3

EXISTING TRAFFIC MANAGEMENT AND RELATED SYSTEM

3.0 EXISTING TRAFFIC MANAGEMENT AND RELATED SYSTEM

3.1 Traffic Signal Control System

3.1.1 Area Traffic Control System (ATCS) of Kuala Lumpur

As of May 1999, there are a total of 287 Traffic Control Signals (TCS) in Kuala Lumpur as shown in *Figure 3.1.1* operated by Dewan Bandaraya Kuala Lumpur (DBKL). The TCS are essentially divided into three zones of system operations.

A total of 89 TCS located in the downtown Kuala Lumpur area (inside the Middle Ring Road) are inter-networked by the Sydney Co-ordinated Adaptive Traffic System (SCATS) under DBKL's Phase 1 and 2 ATC Programs. These SCATS TCS locations are marked in *Figure 3.1.1*. The SCATS system used in DBKL is an old version, Version 3, which needs to be upgraded urgently. DBKL is currently looking into the possibility of upgrading this system to a newer version.

A portion (approximately 40) of the remaining 198 TCS (mainly outside the Middle Ring Road) is currently being inter-networked by the ITACA system under DBKL's Phase 3 ATC System expansion program whilst the others remain as isolated/vehicle actuated systems.

DBKL is the only municipal council in the study area of Klang Valley and the Multimedia Super Corridor (MSC) that operates an inter-networked TCS system.

<u>The SCATS System</u>

a) Vehicle Detection Devices

Loop detectors are installed at all TCS locations in Kuala Lumpur.

There are also loop detectors installed for the purpose of traffic counting but these are merely stand-alone electromechanical counters and are not linked/networked.

Loop detectors installed in the SCATS system by DBKL is used for traffic volume counting and to calculate the "degree of saturation/congestion" (DS) by the central computer system and are depicted by colour graphics on the computer monitor.

Loop data of inter-networked TCS under the SCATS system is transmitted back to the central computer in the Traffic Control Centre housed in DBKL Building via dedicated modems. The traffic data collected is processed in real time and only specific data required for storage in the Hard Disk Drive (HDD) must be manually selected for storage otherwise such traffic data will not be kept. All data stored in the HDD can be retrieved for off-line analysis, if necessary.

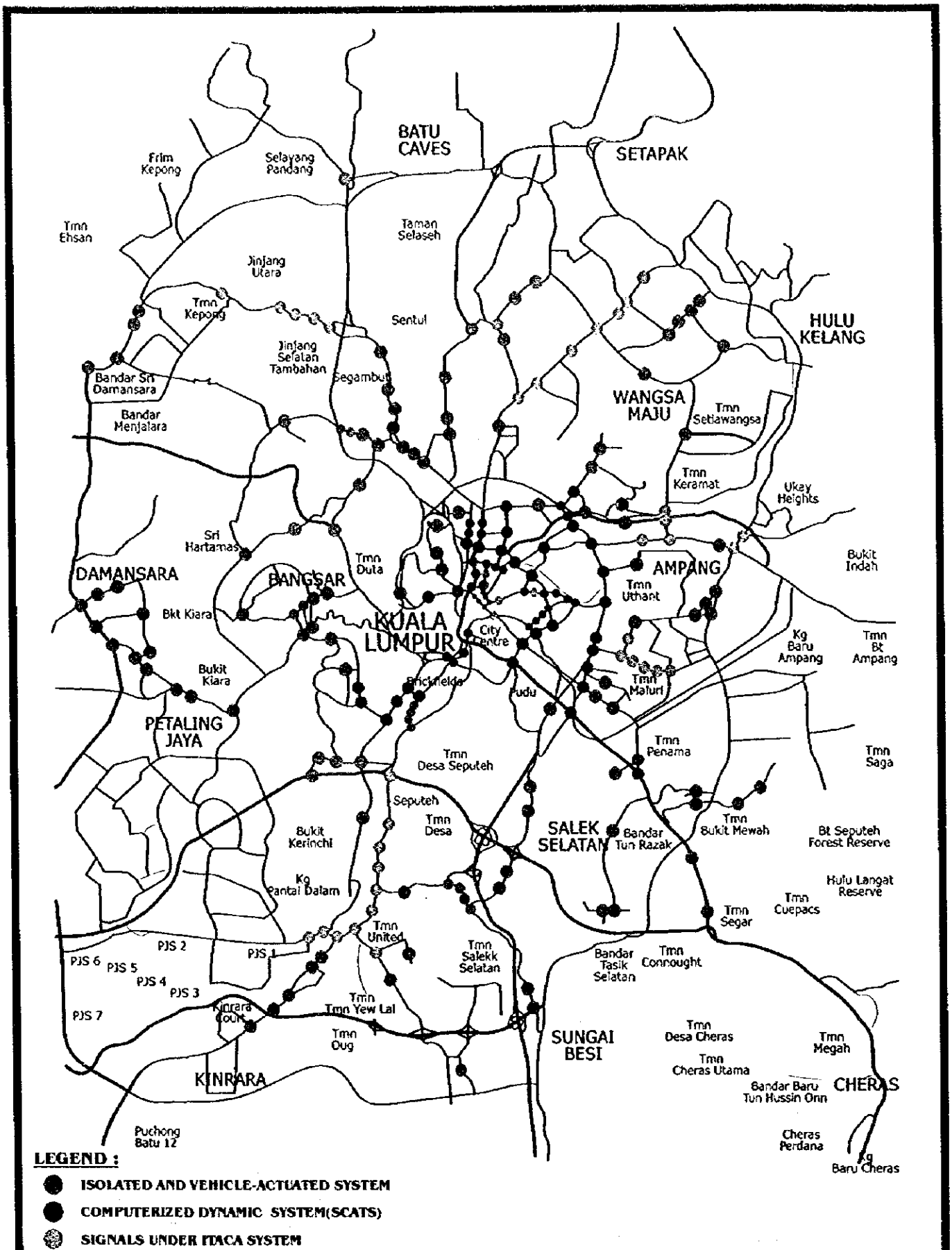


FIGURE 3.1.1 : TRAFFIC CONTROL SIGNALS IN KUALA LUMPUR

Faulty loop detectors are often the result of the loop being cut by road maintenance scraping or trenching works. Another major cause of faulty detectors is pavement rutting or failure brought on by flash foods. Failure of loop detectors caused by induced surges seems to be under control although loop detectors have to be reset occasionally.

b) Television Camera Systems

There are 28 colour Closed Circuit Television (CCTV) cameras complete with Pan-Tilt-Zoom (PTZ) functions installed at 10 locations in Kuala Lumpur for the purpose of obtaining visual images of traffic situation at the selected intersections so that any incident or the real time traffic situation can be monitored. These CCTV are mounted on tall buildings around Kuala Lumpur excluding DBKL's building itself. Locations of these building are given in *Figure 3.1.2.*

1. Dynasty Hotel
2. UMNO Building
3. Maybank Headquarters Building
4. Public Bank Headquarters Building
5. Wisma Mirama
6. Wisma Genting
7. Plaza Ampang (City Square)
8. RHB Headquarters Building
9. Menara Seputeh
10. Ibu Pejabat Polis Kontijen

Video signal from the colour CCTV cameras is sent via an E1 (2Mbps) leased fibre modem circuit back to DBKL's Headquarters. Each CCTV can be viewed by selecting any one camera at any time for each building.

There are also 6 black/white CCTV cameras mounted on 3 poles around Kuala Lumpur. No PTZ capabilities are available for these cameras. Video signal from these cameras' is transmitted back to DBKL via coaxial cables.

The CCTV images are solely used for observations and no further processing is done. Video recordings are made occasionally by a VCR recorder. The police have expressed interest in using the cameras for law enforcement purposes. To this end, discussion with DBKL is ongoing to install more CCTV cameras.

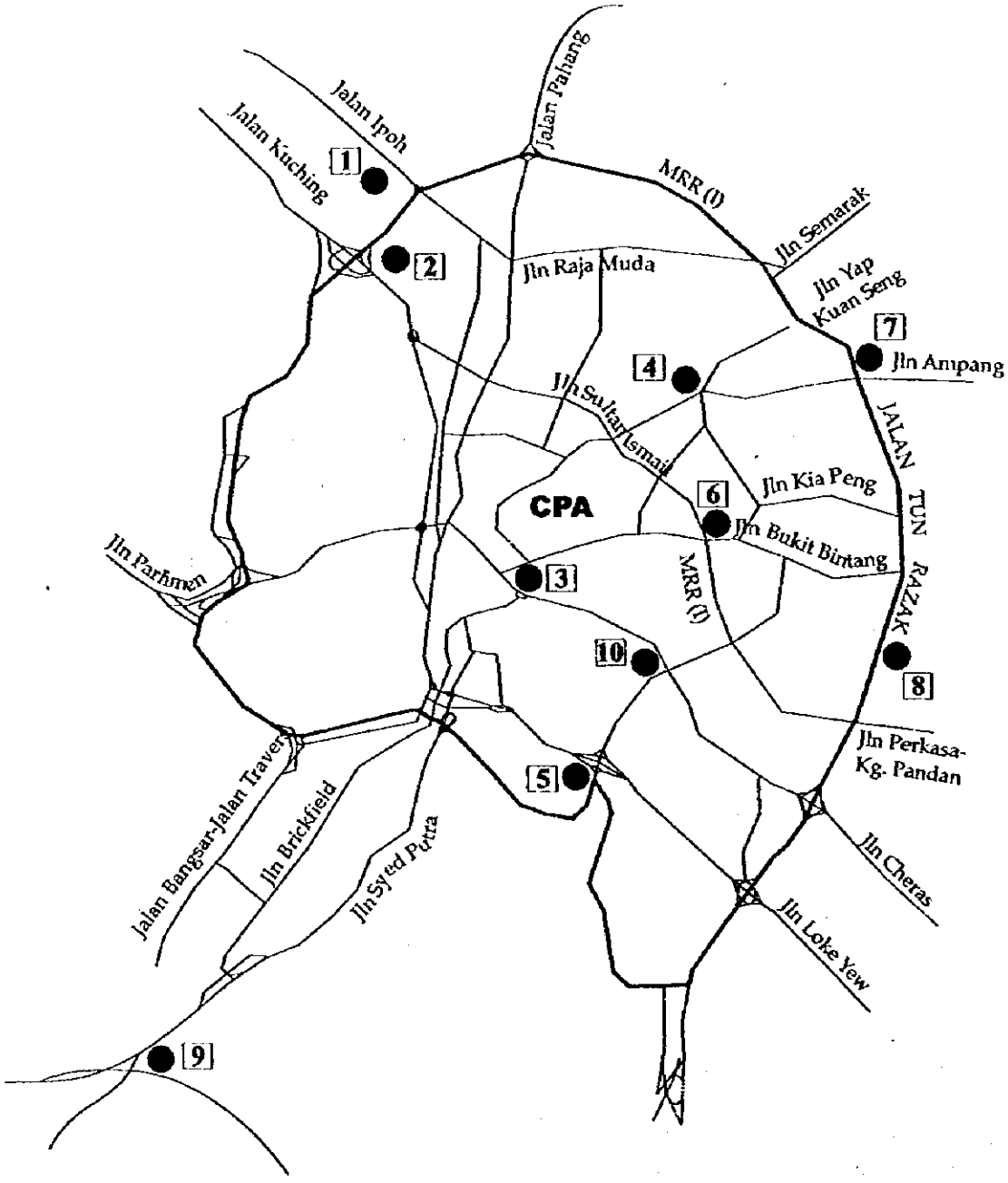


FIGURE 3.1.2 : LOCATION OF CCTVs UNDER DBKL ATCS

c) Data Collection Practices

In Kuala Lumpur, DBKL has appointed contractors to carry out maintenance work on the TCS. Some feedbacks are therefore conveyed by such contractors to DBKL. The SCATS system also does have some fault reporting functions. Faulty loops for instance are also shown as red on the monitor screen. Other form of traffic information collection and reporting practices are the occasional call-ins from the police or public reporting a malfunctioning TCS.

There is a toll-free number that the public can call in to DBKL to complain about TCS failures, accidents and any other traffic abnormality.

d) Information Dissemination Practices

The only form of regular information dissemination on traffic conditions provided to the public in the study area is by radio broadcast. Time Highway Radio (THR), Redifusion (RFM) and ERA are some of the radio stations that regularly broadcast traffic condition during peak hours in the mornings and evenings of weekdays.

Presently, information disseminated on traffic conditions is at the discretion of the respective radio stations. These radio stations relay traffic conditions over the airwaves by viewing the CCTV screens at DBKL.

There is no electronic Variable Message Signage (VMS) used to disseminate traffic conditions nor telephone inquiry services on traffic conditions presently available to the public.

DBKL is however in the process of providing a home page on the Internet to provide administrative as well as traffic related information to the public. Among the information to be given are static video images from the CCTV cameras, current traffic management measures implemented by DBKL; traffic diversion/control measures due to public works, basic public transport information.

e) Telecommunication Network Infrastructure

To inter-network the SCATS system for DBKL, Telekom Malaysia (TMB) laid dedicated underground copper cables to all relevant TCS locations back to the DBKL's headquarters. The copper cables are leased to DBKL on a lump sum per annum basis.

DBKL also leases fibre-optic links (2Mbps each) from TMB for the colour CCTV cameras from all remote building sites.

When applying for leased circuits, the standard practice is for DBKL to trench (at their own cost) to the closest TMB manhole or cabled location in order to be connected.

The ITACA System

37 of the existing signals (including 6 pedestrian and 1 U-turn) and 2 new signals were brought under the ITACA system recently under DBKL's Phase 3 ATCS expansion program. The locations of these signals are indicated in *Figure 3.1.1*. These signals are mostly located outside the KLCPA and are concentrated in the high traffic demand areas of Jalan Ampang/Pandan, Jalan Genting Klang, Jalan Kepong and Jalan Kelang Lama.

This system hence brought another 37 isolated control signals in Kuala Lumpur and 2 new signals into an inter-networked system control. This adds up the total number of signals in KL being centrally controlled to 128. Under this Phase 3 program, no additional CCTV camera was added. Currently, these signals are operated as isolated signals and linkage to the control centre will only be done at a later date.

However, since the ITACA and SCATS are totally different ATC systems, their full integration may be difficult.

The ITACA system attempts to optimise cycle, offset and split times using models calibrated with historic traffic profiles obtained using detectors deployed at the intersections. The aim is to minimise delays and stops at these intersections by constantly adjusting the splits and cycle length to suit the current traffic demand.

The system deploys vehicle detectors beyond the longest queue during a long cycle at the intersection thus enabling it to detect traffic congestion on any approach to the intersection. Such capability allows the system to optimise cycle length and split. The system is thus also capable of computing the saturation flow. The ITACA system is therefore able to provide useful traffic data from its congestion detectors to any future ITIS.

This system is said to be more traffic responsive and able to adjust quickly to changing demands at the intersections. The control centre of the ITACA system is also housed in DBKL.

3.1.2 Traffic Signal Control in Other Areas

Traffic Signal Control in other centres besides DBKL such as Petaling Jaya, Subang Jaya, Ampang Jaya, Shah Alam, Klang, Kajang are all isolated or vehicle actuated signal controls.

Traffic signals at some of the junctions to the toll roads like LDP and SAE were installed and managed by the concessionaires. They are also stand-alone and vehicle activated type of signals.

3.2 Toll Road Traffic Systems

There are presently 14 stretches of privatised toll road located in the study area, which are currently in operation. They are as follows:

1. The "North-South Expressway" (NSE) – Rawang to Bukit Lanjan and Kuala Lumpur to Nilai only
2. The "North Klang Valley Expressway" (NKVE)
3. The "North-South Central Link" (NSCL)
4. The "Shah Alam Expressway" (SAE)
5. The "Damansara-Puchong Expressway" (LDP)
6. The "East-West Link" (EWL)
7. The North Klang Straits Bypass (NKSP)
8. The Federal Highway (FH) from Klang to Subang Jaya
9. The Karak Highway
10. Besraya Sg.Besi Highway
11. Cheras-Kajang Highway
12. Jalan Kuching
13. Jalan Cheras
14. Jalan Pahang

Another 3 stretches of privatised toll road are currently under construction in the study area. They are as follows:

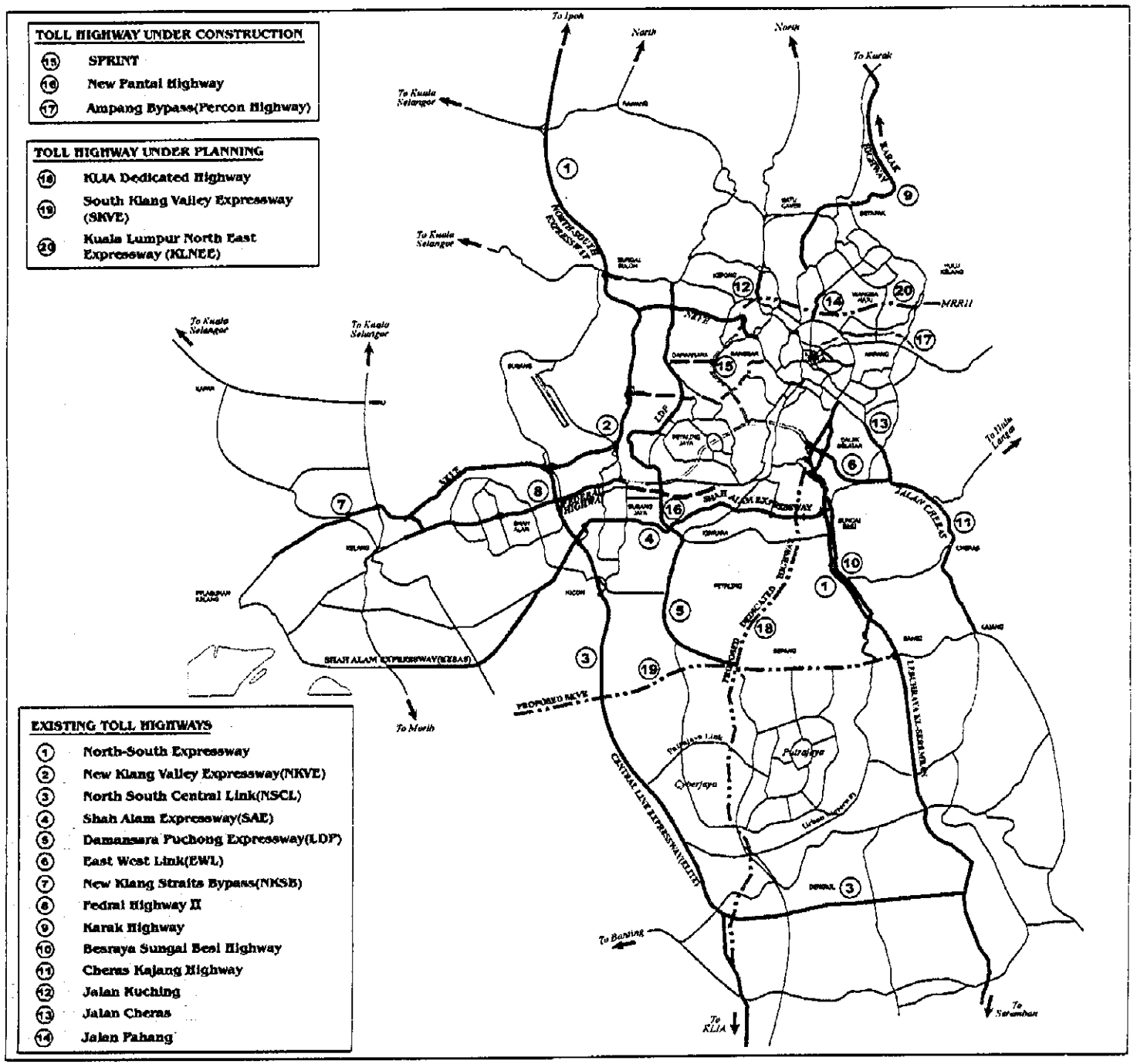
1. The "Western Traffic Dispersal Scheme" (SPRINT)
2. The "New Pantai Highway"
3. The "PERCON Elevated Highway"

Three other major toll highways have also been planned and these are:

1. The KLIA Dedicated Highway
2. The South Klang Valley Expressway (SKVE)
3. The Kuala Lumpur North East Expressway (KLNEE)

All the above listed existing stretches of toll roads are identified in *Figure 3.2.1.* The following sub-sections described the existing traffic management and control systems of the toll highways.

Among the above toll systems, only the Shah Alam Highway (SAE), the Damansara-Puchong Highway (LDP) and the North South Central Link (NSCL) and the North-South Expressway (NSE) have more comprehensive traffic surveillance and management systems.



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

Figure : 3.2.1

Toll Road Systems in the Study Area

LEGEND :

- EXISTING TOLL HIGHWAY
- TOLL HIGHWAY UNDER CONSTRUCTION
- TOLL HIGHWAY UNDER PLANNING

0 5 10km

Scale :

N

Perunding Trafik Klasik Sdn Bhd

Table 3.2.1 below gives a summary on the scope and contents of the traffic surveillance and control systems installed by the major toll road operators.

As can be seen in the table, the various existing systems are quite different in contents. In general, however, it can be said that most of these systems rely on manual gathering of information via patrol and user reporting to detect incidents on the highways. Efforts in traffic surveillance and monitoring are mostly concentrated in the toll plazas using fixed video cameras.

Pole mounted VMS is first introduced on the highways in the Study Area by the operator of Shah Alam Expressway. 4 VMS were installed on SAE. 12 similar VMS was later installed on the NSCL. 4 gantry mounted VMS were deployed on the LDP.

Emergency telephones were provided along the expressway on the NSE/NKVE and NSCL at 2km interval while they are at 1.5km interval on the SAE. Emergency telephones are not provided on other toll highways.

The SAE is also the first toll highway to deploy PTZ CCTV cameras for monitoring traffic conditions at interchanges along the highway.

Table 3.2.1 Summary of Features of Some Traffic Information Systems on Existing Toll Highways

No.	Interchange/ Equipment	SAE	LDP	NSCL	NSE* /NKVE	Sg.Besi Highway	Cheras Kajang Highway	LWL
1	Operator	KESAS	LITRAK	ELITE	PLUS	BESRAYA	GRAND SAGA	METRAMAC
2	Interchanges	12	14	7	10	9	7	3
3	VMS	4	4	12	-	-	-	-
4	PTZ CCTV Cameras	8	8	6	-	1	-	-
5	VVD	21	(78 #)	14	-	-	-	-
6	Mainline Traffic Counters	-	3	-	-	-	-	-
7	Emergency Telephones	@ 1.5km	-	@ 2.0km	@ 2.0km	-	-	-
8	Main Communication network	Optic Fibre	Optic Fibre	Optic Fibre	Optic Fibre	Optic Fibre	Leased TMB Line	Leased TMB Line

No.	Interchange/ Equipment	SAE	LDP	NSCL	NSE* /NKVE	Sg.Besi Highway	Cheras Kajang Highway	EWL
9	Manual data collection	Patrol	Patrol	Patrol	Patrol	Patrol	Patrol	-
10	Toll Plaza (Open System only)	4	4	N.A	N.A.	3	2	2

** NSE sections within the Study Area only*
 # Passive infrared optical detectors at 1km interval at median and 2 detectors at one location
N.A. = Not applicable
VVD = Video Vehicle Detector

Figure 3.2.2 shows the location and type of traffic surveillance equipment on the existing toll roads in the Study Area.

As an existing infrastructure stock, there are therefore, a total of about 250km of optical cable network (though of varying core numbers), 20 VMS, 37 PTZ CCTV cameras (including 4 in Karak Tunnel and 10 from DBKL ATC System), 35 fixed CCTVs, 35 fixed video camera detectors and other types of vehicle detectors. which can be incorporated into the future ITIS Plan.

The following sections described briefly the type of traffic information and surveillance systems on the existing toll highways based on replies to questionnaires sent to the operators by this Study.

3.2.1 North South Expressway, NKVE and Federal Highway

The two sections of the NS Expressway (Rawang Interchange to Bukit Lanjan Interchange, Sg.Besi Toll Plaza to Nilai Interchange), the NKVE and the Federal Highway (section from Klang to Subang Jaya) are toll expressways and highway within the Study Area managed by PLUS.

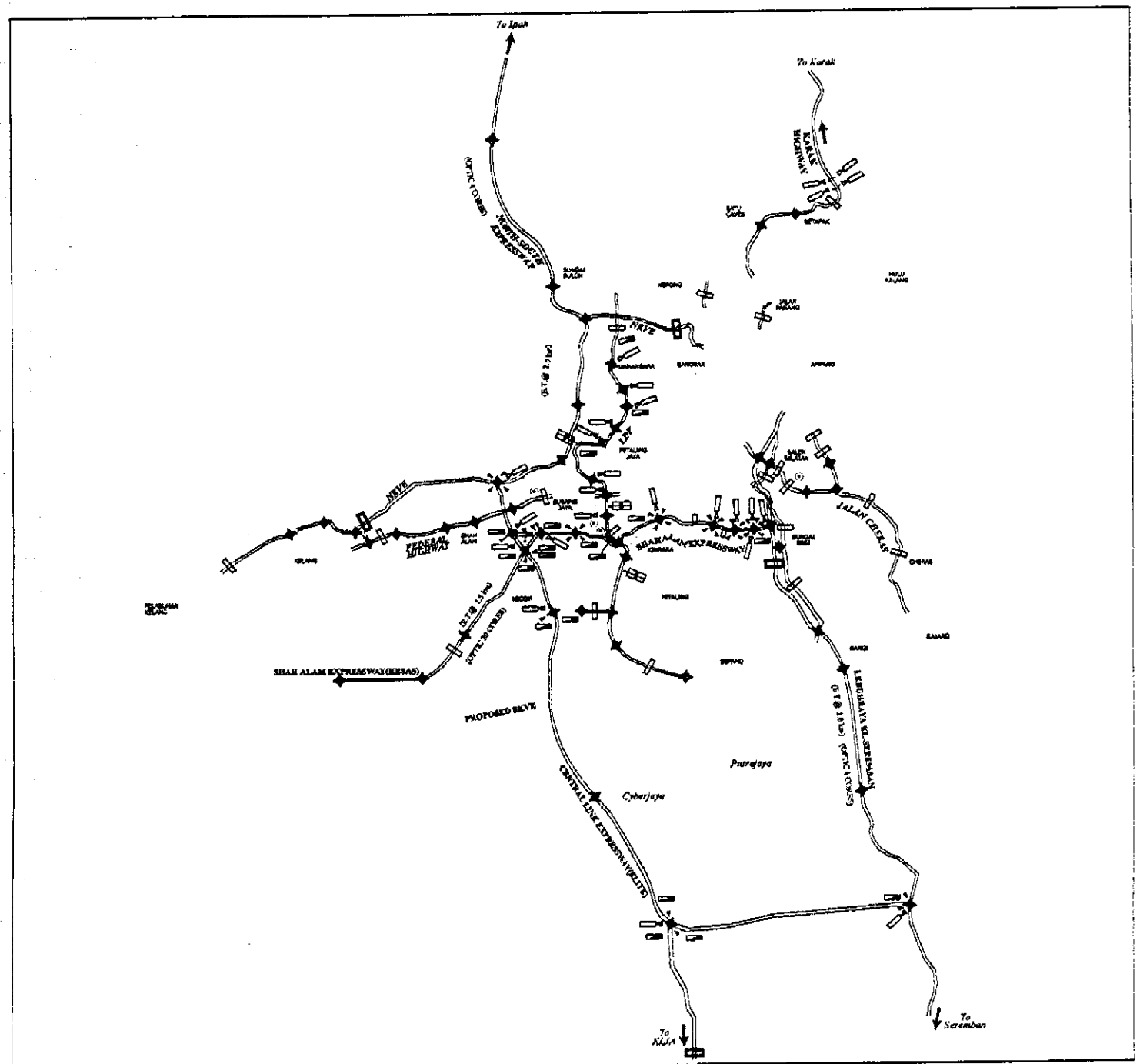
a) Vehicle Detection Devices

At the entire toll plazas (TP) operated by PLUS, treadles and optical sensors are installed as vehicle detection devices for vehicle classification and counting purposes. Loop detectors are not used along the expressway sections.

All the TP are connected via a 34Mbps PDH fibre-optic network.

b) TV Cameras

PLUS has about 500 TV cameras installed at all the TP and tunnel on all its expressway sections. These cameras are only used to monitor traffic flow through the toll plazas and have no Pan-Tilt-Zoom (PTZ) functions. Video images are sent to the toll plaza control rooms via coaxial cable. Images are sometimes recorded.



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

Figure : 3.2.2

Traffic Surveillance Equipment Deployment on the Existing Toll Road Systems

LEGEND :

- INTERCHANGE
- VMS
- CCTV
- TCC
- VIDEO VEHICLE DETECTOR
- TOLL PLAZA(OPEN SYSTEM ONLY)
- TRAFFIC COUNTERS
- E.T. EMERGENCY TELEPHONES
- TOLL GATE TO CLOSE SYATEM HIGHWAY

0 5 10km

Scale :

N

Perunding Trafik Klasik Sdn Bhd

c) Manual Data Collection System

Manual data collection is done by "PLUS RONDA" or patrol teams. These patrols are required to report back to their respective management offices on the general traffic and road conditions as well as accidents or breakdown vehicles on the expressway at regular intervals either via emergency telephone or mobile radio. Accident and other incident data are recorded for analysis purposes. Information are also relay to the management offices by users via emergency telephones installed at 2km interval along the NS Expressway and NKVE mainlines.

d) Information Dissemination

No VMS are used to relay traffic information to users. Traffic information is only given to users via radio broadcasting (THR, ERA, and RFM) every weekday during the morning and evening peak hours. Information is given to the radio stations via either telephone or fax. The public can also called a hotline called "Plusline" (03-2920000) to obtain any traffic-related information from the PLUS traffic monitoring centre.

e) Telecommunication Network Infrastructure

PLUS operates its own internal 34Mbps PDH fibre-optic network from north to south for about 850km. This fibre-optic network is used for both voice-transmission (PBX) as well as data transmission. All TPs are connected to this network. There are spare fibre cores available along the highway. PLUS leases a trunk radio network for their "PLUS RONDA" vehicles.

3.2.2 North South Central Link (NSCL)

The 46.8km of expressway that connects the NKVE to the KL-Seremban Expressway is the last link that completes the National Expressway Network from North to South on the Peninsular. This stretch of the expressway including a spur to KLIA has a total of 7 interchanges and are managed by ELITE under a closed toll system.

a) Vehicle Detection Devices

Like the NS Expressway or NKVE, there is no vehicle detectors deployed on the mainline. Optical sensors are deployed at the toll plazas for vehicle classification counts. 14 video vehicle detectors are however used at the 6 interchanges. Data obtained by these detectors is sent to the control centre by optic fibre cable. Data are stored in disks to enable retrieval.

b) TV Cameras

6 CCTV cameras with PTZ functions were installed each at the 6 interchanges for traffic surveillance. Video signals are sent to the centre via optical cables.

c) Manual Data Collection System

Manual data collection system is done via emergency telephone installed at 2km apart and by trunk radio used by the traffic operation and management team on site. Other form of data collection is via telephone calls from the public on its hot line. Information on other expressways that managed by PLUS are obtained via telephone when required.

d) Information Dissemination

12VMS were installed along the expressway, some on the mainline and others on entry ramps after the toll plazas. Messages and updating are all at the discretion of the operational manager. Signals are sent by optical fibre at 9.6kbps.

e) Telecommunication Network Infrastructure

ELITE uses its own internal communication network. No leased line is used. Both optical fibre and coaxial cables are used for data and voice communication. Optical fibre is used for point to point communication between the control centre and equipment. Coaxial cables are used for communication between equipment to roadside cabinets. The trunk radio used by operational personnel is leased from licensed operator.

3.2.3 Shah Alam Expressway (SAE)

The 32.1km Shah Alam Highway is managed by KESAS whose control centre is located in Subang Jaya. The highway routing and location of various traffic surveillance equipment are shown in *Figure* 3.2.2.

a) Vehicle Detection Devices

At TP along the SAE treadles and optical sensors are used as vehicle detectors to count traffic volume and classify them by types of vehicle. Loop detectors are not used for this purpose.

Traffic volumes along the highway sections are determined using image processing from CCTV images captured by cameras installed on high poles at 14 locations along the highway.

Data collected at each TP are only transmitted to the HQ on a daily basis. Data from the toll lanes are processed locally in the TP according to the standard data processing requirement (hourly, shift, etc). Toll collection data are also processed locally by Digital Equipment computers while traffic volume data collected from image processing of CCTV images are processed by Sun Workstation computers. These data are accessible by external systems.

b) TV Cameras

There are two types of CCTV used on this highway. Those installed on poles for traffic volume counting using video imaging are fixed while those installed at the 8 interchanges used for visual traffic monitoring are equipped with PTZ functions.

All camera images can be sent back to the TP or HQ via fibre modem/multiplexes. Video recording of CCTV images can be made whenever required.

c) Manual Data Collection System

Manual data collection on this highway is performed by SAE patrolling teams. These patrols are required to report back to the TP or HQ at regular intervals on road and traffic conditions, accidents or incidents and vehicle breakdowns via telephones or mobile radios. Emergency telephones are located at 1.5km interval along the highway for public to relay information to the HQ.

d) Information Dissemination

Traffic information on the highway is disseminated to the road users by VMS, radio broadcasting and telephone. There are 4 VMS installed along the highway, which are of the LED character type mounted on gantry. Messages are selected from a table of pre-set "standard messages" and sent from the HQ at the discretion of the operation manager via the fibre-optic network. Any updating of messages is not on a regular fixed time basis but when necessary.

Traffic related or event information are faxed or telephoned or e-mailed twice daily in the morning and evening on weekdays to radio broadcasting stations (THR, ERA, RFM) which broadcasting them to the public.

e) Telecommunication Network Infrastructure

Like PLUS, KESAS also operates its own internal 34Mbps PDH fibre-optic cable networks along the SAE. Only one 2Mbps circuit is leased from Telekom Malaysia (TMB) for networking to a TP (near Klang). The fibre-optic network is used for voice (PBX), data, messaging and CCTV video signal transmission.

3.2.4 Damansara-Puchong Expressway (LDP)

The LDP is managed by LITRAK and its operational control centre is located at the Sunway Toll Plaza Office. The LDP is a 40km highway with 14 interchanges and 4 TPs with 88 toll booths/lanes. *Figure* 3.2.2 also shows the highway routing and locations of various traffic surveillance and management facilities.

a) Vehicle Detection Devices

Passive infrared sensors are installed at 1km interval along the highway for vehicle detection. These sensors, each for one carriageway are mounted on high poles and erected along the median. Vehicle volume and speeds are collected by this method; and relay to the control centre via 12 local controllers. The data are processed and displayed on the control centre's wallmap using LED display indicating 3 levels of congestion (red = congestion, amber = moderate congestion, green = free flow). Treadles and optical sensors are also installed at toll plaza for vehicle counting and classification.

Traffic counters on mainline are installed at three locations to provide traffic count data. Loop vehicle detectors are installed at 12 at-grade intersections with the highway for operating the EVA (Enhanced Variable Actuation) traffic signal control for these intersections. Traffic data from these detectors are relay to the control centre via local controllers.

b) TV Cameras

8 CCTV completed with PTZ functions are mounted on high poles or bridge structure along the highway to capture visual images of traffic flow situations. These images are sent to the control centre via fibre-optic (2Mbps) cable. The cameras are used to visually monitor traffic situations.

c) Manual Data Collection System

Manual data collection on the LDP is carried out by a 24 hours motorcycle patrol system. These patrols are required to report back to the control centre the general traffic and road conditions as well as any incidents. LITRAK also operates its own tow trucks to ensure quite removal of breakdown vehicles.

d) Information Dissemination

Traffic related information is disseminated to the users via VMS, radio broadcasting and telephone. There are 4VMS of the gantry mounted LED character type panels installed along the highway. Each sign has 3 lines each with 15 characters. Messages are displayed by selecting from a set of "standard messages" and sent from the control centre. Messages are updated at the discretion of the operation manager.

Like the other toll operators in the Study Area, traffic information are sent to the radio broadcasting stations (THR, ERA, and RFM) by fax, telephone or e-mail twice daily during the weekdays. These informations are then broadcast to the users.

e) Telecommunication Network Infrastructure

LITRAK operates its own internal 34Mbps fibre-optic network. The fibre-optic cable is used to transmit voice messages, data and video images.

3.2.5 East-West Link, Jalan Cheras, Jalan Pahang and Sg.Besi Expressway

METRAMAC operates four toll road sections in the Study Area. They are all short stretches of arterials that nevertheless carry sizeable traffic volumes. As these sections are physically far apart, the traffic management system used is rather minimal. METRAMAC operates 5 TPs (2 on the EWL [22 lanes], 2 on Jalan Cheras [29 lanes] and 1 on Jalan Pahang [12 lanes]). Toll along Sg. Besi Expressway (from Salak Selatan Interchange to Sg. Besi PLUS TP) is physically not collected by METRAMAC but by PLUS under an agreement between the two operators.

a) Vehicle Detection Devices

Loop vehicle detectors and optical sensors are installed at TPs for traffic counting and classification purposes. Data are transmitted to the data centre located at TP, near the Salak Interchange on the EWL via leased copper lines from TMB at 9.6kps.

b) TV Cameras

No CCTV cameras are used for traffic surveillance.

c) Manual Data Collection System

Manual data collection is carried out by motorcycle patrol teams on the toll roads.

d) Information Dissemination

Traffic information is not given to the public via any VMS or radio broadcasting. Information is however given to DBKL who may pass on to the public. Information is given to the public via a telephone hotline set up by METRAMAC.

e) Telecommunication Network Infrastructure

METRAMAC uses a leased communication cable from TMB for data transmission from the TPs to the surveillance centre or administration centre.

3.2.6 Cheras-Kajang Highway

Grand Saga is managing the 12km Cheras-Kajang Highway, which has 2 TPs.

a) Vehicle Detection Devices

Vehicle detectors are only installed at TPs for traffic counting and classification purposes. The information obtained are transmitted locally to the plaza office and to HQ via leased TMB ISDN lines. The transmission is only done once a day. Traffic data are processed locally to produce revenue and traffic reports. Data are stored in HD and DAT tapes and these are accessible by external systems. Traffic data are also transmitted by leased line to LLM.

b) TV Cameras

No TV cameras are used on the highway.

c) Manual Data Collection System

Manual data collection on the highway is carried out by traffic patrol teams. They are required to report back via two-way radios on the general traffic and road conditions as well as any incidents or breakdown vehicles.

d) Information Dissemination

Traffic information from this highway is only provided via telephones.

e) Telecommunication Network Infrastructure

Grand Saga uses leased ISDN lines from TMB for data transmission and telephone lines for voice communication. A two-way radio system is also used for reporting by its patrol teams with the HQ.

3.2.7 Besraya - Sg.Besi Highway

BESRAYA operates the 16.0km toll highway with 3 TPs.

a) Vehicle Detection Devices

Vehicle detectors are installed only at the two TPs for vehicle counting and classification purposes. Toll revenue and traffic data are transmitted using TCP/IP protocol in real time via LAN Ethernet on its own fibre-optic network to its data centre. Traffic data transmission to LLM however uses a leased ISDN line from TMB.

The toll and traffic data are stored into HD with 8Gbytes capacity capable of holding 3 months history data for retrieval. These information are accessible by external systems.

b) TV Cameras

There are 19 fixed TV cameras and 1 that has PTZ functions. These cameras are all installed at the TPs. The fixed CCTV cameras are connected using coaxial cables to the data centre. All the video images from CCTV are used for visual monitoring of traffic. Video images are recorded at both the TPs.

c) Manual Data Collection System

Manual data collection is done by "BESRONDA" patrols. Traffic and road information, incidents are gathered and reported back by the patrols to the TPs and centre via radio and telephones.

d) Information Dissemination

Traffic information is disseminated to the public via the hotline "BESLINE". No VMS are used for this purpose. Traffic informations are also not given to radio broadcasting station to be broadcast to the public.

e) Telecommunication Network Infrastructure

BESRAYA operates its own fibre-optic network used for data and video image transmission. Transmission is done using TCP/IP protocol at 100 Mbytes fast Ethernet speed. It also operates a wireless communication system at 806-870 MHz for communication by its patrol teams.

3.2.8 Karak Highway

MTD Prime is the private operator that manages the Karak Highway. The Karak Highway has 2 TPs and a tunnel and the highway passes through very difficult terrain connecting Kuala Lumpur with Kuantan in the East Coast.

However, only the section of Karak Highway from the tunnel to Jalan Sentul is included in this Study.

a) Vehicle Detection Devices

Vehicle detectors are installed only at the two TPs (Gombak and Bentong) for vehicle counting and classification purposes. Toll revenue and traffic data are transmitted to the toll plaza using leased Telekom line for processing. These data are recorded in the TP office and are readily accessible. An average of 30% of these vehicle detectors is reported to malfunction due to damages caused by overloaded trucks passing through the TP.

b) TV Cameras

There are a total of 20 cameras installed on Karak Highway. Out of these, 16 are fixed type traffic detector cameras and 4 surveillance cameras with PTZ functions. The fixed type cameras are deployed at the TPs (3) and tunnel (13). The 4 PTZ cameras deployed at the tunnel are for monitoring traffic passing through the tunnel. Video images are sent to the control centre via optical cable for monitoring by operators and are recorded.

c) Manual Data Collection System

Manual data collection is done by highway patrols. Traffic and road information, particularly traffic incidents are gathered and reported back by the patrols to the TPs and centre via two-way radio and emergency telephones.

d) Information Dissemination

The operator of Karak Highway has no system of disseminating the gathered traffic information to the public.

e) Telecommunication Network Infrastructure

MTD Prime owns a fibre-optic network used for video image transmission. Toll revenue and traffic data gathered at the TPs are however transmitted to the TP office using leased Telekom lines. The two-way radio communication system used by patrol personnel is also leased from a licensed operator.

3.3 Telephone/Data Communication Services

3.3.1 Introduction

The telecommunication industry of pre-80s was a very regulated one with Telekom Malaysia being the only player in the market. In Year 1990, the Government of Malaysia (GoM) liberalised this industry with its National Enterprise Privatisation (NEP) plan. This plan brought along to the privatisation of the telecommunication industry and the National Telecommunication Policy (NTP) was written in 1994 opening the market fully. This was a big step as it allowed for telecommunication operators (telcos) to sign interconnection agreement with each other.

The main concern faced by the GoM is the rise of consumer cost and the lack of interest in providing quality service to the rural region of the country. As of 1996, the telephone density in the cities was 19% in contrast to 4.2% in the rural regions. The Malaysian government's target for telephone density is to reach 45% in cities and 25% in rural regions by the Year 2005, which is the target for gaining, developed country status.

3.3.2 Local and Trunk Network Services

There are currently seven local telecommunication operators (telco) in Malaysia. They are:

- Telekom Malaysia Bhd.
- Bina Sat-Com Bhd. (a subsidiary of Binariang Berhad)
- Time Telecommunications Sdn. Bhd.
- Celcom Transmission (M) Sdn. Bhd.
- Digi Telecommunications Sdn. Bhd. (formerly known as Mutiara Telecommunications Sdn. Bhd.)
- Prismanet (M) Sdn. Bhd. (formerly known as Syarikat Telekom Wireless (M) Sdn. Bhd.)
- Fibreail Sdn. Bhd.

The largest telco in Malaysia is Telekom Malaysia Berhad who monopolises about 98% of the Malaysian market. The second largest telco is a toss up between Binariang Berhad and Time Telecommunications Sdn. Bhd. It is difficult to assess the size of both networks as currently it is only possible to compare them according to number of subscribers.

a) Telekom Malaysia Berhad

Telekom Malaysia Berhad provides services ranging from fixed line and cellular telephony to internet-delivered products; from urban broadband multimedia to radio in local loop for rural communities. Of all Telekom Malaysia's products and services, basic telephony still contributes the majority of revenue. Telekom Malaysia currently has a customer base of more than 4Million and functions with operating revenue of approximately RM7.9Billion. Telekom Malaysia has the most extensive copper and duct-manhole-artery network. Traditional copper has slowly been replaced by fibre network for high rise buildings and urbanised developments. Currently, Telekom has access to about 99.5% of all buildings in Klang Valley, and nationwide.

b) Maxis Communications Berhad

Maxis Communications Berhad, formerly known as Binariang Berhad was granted four licenses to build an advanced telecommunications infrastructure and provide a range of services under the brand name Maxis. Maxis Communications operates Maxis Mobile, the country's leading GSM digital wireless network, and Maxis Fibre Network, based on the HFC architecture that is instrumental in offering cost-effective, integrated 3-in-1 cable TV, telephony and multimedia. Some areas that have already been served by Maxis' HFC architecture are Damansara Heights, Bangsar, about 200 buildings in Klang Valley, Bandar Baru Nilai, etc.

Maxis Communications currently has a customer base of approximately 25,000 fixed telephone lines. However, due to high costs and economy downturn (and BT as a new partner with a different corporate strategy), Maxis Communications has halted all HFC projects and is only currently maintaining the ones that have already been built. Hence, the growth of the HFC network has stagnated. Maxis Communications also owns Malaysia's first satellite system; Measat 1 & 2, pioneering Direct-to-User applications.

c) Time Telecommunications Sdn. Bhd.

Time Telecommunications Sdn Bhd known as Time Telekom is a wholly subsidiary of Time Engineering Berhad. Time had obtained the domestic license to establish and operate a telecommunication network in Malaysia. Time has an extensive state-of-art fibre-optic network infrastructure domestically and extending internationally as well. The whole network comprises trunk and regional fibre-optic cables running along major highways and complemented by submarine fibre-optic cables. In Peninsular Malaysia alone, there are 3,000km of land-based fibre-optic cables criss-crossing the country in multiple rings, tied into the main network along the 850km North-South Expressway with Thailand in the north and Singapore in the South.

In major cities in Malaysia, fibre-optic cables are pulled to form SDH based MAN rings exceeding 300kms in total. The submarine fibre-optic cables stretch from Pulau Langkawi, Kedah and south along appointed shorelines of the west coast, ending on the east coast in Kota Bharu, Kelantan. This adds up to 1,624km of submarine cables connected to 25 coastal sites around the Peninsular.

With a capital investment of approximately RM3Billion, Time's digital 100% fibre-optic network has the technology to support high bandwidth applications in the Multimedia Super Corridor (MSC). In June 1997, Time had completed the acquisition of 75% interests in the equity of both ADAM (a PCN cellular operator) and Payphone. These two investments are expected to provide significant synergies and enhancement to Time's Group existing range of fixed line telecommunications services. The latest technology PCN services of ADAM will complement the state-of-art fibre-optic network of Time Telekom giving the Time Group a distinct competitive advantage.

3.3.3 Types of Services

The list of product plans are, but not limited to the following:

No	Telco's	List of Products
1.	**Telekom Malaysia Berhad**	<u>Fixed Network</u> i) TM ISDN *(High bandwidth dial up network and perfect for data transfer, Internet access, global conferencing and can support up to 2Mb/s)*
		ii) TMViPNet *(Virtual Team Applications, Servers & Facilities Management ,Web & Lotus Notes Application Hosting Virtual Private Dial-Up Network (VPDN) and Virtual Private Network (VPN) services)*
		iii) Broadcast Services ▪ Audio Conferencing & Public Address System(ACPA) *(Utilises Digital Congress Network (DCN))* ▪ Broadcast-Closed Circuit TV Network (B-CCTV) *(MPEG-2 or ETSI system encryption transmission)* ▪ Broadcast Transmitter Services(TV/FM Services) ▪ Digital Satellite News Gathering (DSNG/TMiS SKYLINK) *(Both digital & analogue system; KU-Band or C-Band)* ▪ Domestic & International TV Telecast *(Able to up-link and down-link from 2Mb/s to 15Mb/s)* ▪ International Satellite Turnaround Services(TM's Teleport) *(Extensive access to world satellite systems i.e. Panamsat, Intelsat, Measat, Asiasat, Apstar from five (5) TM¼s international earth stations)*

No	Telco's	List of Products
	Telekom Malaysia Berhad (cont.)	• Satellite Master TV (SMATV) *(Integrates TVRO and UHF/VHF antenna in bringing quality Satellite TV and Free-to-Air TV programs)*
		iv) COINS (Corporate Information Super Highway) *(A fast, open, multimedia network with a huge capacity of 10 gigabits per second). Some value added services of COINS are:* • *Private Virtual Circuit (PVC)* • *Virtual Private Network (VPN)* • *Virtual Private Dialup Network (VPDN)* • *Bandwidth on demand* • *Wide Area Network (WAN) management support for back-up and recovery* • *Internet gateway* • *Multimedia Super Corridor (MSC) gateway* • *Consultation on design, implementation and migration strategy of network.*
		v) Data & Broadband Services • Analogue Leased Line *(Medium speed; from 300b/s to 14.4kb/s)* • Digitaline *(High speed i.e. 2Mb/s and 64kb/s)* • Digitaline II *(High speed i.e. 64kb/s, Nx64kb/s (N=2 to 31) up to 2Mb/s)* • Enhanced Maypac *(Malaysian Public Data Network) (Packet switching features; speed up to 128kb/s)* • Telex • Telexbox *(Automatic Telex Interface equipment to integrate PC to Telex Network; storage up to 256k characters)* • Fax
		vi) Freephone services
		vii) Video Conferencing
		viii) Global Business • TM Global Frame Relay • TM Global International Private Leased Circuit (IPLC) *(An internationally dedicated point-to-point leased service)* • TM Global Very Small Aperture Terminal (VSAT) • TM Global Facilities Management Service (FMS) • TM Virtual Private Network *(A way to transport voice communication using the public telephony network)*

No	Telco's	List of Products
	Telekom Malaysia Berhad (cont.)	▪ TM Alliances: TM ACASIA Frame Relay (FR) *(Provides high transmission of data and quick alternate routing through the ACASIA backbone network)* ▪ TM Alliances: TM ACASIA International Private Leased Circuit (IPLC) ▪ TM Alliances: TM ACASIA Very Small Aperture Terminal (VSAT) *(A satellite communications service supporting data, image and voice applications ranging from 64kbps up to 2.048Mbps within ASEAN)* ▪ TM Alliances: WorldSource Frame Relay (FR) *(A global packet-based service)* ▪ TM Alliances: WorldSource International Private Leased Circuit (IPLC) *(A dedicated, digital, point-to-point data service, supplied and monitored by WorldPartners Association. WorldSource/Æ Private Line Service provides digital connectivity at rates from 56/64 through 2048Kbps)* ▪ TM Alliances: Concert Frame Relay (FR) *(Supports high-speed, bursty data applications such as interactive LAN applications, CAD/CAM transfer and file transfers with minimal delay)* ▪ TM Alliances: Infonet FR *(Frame Relay)* ▪ TM Alliances: GMDS FR (Frame Relay) *(Provides an extreme efficient managed service for modern data networking requirements, including LAN to LAN and client/server)*
		<u>Cellular Network</u> (i) TMTOUCH PCN1800 013 services (ii) TMTOUCH Prepaid services (iii) Mobifon 018 services
2.	**Maxis Communications Berhad**	<u>Fixed Network (Telephony, Cable TV & Data)</u> (i) POTS (ii) Analogue DID Service (iii) Domestic Leased Lines (iv) Freefone 1-800 Service (v) IPLC Service (vi) ISDN PRI (vii) MRCR2D Digital Trunk (viii) Payphone Lines (ix) Private Line Services (x) Cable TV via HFC Network
		<u>Cellular Network</u> (i) Maxis Mobile GSM 900 012 service

No	Telco's	List of Products
	Maxis Communications Berhad (cont.)	VSAT Services (i) TDM/TDMA Applications (ii) SCPC Applications
3.	Time Telecommunications Sdn. Bhd.	Fixed Network (i) Time Tone (ii) Time PABX-Link (iii) Time Leased Line (Basic Leased Line, IPLC & Application) (iv) Time Wireless Myphone (v) Time 1-800 FreePhone (vi) Time 800 (vii) Payphone lines Cellular Network (i) ADAM PCN1800 017 service

Typical Leased Line Cost

A typical digital leased line service costs would be as per the following table:

No.	Telco (Bit rate)	Digital Leased Line Service Charge Per Annum (RM)			
		Distance 10km	Distance 20km	Distance 30km	Distance 40km
64kb/s					
1	Maxis Communications	9,120	12,480	15,840	19,200
2	Time Telekom	15,040	19,440	23,840	28,240
3	Telekom Malaysia	About 10,000 within Klang Valley only			
2,048kb/s					
1	Maxis Communications	66,480	92,640	118,800	144,960
2	Time Telekom	70,240	105,440	140,240	211,040
3	Telekom Malaysia	About 70,000 within Klang Valley only			

No discounts incorporated.

Telekom ISDN Line Cost

The cost of an ISDN line from Telekom Malaysia is typically like the following:

ISDN Packages from Telekom Malaysia	
BASIC RATE INTERFACE (2B + D) *(Effective from 1st May 98)* ▪ Type of charges Business Residential ▪ Deposit (Refundable) RM400 RM100 ▪ Installation (One time charge) RM150 RM100 ▪ Monthly Rental RM100 RM70 ▪ Standard facilities offered: Calling Line Identification Presentation (CLIP) ▪ Multiple Subscriber Number (MSN), up to 3 numbers ▪ NT (Network Termination Unit Included) ▪ Also applicable to schools and higher education institution (Government & Private)	**PRIMARY RATE INTERFACE (30B + D)** *(Effective from 1st April 98)* ▪ Item Charges ▪ Deposit (refundable) RM1,500 ▪ Installation RM1,500 ▪ Monthly Rental RM1,000 ▪ DID facility Free of charge

3.3.4 Internet Service Providers (ISP)

The ISP license holders are the following:

- Telekom Malaysia Berhad (TMNet)
- MIMOS Berhad (JARING)
- Celcom (M) Sdn. Bhd.
- Digi Telecommunications Sdn. Bhd.
- Prismanet (M) Sdn. Bhd.
- Time Telecommunications Sdn. Bhd.
- Maxis Communications Bhd.

Currently, the only two active ISPs are TMNet and JARING.

As of December 1997, TMNet has a customer base of 105,000 subscribers and JARING 100,103 subscribers.

3.3.5 Telecommunications Infrastructure in Klang Valley

Telekom Malaysia Berhad

Telekom has the most comprehensive infrastructure network in Klang Valley. Telekom has Local Exchanges in Klang Valley as per the following below:

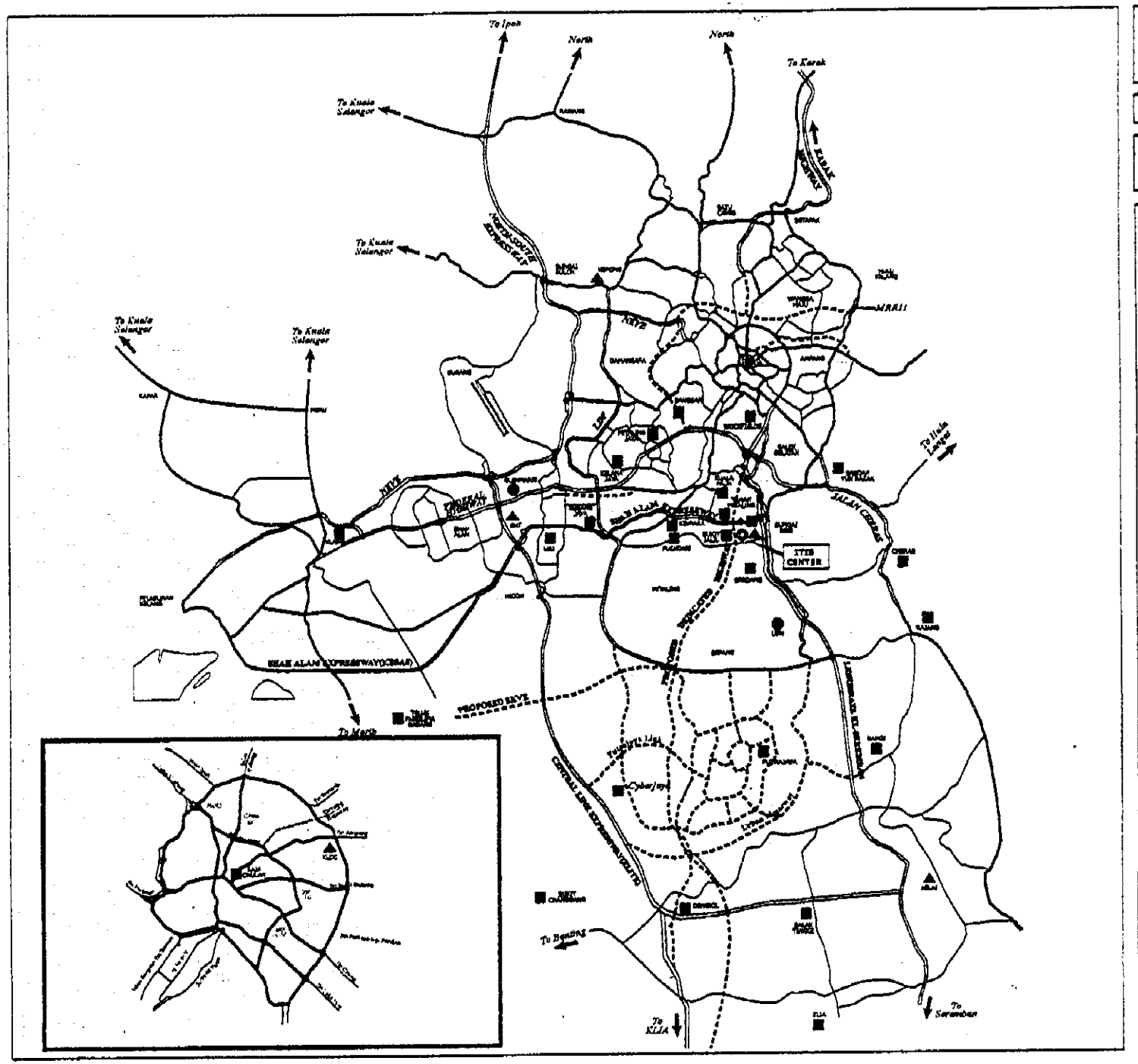
- Bukit Jalil
- Sungai Besi
- Serdang
- Cheras
- Kajang
- Bangi
- Putrajaya 1
- Putrajaya 2
- Cyberjaya 2
- Dengkil
- Bukit Changgang
- KLIA
- Salak Tinggi
- Puchong
- USJ
- Subang Jaya
- Taman Petaling
- Kinrara
- Kuala Pauh
- Bandar Tun Razak
- Jalan Raja Chulan
- Brickfields
- Bangsar
- Petaling Jaya
- Kelana Jaya
- Kelang
- Teluk Panglima Garang
- Banting

Please refer to attached *Figure 3.3.1* for the locations of these Local Exchanges.

All these Local Exchanges are interconnected via fibre in ring topology with capacities up to STM16 and are fully resilient circuits. The MSC backbone ring itself is 230km-route distance and the core distance is 5,520km.

For local network, Telekom has access to about 99.5% of all buildings in the Klang Valley. Telekom Malaysia has the most extensive copper and duct-manhole-artery network. Traditional copper has slowly been replaced by fibre network for high rise buildings and urbanised developments.

Telekom Malaysia is the provider of telecommunications services for the MSC, and with its Frame Relay System (COINS) (which forms the telecommunications foundation of the MSC), the company is expanding the use of its own Internet-based, broadband communications and other innovative new products including an e-commerce portfolio.



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

Figure : 3.3.1

Location of Local Exchange Offices

LEGEND :

- ▲ MAXIS COMMUNICATIONS
- ● TIME TELECOMMUNICATIONS
- ■ TELEKOM MALAYSIA BERHAD

0 5 10km

Scale :

N

Perunding Trafik Klasik Sdn Bhd

Maxis Communications Sdn. Bhd.

Maxis does not have an extensive fixed network as compared to Telekom, seeing that it is relatively new in the telecommunications market. Maxis has Local Exchanges in the Klang Valley as per the following below:

- Subang Hi Tech Industrial Park
- KLCC
- Kepong
- Sungai Besi
- Bandar Baru Nilai

Please refer to attached *Figure 3.3.1* for the locations of these Local Exchanges.

All these Local Exchanges are connected via fibre network in ring topology with capacity of up to STM16 fully backed up by redundant links either in the form of fibre or microwave backup links.

Binariang has access to about 200 buildings in the Klang Valley with a large concentration in downtown Kuala Lumpur. Maxis also has installed the HFC network in Bangsar, Damansara Heights, Bandar Baru Nilai, Bandar Utama, Good Year Court apartments, etc. where telephony and cable TV are provided using the same infrastructure.

Time Telecommunications Sdn. Bhd.

Time Telekom has the most extensive fibre network nationwide known as "Information Super Highway" consisting of regional and submarine fibre-optic cables. This Information Super Highway is also complemented by microwave and satellite services for remote applications. In major cities in Malaysia especially Klang Valley, fibre-optic cables are pulled to form SDH based MAN rings exceeding 300kms in total. More rings are being formed now in order to provide broadband services to more customers.

In the Klang Valley, Time has only two Local Exchanges i.e.:

- Glenmarie, Shah Alam
- University Putra Malaysia (UPM)

Please refer to attached *Figure 3.3.1* for the locations of these Local Exchanges.

Time has access to approximately 400 buildings in Klang Valley and approximately 160 buildings in other regions of Malaysia. Most of Time's customers are commercial customers of which about 70% of these customers are concentrated in the Klang Valley region.

4

FUTURE ROAD TRAFFIC DEMAND AND PUBLIC TRANSPORT SYSTEM

4.0 FUTURE TRAFFIC DEMAND AND PUBLIC TRANSPORT SYSTEM

4.1 Future Road Network

4.1.1 Introduction

The study area, which encompasses five administrative districts in the Klang Valley and the MSC Corridor is expected to experience continuous population and development growth. This is because the study area consists of the most developed urban region and the focal point of development and employment of the country namely:

Kuala Lumpur	-	Despite the plans to move all government offices to Putrajaya, the nation's capital is still expected to function as the focal point of economic and social activity
Petaling Jaya	-	An urban centre equipped with a large population catchment and facilitated with complete urban functions
Shah Alam	-	Selangor's capital, a newly planned urban centre with large industrial development
Klang	-	Port facility which has evolved to an urban centre equipped with commerce, trade and industrial development
MSC Corridor	-	The Putrajaya, Cyberjaya, High Tech Parks are planned to house all governmental offices; equipped with leading edge multimedia technology
Kuala Lumpur International Airport (KLIA)	-	KLIA, the nation's international airport which has been designed to cater for more than 60Million passengers per annum including transit passengers

As the most developed urban region of the country, the study area currently consists of a population of some 3.84Million people and an estimated 1.45Million vehicles (SMURT 1997). The existing population and vehicles ownership is expected to experience growth in tandem with the anticipated economic and development growth in the region.

The forecasted annual population growth rate of the study area is tabulated below in Table 4.1.1.

Table 4.1.1 Population Annual Growth Rate

District	1997 - 2000 (%)	2000 - 2010 (%)	2010 - 2020 (%)
Kuala Lumpur	1.18	1.35	0.68
Gombak	3.60	2.78	1.47
Hulu Langat	3.72	2.17	0.97
Petaling	3.15	2.66	1.66
Kelang	2.80	2.54	2.00
Total	**2.54**	**2.14**	**1.27**

Source : SMURT KL, 1997

Based on the forecasted population growth rate, it is anticipated that the Klang Valley would house a population of 5.7Million people by the Year 2020. The MSC Corridor on the other hand is forecasted to have a population of 1.26Million. Hence, the study area is anticipated to have a total population of 6.96Million in the Year 2020, an average growth of approximately 2.6% over the 23 year period.

The increase in population is expected to increase the travel demand in the study area, which in turn would be translated, to an increase in traffic movement. This increase demands the provision of adequate transport infrastructure and the introduction of integrated transport systems.

4.1.2 Future Road Network and Toll Road Systems

The development of road infrastructure in order to provide between an efficient road transport system has been recognised as a vital part in the development of the country, especially the Klang Valley region.

Beginning from the First Outline Perspective Plan (OPP1) from 1971 - 1990, massive investments have been deployed to the development of transport infrastructure. This emphasis has been continued in the Second Outline Perspective Plan (OPP2), where the focus has been the development of inter-urban linkages and the alleviation of transport related problems in accordance with the rapid urbanisation of major towns.

This has led to the Highway Network Development Plan (HNDP), a study, which has proposed the future road system for the whole country. Under this study, the deployment of funds for road development under the Seventh Malaysia Plan is double to that allocated under the Sixth Malaysia Plan.

Invariably, this and the privatisation policy of the Malaysia Government, which was introduced in Year 1983, had led to the construction of new privatised highways and road projects. These privatised highways are anticipated to accelerate the progress of transport infrastructure while reducing the financial burden on the public sector.

The future road network in the study area can be definitively categorised to the following areas:

- The construction of urban highways to facilitate the ever increasing demand for travel in the Klang Valley, specifically focussing on the Kuala Lumpur CPA
- The construction of expressways and highways to facilitate access between the Kuala Lumpur CPA and the residential hubs bordering it
- The construction of expressways and highways linking Kuala Lumpur to the MSC Corridor and KLIA

The proposed highways in the study area can be generally divided to 3 phases specifically:

- Year 2000
- Year 2010
- Year 2020

Table 4.1.2 below tabulates the proposed tolled expressways and highways over this period.

Table 4.1.2 Proposed Toll Expressways and Highway in the Study Area

No	Name	Management Company	Route	
			From	To
Year 2000				
1	Ampang Elevated Highway	Prolintas Sdn Bhd	Jalan Ampang	Jalan Sultan Ismail
2	Western KL Traffic Dispersal Scheme	Sistem Penyuraian Trafik KL Barat Sdn Bhd	Jalan Damansara	Jalan Bukit Kiara, Federal Highway II

No	Name	Management Company	Route	
			From	To
Year 2010				
1	New Pantai Highway	Maxtro Engineering Sdn Bhd	Subang Jaya Jalan Templer	KL- Seremban Highway Jalan Bangsar
2	KLIA Dedicated Highway	Consortium Lapangan Terjaya	Kg. Pandan Roundabout	KLIA
3	Kajang Trafik Dispersal Ring Road	SILK Sdn Bhd	Kajang	Vicinity
4	Kajang - Seremban Expressway	Antah Holding Sdn Bhd	Kajang	Seremban
5	Kajang Bypass			
6	Assam Jawa- Taman Rimba Templer Expressway	Lebuhraya Assam Jawa Taman Rimba Bhd	Assam Jawa	Taman Rimba Templer
7	KL- North- East Highway	Consortium Lebuhraya- Kuala Lumpur Sdn Bhd (KEKAL)	Jalan Duta	Karak Highway, MRR II
8	Pandan Corridor Extension	Alloy Consolidated Sdn Bhd	Jalan Ampang	Jalan Syed Putra
9	KL Transit Route	Spektra	Upgrading Jalan Kuching upgrading Jalan Duta, Damansara Transit Route	
10	KL-Rawang Expressway	-	Kepong Roundabout	Rawang
11	Shah Alam-Rawang Expressway	Guthrie	Sg. Damansara Taman Subang Paya Jaras	Kuang
12	Wangsa-Keramat Expressway	Konsortium Lebuhraya Wangsa- Keramat Sdn Bhd	Kg. Relawan Kg. Dato Keramat	Wangsa Maju Kg. Pandan
13	South Klang Valley Expressway	Gadek/Perspek Consortium	Ikatan Kajang	West Port Port Klang

No	Name	Management Company	Route	
			From	To
Year 2020				
1	Subang-Kajang Highway	Silk Sdn Bhd	Subang	Kajang
2	PJ-Puchong-Serdang Highway	Panzana Enterprise Sdn Bhd	Petaling Jaya	Serdang
3	KL Outer Ring Road			

All the proposed tolled and non-tolled road developments are highlighted in *Figures 4.1.1, 4.1.2* and *4.1.3*, where the future road network in the Years 2000, 2010 and 2020 are shown.

4.2 Future Major Traffic Attraction/Generation Centres

Traffic is a function of landuse, hence the forecast of future traffic demand is dependent on the proposed development in the study area.

The development projects in KL can generally be categorised into the following four stages in terms of application procedure:

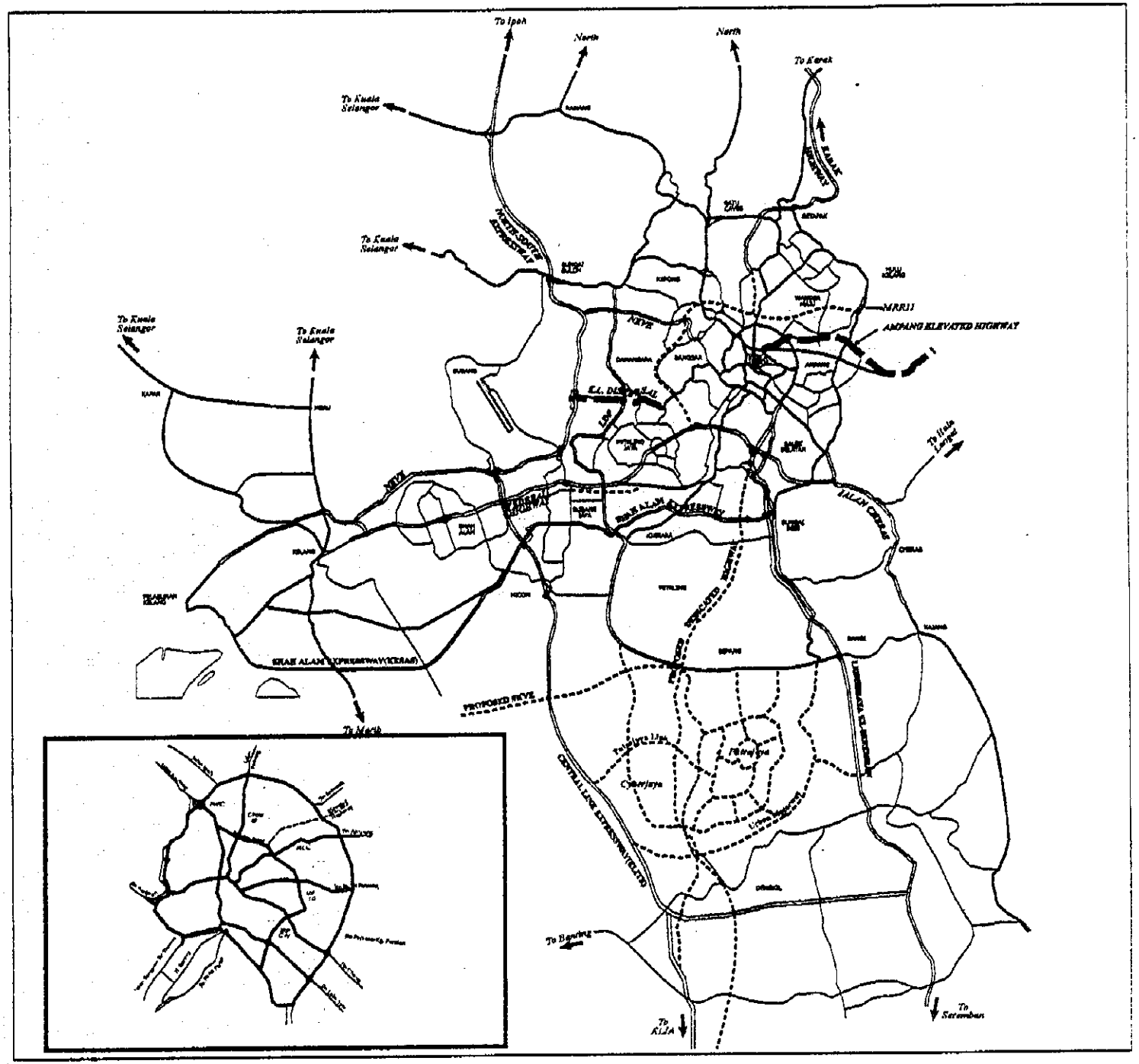
- Under construction stage
- Development order stage (some amendments may be requested by authorities)
- Committed stage (application for development was committed by the authorities)
- Not committed stage (just a plan)

Figure 4.2.1 shows the location of the proposed development projects, while Table 4.2.1 tabulates the information on the site area and floor area of the projects and their development stage.

Table 4.2.1 Proposed Development Projects

Development Stage	Area (sq. m.)	Open Space (sq. m.)	Office (sq. m.)	Hotel (sq. m.)	Residence (sq. m.)
Current	427,061	304,433	788,814	241,633	108,879
Under Construction	867,779	923,519	2,088,296	402,536	323,757
Development Order	575,330	526,186	1,144,435	469,052	206,145
Committed	1,005,921	1,746,892	1,621,941	335,183	133,590
Grand Total	**2,876,091**	**3,501,029**	**5,643,396**	**1,448,404**	**772,371**

Source : KL-SMURT Study, 1997



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

Figure : 4.1.1

Highway Network 2000

LEGEND :

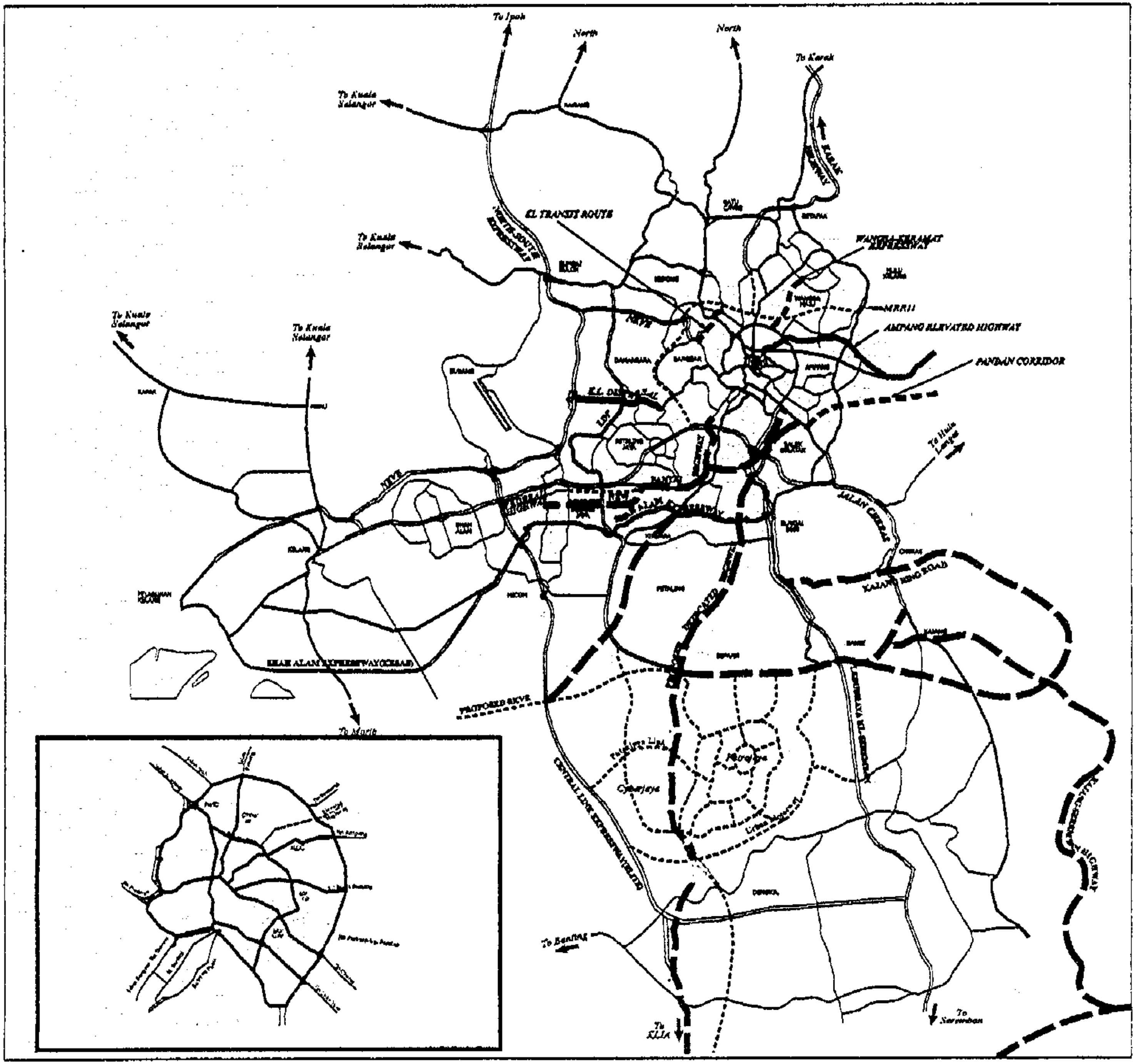
PROPOSED HIGHWAY/ROAD

0 5 10km

Scale :

N

Perunding Trafik Klasik Sdn Bhd



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

Figure : 4.12

Highway Network 2010

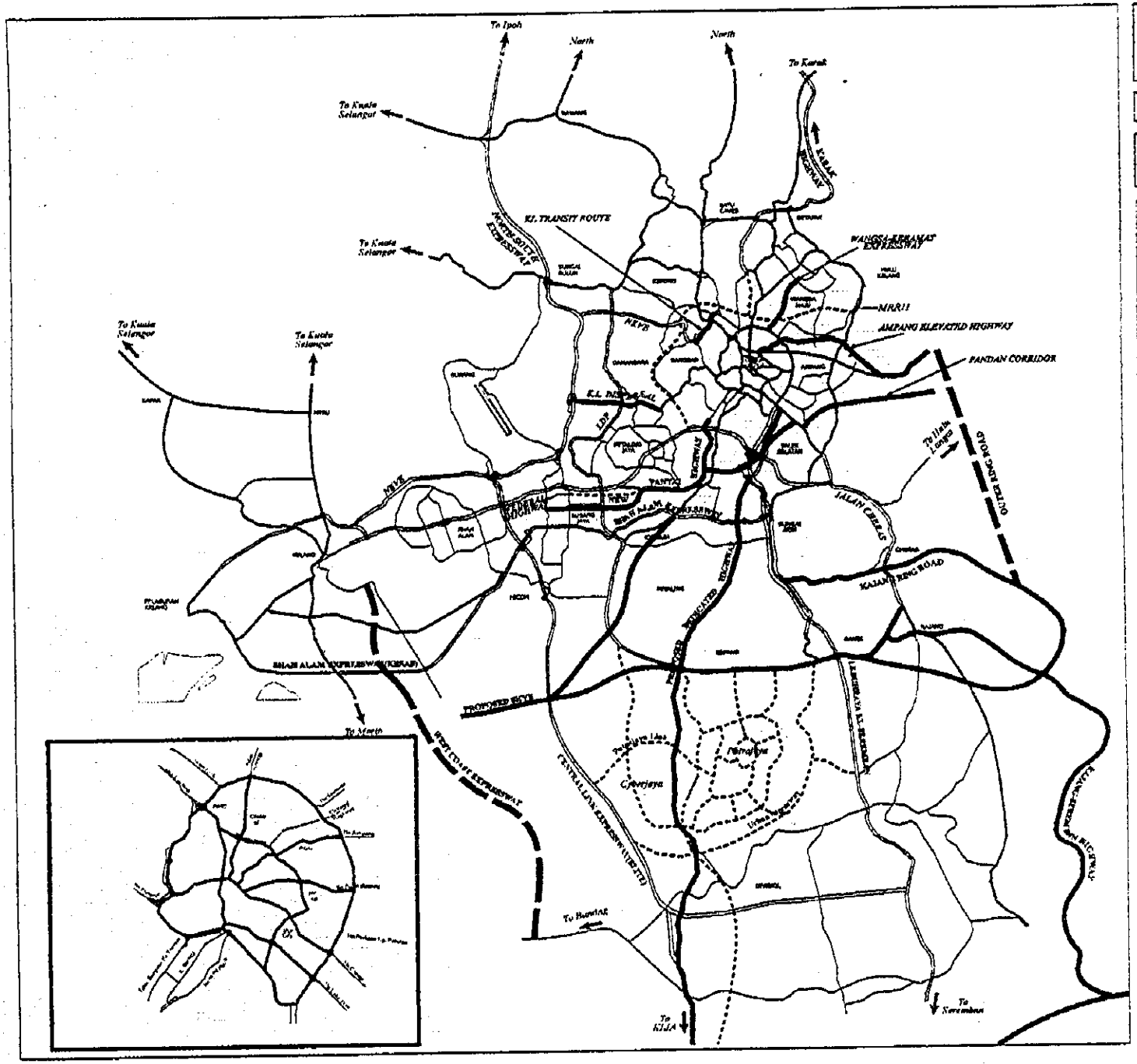
LEGEND :

PROPOSED HIGHWAY/ROAD

Scale : 0 5 10km

N

Perunding Trafik Klasik Sdn Bhd



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

Figure : 4.1.3

Highway Network 2020

LEGEND :

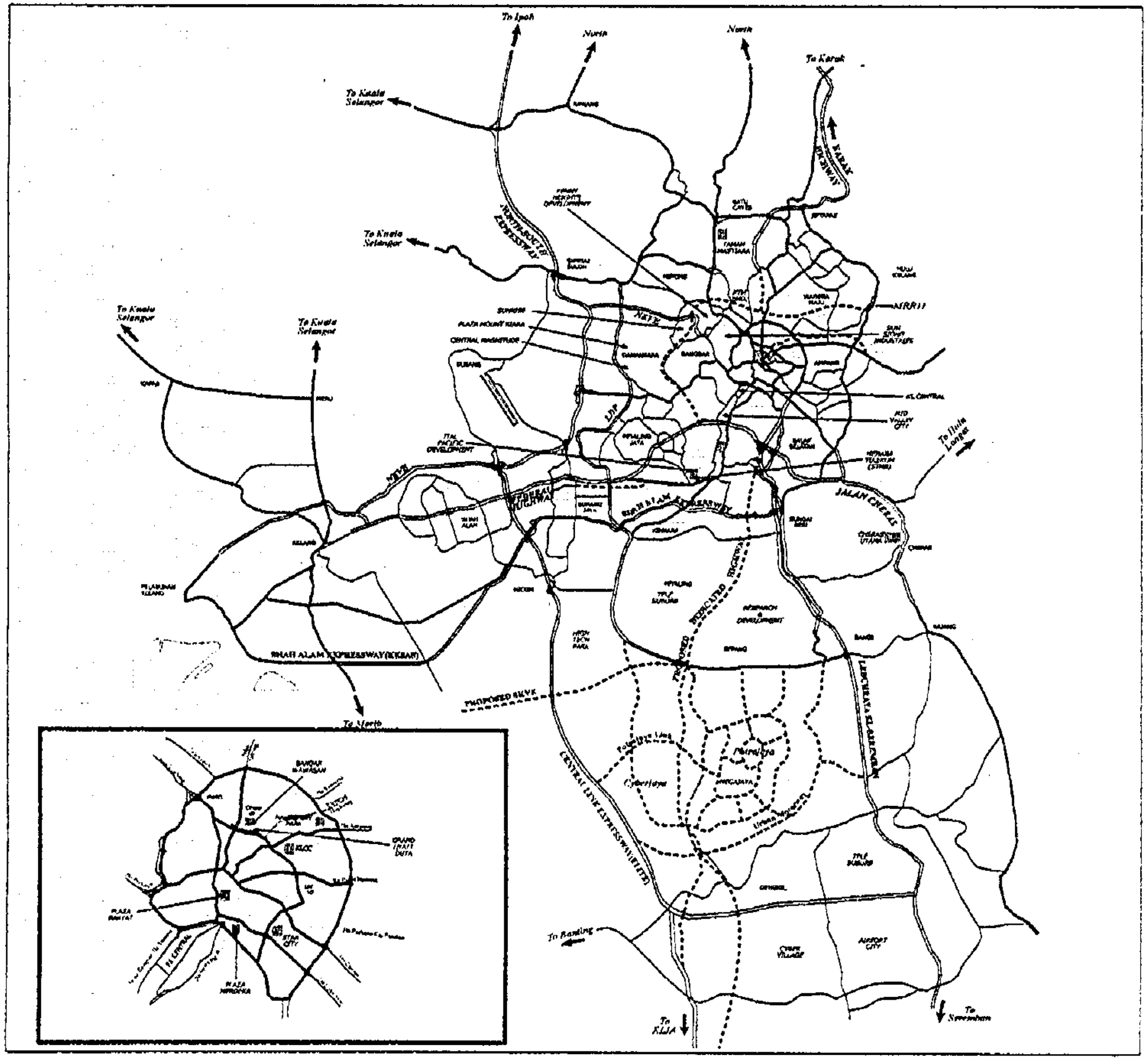
PROPOSED HIGHWAY/ROAD

0 5 10km

Scale :

N

Perunding Trafik Klasik Sdn Bhd



A Study On Intergrated Transport Information System (ITIS) in Klang Valley And The MSC in Malaysia	
Figure : 4.2.1	
Location of Development Projects	
0 5 10km Scale :	N
Perunding Trafik Klasik Sdn Bhd	

Another factor, which is closely linked with proposed developments and can be directly attributed to trip generation, is employment.

The forecasted number of employment for the Years 2010 and 2020 in the study area is tabulated below in Table 4.2.2.

Table 4.2.2 Employment Figure in the Study Area

	Year 2010 ('000 persons)	Year 2020 ('000 persons)
Kuala Lumpur	1,010.3	1,177.1
Gombak	142.8	169.2
Hulu Langat	191.6	227.2
Petaling	576.5	692.2
Klang	213.1	252.6
MSC Corridor	125.6	157.0
Total	**2,259.9**	**2,675.3**

Source : SMURT – KL, 1997

4.3 Estimated Future Road Traffic Demand

4.3.1 Introduction

The future traffic demand has been based on the findings of the SMURT – KL, 1997 study. The development of the traffic model and the estimation of the future traffic demand in the SMURT-KL study have been based on a series of policies and urban transport strategies.

The policies and strategies can be broadly summarised to the following:

Stage 1 : Traffic Control and Management Stage (Year 2000)

Stage 2 : Facility Development Stage (period when major highways and other facility development projects will be opened) (Year 2000 - 2020)

Stage 3 : Information Management Stage (when most major roads and other projects are completed) (Year 2005 - 2020)

Another aspect, which has been taken into consideration in forecasting the future traffic demand, is the possibility of implementing traffic restraint schemes for the traffic movement into the Kuala Lumpur CBD.

To this effect, the SMURT – Kuala Lumpur Study has incorporated the effects of implementing an Area Road Pricing Scheme for the Kuala Lumpur CBD.

4.3.2 Future Road Traffic Demand by SMURT

The future road traffic demand by the SMURT - Kuala Lumpur study has been forecasted under 2 scenarios;

- Without any traffic restraint scheme
- With Area Road Pricing Scheme as a traffic restraint scheme

The forecasting exercise in the study has incorporated:

- The future road network including the various proposed road upgradings and tolled expressways
- The future public transport network which includes extension to the urban transit system and improvement to the bus system
- The application of traffic controls and management to increase capacity and improve safety
- The effect of the proposed development of the MSC Corridor, which is anticipated to decentralise the KL CPA and contribute to the mitigation of traffic congestion in the CPA area

Incorporating the above factors, the SMURT-KL Study forecasted the future travel demand as:

Table 4.3.1 Forecasted Future Traffic Volumes at the KL CPA Screenline

	KL CPA Screenline Volumes (1000pcu/day)		
	Year 2000	Year 2010	Year 2020
Without Area Road Pricing	1,099	1,109	1,518
With Area Road Pricing	996	1,005	1,376
Road Capacity at the CPA Screenline	930	1,187	1,327

Source : SMURT-KL, 1997

Based on the forecasted increase in employment and taking into consideration the various socio-economic factors, the SMURT-KL study has forecasted an average annual growth rate of 2.73% for trip production in the Kuala Lumpur Metropolitan Area. (The increase in population within the metropolitan area is forecasted to be 1.2% per annum, while job opportunity is expected to grow 2.0% per annum).

Table 4.3.2 below summarises the trip production to and from the Kuala Lumpur Metropolitan Area by trip purpose.

Table 4.3.2 Trip Production by the KL Metropolitan Area by Trip Purpose

Trip Purpose	Person Trips (Unit '000)			Average Annual Growth Rate
	2000	2010	2020	1997 - 2020
Home Based Work	2,461	2,994	3,491	2.11%
Home Based School	1,498	1,796	1,954	1.82%
Home Based Other	1,514	1,734	1,896	2.02%
Non-Home Based Business	1,073	1,787	2,444	4.99%
Non-Home Based Others	1,183	1,582	1,940	3.54%
Total	**7,729**	**9,893**	**11,725**	**2.73%**

Source : SMURT - KL Estimate

As seen in the table above, the work-based and business-based trips are still anticipated to be of a high volume for the movements in the Kuala Lumpur Metropolitan Area. This further emphasises the point that Kuala Lumpur would continue to operate as the focal point of employment and business in the region.

The MSC Corridor and the KLIA are two other areas, which are expected to generate and attract a significant volume of traffic in the study area. The forecasted average daily number of trips made to the KLIA is tabulated below in Table 4.3.3.

Table 4.3.3 Traffic To and From KLIA by Mode

Made	Unit	2000	2010	2020
Car	Vehs/day	11,500	22,200	30,700
Taxi	Vehs/day	15,300	29,400	40,700
Bus	Vehs/day	1,700	400	600
Rail	Passenger/day	-	18,800	39,900

Note : ERL is not available in 2000
Source : SMURT - KL Estimate

The forecasted future traffic demand for the MSC area is tabulated below in Table 4.3.4.

Table 4.3.4 Forecasted Trip generation of The MSC Corridor

Area	Daily Trips ('2020)	
	Year 2010	Year 2020
MSC Corridor	128.4	427.8

4.3.3 Major Travel Corridors

The traffic analysis as presented by the SMURT-KL study identified various major corridors of travel in the study area. Significantly it was found that in the Years 2000 to 2020, Kuala Lumpur would remain as the focal point of travel in the Klang Valley although it should be noted that a significant volume of trips would be diverted to the MSC area, specifically after the Year 2010.

In total, it is anticipated that the introduction of the MSC corridor would divert a total of 111,000pcu/day from the KL CPA.

Effectively, the major travel corridors in the Year 2020 as identified in the SMURT-KL 1997 study are tabulated below:

Table 4.3.5 Major Corridors of All-Purposes Trip Demand in Year 2020

Corridor	Trips/Day
KL CPA - Ampang	250,000
KL CPA - Wangsa Maju	175,000
KL CPA - Segambut/Jinjang/Kepong	200,000
Subang - Petaling Jaya	150,000
KL CPA - Pudu/Brickfields	150,000
KL CPA - Puchong	120,000
KL CPA - Subang	100,000
KL CPA - Salak Selatan/Sg. Besi	100,000
KL CPA - Selayang	100,000
KL CPA - Setapak	100,000
KL CPA - MSC Corridor	110,000

The identification of the major corridors is vital, in that they provide an overview on the desire of travel between the various sectors of the study area.

As seen by the tabulation, it is again evident that the KL CPA would continue to function as the focal point of traffic movement due to the employment catchment which it provides as the business and commercial centre of the country.

It is in view of this continuous increase in traffic demand that various Expressways and tolled highways have been planned to provide direct and fast access between suburban Kuala Lumpur and the KL CPA.

Another significant corridor, which is expected to develop in the future, is the movement between the KL CPA and the MSC area. This corridor is expected to generate and attract a total of 200,000 trips/day in the study area by the Year 2020.

4.3.4 High Traffic Demand Road Sections

The high traffic demand road sections are expected to be the arterials, which serve to link the major corridors of travel.

It has been found that the major travel route pattern would not change extensively, as the focal point of development and business is not expected to change. Thus it is only logical that roads leading to the KL CPA would be catering for high travel demand.

The major road sections anticipated to cater for high traffic demand are tabulated in Table 4.3.6.

Table 4.3.6 Road Sections With High Traffic Demand

Section	Year 2000	Year 2010	Year 2020
North - East			
Middle Ring Road II	150,001 - 200,000	250,001 - 300,000	250,001 - 300,000
Pandan Corridor	-	100,001 - 150,000	150,001 - 200,000
Jalan Jelatek/Wangsa Keramat Corridor	40,001 - 60,000	100,001 - 150,000	150,001 - 200,000
North - West			
Jalan Kuching	200,001 - 250,000	250,001 - 300,000	250,001 - 300,000
Jalan Ipoh	150,001 - 200,000	200,000 - 250,000	200,001 - 250,000
Jalan Duta	150,001 - 200,000	150,001 - 200,000	200,001 - 250,000
KL-Traffic Dispersal	-	150,001 - 200,000	200,001 - 250,000

Section	Year 2000	Year 2010	Year 2020
South - West			
Federal Highway	250,001 - 300,000	300,001 - 350,000	300,001 -350,000
KL-Seremban Highway	200,001 - 250,000	250,001 - 300,000	250,001 - 300,000
Jalan Damansara	150,001 - 200,000	150,001 - 200,000	200,001 - 250,000
Jalan Bangsar	150,001 - 200,000	150,001 - 200,000	200,001 - 250,000
Shah Alam Expressway	100,001 - 150,000	150,001 - 200,000	200,001 - 250,000
Lebuhraya Damansara - Puchong	80,001 - 100,000	150,001 - 200,000	200,001 - 250,000
New Pantai Highway	-	80,001 - 100,000	100,001 - 150,000
South - East			
Jalan Sg. Besi	200,001 - 250,000	200,001 - 250,000	200,001 - 250,000
Jalan Loke Yew	150,001 - 200,000	150,001 - 200,000	150,001 - 200,000
Jalan Syed Putra	150,001 - 200,000	150,001 - 200,000	150,001 - 200,000
Jalan Cheras	100,001 - 150,000	150,001 - 200,000	150,001 - 200,000
Cheras - Kajang Highway	100,001 - 150,000	150,001 - 200,000	150,001 - 200,000

Note : i) SMURT-KL Estimates
ii) The highest volume on each of the respective roads has been shown

As seen here, it is evident that all the major roads of the Klang Valley specifically ones catering for the previously identified major corridors, would cater for a traffic of above 150,000pcu/day.

Federal Highway is still expected to be the highest trafficked road with volumes exceeding 300,000pcu/day by the Year 2010. As seen in Table 4.3.6, the KL-Seremban Highway and Jalan Kuching, are two other carriageways in the study area anticipated to cater for high traffic volumes.

The traffic demand was one of the criteria, which was the basis in selecting the road network for the implementation of the Integrated Transport Information System.

Hence, one of the basis of development of the base road network for the ITIS study was the traffic demand and the major corridors of traffic movement.

It is also vital to point out that severe congestion and extensive delays would be experienced along the major arterials of the study area based on the forecasted traffic volumes. Thus, it is essential that the Integrated Transport Information System be introduced not only to control and manage traffic but also to create a better quality of life.

In addition, as pointed out by the KL-SMURT 1997 Study, traffic restraint measures such as Area Road Pricing can also be considered.

Another major factor, which would determine the future traffic demand, is the modal split between private and public transport.

4.3.5 Modal Split

The forecasted modal split (i.e. the ratio between public and private transport can be viewed under two scenarios, which are:-

Scenario 1 : Implementation of highway and public transport network without traffic restraint scheme

Scenario 2 : Implementation of highway and public transport network with a traffic restraint scheme (Area Road Pricing)

Table 4.3.7 Existing and Estimated Modal Split in the Study Area

Year	Case	Private (%)	Public (%)
1997	Existing	80.6	19.4
2000	Without Traffic Restraint With Traffic Restraint	76.0 75.7	24.0 24.2
2010	Without Traffic Restraint With Traffic Restraint	76.5 74.6	23.6 25.4
2020	Without Traffic Restraint With Traffic Restraint	74.4 71.1	25.6 28.9

As shown in the table above, it is anticipated that the share of public mode of transport is estimated to be 24.0% in Year 2000, 23.6% in Year 2010 and 25.6% in Year 2020, when both the proposed highways and the public transport network is developed as planned.

However the introduction of a traffic restraint scheme (such as area road pricing which was applied in the testing options of the SMURT-KL study) would reduce the total number of car trips in the KL CBD and slightly increase the share of public transport as shown in Table 4.3.7.

4.4 Future Public Transport System

4.4.1 Network Of The Future Area

The public transport network of the future area is expected to comprise of:

- Urban transit rail services and feeder bus services
- Bus operations
- Trunk Bus

The future urban transit rail services would comprise of:

- LRT System I (STAR)
- LRT System II (PUTRA)
- People Mover Rapid Transit (PRT) - KL Monorail
- KTMB - KTM Komuter Services
- ERL - Express Rail Link

The bus services in the study area, on the other hand can be categorised to the following:

- Public Bus (trunk bus systems)
- Feeder Bus Services (supporting the transit rail services)

Figure 4.4.1 depicts the overall public transport network of the study area. The future public transport network has been based on the findings of the SMURT-KL 1997 study, which took into account the following parameters in the forecasting exercise:

- Existing public transport passenger demand
- Existing railway services and feeder bus services
- Existing bus operation
- Rail-based transport network development plan

The process of identifying the future public transport requirement firstly involved extracting areas which have been left out by the urban rail transit services, following which the corridors which required an enhanced public transport system were identified.

The corridors include:

- Kepong
- Damansara
- Puchong
- Cheras
- Ampang
- Genting Klang/Gombak

In view of the existing and planned urban transit network, the SMURT-KL study proposed the public transport network to comprise of a combination between the LRT and Trunk buses. This combination has been found to provide the most optimal public transport service.

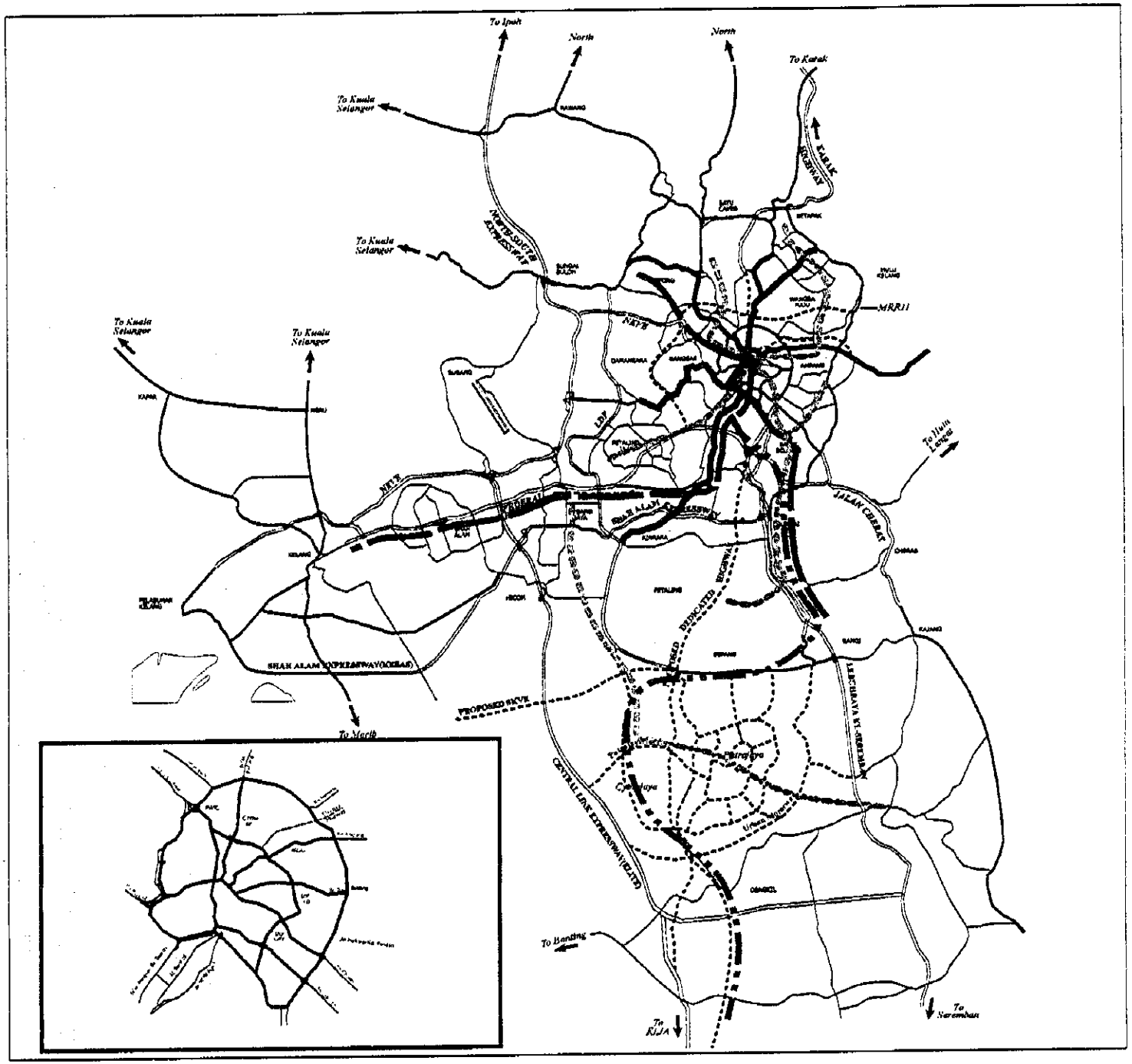


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Figure : 4.4.1

Public Transport Network

LEGEND :

- EXPRESS RAILWAY LINK
- LRT
- KTM
- TRUNK BUS

0 5 10km

Scale :

N

Perunding Trafik Klasik Sdn Bhd

The combination between the LRT and Trunk buses would involve the introduction of an additional LRT line, which serves the Damansara - Raja Chulan - Cheras corridor.

It is estimated that the LRT System (I) STAR northern line from Sultan Ismail to Sentul Timur would be completed by the Year 2000.

Another rail-based urban transit planned for the study area is the Express Rail Link, which is planned to link the KL CPA to KLIA via Putrajaya. The alignment of the ERL, which is expected to be completed by the Year 2010, is also highlighted in *Figure 4.4.1.*

In the Year 2010, it is also anticipated that the PRT Monorail services in the KL CBD and the KTMB Batu Caves extension are all completed in addition to the existing railway network.

Public transport passenger demand is expected to continually increase in the Year 2020, however, this increase is expected to vary from line to line. For instance, at locations with high expressway development, only moderate increase in passenger demand is expected. This would include the Genting Klang, Damansara and the Wangsa - Keramat Corridors.

For example, the Wangsa - Keramat expressway is expected to enhance the utilisation of private transport in the Genting Klang and Wangsa Keramat corridors, while the Western Traffic Dispersal Scheme is anticipated to derive the potential passenger demand in Damansara locality.

The forecasting of the passenger demand can be viewed under two scenarios. The first involves a scenario where no traffic restraint scheme is applied to the CBD, while the second assumes the implementation of an Area Road Pricing Scheme to control the traffic demand in the Kuala Lumpur CBD.

Table 4.4.1 below tabulates and compares the passenger volumes under the two scenarios.

Table 4.4.1 Comparison of Passenger Demand With and Without Area Road Pricing Adopting the Combined Railway and Trunk Bus Network (Years 2000, 2010 and 2020)

Line	+2000		2010		2020	
	Without Area Pricing	With Area Pricing	Without Area Pricing	With Area Pricing	Without Area Pricing	With Area Pricing
KTM Klang - Sentul	162,800	163,500	219,900	226,200	347,500	364,500
KTM Rawang – Seremban	114,900	115,800	156,800	164,200	241,900	260,100
KTM Batu Caves	14,900	15,200	26,800	28,200	35,800	38,300
STAR Phase (1)	105,800	107,700	141,200	153,000	211,800	242,800
STAR Phase (2)	23,900	24,200	33,200	34,600	46,800	49,900
PUTRA Phase (1)	63,500	64,000	72,500	76,400	114,500	125,000
PUTRA Phase (2)	41,700	42,700	46,600	55,400	71,200	90,800
Monorail North	-	-	71,500	91,200	104,900	153,500
*Trunk Bus Ampang	33,400	34,200	41,100	47,600	62,100	75,200
*Trunk Bus Cheras	58,700	59,600	67,400	74,300	93,500	107,100
*Trunk Bus Damansara	52,900	54,300	55,400	65,700	77,000	100,000
*Trunk Bus Genting Klang	41,400	42,100	43,600	47,200	61,000	68,400
*Trunk Bus Gombak	5,700	5,800	6,100	6,600	8,200	9,000
*Trunk Bus Kepong	41,800	42,500	47,500	53,400	65,800	74,500
*Trunk Bus Puchong	29,300	29,900	33,200	37,100	50,700	59,000

Source : SMURT-KL, 1997

*Note : * Trunk Bus Volume are shown for the Year 2000 only as an indicator, as it may not be implemented by the Year 2000 due to the economic downturn.*

+ Caution should be exercised in adopting the forecasted demand for the Year 2000, as the economic downturn may have had serious implication or the passenger demand.

As shown in Table 4.4.1, the main public transport commuter line are the:

- Klang - Sentul Corridor
- Rawang - Seremban Corridor
- Ampang - KL Corridor
- Kelana Jaya - KL Corridor
- Cheras - KL Corridor
- Damansara - KL Corridor

As seen in the table above, it is evident that significant impact in traffic demand can be seen in the volumes of the PRT Monorail with the implementation of the Area Road Pricing Scheme. For instance, the volume on the monorail in the Year 2010 is forecasted to be 71,500 persons per day without the private vehicle restraint scheme. This volume is forecasted to be 91,200 persons per day with the implementation of the Area Road Pricing Scheme. For the Year 2020 the volumes are 104,900 with no restraint scheme and 153,500 persons/day with the Area Road Pricing. Other roads also show differences in the volume of persons/day although not as significant as the PRT monorail system.

It should be noted that efforts to reduce the use of private vehicles and encourage the use of public transport should include ITIS measures. Where, the implementation of the information system would provide public transport commuters with real-time arrival and departure times, which would allow them to plan their journeys. This will further encourage the use of public transport as the mode of travel.