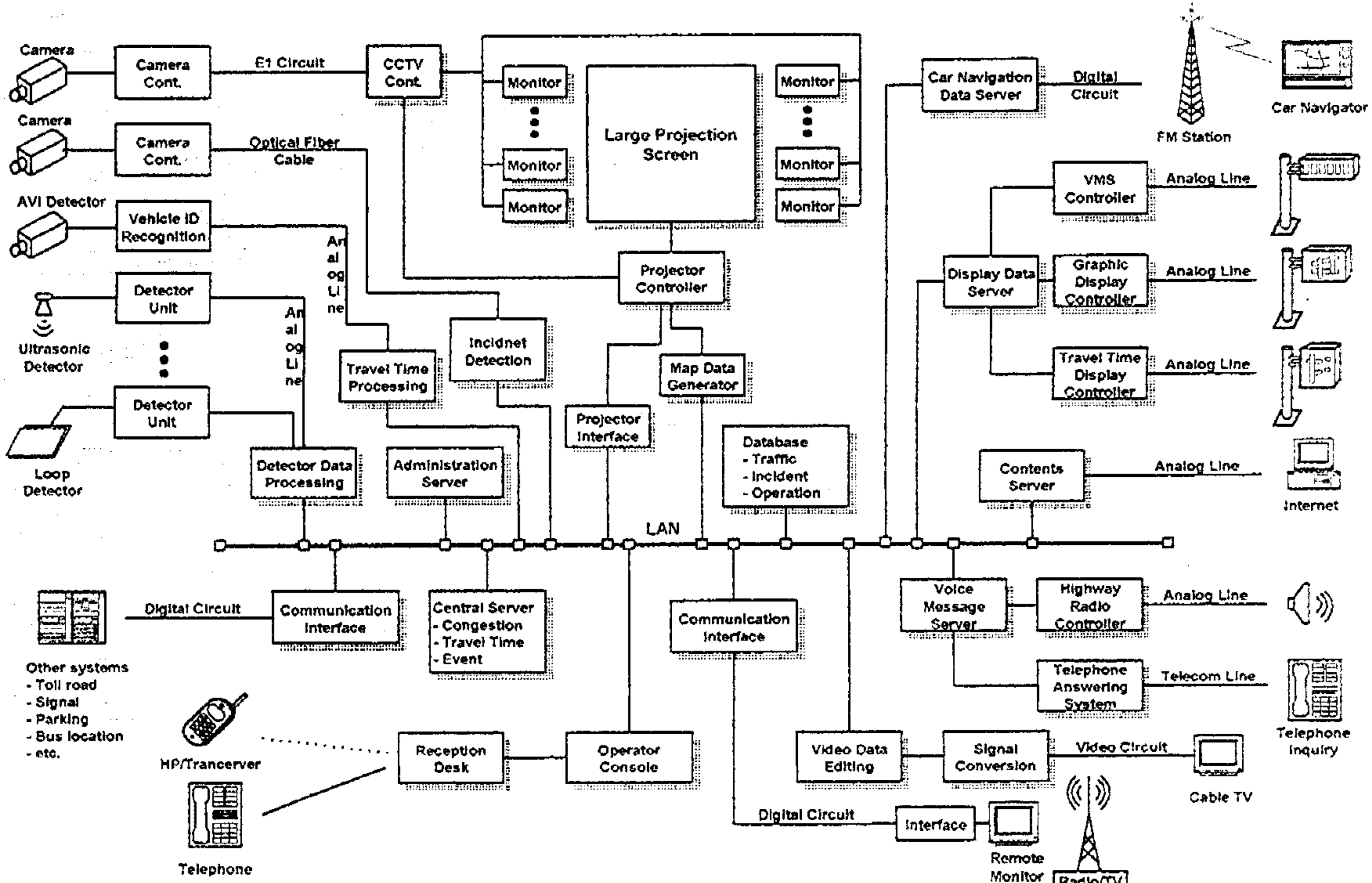


Figure ES2.0 : Conceptual Configuration of Pre-trip Traveler and En-route Driver Information

The proposed system will cover the Klang Valley and the Multimedia Super Corridor with a lesser number of links included in Phase 1. In Phase 1, traffic condition data will be gathered at all the toll roads and highways such as Federal Highway II in the study area, and arterial roads mostly within Kuala Lumpur and Petaling Jaya. Phase 1 will therefore covers a total of 564.2km of roads, out of which 290.8km are highways. In Phase 2, links will be added which include newly opened toll roads and highways, if any, and more arterial and distributor roads in the study area. Phase 2 will cover another 414.4km of road. Table 5.2 shows the road network and their breakdown by categories for Phase 1 and 2. *Figure ES3.0* shows the road network selected for ITIS deployment.

Table 5.2 Details of Road Network

		Phase 1	Phase 2	Total
Network	No. of road sections	260	143	403
	No. of links	520	286	806
Distance by road type	Total (km)	564.2	414.4	978.6
	Highway	290.8	69.6	360.4
	Arterial	180.8	55.9	236.7
	Distributor	92.6	288.9	381.5
By Toll & Non-Toll	Toll (km)	276.5	59.7	336.2
	Non-toll	287.7	354.7	642.4
By Traffic volume	Heavy volume (km)	332.7	112.4	445.1
	Medium/light volume	231.5	302.0	544.5

The ITIS Centre is a nucleus of the proposed integrated traffic information system where data are gathered and processed, communications directed, decisions made, information and instruction issued and traffic and operation data stored.

In this study, the location of the ITIS centre is set at Technology Park Malaysia (TPM) in Bukit Jalil for the basic design purpose. The proposed TPM site has the advantages of being centrally located within the coverage network, within the MSC corridor to enjoy MSC status and in the hub of high technology research activities in Malaysia.

5.3 Parking Guidance System

Parking guidance system is intended to provide parking availability information to the drivers looking for a parking space so that driver can save the time spent in searching for a vacant parking slot. Parking lot availability can be expressed in two levels. At a macro level, availability is expressed as the number of remaining parking lots, while at a micro level, location of vacant lot is identified.

Table 5.3 Function of Parking Guidance System

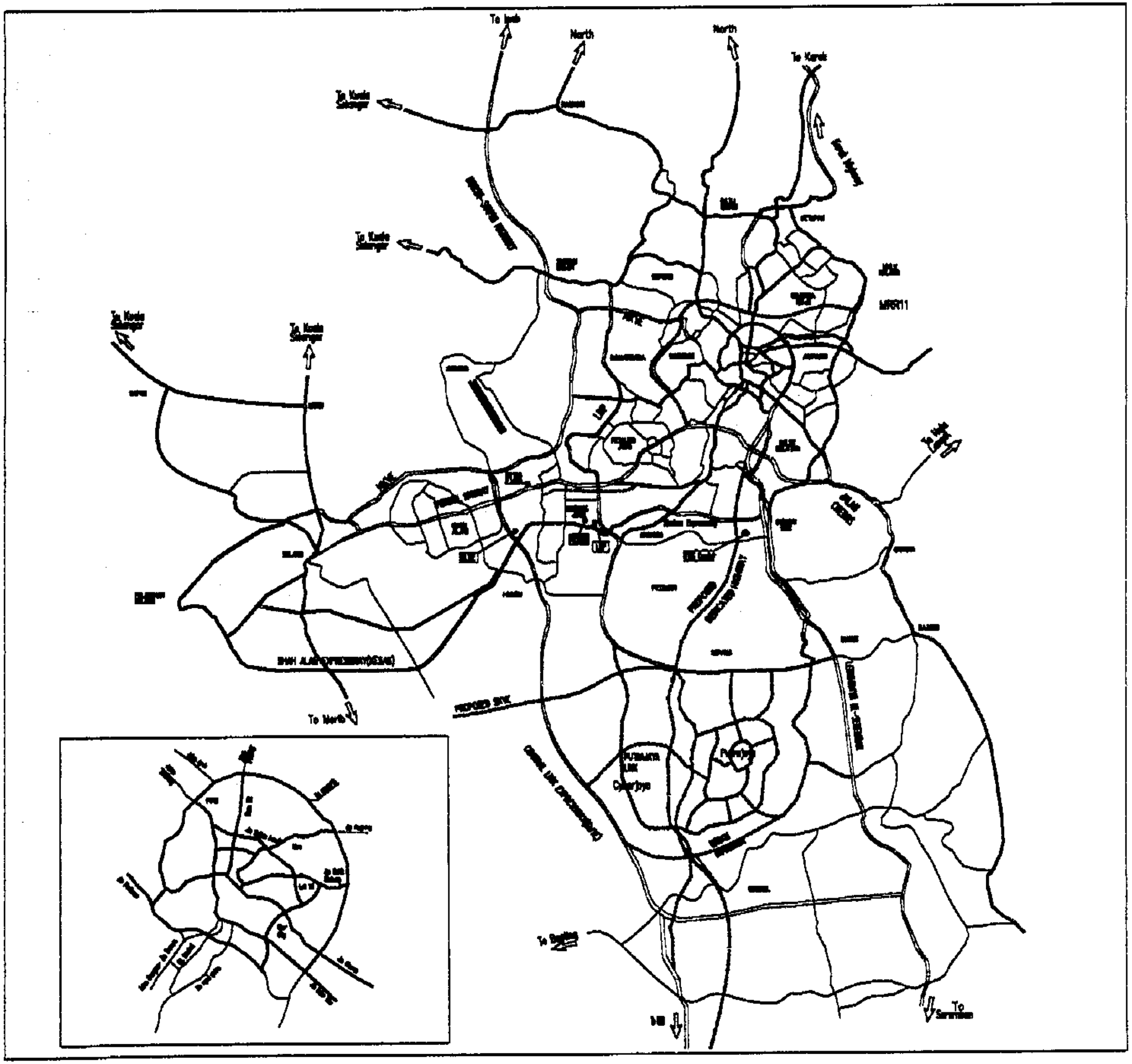
Sub-system	Function
Information collection	• Collects information on - Open/close status of parking area - Number of parking lots available
Information processing	• Determines display contents • Monitors the operation of the equipment comprising the system • Exchanges information with ITIS Centre • Logging of system operation
Information dissemination	• Displays on signboard - Open/close status of parking area - Number of parking lots available

5.4 Public Transport Information System

Public transport information system is useful to both bus users and bus operators. For bus passengers waiting at bus stop, bus location information provides approximate waiting time until the next bus arrives thus relieves the user's stress of uncertainty.

Table 5.4 Function of Public Transport Information System

Sub-system	Function
Information collection	• Collects information on - Bus ID, route number, status - Geographical location data
Information processing	• Determines bus location along the route • Prepares display data on the signboard • Monitors the operation of the equipment comprising the system • Exchanges with ITIS Centre • Logging of system operation
Information dissemination	• Displays on the signboard at bus stop - Location of bus for the requested route - Bus routes and their destinations/timetables



A Study on Integrated Transport Information System (ITIS) in Klang Valley And The MSC in Malaysia

Figure : ES3.0

Phase 2 Road Network

LEGEND :

- EXPRESSWAY/HIGHWAY
- MAJOR ARTERIALS
- MAJOR DISTRIBUTORS
- FUTURE ROADS

0 5 10km

Scale :

N

Perunding Trafik Klasik Sdn Bhd

6.0 PRELIMINARY DESIGN FOR PRE-TRIP TRAVELER AND EN-ROUTE DRIVER INFORMATION SYSTEMS

6.1 System Architecture & Functional Subsystems

The proposed integrated traffic information system which offers two main user services of pre-trip traveller information and en-route driver information systems, consists of three functional subsystems, namely information collection, information processing and information dissemination subsystems. The system architecture is shown in *Figure ES4.0.*

Traffic congestion, incidents, construction work, temporary regulation, and other information that affect the traffic flow will be collected both automatically and manually.

Information processing system at the ITIS Centre will be a computer network, in which several computers and other devices are inter-connected through a local area network (LAN).

A real-time database will be established in the control centre system. The database must be capable of coping with the requirements of the on-line real-time traffic information system and operating without manual intervention or periodic shutdown. The database will collect and store the following data:

- Traffic information
- Incident information
- System administration

Information is disseminated to drivers and potential road users through various means.

The proposed ITIS network will utilise a mix of digital and analogue leased circuits from telecommunication operators. Use of the existing transmission system facilities owned by the toll road operator and installing self-owned cable network may be exploited to find out the most suitable transmission system. In this basic design, however, leased line in a star network is assumed for simplicity and time constraint.

6.2 Cost Estimates & Expected Benefits

Cost of the proposed integrated traffic information system project is estimated by examining the costs for three different components of the project; namely engineering services, system construction, and operation and maintenance. It must be noted that the project cost presented here is only a rough estimate meant to be an indication on the size of project. The estimated costs are shown below:

Table 6.1 Cost Summary

	Phase 1 (RM Million)	Phase 2 (RM Million)
Engineering service	26.7	15.9
System construction	460.4	282.8
Annual operation and maintenance	21.7	28.0

The proposed integrated traffic information system in Klang Valley and MSC can be expected to produce significant benefits. Among them, time saving brought about by the efficient use of the existing road network will be the biggest benefit. Other benefits include improved traffic safety, reduced adverse environmental impacts by traffic, and enhanced comfort and reliability in vehicular travel.

An attempt is made to estimate the amount of direct benefits to road users due to improved efficiency. Only savings in vehicle operating costs and travel time costs of drivers and passengers, which can be expressed in monetary terms, are considered in this report. The amount of benefits for the first ten years is shown in Table 6.2.

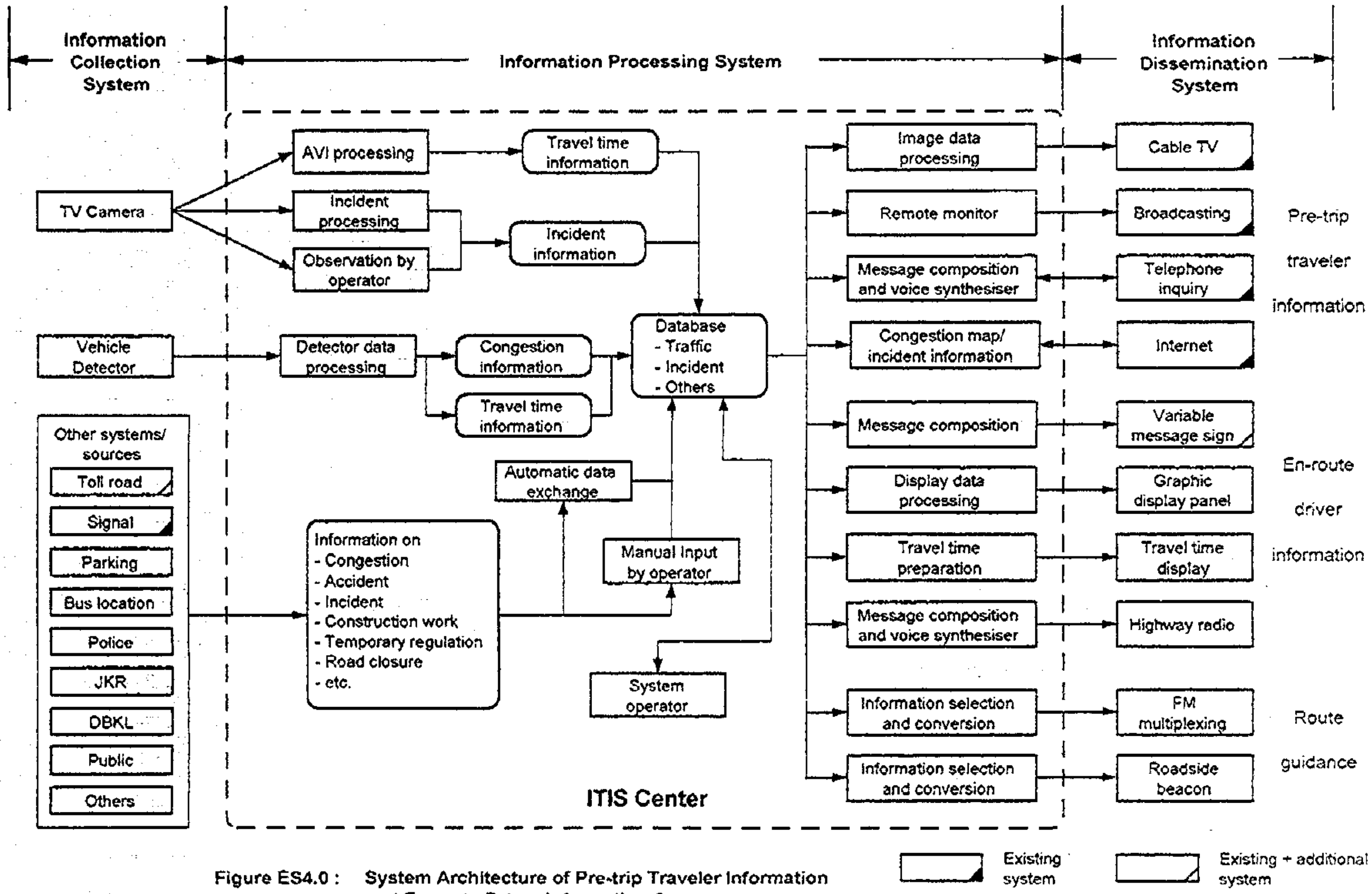


Figure ES4.0 : System Architecture of Pre-trip Traveler Information and En-route Driver Information Systems

Table 6.2 Annual Benefit by Travel Time Savings

Year	Benefit from Travel Time Saving		Total Benefits (RM – Million)
	Benefits by saving in travel time cost (RM - Million)	Benefits by saving in car operating cost (RM - Million)	
0	36.92	19.52	56.44
1	82.70	43.73	126.43
2	90.97	48.11	139.08
3	138.49	73.24	211.73
4	163.98	86.72	250.70
5	193.60	102.39	295.99
6	228.30	120.73	349.03
7	265.96	140.65	406.61
8	306.00	161.83	467.83
9	345.46	182.70	528.16
10	385.47	203.85	589.32
Total	2,237.86	1,183.48	3,421.33

Based on the estimated cost of engineering service, system construction, operation and maintenance, the amount of benefits shown above, and project implementation schedule presented in the next section, an economic internal rate of return of the project is calculated at 14.1% assuming the annual discount rate of 12%.

7.0 THE FUTURE AHEAD

7.1 Rationale For The Setting Up Of A Malaysia Traffic Information Authority

The implementation and operation of a successful ITIS involves many key industries notably the transport sector, telecommunication, broadcasting and so on. It also requires the active roles from both the public and private sectors. An administrative body is proposed for the implementation of ITIS in Malaysia with the following considerations.

1. The proposed ITIS will generate a large amount of social benefits that are difficult to quantify and collect from the beneficiaries. The Project should therefore be viewed as an important social infrastructure investment by the Government of Malaysia and thus should be implemented by the Government. It is not appropriate to be privatised as these information are of national security interests to the government and social in nature;
2. Many government agencies will be involved in regulating the various aspects of the ITS industry and an advisory committee or council make up of representatives from these various ministries or agencies to oversee the implementation should be formed to ensure consensus and compliance of various sector's requirements or regulations,
3. There are various existing systems operated by different organisations both public and private, that need to be integrated into the ITIS,
4. There is a need to have a single authority to facilitate the standardisation and integration of all traffic information gathering, processing and dissemination practice and procedure in the study area.
5. With the ITS industry still in its infant development stage in most of the countries in the region, there is a great opportunity for Malaysia to encourage home-grown ITS related industries through the implementation of the ITIS Project. Locally developed ITS technology may be exported to neighbouring countries in the near future.

An independent quasi-government agency, similar to agencies like the MHA, and tentatively called the Malaysia Traffic Information Authority (MTIA) should be formed to implement the ITIS Project, and to operate and manage the ITIS centres.

MTIA shall be a single agency that implements, manages and operates the ITIS and will eventually implement and manage the future car navigation system as well. The MTIA may be headed by a Director General to be appointed by the Government and who shall work closely with a council or steering committee. The council or steering committee shall be made up of representatives from the relevant agencies as shown in *FigureES5.0*.

Under this top management will be several divisions headed by technical directors. These may include Operation (system operation and ITIS centre), Planning, and Research & Development Divisions. To further strengthen the administration of MTIA, it could include the direct participation of other quasi government bodies like MHA, MIMOS and the MDC which are experienced traffic or IT related entities. The MTIA should also set up regional centres in the northern and southern regions of Peninsular Malaysia to facilitate information gathering and dissemination on a nation wide scale.

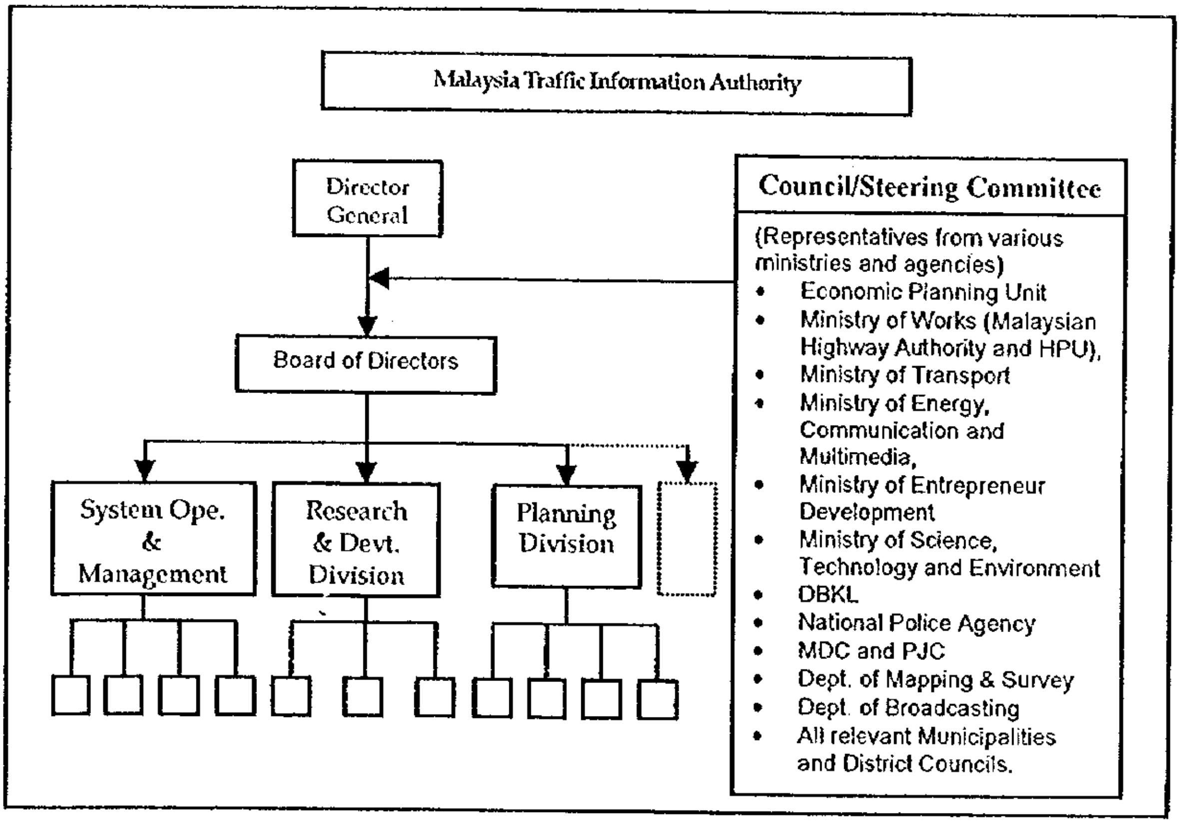


Figure ES5.0 : Proposed Administrative Set-up for MTIA

The specific roles and functions of MTIA shall therefore include:

- To implement the ITIS Project in the Klang Valley,
- To operate, manage and maintain the ITIS system,
- To facilitate the exchange of information between ITIS centre with those of the existing systems,
- To develop standard specifications, procedures and protocols to ensure interoperability among systems,
- To expand the system to other regions of the country, and
- To promote the research and development of ITS related industries in the country.

7.2 Implementation Program

A tentative schedule of project implementation is shown in *Figure ES6.0* assuming that the project is to be implemented in a shortest time. In order to realise the system, fund must be secured first of all. One of the possible fund sources is Yen credit loan offered by Japanese Government through Japan Bank for International Cooperation (JBIC, formerly Overseas Economic Cooperation Fund, OECF). The duration for this activity is difficult to estimate but it is expected that six to eight months are necessary. Then a consultant team will be selected to undertake the detailed design and tender preparation. The construction of the system itself is expected to take one and half year after the commencement of the work. If the project is initiated before the end of year 1999, the system will become operational in the middle of year 2003, about three and half years after the start.

The activities for Phase 2 system must start while the Phase 1 system is still under construction for the second phase system to be operational in 2006. The same process as Phase 1 system will be taken with shorter duration due to the less amount of work involved in Phase 2. It is pointed out, however, that new technology of car navigation system will be installed in Phase 2.

In the meantime, the Malaysian Traffic Information Authority proposed above will be established to manage the system and ITIS building will be constructed where all the central equipment will be placed.

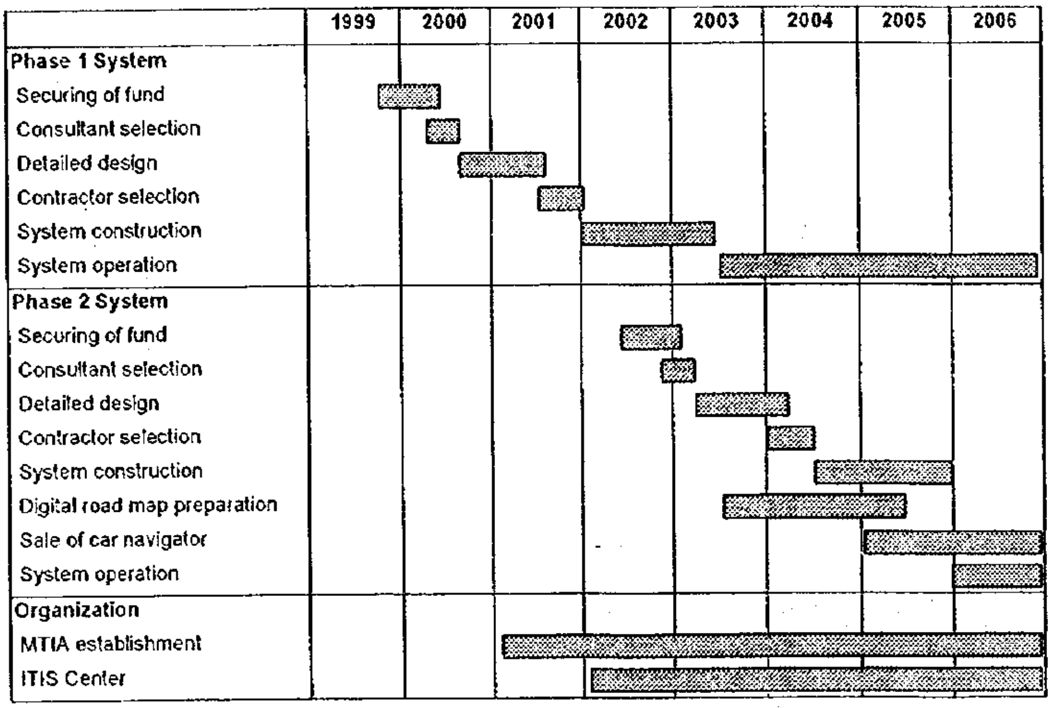


Figure ES6.0 : Implementation Schedule

7.3 Conclusion

Intelligent Transportation System (ITS) is gaining momentum in many developed countries in Europe, USA and Japan. There is a common understanding among these countries that ITS is one of the key technologies in the next millennium and without this technology, a country cannot survive in a severe international competition. It is hoped that with the good IT infrastructure already in place in Klang Valley and MSC, Malaysia would embark on the deployment of ITS now to help attain the vision of becoming a developed country in the year 2020.

PARTICIPANTS OF THE STUDY

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1

INTRODUCTION

1.0 INTRODUCTION

1.1 Background of the Study

Like many of the capital cities in South East Asia, Kuala Lumpur and its conurbation area commonly referred to as the Klang Valley Area is experiencing an ever increase in urban transport demand over the last two decades. This high transport demand has put great strain on its transport infrastructure, which find hard to catch up with the demand. The results have been worsening traffic congestion which then lead to lowering of road-based public transport services, overcrowding in buses and finally deteriorating urban living environment.

In Year 1997, there were an estimated 8.29 million trips a day within the region.* This represented some 1.87 million trips increase over the last ten years. Out of these, 6.28 million trips (or 76%) were made by motorised modes. Travel by cars and motorcycles alone accounted for 61% of the total trips made. With the new urban centres planned and under construction in Putrajaya and Cyberjaya to the south of the Klang Valley in a corridor now referred to as the Multimedia Super Corridor (MSC), travel demand in the region is expected to increase further in the near future.

The progress of motorization has significantly increased people's mobility and benefited many in obtaining accesses to health, education and other services. On the other hand, however, deterioration in the urban living environment, traffic accidents, pollution, congestion is estimated to have incurred huge losses to cities in the range of Billions of Malaysian Ringgits annually.

It has become increasingly obvious to urban transport planners that better management of travel demand and the optimal use of existing facilities are some of the crucial measures to take in overcoming these problem. Development in the field of Intelligent Transport Systems (ITS) in recent years has provided a powerful tool in this endeavour to mitigate traffic congestion on roads, improve transport efficiency, improve traffic safety and the general urban environment. The ability to remotely control and monitor traffic using new technology has presented a new dimension in managing traffic in highly congested and saturated road networks.

The prime objective of ITS is to create a safe, comfortable, efficient, environment-friendly and highly mobile society. ITS integrates human, road and vehicle using the leading edge information and communication technologies. It covers a wide range of systems, which gather and disseminate various road and traffic-related information to road users.

The Malaysian Government recognises the necessity of ITS, particularly the role of transport information, to achieve an effective and optimal utilisation of road infrastructure in the metropolitan area. Mid-term Review of the Seventh Malaysia Plan 1996 - 2000 endorses this recognition and stipulates that " Intelligent Transport Systems (ITS), which involve the deployment of advanced electronics, communications and IT for monitoring, tracking and real-time information on traffic flows and volumes, will be used on a wider scale." Under such circumstances, the Malaysian Government requested the Japanese Government to conduct a study on the Integrated Transport Information System (ITIS) in Klang Valley and Multimedia Super Corridor (MSC).

The Japanese Government accepted the request and Japan International Co-operation Agency (JICA) the official agency responsible for the implementation of the technical co-operation program of the Government of Japan is to undertake the study. A local consultant was subsequently retained by JICA to carry out the work. The study officially started on 22nd of March 1999 and has completed within six (6) months on 21st September 1999. This Final Report contains all the findings and outputs of the Study.

1.2 Objectives of the Study

The objectives of the study, as stipulated in the Terms of Reference, are as follows:

- To provide assistance for Malaysia to go into the Information Technology Society in the field of transportation which is believed to ensure the betterment of quality of life;
- To obtain necessary data and information for the introduction of the Integrated Transportation Information System (hereinafter referred to as "ITIS"); and
- To formulate a guideline on the Integrated Transport Information System in Klang Valley, which will contribute to solve the traffic woes in the region.

The Study area covers the whole Klang Valley region and Multimedia Super Corridor as shown in *Figure 1.2.1.*

The Interim Report was submitted in June 1999 and various comments were received from both JICA and the other agencies in the steering committee. Responses to these comments were incorporated into this Draft Final Report.

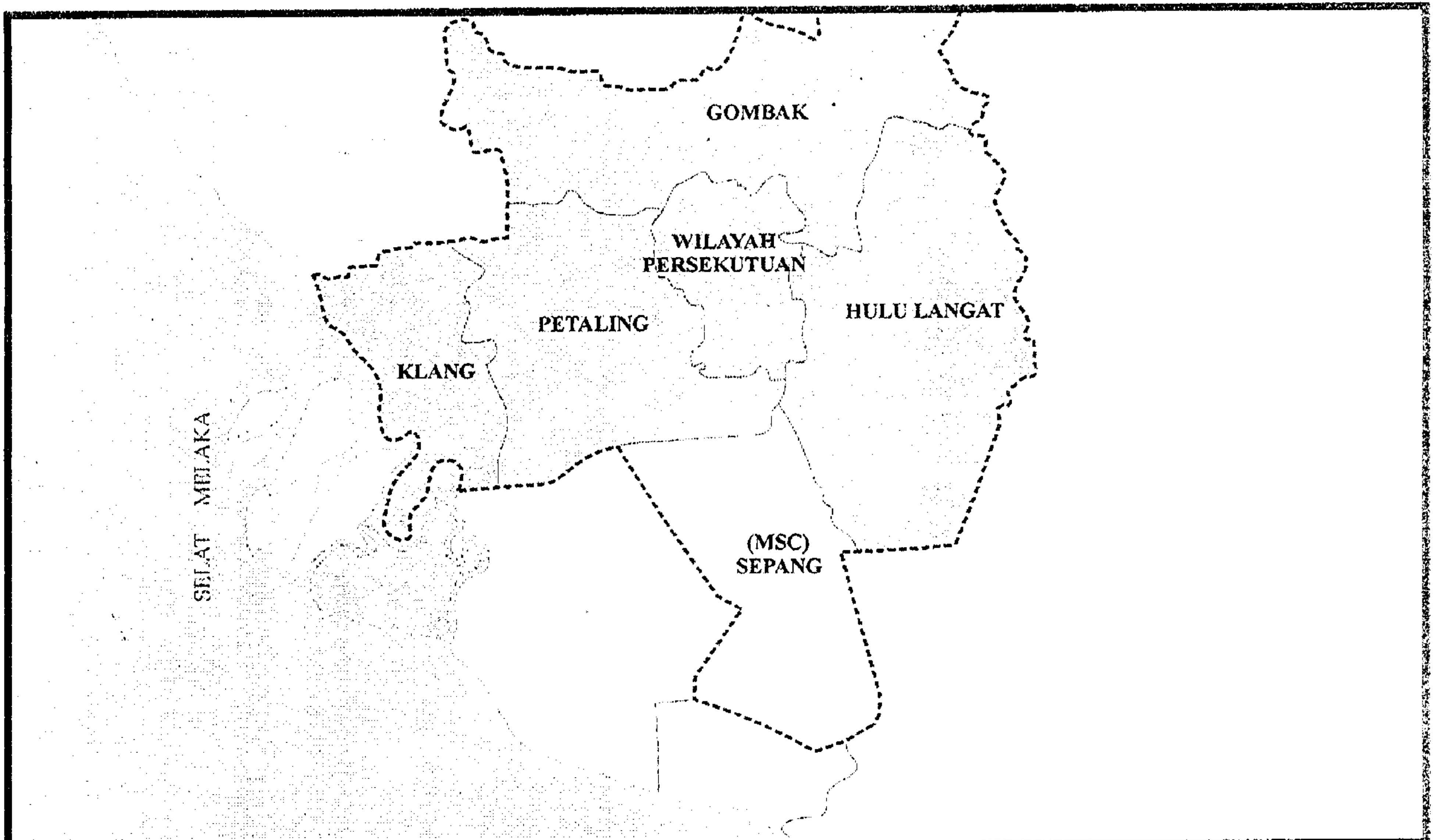


FIGURE 1.2.1 : THE STUDY AREA - KLANG VALLEY & THE MSC

1.3 Study Phases

This study was conducted in two phases. The first phase concentrated on the gathering of information on various existing systems, conducting a number of surveys and analyses of these information. This phase of the study also examined the future road network and identifying the existing and possible future problems road users may face in relation to ITS. Lastly, based on an analysis of the current ITS deployment in the study area, the study identified the needs for an ITIS in the Study Area as well as specific user services to be implemented.

Phase 2 of the study was devoted to developing the system architecture suitable for the proposed ITIS and the proposed user services based on an overall concept plan for the Study Area. Guidelines on the system installation were set-up. Cost for the system was estimated based on a proposed system installation plan. A simple cost and benefit estimation was then carried out. To demonstrate how some of the user services may be implement to realise the expected benefits, two simple case studies were also carried out. Finally, a discussion and recommendation on the implementation authority and implementation plan were put forth.

Figure 1.3.1 shows the study framework with its associated work tasks according to the two study phases.

1.4 ITS And ITIS

Intelligent Transport System (ITS) may be defined as a transport system in which human, vehicle, road and transport facilities are dynamically integrated for the purpose of achieving a safe, efficient, comfortable and environmentally sound transportation system.

Since the invention of the automobile in the early 19th century, little progress has actually been made to road traffic in terms of operation and management, despite the tremendous improvements on vehicle performance. Each vehicle is still controlled individually by the driver with very little control from outside. Freedom of movement offered by vehicle made it an attractive transportation tool second to none. For this reason, vehicle number just multiply in every country as its economy develops. Gradually this individuality of vehicle traffic has become the chief cause of transport inefficiency in urbanised areas where many conflicting users must share the limited road space. In addition, adverse effects of vehicular traffic such as accident and air pollution have created various social problems.

Mass transport system, either road based or rail based, is a prospective alternative to vehicular traffic in terms of efficiency in space usage and energy consumption. However, it has failed to attract enough passengers to alleviate the road traffic problem in many countries mainly due to less comfort, convenience and versatility compared with private vehicles. Fresh measures to enhance its attractiveness and to stimulate its patronage are required through better management as well as the use of new technologies.

OBJECTIVES

Inception Report

(PHASE 1)
DEVELOPMENT OF AN ANALYTICAL TRANSPORTATION PLANNING AND MANAGEMENT PROCESS

- Data Collection
- Transport surveys
- Transport System Analysis
- Identification Of Problems & Issues
- Reviews Of Performance Of Transportation Facilities Policies And Information Systems
- Needs & Priorities : ITIS And User Services

Interim Report

(PHASE 2)
DEVELOPMENT OF A SYSTEM ARCHITECTURE

- Selection of ITIS User Services(Including Costs Benefits Analysis)
- Logical System Architecture
- Physical System Architecture
  - Information Collection System
  - Information Processing System
  - Information Dissemination System
  - Data Communication System
  - Coordination With Other System
- Strategies For Implementation

Draft Final Report

Comments & Feedback From JICA

FINAL REPORT

FIGURE 1.3.1 : STUDY FRAMEWORK AND VARIOUS WORK TASKS

ITS introduces a new dimension backed up by new technologies to transportation system. It applies recent developments in electronic sensor, communication, and data processing technologies to transportation system to make it more intelligent, reliable and systematic. More and accurate traffic information can be given in real time through various ITS systems and devices to drivers who received almost no information in the past. Driving vehicle is made safer with additional built-in sensors that help avoid collision. Road network can be utilised more efficiently and vehicle operation can be improved, as more data are available to road administrator and vehicle operator.

Early research and development efforts have been taken in Japan, USA and Europe to make ITS a reality. In the process, a variety of ITS applications called user services have been conceived, developed, experimented and implemented to various degree of success. Reflecting the local condition of society in which ITS operates, user services are different among these countries and areas. More detailed explanation on these user services are given in a later chapter of this report.

Integrated Transport Information System (ITIS) is a subset of ITS. It focuses more on the use of information in road traffic. The system collects, processes and disseminates information related to road traffic for road users and road administrators in a comprehensive and timely manner to promote safe and efficient road traffic. This relationship between ITS and ITIS is shown in *Figure 1.4.1*.

Information that can be provided by ITIS includes the following:

- Congestion and cause of congestion information
- Route guidance traffic information
- Destination-related information
- Driving and road condition information
- Roadway hazard information
- Public transport information

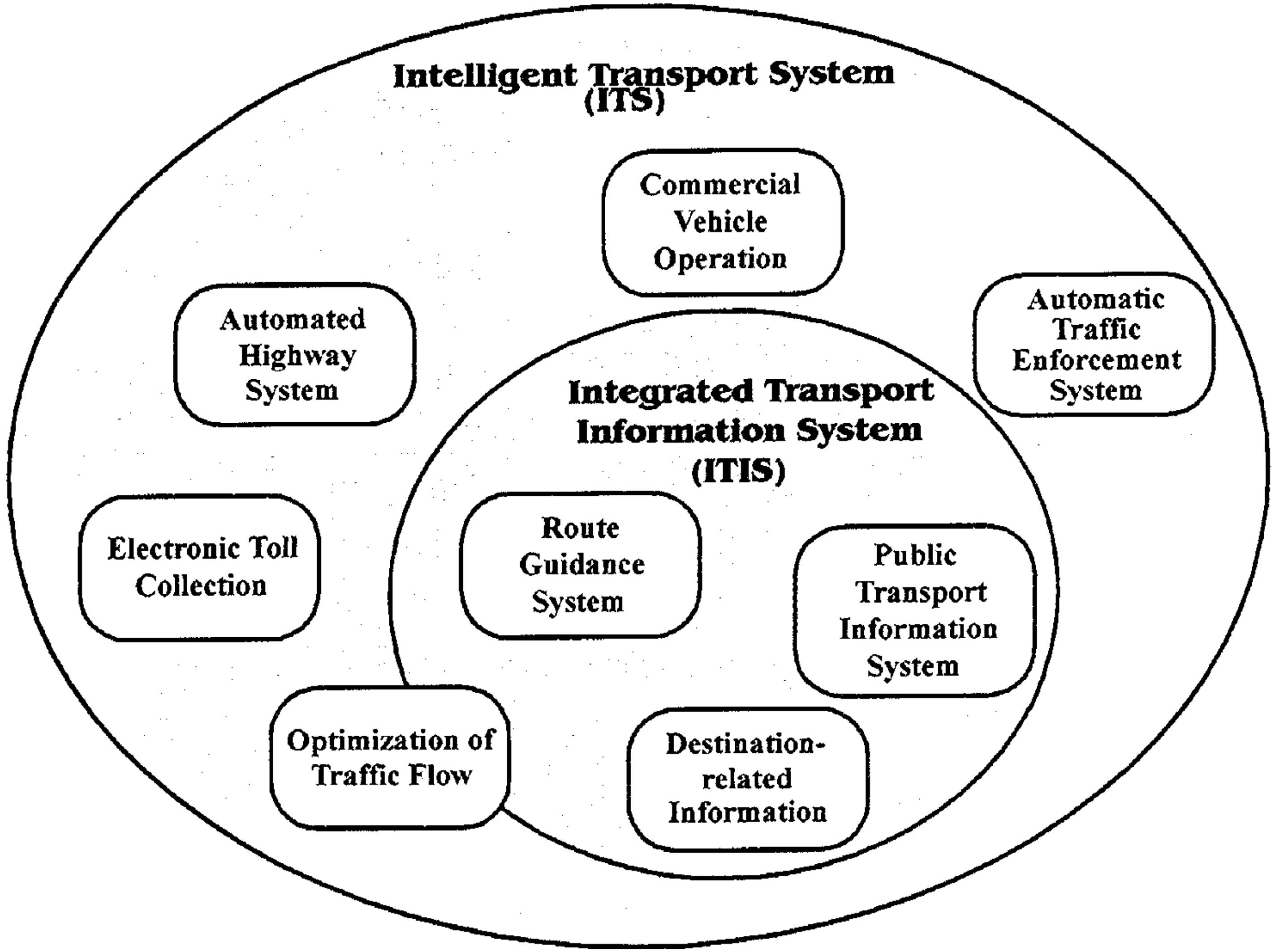


FIGURE 1.4.1 : RELATIONSHIP BETWEEN ITS, ITIS AND USER SERVICE

Whatever the information an ITIS handles, the process normally consists of the followings four (4) components or steps:

- Data collections (using vehicle detector, automatic vehicle identification sensor, TV camera, etc.);
- Data processing (compilation, computation, identification of congestion and incident, information selection, message editing);
- Information dissemination (through variable message sign, graphic display panel, broadcasting, highway radio, navigation system, information terminal, Internet, telephone, etc.);
- Data communication between centre and roadside equipment (voice, data, video signal over conventional and optical fibre cable in either analogue or digital form), and between roadside equipment and vehicle using wireless communication method.

In subsequent chapters, an Integrated Transport Information System most suited to the Malaysian environment is studied and proposed for the Study Area.

As the Malaysia's economic hub, the study area has witnessed the most rapid urbanisation and motorization processes in the country. Traffic demand has increased many times over and trip length has become longer as the urban area expands. Economic and social activities are now no longer confined to any specific administrative boundary but have overflow to neighbouring districts creating a huge urbanised conglomerate.

To support such growth, road network in the region has expanded steadily in recent years by both the central and local governments. A number of new roads were constructed and the existing roads widened. In addition, several toll roads serving as important inter-urban highways and intra-urban arterials have been constructed and operated by various private organisations as Build-Operate-Transfer (BOT) projects.

In spite of these growths of road traffic both in volume and space, there is no central body that manages the traffic on the road network in the study area as a whole. Each road is operated separately by its respective road administrators, either the federal or local government agencies or private entity, with very little interaction among them. It is hoped that the introduction of ITIS will provide an opportunity to integrate the operation of road network in the study area and maximise the efficiency of its use.

2

CURRENT ROAD TRAFFIC AND PUBLIC TRANSPORT CONDITIONS

2.0 CURRENT ROAD TRAFFIC AND PUBLIC TRANSPORT CONDITIONS

2.1 Characteristics of the Study Area

2.1.1 Administrative Districts and Urban Functions

Effectively the study covers the five administrative districts of the Klang Valley and the MSC; the latter is not an exclusive district but a north south development corridor that chiefly occupies a large part of the district of Sepang and parts of Petaling District and the Federal Territory.

The Klang Valley is comprised of the following:

- The Federal Territory of Kuala Lumpur,
- Petaling District in the State of Selangor,
- Klang District in the State of Selangor,
- Gombak District in the State of Selangor,
- Hulu Langat District in the State of Selangor.

The MSC is,

- a development corridor covering a large part of Sepang District in the State of Selangor and contains the planned new Federal Government Administrative Centre of Putrajaya, an IT research and development centre called Cyberjaya, the new KL International Airport and the KLCC.

Figure 2.1.1 shows the five districts of the Klang Valley and the MSC.

Within this Study Area, Kuala Lumpur, being also the national capital, is the largest urban centre with major urban services and functions such as government, finance, banking, commerce, trade, education, recreation and health. A large part of the government services will however move to Putrajaya in the MSC soon. Nevertheless, Kuala Lumpur remains the main employment centre, thus attracting a large volume of traffic from its surrounding conurbation areas, sub-regional as well as regional centres. Petaling Jaya, originally planned as a new town way back in the 1960s was the major suburban residential area that provided housing for people working in Kuala Lumpur. With the attainment of municipality status in the 1970s, Petaling Jaya now contains many other urban functions such as municipality services, recreation, banking, finance, industry, commerce and has become more of an independent centre.

Shah Alam is the new capital of Selangor State. It is a newly planned urban centre with state government services, banking, manufacturing and local commerce. The southern section of Shah Alam is one of the major industrial development areas in Klang Valley commonly referred to as the HICOM area.

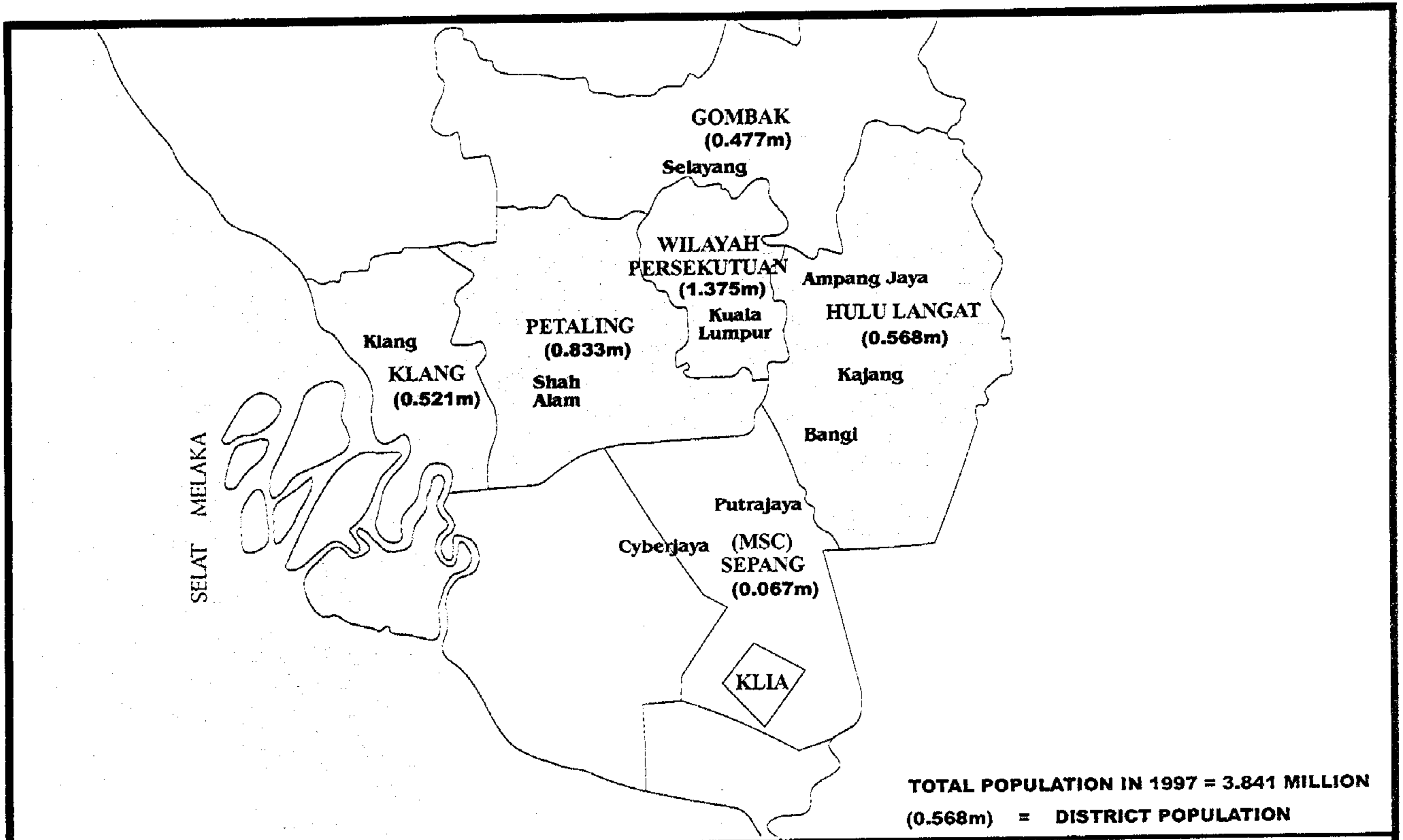


FIGURE 2.1.1 : ADMINISTRATIVE DISTRICTS IN THE KLANG VALLEY

Klang to the west is the urban centre and municipality for the district of Klang. It is a port town boosting of commerce, trade and industry. Klang has now one of the largest port facilities in the country and is therefore an important export and import point for the Klang Valley. Selayang to the north is the municipality for Gombak District. It is a new town with commerce, industry and wholesale functions.

Bangi in the district of Hulu Langat is a new town boosting of education and other urban functions. Ampang Municipality is another important suburban residential area to the east of Kuala Lumpur. Kajang is an old commercial centre close to Bangi.

Table 2.1.1 Major Urban Centres and Their Functions in the Study Area

No	District	Name (Urban Centre)	Administrative Status	Hierarchy of Centres	Major Urban Functions
1	Federal Territory	Kuala Lumpur	National Capital	National Centre	Federal Govt*, Commerce, Trade, Banking, Office Wholesale, Health, Education
2	Petaling	Shah Alam	State Capital	Regional Centre	State Govt., Industry, Commerce
		Petaling Jaya	Municipality	Regional Centre	Commerce, Industry
		Subang Jaya	Municipality	Sub-regional Centre	Commerce
3	Klang	Klang	Municipality	Regional Centre	Port, Industry, Commerce, Trade,
4	Gombak	Selayang	Municipality	Regional Centre	Industry, Wholesale, Commerce
5	Hulu Langat	Bangi	Municipality	Regional Centre	Education, Commerce, Training, Industry
		Kajang	Municipality	Sub-regional Centre	Commerce
		Ampang Jaya	Municipality	Sub-regional Centre	Commerce
6	Sepang	Putrajaya	Municipality	Sub-regional Centre	Federal Government
		Cyberjaya	Municipality	Sub-regional Centre	Research, Training, Education,

** Most of the Federal Government Functions will be moved to Putrajaya.*

Putrajaya is planned to house the seat of the Federal Government. Cyberjaya, next to Putrajaya is planned to be the centre or hi-tech nucleus for the MSC. It will also provide education and other technical development functions. To the south of these two new centres is the newly operational Kuala Lumpur International Airport (KLIA).

With such an urban structure in the Study Area, it is not difficult to see that traffic desires between Kuala Lumpur with Petaling Jaya, Shah Alam, Klang, Selayang, Ampang Jaya and Kajang are high. Putrajaya and Cyberjaya, being new and currently being developed are not the major travel destinations yet.

2.1.2 Population and Vehicle Numbers

As described above, the Klang Valley is the most developed urban region in Malaysia encompassing the National Capital of Kuala Lumpur, state capital of Shah Alam, several regional centres like Bangi, Klang, Selayang, Petaling Jaya and sub-regional centres like Kajang, Ampang Jaya, Subang Jaya. This region is home to a population of some 3.8Million people and an estimated 1.45Million vehicles (SMURT 1997). It is also an important economic, industrial and employment centre in the country. The former Subang International Airport and Port Klang are located in the Klang Valley. By the Year 2020, this region is expected to have a population of 5.7Million people.

MSC is a special national project to spearhead the achievement of the nation's Vision 2020 objectives of attaining developed economy status. The corridor extends from Kuala Lumpur to the new KL International Airport encompassing part of Petaling District and a large part of Sepang District that will contain two new centres of Putrajaya and Cyberjaya. It is planned to be a main multimedia hi-tech and IT research and development as well as educational centre, covering an area of about 575km^2.

Presently, the MSC has an estimated population of only about 653,900 including part of Kuala Lumpur and the MPSJ (Subang Jaya Municipality in Petaling District). The corridor is planned to house a future population of about 2.2Million by Year 2020.

In total, the Study Area has a population of 3.84Million in Year 1997 and this is expected to increase to 6.96Million by the Year 2020.

Table 2.1.2 . Present and Future Population of Study Area (in '000)

No.	District/Area	1997	2010	2020
1	Kuala Lumpur	1,375	1,628	1,742
2	Petaling District	833	1,189	1,402
3	Klang District	521	727	886
4	Gombak District	477	698	807
5	H.Langat District	568	786	866
Sub-Total		3,774	5,028	5,702
6	MSC *	67.4	n.d.	1,258
Total		3,841.4	-	6,960

* *Estimated figures for 1998 and excluding areas in Kuala Lumpur and Petaling District*
Source: SMURT, 1997, n.d. = no data

2.2 Existing Road Network

2.2.1 Overall Road Network and Configuration

Road network in the Study Area is distinctively that of a combination of both ring and radial road system and ladder system. Kuala Lumpur itself has a ring and radial road system while the east-west corridor towards Klang and the south corridor towards KLIA have ladder pattern. *Figure 2.2.1* shows the existing road network pattern for the region.

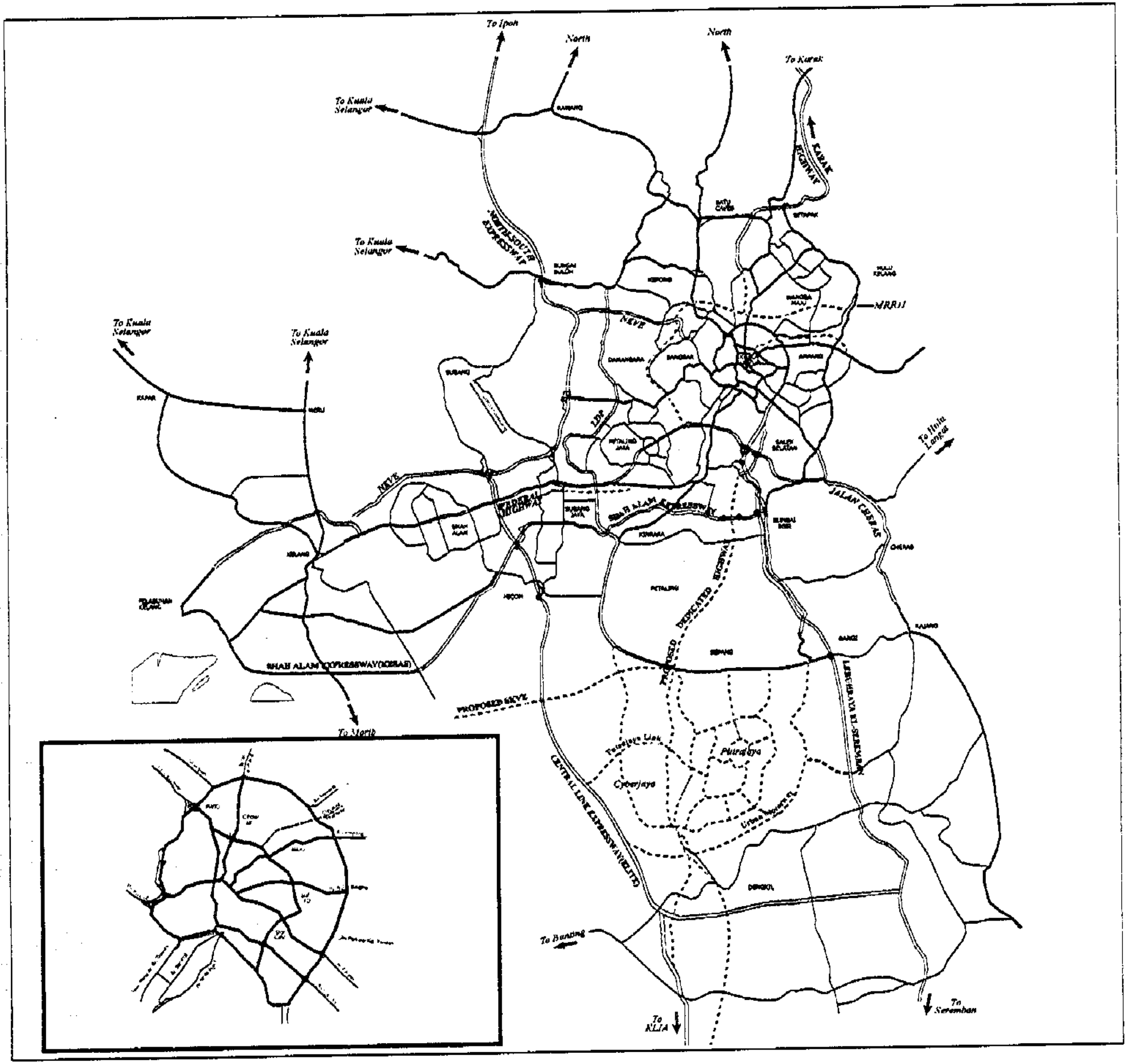
Kuala Lumpur road network is comprised of three ring roads, namely Inner Ring Road (IRR), Middle Ring Road I (MRR I) and Middle Ring Road II (MRR II); and a number of radials roads, notably Jalan Ampang, Jalan Genting Klang/Pahang, Jalan Ipoh/Sentul, Jalan Kuching/Kepong, Jalan Damansara/Duta, Jalan Syed Putra, Jalan Sg. Besi and Jalan Cheras.

The road network in the east-west development axis between Kuala Lumpur and Klang is formed by three almost parallel highways/arterials. These are the NKVE to the north, the Federal Highway (II) and Shah Alam Expressway in the south. The major N-S linkages between these three parallel roads include the North Klang Straits Bypass-Jalan Langat route, North South Central Link (NSCL), Jalan Kewajipan (in Subang Jaya and USJ) and the Lebuhraya Damansara Puchong (LDP).

The KL-Seremban Expressway, the LDP and the NSCL with horizontal routes like the Federal Highway, Shah Alam Expressway (SAE), and the Sri Kembangan - Puchong Road and B11 state road, form the ladder pattern in the southern corridor.

The road network in the Study Area comprises various categories of roads, ranging from expressway with full access control to urban highways having only partial access control, arterials and ring roads, distributors and finally access roads. For the purpose of this study, however, we shall be concentrating on the expressway, urban highways and major arterials network in the study area.

Expressway here consists part of the North-South Expressway network managed mainly by PLUS, specifically from Rawang Interchange to Bukit Lanjan; and from Sg.Besi to Nilai Interchange on the KL-Seremban Expressway; the NKVE (North Klang Valley Expressway) from Duta Toll Plaza to North Klang Bypass; the North-South Central Link (NSCL) from NKVE to Nilai Interchange and lastly, the Karak Highway. Under this category also is the KLIA Access or spur from the NSCL to KLIA. These expressway sections except the Karak Highway are tolled under a close system of toll collection. The Shah Alam Expressway (SAE, managed by Kesas) from KL-Seremban Expressway to Klang uses the open toll system but also has full access control.



A Study On Intergrated Transport Information System (ITIS) in Klang Valley And The MSC in Malaysia

Figure : 2.2.1

Existing Road Network Pattern in the Study Area

LEGEND :

- EXPRESSWAY/HIGHWAY
- MAJOR ARTERIALS
- MAJOR DISTRIBUTORS
- FUTURE ROADS

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The next category is the urban highway, which has only partial access control. Among these are the Lebuhraya Damansara Puchong (LDP, privatised and managed by Litrak), the East-West Link (EWL, privatised and managed by Metramac), the North Klang Straits Bypass (NKSB, privatised and managed by Shapadu) and the Federal Highway (II) (with the section from Klang to Subang Jaya managed by PLUS).

In Kuala Lumpur besides the ring roads, namely the Inner Ring Road (IRR), the Middle Ring Road I (MRR I) and Middle Ring Road II (MRR II) being major arterials, the other major arterials are Jalan Kuching, Jalan Ampang, Jalan Cheras, Jalan Damansara, Jalan Pahang/Ulu Kelang, Jalan Gombak, Jalan Kelang Lama/Puchong, Jalan Kepong/Ipoh and Jalan Sg.Besi (Fed. Route 1). Those in the other areas are Jalan Kapar, Jalan Meru and Jalan Langat in Klang; Federal Route 1 from Batu Caves to Rawang and from Cheras to Kajang, Selayang Bypass, Sg. Buloh-Subang Bypass and others.

2.2.2 Toll Road Network

The toll roads within the study area are listed in the table below totalling about 244km. These toll roads are shown in *Figure 2.2.2*. Understandably, toll roads are largely concentrated along the high traffic demand corridors, namely the southwest, south and southeast corridors. Except for the short stretch along Jalan Kuching and Jalan Pahang, the north and northeast sections have no major toll roads.

Table 2.2.1 List of Toll Roads within the Study Area

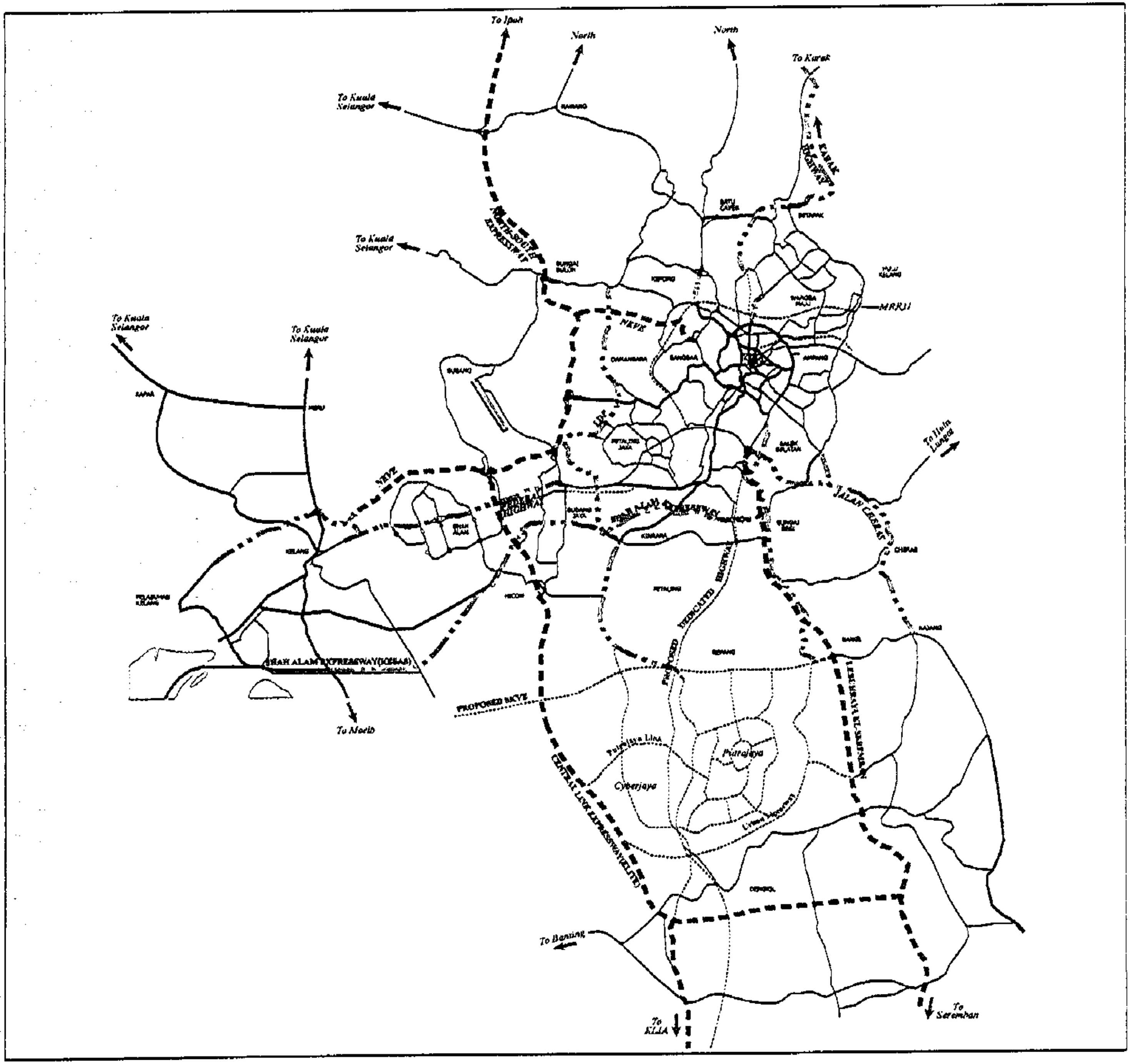
No	Name	Management Company	From	To	Distance	Toll System
1	North South Expressway	PLUS	Rawang IC	Bukit Lanjan	7.0km	Close
			Sg. Besi Toll Plaza	Nilai Interchange	8.8km	Close
2	NKVE	PLUS	Duta Toll Plaza	North Klang Strait Bypass	32.4km	Close
3	Federal Highway (II)	PLUS	Sultan Ibrahim R/A	Subang Jaya	12.8km	Open
4	NSCL	ELITE	NKVE	Nilai IC	46.8km	Close
5	Karak Highway	MTD PRIME	MRR II	Karak	9.5km	Open
6	LDP	LITRAK	Jalan Kepong	Puchong	40.0km	Open
7	Shah Alam Highway	KESAS	Jalan Langat	KL-Seremban Expressway	32.1km	Open
8	East-West Link	METRAMAC	Jalan Cheras	KL-Seremban Expressway	6.0km	Open
9	Jalan Sg. Besi	BESRAYA	Jalan Chan Sow Lin	JTM to UPM I/C	16.0km	Open
10	Cheras-Kajang Highway	GRAND SAGA	Cheras	Kajang	12.0km	Open
11	North Klang Straits Bypass	SHAPADU	Port Klang	Federal Highway	10.9km	Open
12	Jalan Kuching	KAMUNTING	Jtn of Jln Kepong	Jtn with Jln. Duta	3.8km	Open
13	Jalan Cheras	METRAMAC	Jalan Loke Yew	MRR (II)	2.8km	Open
14	Jalan Pahang	METRAMAC	Jalan Gombak	MRR (I)	2.7km	Open

NKVE = North Klang Valley Expressway
NSCL = North South Central Link
LDP = Lebuhraya Damansara Puchong

A Study On Intergrated Transport Information System (ITIS) in Klang Valley And The MSC in Malaysia

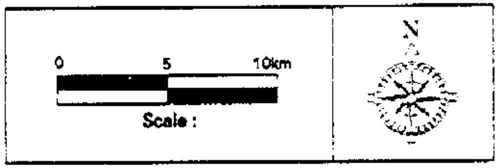
Figure : 2.2.2

Existing Toll Road Network in the Study Area



LEGEND:

- CLOSED SYSTEM
- OPEN SYSTEM



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2.2.3 Major Travel Corridors

By analysing the travel behaviour in the Study Area, traffic movements can be identified into corridors with KL as the nucleus. Table 2.2.2 below lists the five major travel corridors.

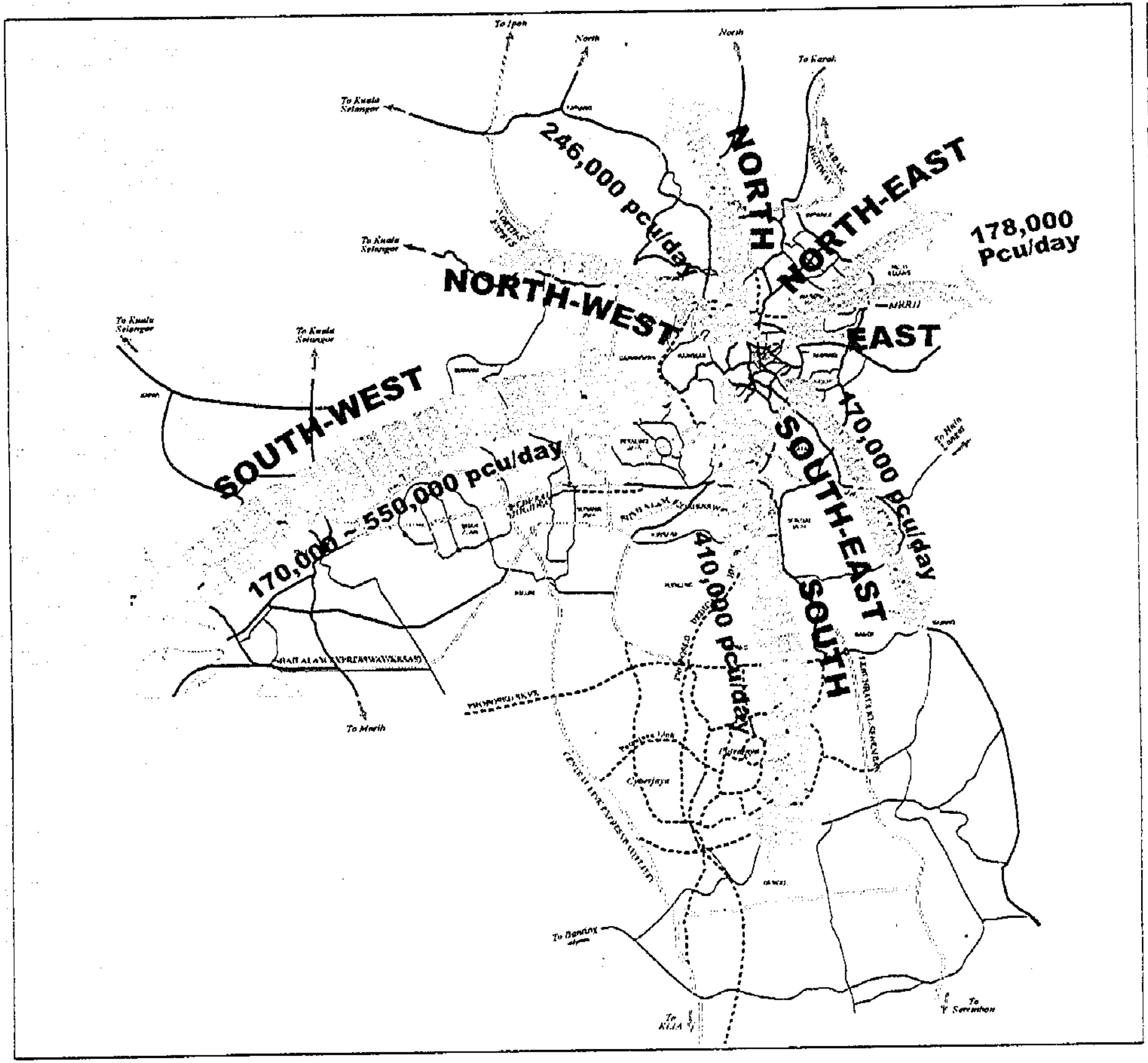
The Southwest corridor is by far the most important and having the highest travel demand as the corridor serves urban centres like Kuala Lumpur, Petaling Jaya, Subang Jaya, Shah Alam and Klang. The importance of this corridor is reflected by the existence of three main expressways and highways - the NKVE, the federal highway and SAE.

The next is the South corridor that links Kuala Lumpur with the suburban areas of Puchong and Sri Kembangan; Bangi, Putrajaya/Cyberjaya and KLIA. Because the new centres of Putrajaya/Cyberjaya are not fully developed yet, the travel demand along this corridor is small at present but is expected to increase very rapidly in the near future.

Table 2.2.2 Major Travel Corridors in the Study Area

No.	Travel Corridor	Urban Centres within the Corridor	Major Traffic Carriers in the Corridor
1	Southwest	Kuala Lumpur- Petaling Jaya-Shah Alam- Klang	• Federal Highway (II) • NKVE/Jln. Damansara • Shah Alam Expressway
2	South	Kuala Lumpur-Sri Kembangan -Puchong/Bangi-Putrajaya/ Cyberjaya - KLIA	• KL-Seremban Expressway • NSCL • Jln. Klang Lama/Puchong • Jln. Sg. Besi
3	Southeast	Kuala Lumpur-Cheras-Kajang	• East West Link • Jln. Cheras
4	North & Northwest	Kuala Lumpur- Kepong-Selayang	• Jln. Kuching/Fed. Route 1, • Jln. Kepong/Ipoh • Jln. Yang Emas
5	East and Northeast	Kuala Lumpur- Ampang Jaya and Wangsa Maju/Melawati	• Jln. Ampang • Jln. Pahang/Ulu Kelang • Jln. Sentul

The Southeast corridor connects Kuala Lumpur with Cheras and further afield to Kajang. The North and Northwest corridor connects Kuala Lumpur with Selayang, Rawang, Batu Caves and Kepong areas. The Northeast and East Corridor has relatively less interurban traffic compared with the others as it connects Kuala Lumpur with suburban residential areas of Gombak, Wangsa Maju/Melawati and Ampang Jaya. *Figure 2.2.3* illustrates these five travel corridors.



A Study On Intergrated Transport Information System (ITIS) in Klang Valley And The MSC in Malaysia

Figure : 2.2.3

THE MAJOR TRAVEL CORRIDORS & TRAFFIC DEMAND

LEGEND :

- EXPRESSWAY/HIGHWAY
- MAJOR ARTERIALS
- MAJOR DISTRIBUTORS
- FUTURE ROADS

0 5 10km

Scale :

N

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2.3 Present Traffic Demand On Road Network

2.3.1 Present Traffic Volume on Major Roads

The Federal Highway (II) by far carries one of the highest traffic volume everyday compared to most other routes in the study area. The Federal Highway (II) in fact is said to be the backbone of total travel along the east-west axis in the Klang Valley. Section of this highway was reported to carry more than 220,000pcu/day (SMURT, 1997). Similarly, Jalan Damansara was also reported to carry more than 200,000pcu/day. The NKVE is estimated to have about 75,000pcu/day based on the screen line traffic counting survey results. The Southwest corridor thus is estimated to have a cross-sectional daily traffic demand of more than 550,000pcu/day when taking into account traffic volume on the SAE and Jalan Kelang Lama.

Traffic demand on the KL-Seremban Expressway was also reported to have exceeded 220,000pcu/day. Jalan Sg.Besi has a daily traffic demand of 120,000pcu/day. Traffic on the other major roads in the southern corridor, the NSCL (Elite) Highway and Puchong-Klang Lama Road, were observed to have a peak hour traffic of 3,100pcu/hr and 2,700pcu/hr respectively (screen line traffic count survey). Traffic on these roads is still low because the two new centres of Putrajaya and Cyberjaya are still under construction. These volumes may be expanded to be about 39,000pcu/day and 33,000pcu/day respectively. The southern corridor would therefore have a cross-sectional traffic demand of about 412,000pcu/day.

Jalan Cheras was reported to have 117,000pcu/day in SMURT. The EWL is reported to have a traffic demand of about 60,000pcu/day. This southeast corridor thus would have a total of some 170,000pcu/day.

Jalan Kepong was reported in SMURT to have a traffic volume of 100,300pcu/day. From the screenline traffic count survey, Jalan Ipoh and Jalan Lang Emas are estimated to have a daily traffic volume of about 97,000pcu/day and 48,000pcu/day respectively. The northwest and north corridors thus would have a total traffic demand of about 246,000pcu/day.

Jalan Ampang and Jalan Pahang were reported to have daily traffic volumes of 97,000pcu/day and 47,000pcu/day respectively. Jalan Sentul is estimated to have 34,000pcu/day, based on the screenline traffic count results. The east and northeast corridor thus would have a total demand of about 178,000pcu/day. These volumes are illustrated in the previous *Figure* 2.2.3.

Table 2.3.1 **Traffic Demand on the Major Travel Corridors**

No.	Corridor	Major Routes	Daily Traffic Demand	Total Demand
1	Southwest	• Federal Highway (II) • Jln. Damansara • NKVE • SAE/J. K. Lama	220,000pcu/day 200,000pcu/day 75,000pcu/day 55,000pcu/day	550,000pcu/day
2	South	• KL Seremban Exp. • Jln. Sg. Besi • NSCL • Jln Puchong	220,000pcu/day 120,000pcu/day 39,000pcu/day 33,000pcu/day	412,000pcu/day
3	Southwest	• Jln. Cheras • EWL	117,000pcu/day 60,000pcu/day	170,000pcu/day
4	North & Northwest	• Jln. Ipoh • Jln Kepong • Jln. Yang Emas	97,000pcu/day 100,000pcu/day 48,000pcu/day	246,000pcu/day
5	East & Northeast	• Jln. Ampang • Jln Pahang • Jln. Sentul	97,000pcu/day 47,000pcu/day 34,000pcu/day	178,000pcu/day

Data source from SMURT study 1997 and estimates from Screen Line Survey

2.3.2 Traffic Attraction to KLCPA

KLCPA is by far the major traffic attraction point in the Study Area. *Figure 2.3.1* shows the major traffic routes towards the CPA from all the travel corridors mentioned above. There are about 12 major access points.

Traffic counts across the MRRI (Middle Ring Road I) conducted in Year 1996 showed that the largest influx of traffic to CPA during the morning peak hour comes from the south-west direction and amounts to 16,000 vehicles per hour (per direction, CPA-bound). (See, *Figure 2.3.2*). Assuming an average lane capacity of 1,500vph/lane per direction, it means a minimum of 11 traffic lanes are required to deliver these 16,000 vehicles to the CPA from the south-west direction. This traffic capacity is to be provided by the roadways in the south-western routes, namely the Jalan Damansara-Semantan route, the Federal Highway (II) route and the Jalan Puchong-Jalan Klang Lama route.

Some 15,000 vehicles per hour flowed in from the northwestern direction, servicing mainly the Gombak catchment and, to a lesser extent, the northern portion of the Petaling catchment. At this flow rate, a minimum of 10 traffic lanes per direction is needed to accommodate this demand. In the northwestern sector, these traffic demands are to be met by Jalan Kuching, Jalan Ipoh and Jalan Duta routes.

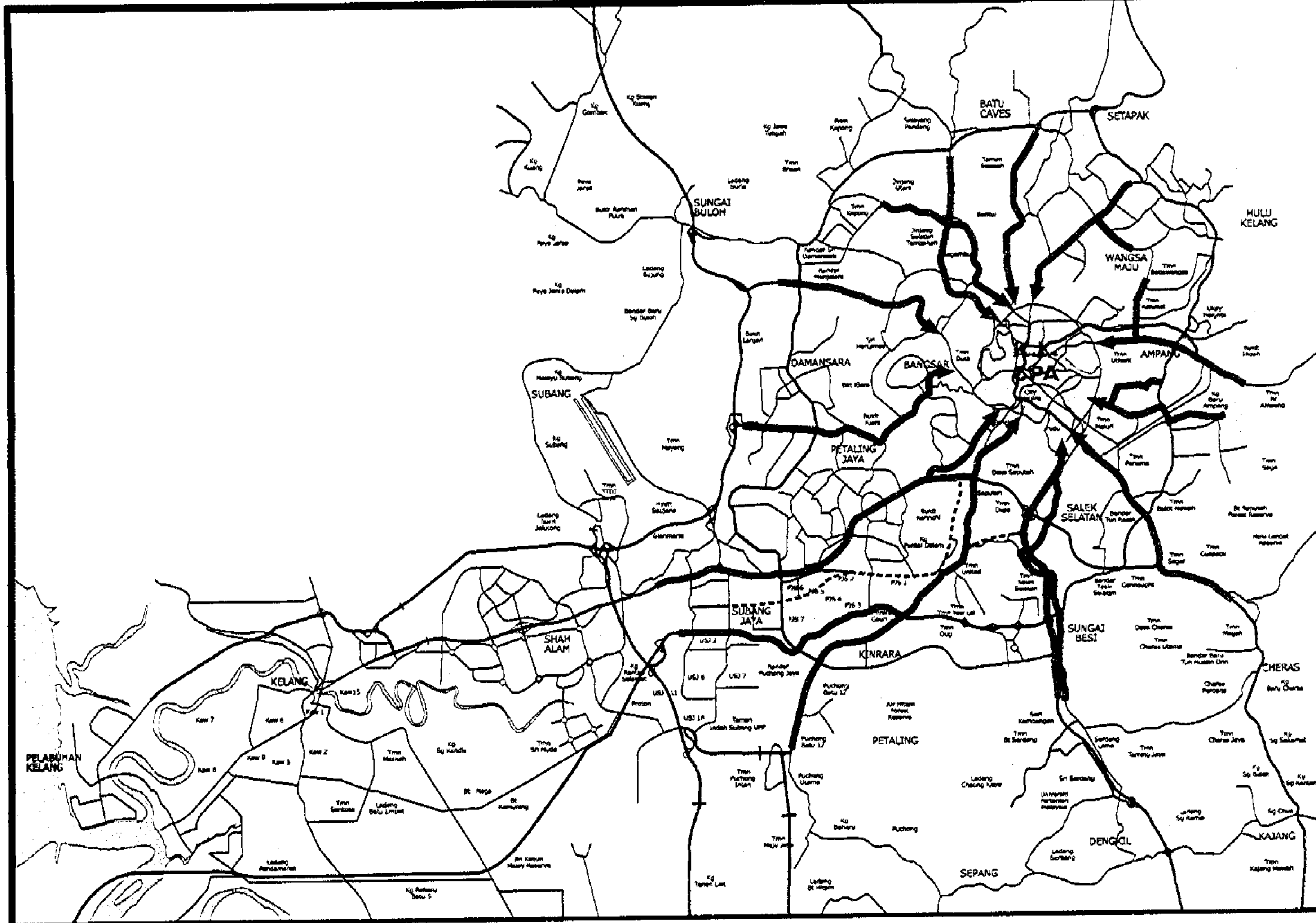
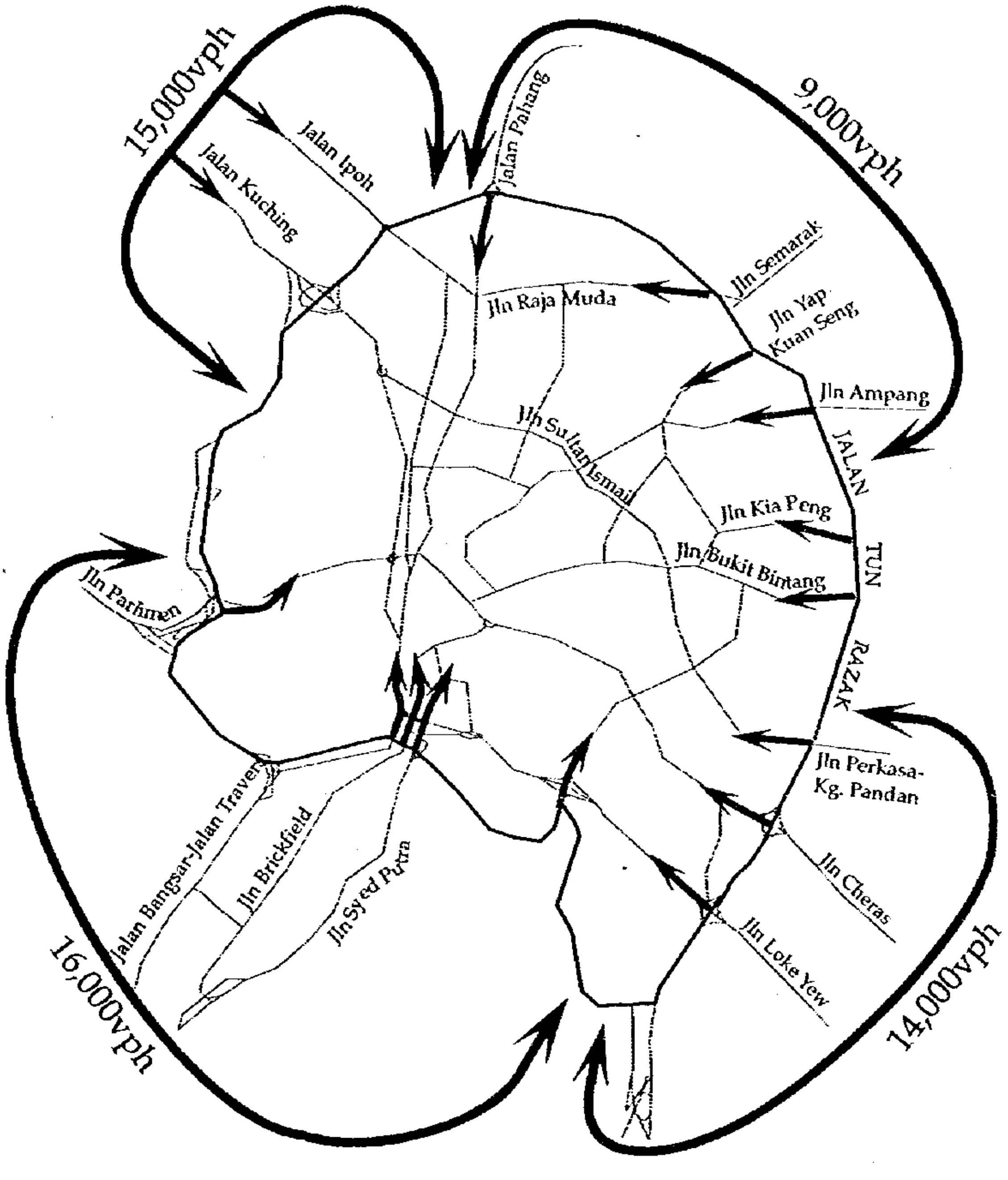


FIGURE 2.3.1 : MAJOR CPA-BOUND ACCESS ROUTES TO K.L. CPA



TOTAL = 54,000 vph (Year 1996)

FIGURE 2.3.2 : MORNING PEAK HOUR TRAFFIC TO KLCPA (YEAR 1996)

The next major movement comes from the southeast; a total of 14,000 vehicles per hour were recorded to flow into the CPA from this direction. The main conduits for this traffic are to be found in the KL-Seremban- Sg. Besi Highway, Jalan Loke Yew, and Jalan Cheras. A combined total of 10 traffic lanes per direction are needed to cater for this level of demand.

The movement from the east and the northeast with 9,000 CPA-bound vehicles per hour has been found to come through mainly via the Jalan Pahang-Jalan Genting Kelang route and the Jalan Ampang-Jalan Semarak route.

In general, the rate of traffic growth in an already built-up area has been found to range between 3% to 6% per annum. This is because in a built-up area, new traffic generators are mainly confined to sites where re-developments are feasible. Conversely, in rapidly developing new areas where new townships and commercial offices are replacing green fields or agricultural land, a higher growth rate is expected.

The traffic growth pattern in the Klang Valley also appears to reflect this trend, with the South-East and North-West sectors showing greater greenfield-type developments and, hence, higher growth rates than the other sectors.

During the morning peak hour, therefore a total of 54,000 vehicles were reported to have poured into the CPA in Year 1996 or an estimated 675,000veh/day.

The table below tabulates the pattern and growth of CPA-bound traffic into Kuala Lumpur at the four directional corridors in the morning peak between Year 1993 and Year 1996.

Table 2.3.2 Pattern and Growth of CPA-Bound Traffic into Kuala Lumpur by Directional Corridor (Morning Peak; 1993 –1996)

Directional Corridors	Morning Peak 1993 (vph)	Morning Peak 1996 (vph)	Change (%)	Growth Per Annum (%)
North West	11,000	15,000	+36	11.0
North East	8,000	9,000	+13	4.0
South West	14,000	16,000	+14	4.5
South East	10,000	14,000	+40	12.0
Total	**43,000**	**54,000**	+26	8.0

Assuming an annual rate of 8% still applies and a peak hour rate of 8%, by present day, an estimated total daily traffic of about 850,000veh.trips per day could have been attracted to the KLCPA by Year 1999. (However, some of these vehicles trip albeit marginally could have been diverted to public transport with the recent opening of the LRT lines.)

Given this pattern of access, it is not surprising that some of the most severe points of congestion are located at intersections along these access corridors or with the ring roads.

2.3.3 Traffic Demand on Ring Roads

Ring roads in Kuala Lumpur play the major role of traffic dispersal. Hence, the Middle Ring Road that encircles the KLCPA is a major traffic dispersal road in Kuala Lumpur that distributes traffic to the CPA. Due to heavy traffic demand on the IRR, its role in traffic dispersal has diminished over the years. In the SMURT Study in Year 1997, the IRR was found to carry between 105,000pcu/day (Jalan.Sultan Ismail) to 136,000pcu/day (Jalan Kuching) and the MRR (I) was found to carry between 189,000pcu/day along Jalan Tun Razak section to 205,000pcu/day along Jalan Mahameru section. *Figure* 2.3.3 shows the traffic demand on the IRR and MRR (I).

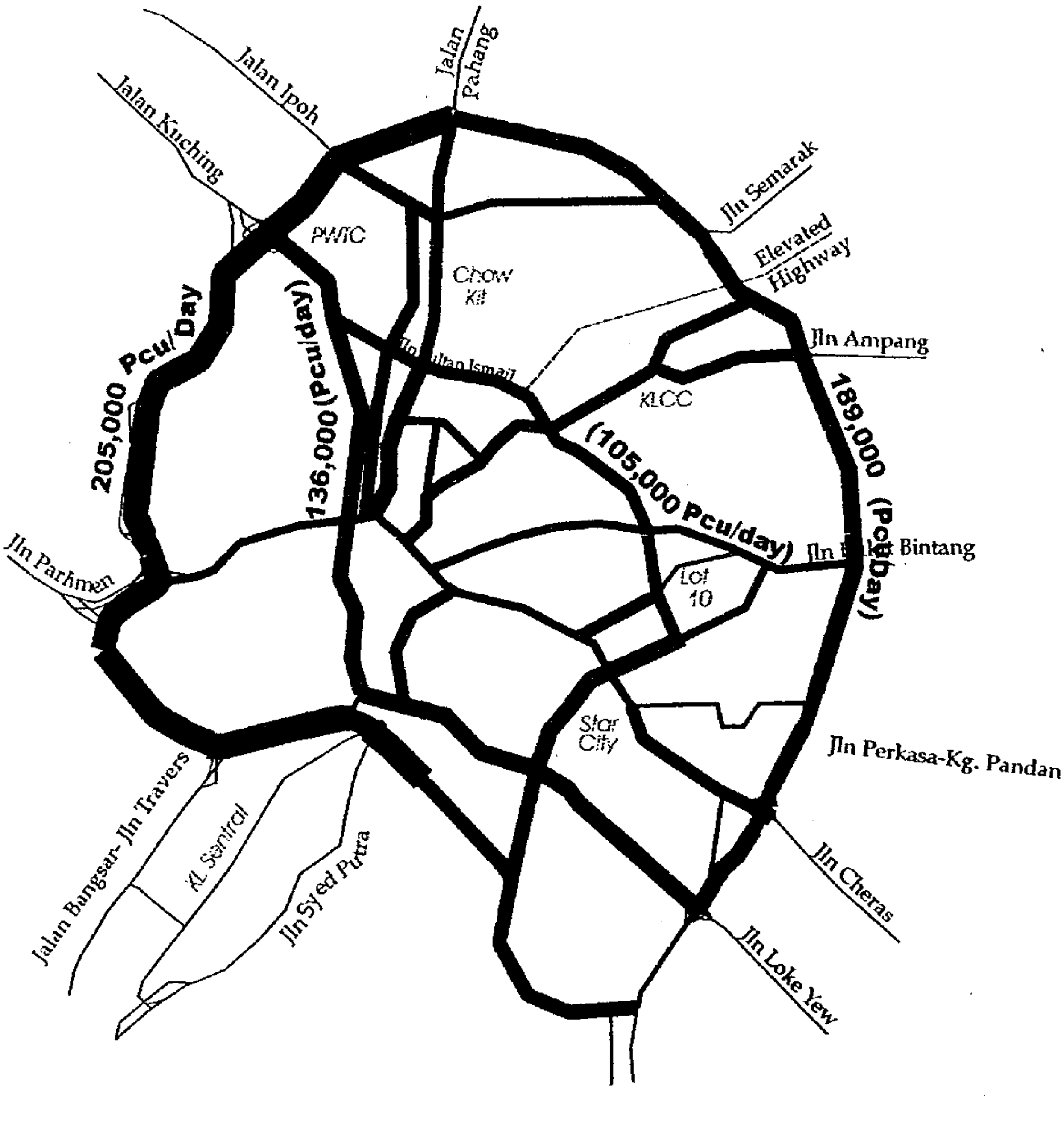
The MRR (II) also performs the very important function of traffic dispersal for Kuala Lumpur. The western section from Jalan Kepong to Puchong (section of LDP) and the southern section from Puchong to KL-Seremban Expressway (section of SAE) are however tolled roads. Nevertheless, the busiest section of LDP between Sunway Interchange and SS/2 Interchange is reported to carry about 150,000 vehicles/day.

2.3.4 KL-PJ-SA-Klang Corridor Traffic Demand

As discussed above, the Southwest Corridor, i.e. KL-PJ-SA-Klang Corridor is the most heavily trafficked travel corridor in the Klang Valley.

The Federal Highway (II) was reported to carry between 78,300pcu/day at the Klang end to 223,400pcu/day at the Kuala Lumpur end. (SMURT, 1997). The NKVE has an average traffic demand of 75,000pcu/day; while the Shah Alam Expressway (SAE) has an estimated traffic volume of 20,000pcu/day to 50,000pcu/day.

This corridor thus has a total cross-sectional demand of between 170,000pcu/day to 330,000pcu/day on these three inter-urban highways.



Source : smurt(1997)

FIGURE 2.3.3 : TRAFFIC DEMAND ON THE IRR & MRR (1)

Figure 2.3.4 shows the various level of traffic demand along the Federal Highway (II) towards the city centre of Kuala Lumpur during the morning peak hour for the section from Subang Jaya to end of Jalan Syed Putra. The section with the highest demand is between the Intersection with Jalan Universiti and Jalan Pantai with peak-hour traffic of 11,800pcu. From Shah Alam and Klang, the net traffic volume after exiting the toll plaza is about 6,700pcu in the peak hour. As the traffic stream progresses towards Kuala Lumpur, there is a net increase from the adjoining developments. The net traffic entry points are notably at the interchanges with LDP (commonly called the Motorola/Sunway Interchange), Jalan Universiti and Jalan Timur. The net exit points are junctions at Jalan Kelang Lama, Jalan Pantai, and Federal Highway section to Sg. Besi, Brickfields and Jalan Istana (MRR (I)).

Hence the large traffic stream along the Federal Highway from Klang and Shah Alam towards the city centre of KL is moderately disperse off to distributors along the section between the Sunway Interchange and Jalan Timur probably to destinations in PJ and Bandar Sunway. Traffic bound for KL are largely dispersed off only at Jalan Pantai, Highway to Sg.Besi, Jalan Brickfields and the MRR(I).

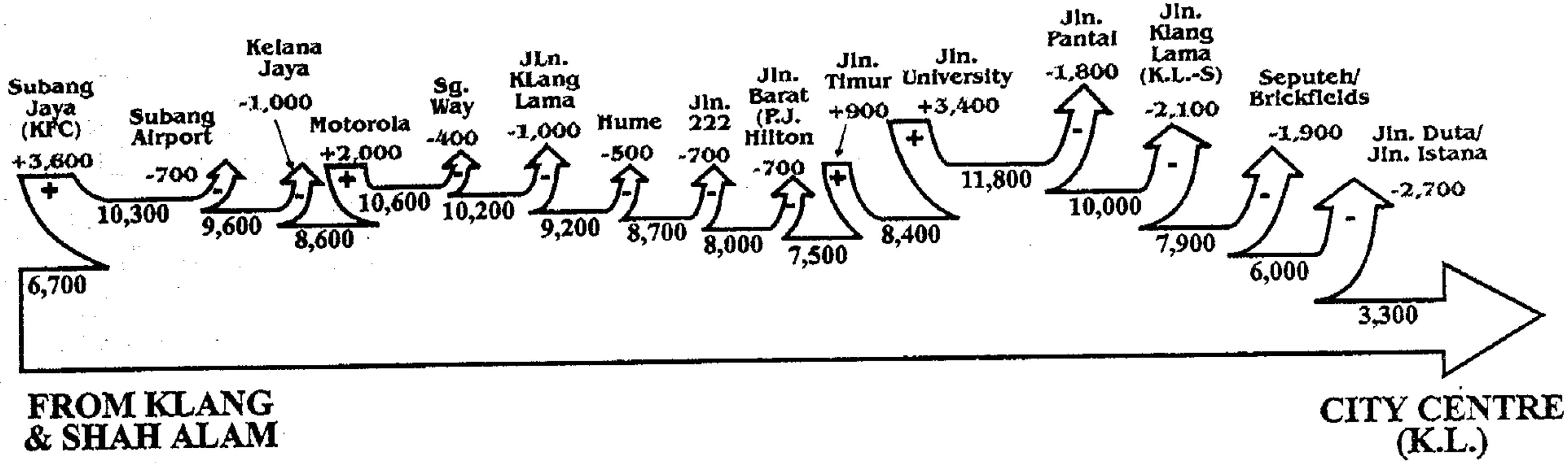
2.4 Current Travel Speed Levels

2.4.1 Results of Travel Time Survey

Travel speed is a good indicator of road traffic congestion. A travel time survey was conducted on selected routes in the study area. Routes were selected to cover all the major travel corridors discussed above. *Figure 2.4.1* shows the road coverage of the travel time survey. A total of 22 routes were surveyed in both directions. Observations were taken during the morning peak and evening peak hours as well as the off-peak hours. The survey was conducted for three consecutive working days and the average values computed. Routes for a specific origin-destination pair as given in Table 2.4.1 represent the major alternative travel routes.

The travel speeds were computed for each of the road links along these survey routes and ranked into 4 categories. These are then plotted on the map to indicate the overall travel speed levels in the study area during the morning peak, evening peak and off-peak hours.

From these figures, low travel speeds were observed mainly in the northeast and eastern sectors of Kuala Lumpur and within the CPA of Kuala Lumpur. Moderate travel speeds were predominantly around the MRR (II), PJ, south-eastern section of Kuala Lumpur and Klang Town. Relatively good travel speed and excellent travel speed were observed in the western section of the southwest corridor.



LEGEND :
ALL VOLUMES SHOWN IN PCU PER HOUR

FIGURE 2.3.4 : FLOW PROFILE ON FEDERAL HIGHWAY BY SEGMENT FOR CPA-BOUND TRAFFIC IN THE MORNING PEAK HOUR (FROM SUBANG JAYA TO KUALA LUMPUR)

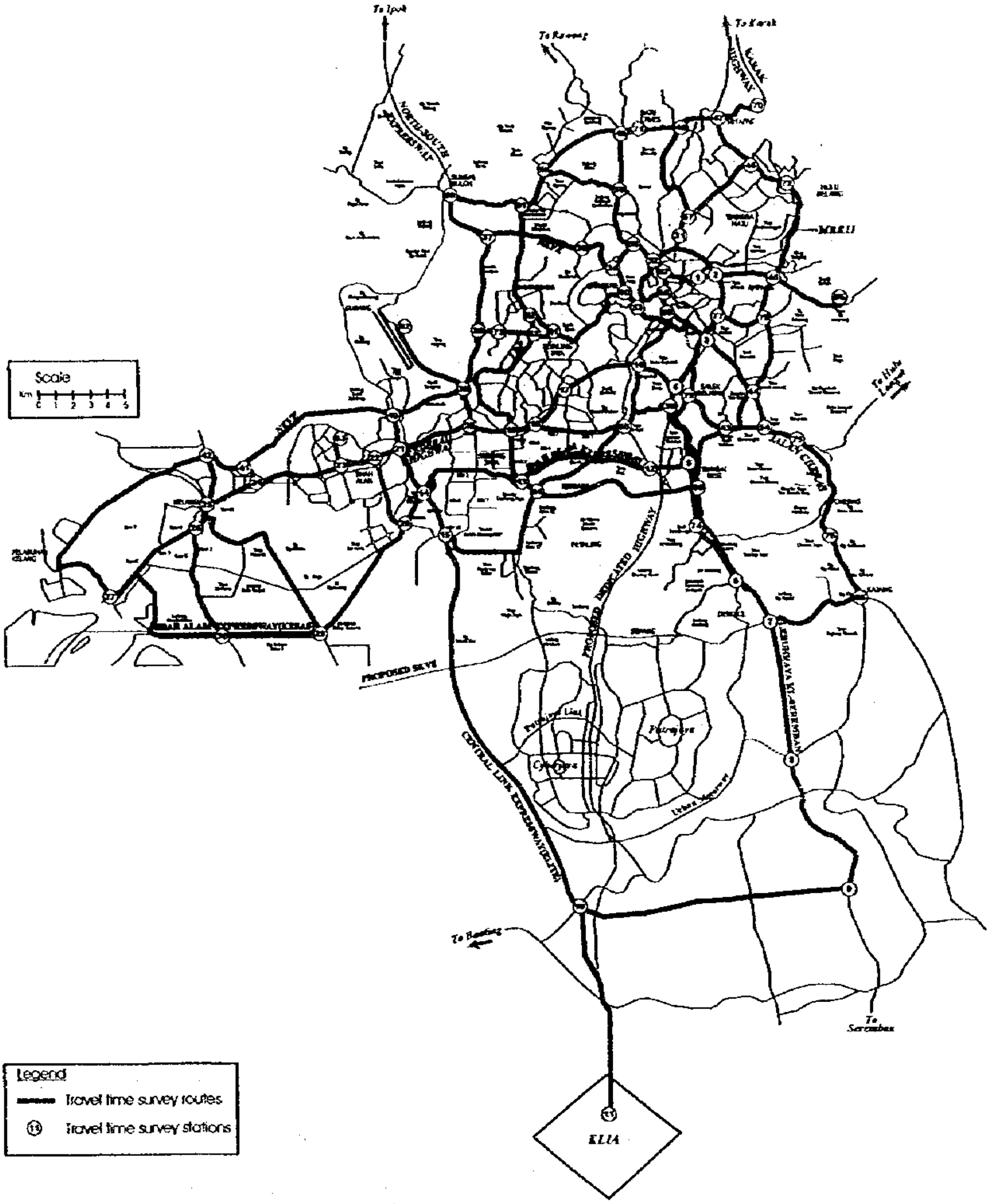


FIGURE 2.4.1 : ROUTE COVERAGE OF TRAVEL TIME SURVEY ROUTES

Table 2.4.1 Travel Time Survey Routes

Origin - Destination	Route No.	Route	Distance (km)
Port Klang to KLCPA (Bank Negara)	1	NKVE- Jln. Damansara-Jln. Semantan- Jln. Duta- Jln. Parlimen	48.9
	2	Federal Highway-Jln. Syed Putra-MRR(I)-Jln. Parliament	44.0
	3	SAE-KL Seremban Exp.- Jln. Istana- Jln. Parlimen	55.5
KLIA to KLCC	4	Airport Access- Elite Highway- KL Seremban Expressway- Jln. Tun Razak- Jln. Ampang	73.0
	5	Airport Access- Elite Highway- SAE- KL Seremban Expressway- Jln. Tun Razak- Jln Ampang	73.6
	6	Airport Access- LDP- Jln Puchong- SAE- KL Seremban Expressway- Jln Tun Razak- Jln. Ampang	73.7
Kajang to KLCC	7	KL Seremban Exp.- Jln. Tun Razak- Jln. Ampang	29.7
	8	KL Seremban Exp.- Jln Sg.Besi- Jln. Tun Razak- Jln. Ampang	30.1
	9	Kajang Cheras Hwy- EWL- Jln.Tun Razak - Jln. Ampang	27.4
	10	Kajang Cheras Hwy- Jln. Cheras - Jln. Tun Razak- Jln. Ampang	23.7
	11	Kajang Cheras Hwy- Jln. Cheras- MRR(II)- Jln. Pandan Jaya- Jln. Tun Razak - Jln. Ampang	25.1
	12	Kajang Cheras Hwy- Jln. Cheras - MRR(II)-Jln. Ampang	25.7
Sg.Buloh Toll to CPA (Bank Negara)	13	Jln. Sg. Buloh- Jln. Kepong- Jln. Kuching	18.5
	14	NS Exp.- NKVE- Jln. Duta- Jln. Parlimen	17.4
	15	NS Exp.- NKVE- Jln. Duta- Jln. Kuching	17.5
	16	NS Exp.- NKVE- Jln. Damansara- Jln. Duta- Jln. Parlimen	22.4
Karak Hwy Toll to KLCC	17	Karak Hwy- MRR(II)- Jln. Ampang	16.7
	18	Karak Hwy- MRR(II)- Jln. Genting Klang-Jln. Pahang- Jln. Tun Razak- Jln. Ampang	15.3
	19	Karak Hwy- MRR(II)- Jln. Gombak- Jln. Pahang-Jln. Tun Razak- Jln. Ampang	15.7
	20	Karak Hwy- MRR(II)- Jln. Kuching- Jln Sultan Ismail- Jln. Ampang	18.9
Motorola IC to Tmn. Melawati	21	LDP- SAE- MRR(II)	32.9
	22	LDP- Jln. Kepong- MRR(II)	34.3

2.4.2 Congested Road Links

Average travel speed for each link based on results of the three days survey was computed and ranked into the four categories. *Figure 2.4.2* shows the average travel speeds during the morning peak hours. Road sections with outstanding low speeds are Jalan Ampang, Jalan Pahang, Jalan Genting Kelang, and Jalan Perkasa. Sections of the MRR(I) between Jalan Pahang and Jalan Ampang were found to have low speed but this could be due to road construction work at the time of survey. Parts of the MRR(II) (between Jalan Cheras and EWL) and Jalan Batu Caves also have very low speed.

Most of the radial roads to KLCPA have average speeds between 30kph to 60kph. Within the Klang Valley, only the toll expressway or highways have higher average travel speeds of between 60kph to 90kph. Average travel speed of more than 90kph were observed only for expressways on the NSCL and KL-Seremban Expressway towards the MSC and KLIA.

The pattern of travel speeds on the major roads in the Study Area is quite similar in the evening peak hours (*Figure 2.4.3*) except that Jalan Cheras and Jalan Kajang-Bangi also had low travel speed.

Travel speeds in the off-peak hours (*Figure 2.4.4*) generally were higher than the morning and evening peaks except for Jalan Ampang, Jalan Tun Razak, Jalan Kajang-Bangi and Jalan Perkasa.

From the above analysis, it is clear that Jalan Ampang, Jalan Pahang, Jalan Genting Kelang and sections of the MRR(I) and (II) are congested while most radial roads to KLCPA are either saturated or approaching congested. Only free flow traffic is maintained on the main toll highways and expressways of NKVE, NSCL, KL-Seremban Expressway, SAE and western section of Federal Highway.

2.4.3 Congested Intersections

Due to the concentration of traffic in and around the KLCPA, intersections in this area are some of the most congested in the Study Area. These severe traffic bottle-necks are intersections of Middle Ring Road (I) with Jalan Pahang, Jalan Semarak, Jalan Ampang, Jalan Bukit Bintang, Jalan Perkasa, Jalan Cheras, Jalan Loke Yew, Jalan Ipoh and Jalan Kuching. Intersections of the Inner Ring Road with Jalan Kuching, Jalan Parlimen, Jalan Bangsar-Travers, Jalan Syed Putra, Jalan Loke Yew, Jalan Cheras, Jalan Pudu and Jalan Ampang are also critical points.

Long queues and delays in the CPA are largely due to over-saturation at intersections or interruptions from intersections. *Figure 2.4.5* shows the locations of some of these severely stressed intersections in KLCPA.

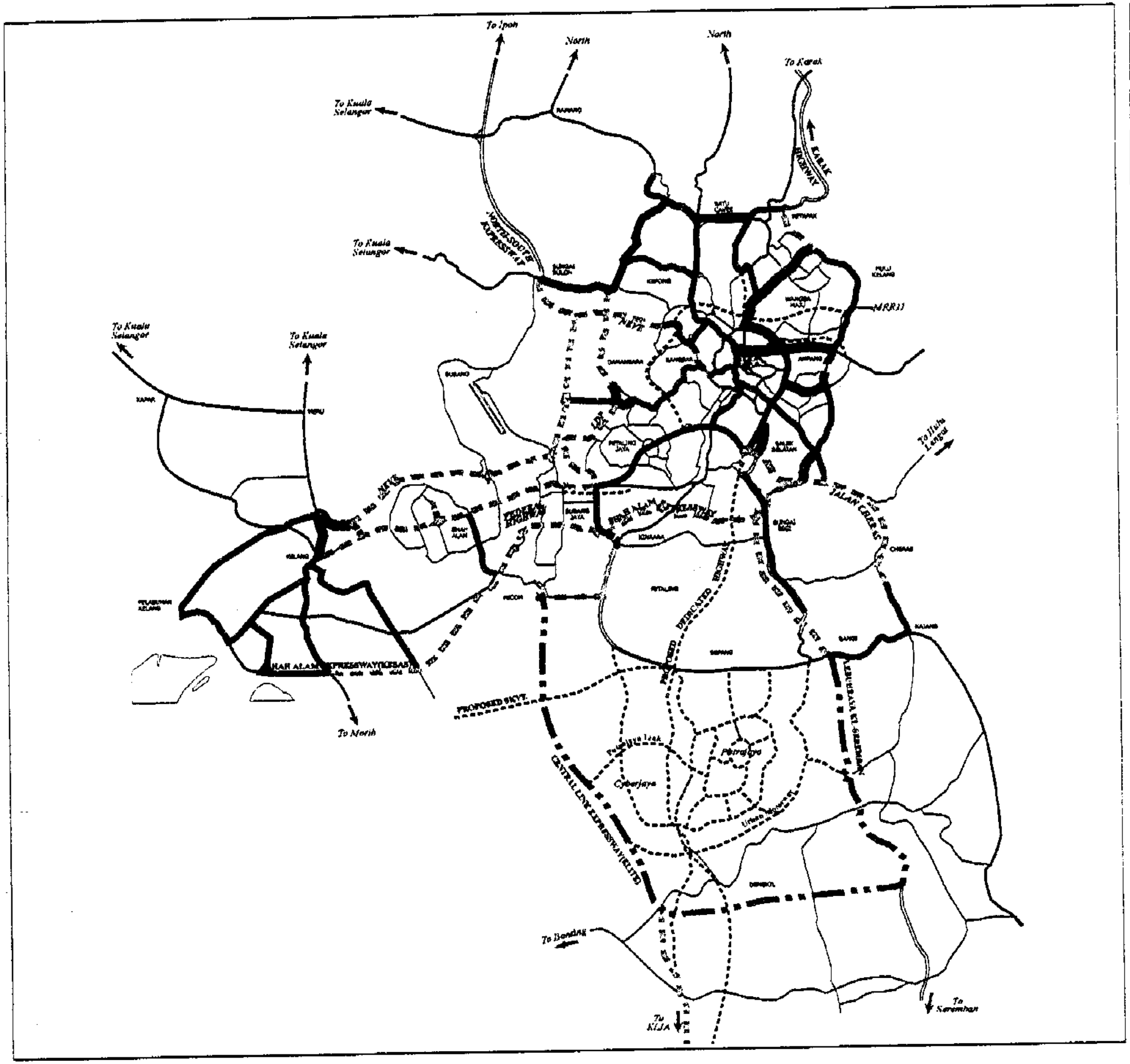


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Figure : 2.4.2

Average Travel Speed During Morning Peak Hour

LEGEND :

- < 30 Kph
- 30 - 60 Kph
- 60 - 90 Kph
- > 90 Kph

0 5 10km

Scale :

N

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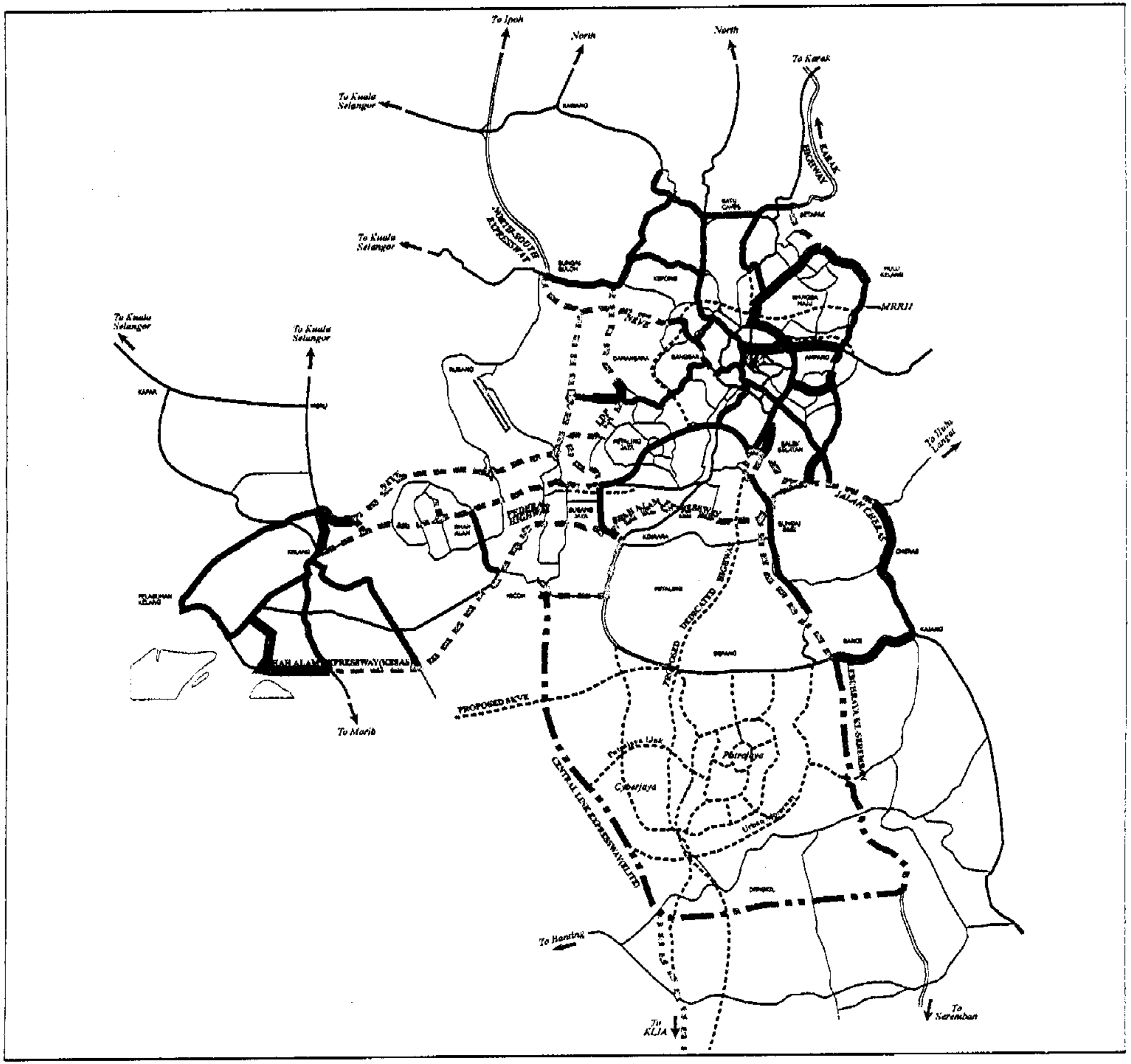

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Figure : 2.4.3
Average Travel Speed During Evening Peak Hour

LEGEND :

- < 30 Kph
- 30 - 60 Kph
- 60 - 90 Kph
- > 90 Kph

0 5 10km
Scale :

N

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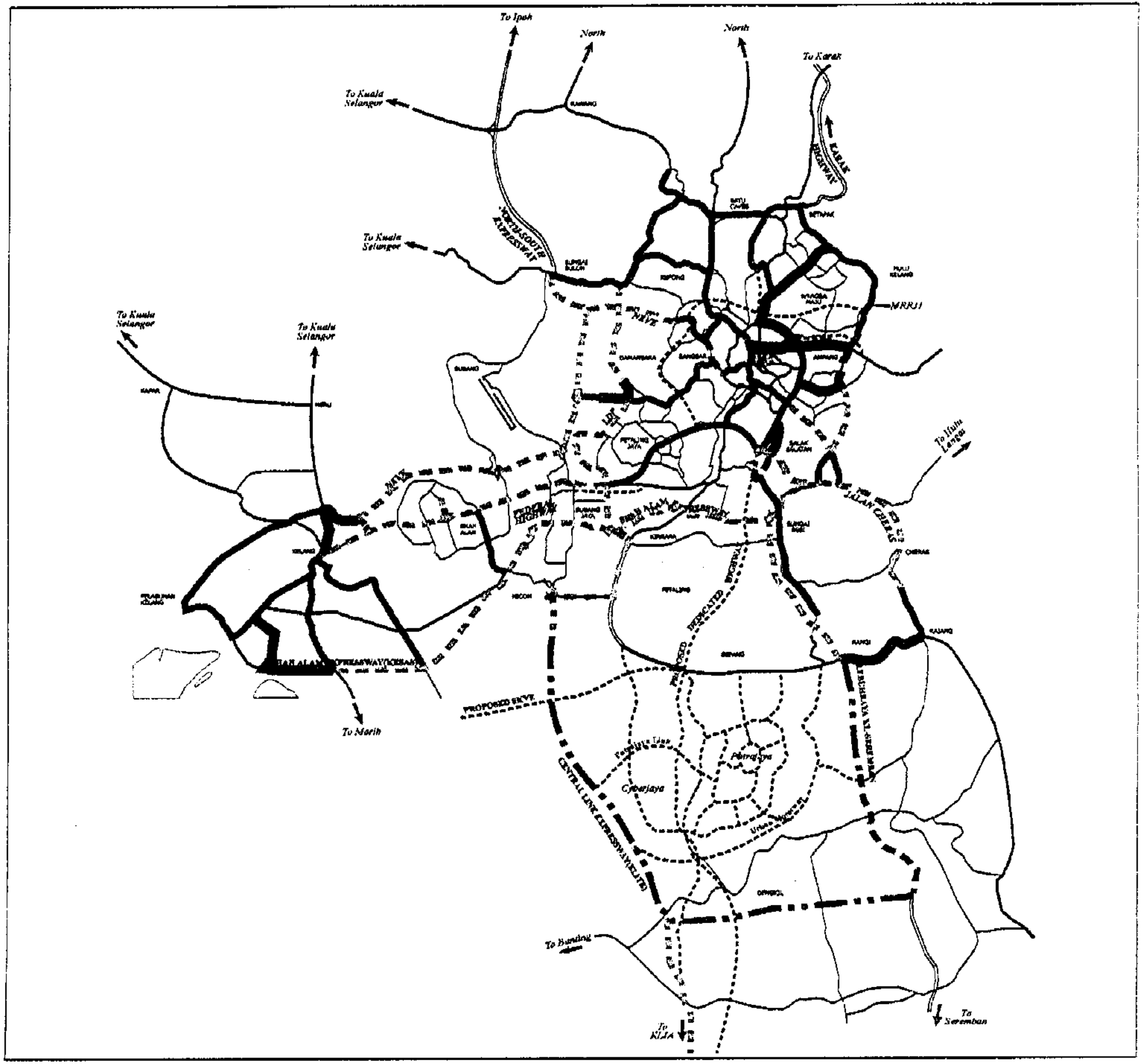

A Study On Intergrated Transport Information System (ITIS) in Klang Valley And The MSC in Malaysia

Figure : 2.4.4

Average Travel Speed During Off Peak Hour

LEGEND :

(line)	< 30 Kph
(line)	30 - 60 Kph
(line)	60 - 90 Kph
(line)	> 90 Kph

Scale : 0 5 10km

N

Perunding Trafik Klasik Sdn Bhd

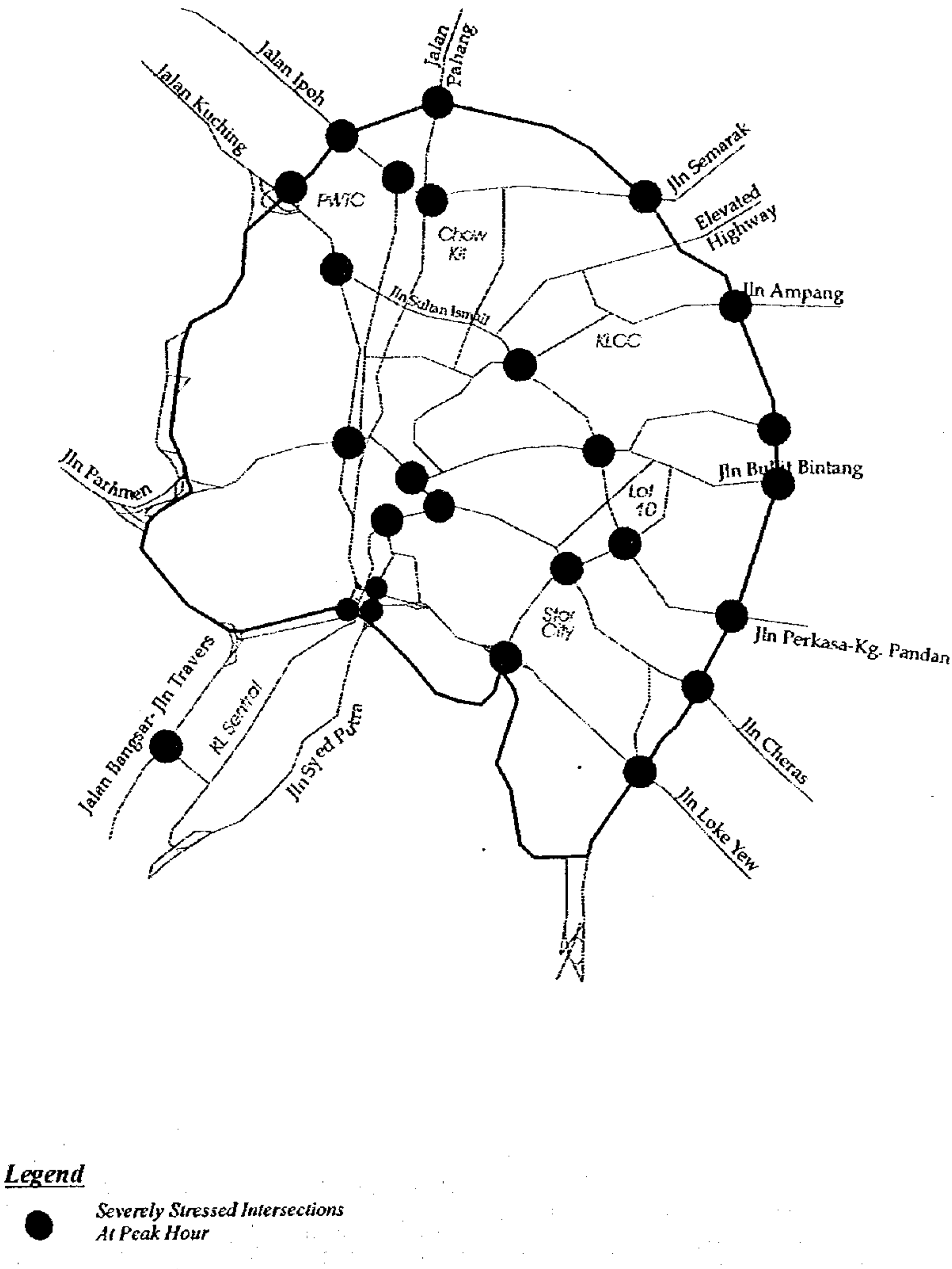

FIGURE 2.4.5 : LOCATIONS OF CONGESTED INTERSECTIONS IN KUALA LUMPUR

Outside the Kuala Lumpur area, long queues at some of the signal-controlled intersections on the slip roads on Federal Highway are also common. Sometimes these queues would extend downstream until the highway. Typical locations are intersections at Jalan University, Jalan Pantai, Jalan Utara, Jalan Barat and Jalan 222.

2.5. Present Parking Conditions

2.5.1 Parking Supply in KLCPA

SMURT-KL JICA Study had conducted a parking survey in Year 1997. The study has estimated that within the CPA there is a total of 87,000 car parking lots, and more than half of these are located in the KLCC and the Golden Triangle-Bukit Bintang area.

Table 2.5.1 presents the estimated distribution of these car parking lots within the CPA 8 traffic zones. *Figure 2.5.1* shows the division of such zones.

Table 2.5.1. Office Parking Capacity in CPA and its Distribution (Year 1997)

Zone	Area	Estimated Capacity (lots)	%
1	DBKL, Pertama Complex, Sogo, Jalan Bunus, Dang Wangi, etc.	9,506	10.9
2	Golden Triangle - Bukit Bintang area, KL Tower, Shangri-La Hotel, Istana Hotel, Sg. Wang Plaza, etc.	20,692	23.8
3	Old Part of City Centre, Jalan H.S. Lee, Jalan Petaling, Kota Raya, Pudu Raya, Merdeka Stadium, Klang Bus Station, Royal Selangor Club, etc.	10,578	12.1
4	Kg. Baharu, Chow Kit, KL Hospital, Pekeliling, Wisma Sime Darby, The Mall, Putra World Trade Centre, etc.	8,592	9.9
5	KLCC, Wisma Central, Matic, Wisma Tan & Tan, Pernas International, Lot 10, Star Hill, Wisma LTAT, etc.	25,066	28.8
6	Jalan Davis area, Wisma Inai, Wisma Time, Pudu Plaza, Star City (under construction), etc.	2,861	3.3
7	Kg. Attap - Pudu area, Wisma Tun Sambanthan, Chinese Assembly Hall, Wisma Putra, San Peng Flats, etc.	7,184	8.2
8	Mahameru - Tasik Perdana area, Kompleks Kerja Raya, EPU, Government Offices, Bank Negara, Bkt. Aman Police HQ, Masjid Negara, Railway Station, etc.	2,579	3.0
	Total	**87,057**	**100**

Source : SMURT, 1997

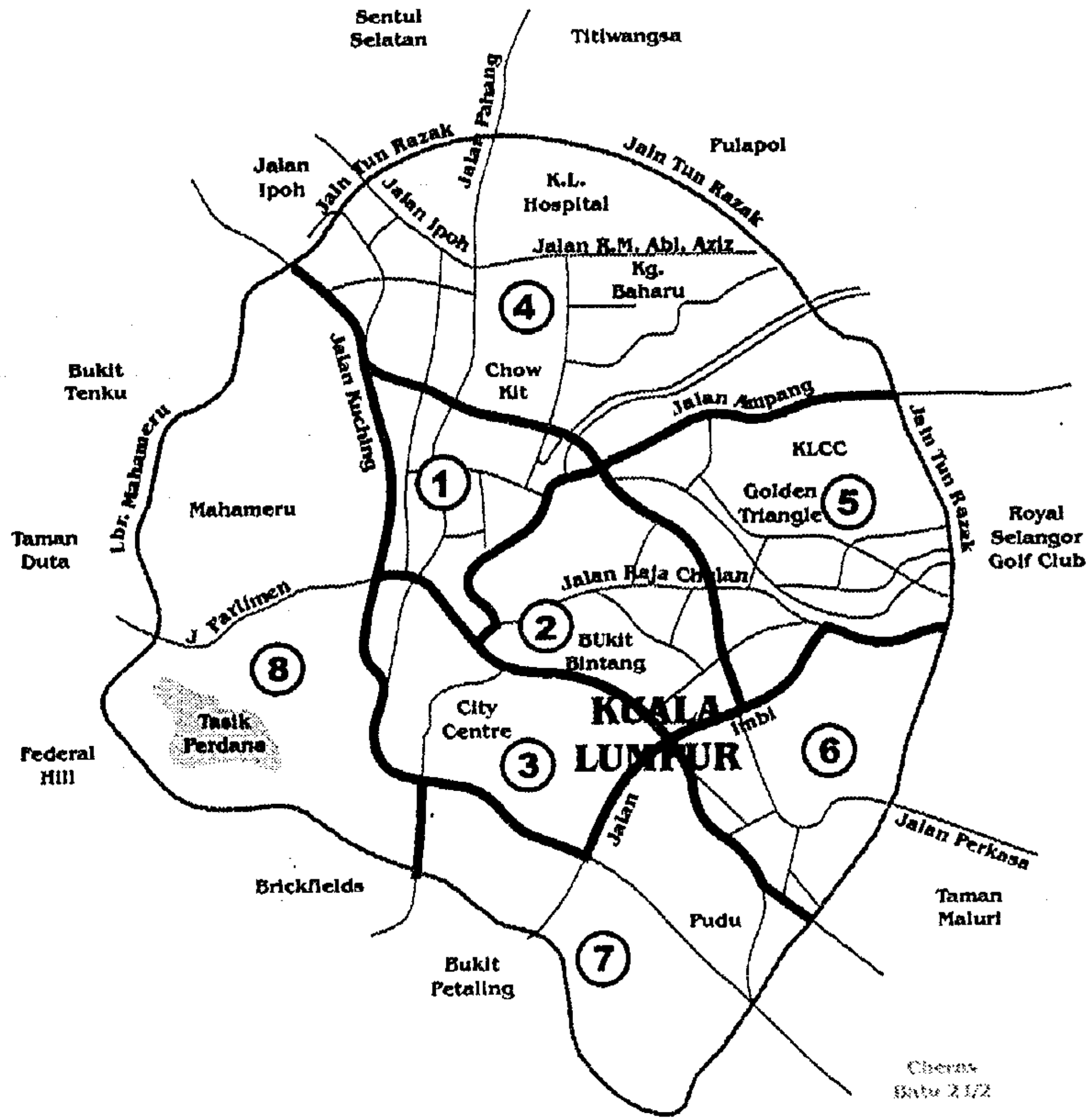

FIGURE 2.5.1 : PARKING ANALYSIS - TRAFFIC ZONES IN THE CPA OF K.L.

From the above table, it can be seen that in terms of office parking supply provision, zone 5 (KLCC zone), zone 2 (Bukit Bintang zone), zone 3 (Old City Centre zone) and zone 1 (Dang Wangi - Jalan Bunus zone) provide the largest number of supply in that order. These 4 zones combined contribute close to 80% of this parking supply in the CPA.

2.5.2 Parking Demand in the CPA

The parking demand by zone for the Year 1997 was estimated by the SMURT-KL Study and given in Table 2.5.2.

Table 2.5.2 Parking Demand of Office in the CPA (Year 1997)

Zone	Demand	%
1	1,776	2.3
2	34,201	44.7
3	9,826	12.9
4	8,080	10.6
5	14,419	18.9
6	3,713	4.8
7	2,694	3.5
8	1,756	2.3
Total	**76,465**	**100.0**

Source : SMURT, 1997

In terms of parking demand, Zone 2 (Bukit Bintang zone) appears to have the highest demand requirements, constituting close to 45% of all requirements in the CPA. This is followed by Zone 5 (KLCC zone), then Zone 3 (Old City Centre zone) and Zone 4 (Chow Kit-PWTC zone). Together, these 4 zones constitute more than 87% of all the CPA parking demand.

Overall, the total estimated supply of car parking spaces in the CPA of 87,000 lots seems to be able to meet the total demand 76,000 lots adequately. However, some zones in the CPA have shortfalls of parking spaces while others have excesses.

Table 2.5.3 compares the parking supply and demand by zone in the CPA and the results show that Zone 2 (Golden Triangle-Bukit. Bintang) has a shortfall of 13,500 spaces while Zone 6 has a small shortfall of 852 spaces. Zones 5, 1 and 7 have large parking excesses. This analysis shows that parking supply and demand in the CPA are not in equilibrium by locality. Zone 2, which has the major shopping centres in Kuala Lumpur, does experience shortage of parking especially during the weekends. It thus provides a good case study for the proposal of a parking information guidance system.

Table 2.5.3 Comparison of Parking Supply And Demand in the CPA (Year 1997)

Zone	Parking Supply	Parking Demand	Excess	Short-Fall
1	9,506	1,776	7,730	
2	20,692	34,201		13,509
3	10,578	9,826	751	
4	8,592	8,080	513	
5	25,066	14,419	10,647	
6	2,861	3,713		852
7	7,184	2,694	4,490	
8	2,579	1,756	822	
Total	**87,057**	**76,465**	**24,953**	**14,361**
Nett			10,592	-

2.6 Existing Public Transport System

In theory, as a city grows in size, the importance of public transport is also expected to grow in tandem. However, Kuala Lumpur appears to be experiencing a paradox in that as the city grows in the last two decade, the contribution from its public transport system seems to be diminishing in significance. Transportation studies conducted for the Klang Valley have consistently recommended to the Government to take vigorous measures and strategies to reverse this trend.

Table 2.6.1 presents the percentage shares of various transport modes in Klang Valley for the Year 1985 and Year 1997 (Source: SMURT-KL JICA Study, 1997). The diminishing role of public transport is glaring and has become a source of concern.

Table 2.6.1 Percentage Shares of Various Transport Modes in Klang Valley (Year 1985 and Year 1997)

Mode	Percentage Share (%)		
	1985	**1997**	**Difference**
Car	33.8	42.9	+9.1
Motorcycle	13.8	18.0	+4.2
Stage Bus/Mini Bus	17.69	6.0	-11.6
Factory Bus/School Bus	7.2	7.7	+0.5
Rail-Based Transport	-	1.2	+1.2
Non-Motorised Transport (Walk and Bicycle)	27.6	23.9	-3.7
Other Mode	-	0.3	+0.3
Total	**100.0**	**100.0**	-

As shown from the table above, the percentage share of trips carried by the stage and mini buses has dropped drastically from 17.6% in Year 1985 to just 6.0% in Year 1997, representing a reduction of 11.6% in percentage share. The factory and school buses managed to maintain their percentage share at slightly more than 7% for the twelve intervening years from Year 1985 to Year 1997. While the nascent rail-based transport (KTM Commuter) has succeeded in securing 1.2% of the total share in Year 1997.

The most significant increase was found in the private car mode with a jump in percentage share from 33.8% to 42.9% (representing an increase of more than 9.1% points). Likewise, but to a lesser degree, the motorcycle's share has also increased by 4.2 percentage points from 13.8% in Year 1985 to 18.0% in Year 1997.

It is important to note that the non-motorised mode in the form of walking and cycling remains very significant throughout the 12-year period at close to 25% (i.e. 1 in 4 trips is either a walking trip or a cycling trip in Klang Valley in Year 1997).

Hence, it may be summarised that in Year 1997, in the Klang Valley, the significance of various transport modes in order of percentage share may be ranked as follows:

1. Private cars (42.9%)
2. Non-motorised mode of walking and cycling (23.9%)
3. Motorcycles (18.0%)
4. Buses - stage, mini, factory and school buses (13.7%)
5. Rail-based transport such as KTM commuter and LRT (1.2%)

This trend of diminishing public transport share will have to be arrested and reversed for the good of Kuala Lumpur City and the Klang Valley, as it is believed that private cars could not and will not be able to cater solely and fully for the travel demand of a growing city like Kuala Lumpur. The role and operation of the public transport in Kuala Lumpur and the Klang Valley will have to be improved and uplifted if the city is to avoid from grinding to a halt by the private vehicles. Fortunately, the City Hall of Kuala Lumpur has begun to take steps to achieve a larger mode share by public transport. With the introduction of LRT lines (STAR and PUTRA Lines) there are now better public transport options to encourage the public to use public transport. The use of ITIS may further enhance the service level of public transport in order to induce the public to switch mode from the private to the public modes.

2.6.1 Bus System

Bus transport that is available to the general public in the Study Area consists of stage buses, which are operated by several private companies. The 3 major operators being Intrakota, Park May and Metro who provided most of the bus services that cover the KL, PJ, Subang Jaya and other conurbation areas such as Klang, Bangi and Selayang. The others are smaller operators such Len Seng, Foh Hup and Selangor which serve the Setapak/Wangsa Maju, Cheras and Taman Sri Damansara areas respectively. The previous minibuses are now replaced by Metro stage buses, which serve 20 routes, most of which are short-trip length routes in Kuala Lumpur.

Intrakota buses charges a flat rate of RM0.90 per ride while Cityliner and the other two smaller operators charge by distance. Intrakota operates about 80 routes while Cityliner serves a total of about 35 routes. Len Seng has about 11 routes and Foh Hup about 5 routes. *Figure 2.6.1* shows the major bus routes in the study area.

Roads on the outskirts of Kuala Lumpur with heavy bus traffic are the Federal Highway/Syed Putra, Jalan Bangsar/Travers, Jalan Brickfields, Jalan Cheras, Jalan Kuching/Ipoh, Jalan Pahang/ Genting Kelang, Jalan Ampang and Jalan Damansara/Semantan. Within Kuala Lumpur city centre, most of the radial and arterials carry heavy bus traffic, notably Jalan Pudu, Jalan Ampang, Jalan Raja Laut, Jalan Tuanku Abdul Rahman and Jalan Cheng Lock.

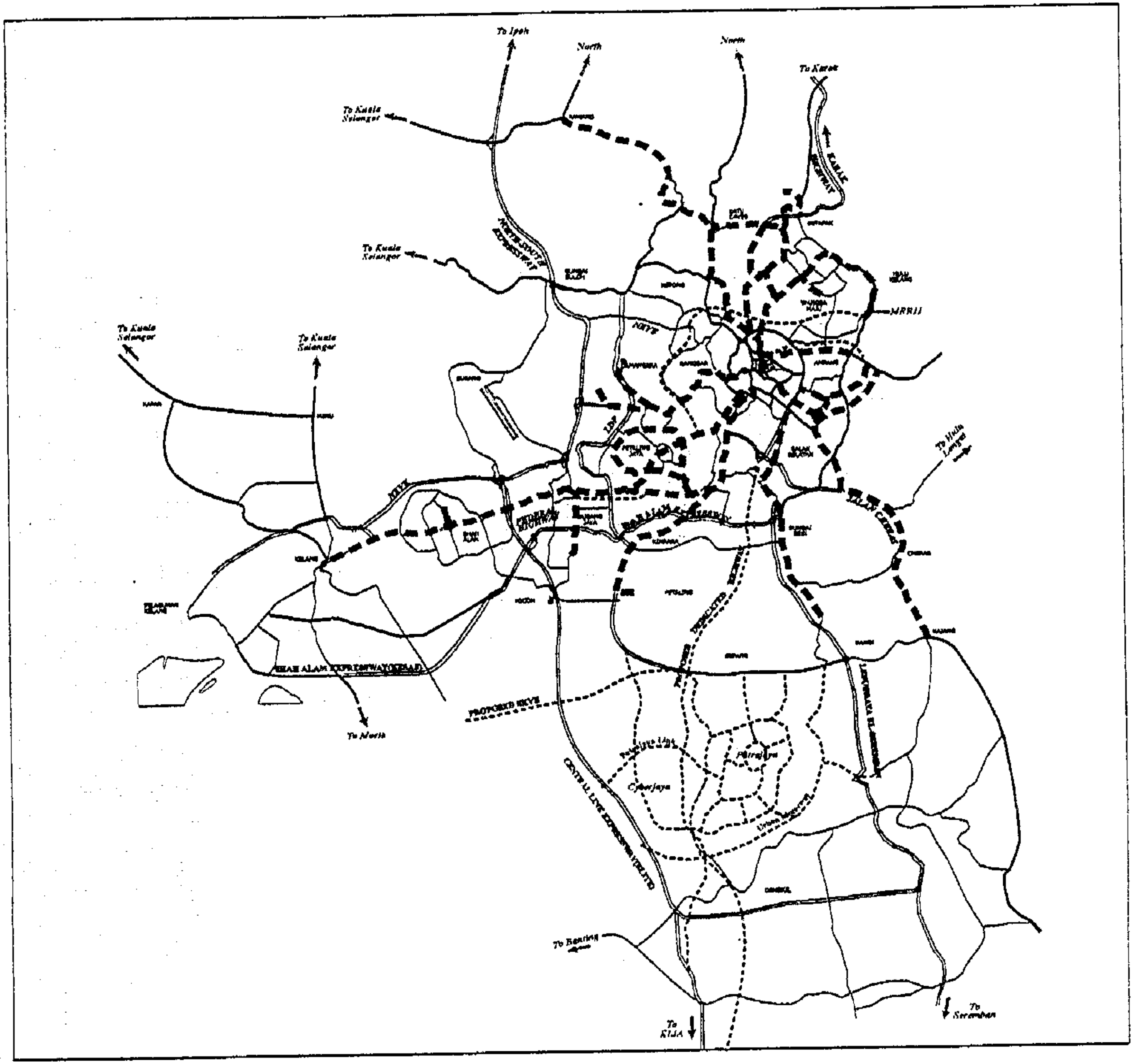

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Figure : 2.8.1

Major Bus Routes in the Study Area

LEGEND :

▬ ▬ ▬ ▬ MAJOR BUS ROUTES

0 5 10km

Scale :

N

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A bus travel time survey was carried by this study and the results are given in Table 2.6.2.

Table 2.6.2 Bus Journey Speed by Segment for Routes Surveyed (Travel Time Survey)

A) Route : Taman Melawati to KLCC

Segment	Journey speed (kph)		
	AM Peak	PM Peak	Off-Peak
Taman Melawati to AU3	25	25	29
AU3 to B. Mara	17	23	27
B. Mara to Perkeso	8	16	16
Perkeso to Tabung Haji	17	20	8
Tabung Haji to KLCC	24	8	24
Total Journey	**17**	**20**	**18**

B) Route : Batu Caves to KLCC

Segment	Journey speed (kph)		
	AM Peak	PM Peak	Off-Peak
Batu Caves to Batu Muda	20	18	23
Batu Muda to Central Market	16	18	16
Central Market to Jalan Silang (Transfer + Walk)	2	2	3
Jalan Silang to KLCC	14	13	14
Total Journey	**14**	**14**	**16**

C) Route : Taman Segar to KLCC

Segment	Journey speed (kph)		
	AM Peak	PM Peak	Off-Peak
Tmn Segar to Central Market	13	23	27
Central Market to Jln Silang (Transfer + Walk)	3	2	2
Jln Silang to KLCC	7	7	5
Total Journey	**10**	**13**	**10**

D) Route : Klang to KLCC

Segment	Journey speed (kph)		
	AM Peak	PM Peak	Off-Peak
Klang to Shah Alam	45	50	38
Shah Alam to Subang Jaya	72	50	72
Subang Jaya to PJ Hilton	65	56	65
PJ Hilton to Kota Raya	40	37	33
Kota Raya to Jln Silang (Transfer + Walk)	2	1	2
Jln Silang to KLCC	11	9	10
Total Journey	31	27	30

A bus and taxi priority lane strategy was implemented by City Hall in Year 1992. These priority lanes however were confined to certain sections of the major arterials in Kuala Lumpur and due to physical constraints were often not contiguous. Bus priority at signalised intersection (Jalan Sultan Ismail with Jalan Raja Laut) was also implemented. The priority lane system has help to improve the bus travel speed somewhat although due to the limitations of the network and some violations by private vehicles, the impact was not very significant. Other reason quoted by SMURT was the excessive overlapping of services on certain routes such as along Jalan Raja Laut such that the platoon of buses itself caused confusion and congestion at bus stops.

Bus services in the study area are unavoidably subject to the effects of frequent traffic congestion on the city streets. Bus travel speed is thus low and the headway is seriously affected. This irregularity in frequency hence has caused ridership to drop. SMURT has reported that waiting time for a bus can sometimes exceed an hour. The other problems with the bus services in the Study Area are over- crowded during peak hours and difficulty in transfer. Bus operators do not follow any fix time schedule. The first run buses that came from the depot in the morning generally follow a particular departure time, but after this first run, the rest of the runs are much dependent on traffic conditions and the drivers.

2.6.2 LRT

There are now two LRT lines in the Study Area. Putra Line which serves the northeastern sector of Kuala Lumpur (Melati, Wangsa Maju, Keramat) and the southwestern suburbs (PJ, Taman Jaya, Bangsar) with the city centre (KLCC, Dang Wangi, Central Market) for a distance of about 29km with 24 stations. Frequency of service during peak hours is about 2 to 3 minutes. PUTRA operates its own bus feeder services to ensure better services to and from the stations. PUTRA started operation for a section of the route in August 1998 to coincide with the Commonwealth Games. But full operation of its 29km track only started in June 1999. In July this year, PUTRA has decided to make its rail travel more affordable and introduce a season ticket that includes unlimited travel on its trains and feeder buses. The monthly ticket even allows free travel for accompanying family members during weekends. These measures were direct response to the lower than expected ridership especially during the initial operation period.

The STAR Line began operation in Year 1996 and serves the Ampang area in the eastern suburb with down town area along Jalan Raja Laut, Jalan Pudu, Jalan Perak. A second line was later added to serve the south-eastern suburbs of Bandar Tun Razak and further on to the Bukit Jalil Sports Complex. STAR LRT now has a total of 25km of track and 25 stations. Frequency of service during peak hours is about 3 to 5 minutes and 7 to 15 minutes during off-peak period. STAR LRT is reported by SMURT to have only an average of 54,000 passengers a day in Year 1997. Ridership on the STAR was found to have two distinct peaks in the morning and evening, indicating the usage by commuters only and very low demand during off peak hours indicating the low demand by business, shopping and school trip makers. Feeder bus service to and from STAR stations is provided by Intrakota. Ridership on STAR was low and its increase very gradual on account of its high fares and poor feeder services. Recently, STAR has also followed the measures of PUTRA in introducing monthly discounted season tickets to attract more users.

The two LRT lines cross each other at one station in Masjid Jamek but are not physically or operationally integrated. Each line has its own station at this location. With the opening of PUTRA, the LRT network undoubtedly has expanded to cover more areas in the Klang Valley and ridership on the STAR and PUTRA should be more than the previous average of 54,000 passengers a day. *Figure 2.6.2* shows the routes of LRT lines and stations in the Klang Valley.

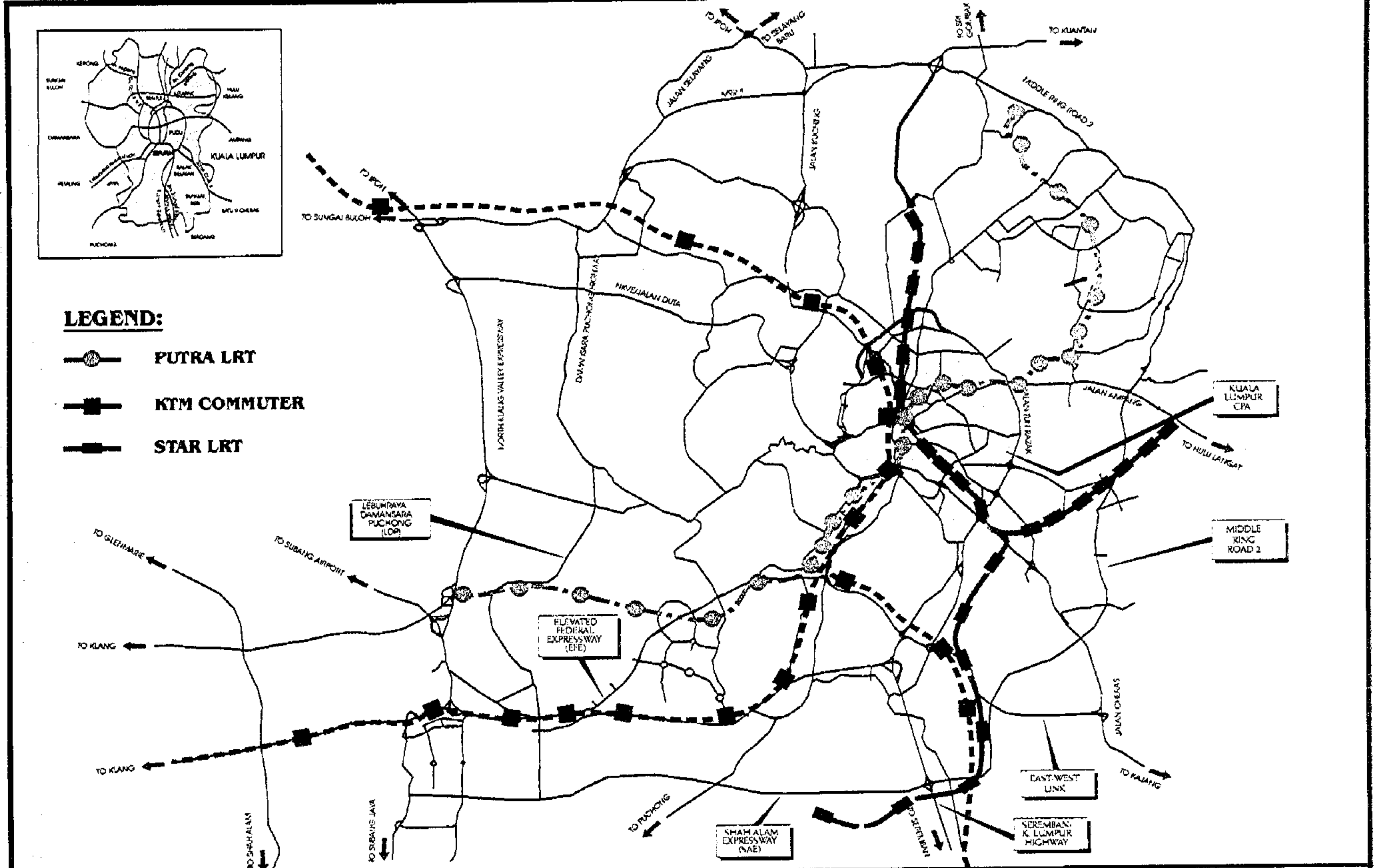

FIGURE 2.6.2 : LRT AND KTM COMMUTER NETWORK : ROUTES & STATIONS

2.6.3 KTM Commuter System

The KTM Commuter Trains came into operation in Year 1995 and the rail network extends from Rawang in the north to Seremban in the south, from Kuala Lumpur to Klang to the west and Sentul to the northeast suburb covering a total distance of about 153km with 42 stations. The service frequency of KTM commuter rail is much longer than the LRT lines at 30 minutes during peak and off peak hours. Feeder services to and from KTM stations are provided by Park May Bus Company. In Year 1996, the average daily ridership was about 30,000 passengers per day and the trend has been increasing at about 47% from Year 1996 to Year 1997. (SMURT) The average daily passenger volume in Year 1997 was about 43,000 passenger.

2.6.4 Taxi

There are a total of 11,275 registered taxis in Kuala Lumpur in Year 1997 under several management companies. SMURT has compared the number of taxis per population of Kuala Lumpur to many cities in Japan and found that Kuala Lumpur in fact has a very high density of taxis surpassing even those of Tokyo or Osaka. Taxis in Kuala Lumpur are however concentrated in the CPA usage with short trip lengths. All taxis in Kuala Lumpur are fitted with two-way radio communication system with their respective service centres.

2.7 Frequent Accident Areas/Black Spots

Traffic accident data in the Study Area are normally gather by traffic police. Within Kuala Lumpur area, such data are kept with the police.

Accidents on Federal roads are kept by JKR. Some form of analysis has been done by JKR in collaboration with the Traffic Safety Council and UPM. Based on the severity of the accidents, they are ranked and a list of the top 200 accident spots is produced. For the list of Year 1996 to Year 1998, out of the total of 200 spots, 15 are found in Selangor. As can be seen in the table (Table 2.7.1), the spots are listed by road section number and district.

Accident data on state roads are not covered in the analysis. Most accident data are therefore, still in their raw state or are in the process of being analysed. There is very little readily available information on accident black spots for roads in the Study Area.

Table 2.7.1 List of Accident Black Spots in Selangor, Year 1996 - Year 1998

Ranking	Route No.	Section No.	District	Severity		Weighted Frequency
				Fatal	Hospitalised	
51	F0001	425	Hulu Selangor	2	13	64
52	F0005	418	K. Langat	2	13	64
59	F0005	494	K. Selangor	5	8	62
60	F0005	495	K. Selangor	5	8	62
64	F0005	420	K. Langat	4	9	60
72	F0005	402	K. Langat	1	13	58
83	F0005	467	K. Selangor	4	8	56
114	F0005	399	K. Langat	1	11	50
120	F0005	417	K. Langat	4	6	48
121	F0005	401	K. Langat	2	9	48
154	F0005	403	K. Langat	2	8	44
170	F0005	411	K. Langat	1	9	42
182	F0005	523	Sabak Bernam	2	7	40
183	F0005	400	K. Langat	2	7	40
184	F0005	409	K. Langat	4	4	40

Source : JKR: Top 200 Hazardous sites, 1996-1998

Out of the total 15 spots, only one spot is on Federal Route No.1 and the rest are all on Federal Route No.5 (coastal road). All of these road sections are beyond the Study Area boundary.