# Chapter 6

# Long Term Development Plan

# Chapter 6 Long Term Development Plan

## 6.1 Master Plan

### 6.1.1 Road Development Plan

(1) Arterial Road Network

The currently proposed future road network by the private sectors appears to be well planned. However, the following new road projects should be added during the planning period (see Figures 6.1.1 and 6.1.2).

Under Ground Expressway

The newly developed Kuala Lumpur City Centre (KLCC) will be another urban core in the CPA, together with the existing two urban cores: the City Centre and the Golden Triangle. Thus three urban cores are lined up in the east-west direction. A considerable amount of traffic demand will be augmented in this direction. (see Figure 6.1.3)

However, there is no room for improvement and construction of surface roads in this area, since it is densely built. An underground expressway is, thus, proposed to solve the problem, which runs under Jln. Raja Chulan with several access ramps connecting to the existing streets and connecting eventually with the Middle Ring Road (II).

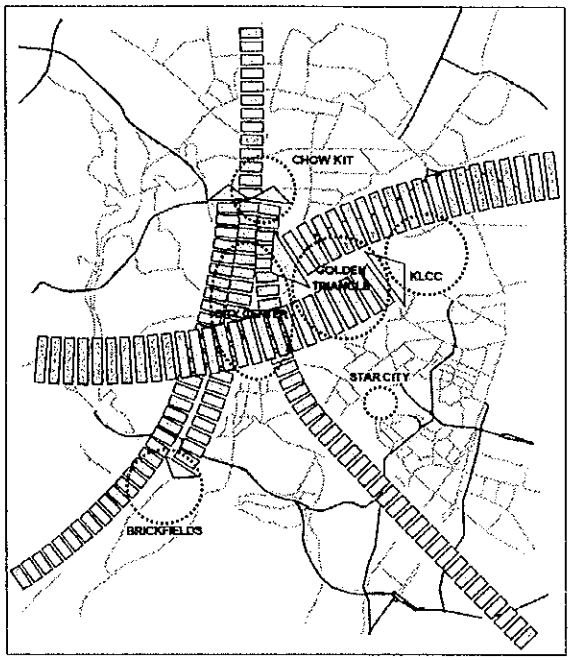


**Figure 6.1.3 Heavy Traffic Flow in Future**

A01 Arterial Road 1 (KL Elevated Highway – Wangsa Keramat)

This road provides a direct connection between the KL Elevated Highway and Wangsa Keramat by an elevated road passing through the CPA from the north to the south alongside Jln. Tun Razak.

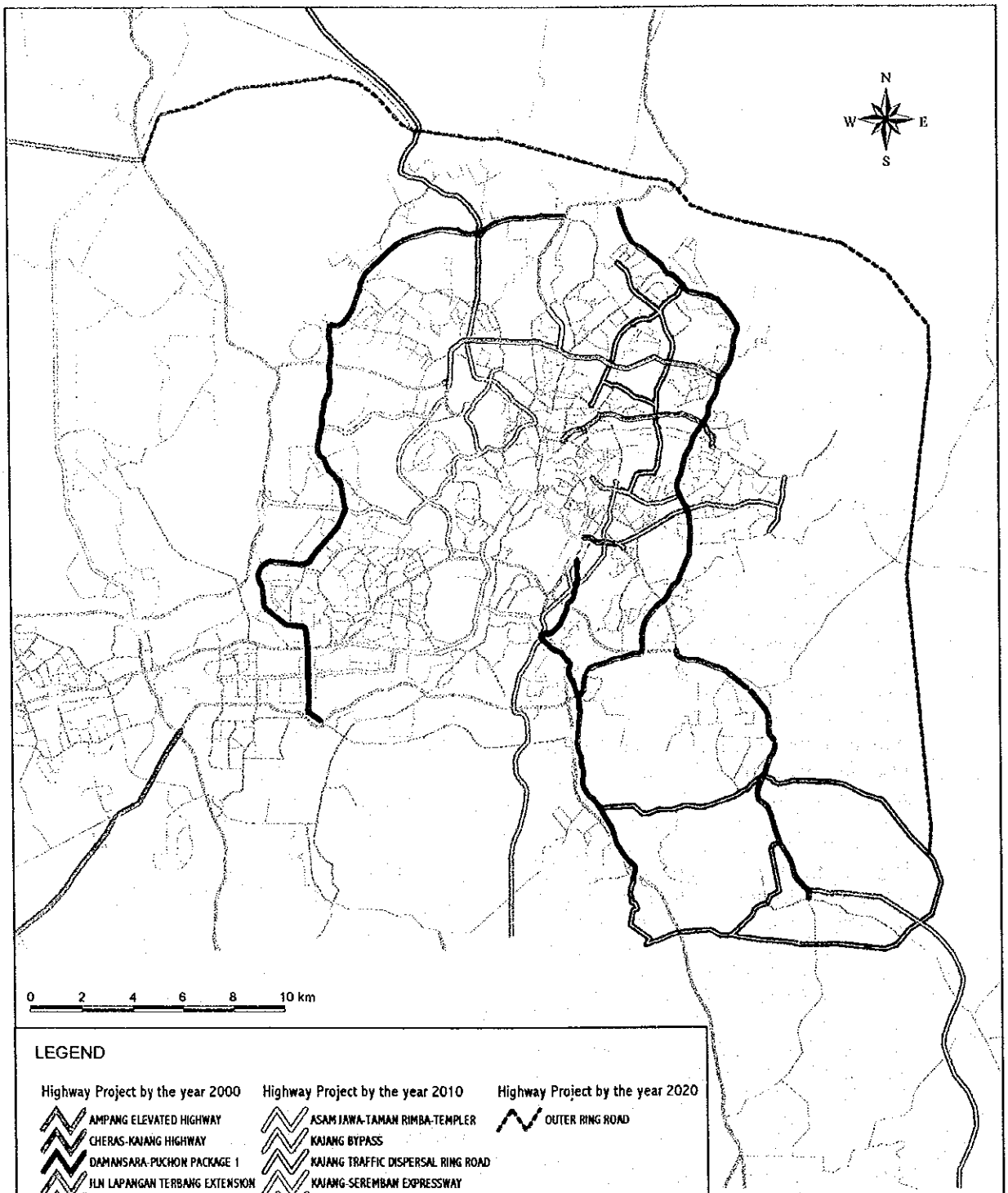


**Figure 6.1.1**
**Road Development Plan**

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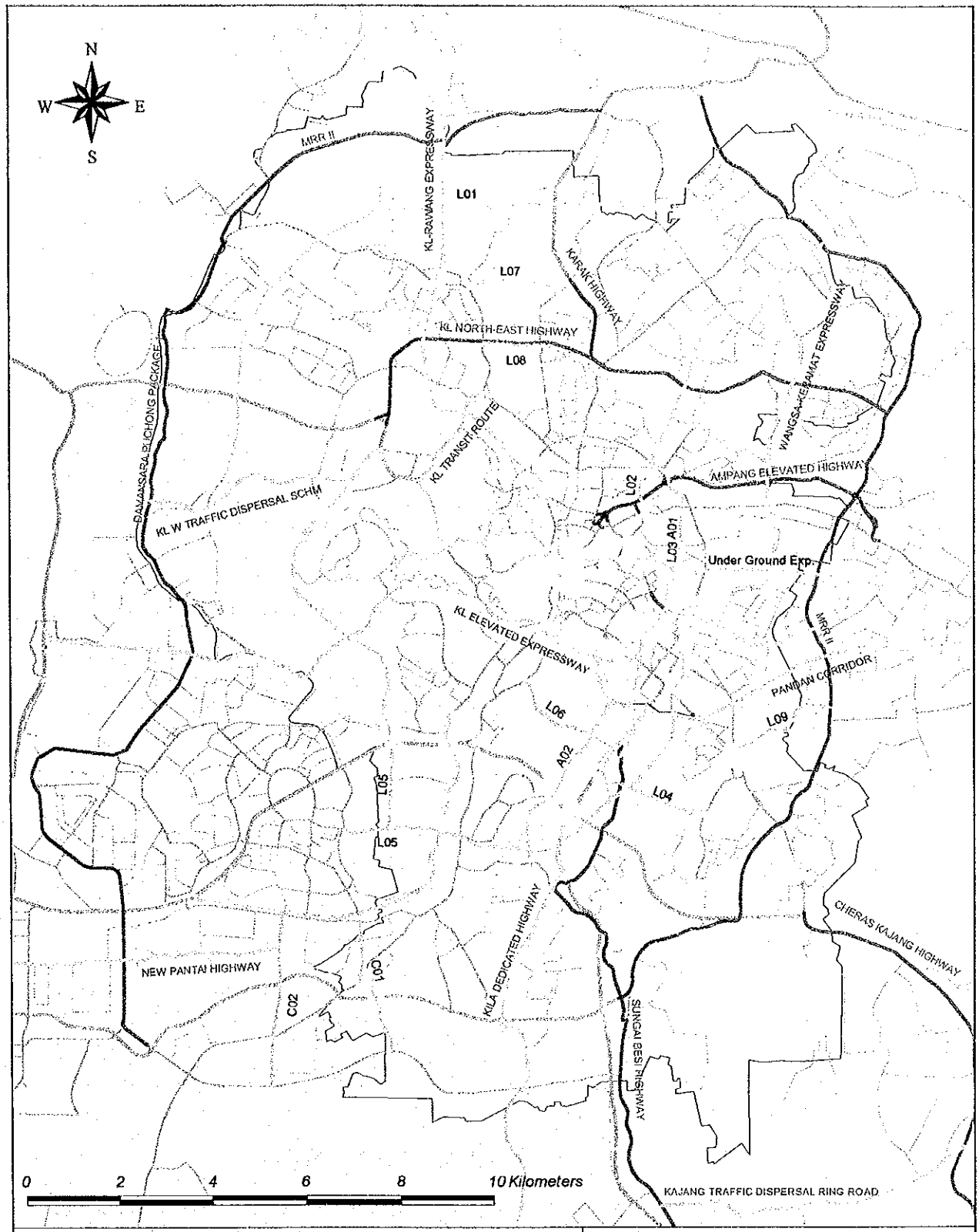


LEGEND

- SMURT Road Development Plan
- Proposed Road by the Year 2000
- Proposed Road by the Year 2010
- Proposed Road by the Year 2020
- Roads in 1997
- Kuala Lumpur

**Figure 6.1.2**

**SMURT Road Development Plan**

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A02 Arterial Road 2 (KL Elevated Highway – New Pantai Highway)

This road is planned in order to mitigate the heavy traffic burden of Syed Putra connecting to the CPA directly from the Federal Highway. There is a cemetery at the west side of Jln. Sungai Besi. The road project is to pass through the land area of the cemetery. However, if a redevelopment plan of the cemetery is allowed in future, the route will be subject to change and have to be planned elaborately to include, peripheral minor arterial roads at that stage.

C01 Connection Road 1 (Access to Petaling Jaya)

The area located in the southern part of the Shah Alam Expressway has big development potential. Two main impacts are the Multimedia Super Corridor, and provision of big transport infrastructure facilities, such as the Shah Alam Expressway, and the North-South Central Link, and other relevant road developments. The new road between Jln. Pintasan Puchong Sungai Besi and Jln. Templar aims to provide smooth access from this area to Petaling Jaya, where there is no definitive road at present, due to the presence of the Klang River.

C02 Connection Road 2 (the Federal Highway and Jln. Pintasan Puchong Sungai Besi)

As mentioned above, the area located in the southern part of the Shah Alam Expressway has big development potential. Taking this situation into consideration, a new road to connect both the Shah Alam Expressway and the Federal Highway was planned, in order to facilitate smooth high speed traffic movement within the region.

(2) Local Roads

Since it is essential to cater for the creation of a well arranged neighbourhood environment from the perspective of future area development in the Study Area, nine local road projects are proposed.

i) L01 (Section between Jln. Genting Kelang and Jln. Damansara)

The necessity of this new road will not be so urgent from a traffic demand point of view. However, the areas alongside the road are not so densely populated at present, but they are expected to develop in future. There is no systematic provision of local roads in the area except radial roads. Once making progress in the area development, it will be too late to realise construction of a new local road here, due to land acquisition problems. This new road is planned to guarantee a better neighbourhood environment in advance.

ii) L02 (Section between Jln. Yap Kwan and Jln. Datuk Abu Malik)

The area where this new road is planned consists of badly arranged narrow roads and an aggravated neighbourhood environment. The new road will help to improve the environment in the area by providing a basic road arrangement.

iii) L03 (Section between Jln. Ampang and Jln. Raja Chulan)

The roads in this area consist of radial roads only and there is no north-south road. In addition, a local road, which comprises of one peripheral road around KLCC, has been

already constructed. The new road will be connected by taking advantage of the already constructed road.

**Table 6.1.1 Proposed Roads in 1998**

**COMMITTED HIGHWAY PROJECTS BY THE YEAR 2000**

| | Name | Length (km) |
|---|---|---|
| 1 | North-South Interurban Toll Expressway | 847.0 |
| 2 | North-South Central Link Toll Express way | 48.0 |
| 3 | New Klang Valley Toll Expressway | 22.0 |
| 4 | Federal Highway 2 Extension | 18.0 |
| 5 | Shah Alam Toll Expressway | 34.5 |
| 6 | KL-Karak Highway | 68.0 |
| 7 | Cheras-Kajang Highway | 11.7 |
| 8 | Sungai Besi Highway | 16.0 |
| 9 | Damansara-Puchong Highway | 40.0 |
| 10 | Ampang Elevated Highway Phase 1 | 7.4 |
| 11 | KL North-East Highway | 19.3 |
| 12 | New Pantai Highway | 19.0 |

**COMMITTED HIGHWAY PROJECTS BY THE YEAR 2010**

| | Name | Length (km) |
|---|---|---|
| 13 | KLIA Dedicated Highway | 45.0 |
| 14 | Kajang Traffic Dispersal Ring Road | 36.0 |
| 15 | Kajang-Seremban Expressway | 46.0 |
| 16 | Kajang Bypass | 4.7 |
| 17 | Asam Jawa-Taman Rimba Templer Expressway | 36.0 |
| 18 | Banting-Taiping Expressway | 255.0 |
| 19 | Western KL Traffic Dispersal Scheme | 26.0 |
| 20 | Pandan Corridor Extension | 12.7 |
| 21 | KL Elevated Inner Ring Road | 30.0 |
| 22 | KL Transit Route | 11.0 |
| 23 | Kuala Lumpur-Rawang Expressway | 30 |
| 24 | Shah Alam-Rawang Expressway | 25 |
| 25 | Wangsa-Keramat Expressway | 20 |
| 26 | South Klang Valley Expressway | 57.0 |
| 27 | East Coast Expressway | 365.0 |

**EXPECTED HIGHWAY PROJECTS BY THE YEAR 2020**

| | Name | Length (km) |
|---|---|---|
| 28 | Subang-Kajang Highway | 25.3 |
| 29 | KL Outer Ring Road | 89.0 |

Source: Malaysian Highway Authority (1997)

**Table 6.1.2 Newly Proposed Roads**

| NO | | NAME | Length (km) | Cost (mil. RM) |
|---|---|---|---|---|
| (1) | | Under Ground Expressway | 6.6 | 2149.7 |
| (2) | A01: | Arterial Road 1 | 2.2 | 597.7 |
| (3) | A02: | Arterial Road 2 | 4.0 | 457.4 |
| (4) | L01: | Local Road 1 | 16.5 | 224.6 |
| (5) | L02: | Local Road 2 | 0.6 | 10 |
| (6) | L03: | Local Road 3 | 0.2 | 8.2 |
| (7) | L04: | Local Road 4 | 1.8 | 20.5 |
| (8) | L05: | Local Road 5 | 2.6 | 26 |
| (9) | L06: | Local Road 6 | 1.8 | 21.8 |
| (10) | L07: | Local Road 7 | 1.7 | 28.9 |
| (11) | L08: | Local Road 8 | 2.6 | 37.8 |
| (12) | L09: | Local Road 9 | 1.0 | 15.6 |
| (13) | C01: | Connection Link 1 | 3.2 | 25.9 |
| (14) | C02: | Connection Link 2 | 3.9 | 14.3 |

Note: Length = excluding existing road section
Cost = Construction Cost + Land Acquisition Cost
Source: SMURT-KL (See Appendix 12 in the Main Volume)

### 6.1.2 Service Level of Road Network

According to the results of the traffic assignment for the years 2000, 2010, and 2020, the service level of the road network and its characteristics were analysed, and the major results are summarised as out lined below:(see Figure 6.1.4):

1) The year 2000: High traffic congestion ratios can be observed in parts of the CPA, that is Jln. Duta and Jln. Damansara. In other sections, seriously low level of service cannot be seen.

2) The year 2010: Although traffic congestion with a V/C of over 2.0 can be observed only on the part of Jln. Duta as well as that of 2000, all sections indicate an affordable level of service of less than 1.5 of V/C ratio.

3) The year 2020: The eastern part of Jln. Tun Razak, Jln. Istana and section of the KL Elevated Inner Ring Road alongside of the same section of Jln. Istana show high V/C ratio. In addition, more sections with a ratio of over 1.5 can be observed in the Study Area compared to the year 2000 and 2010.

Considering these road network characteristics from the viewpoint of traffic demand on major road sections, the major arterial road network seems well established by sharing various trips in accordance with the location and function of the roads.

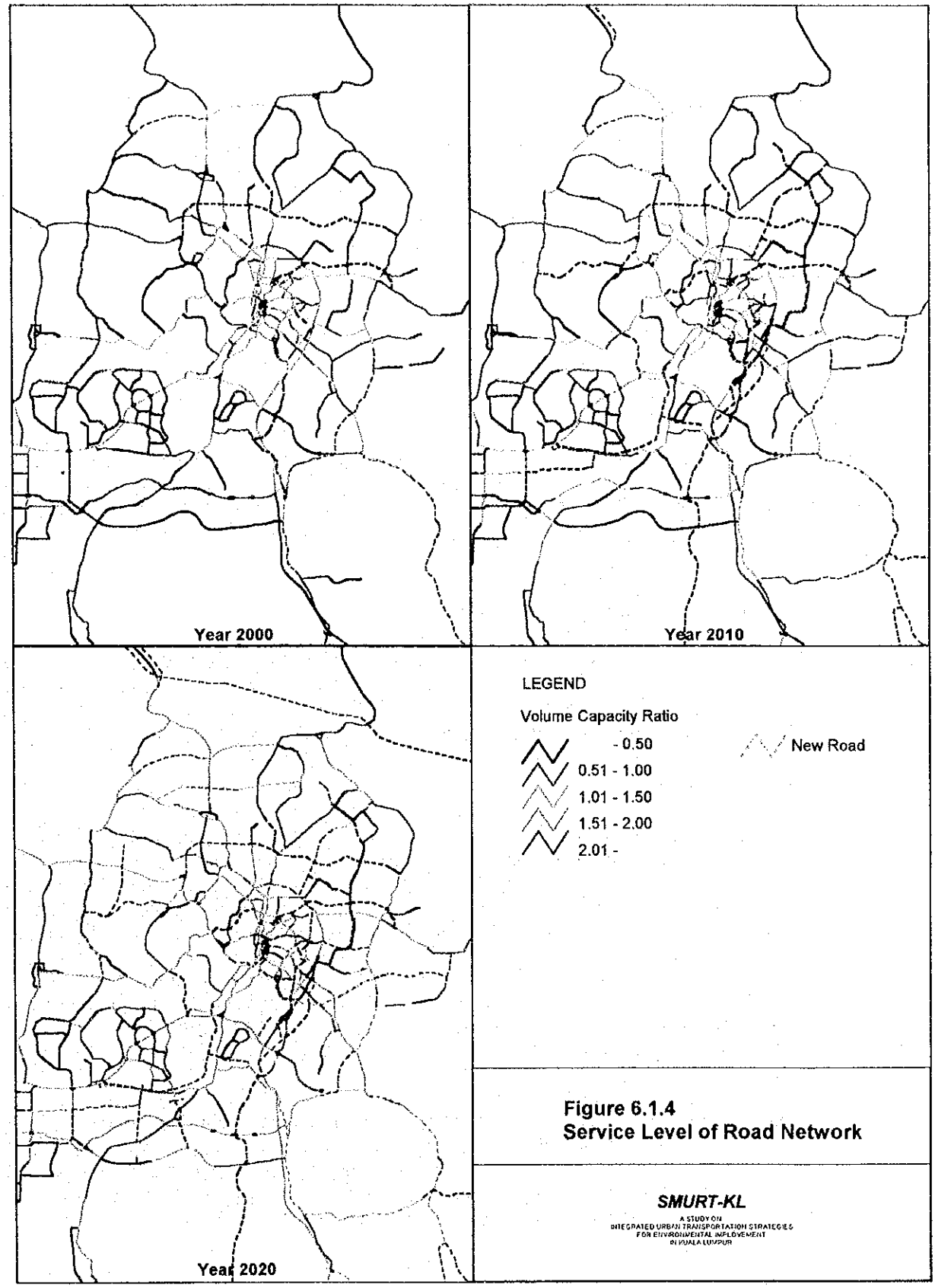


**Figure 6.1.4**
**Service Level of Road Network**

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### 6.1.3 Implementation Priority

There are many road development projects in the Study Area. Some planned roads might not have enough traffic to meet the demand if basic conditions changed. Much attention has to be paid to the adjustments in the implementation schedule of the road projects listed below according to future traffic demand and progress of other related road projects which might be deferred due to various external conditions. They are the:

- The North East Highway;
- The Wangsa Keramat Expressway; and
- The Eastern section of the Underground Expressway.

### 6.1.4 Guarantee of Road Plan

Several road projects have been newly proposed in the Study. A key issue is how to obtain the land for new roads, since one of the major difficulties in constructing new roads is land acquisition. It is, therefore, necessary to establish certain measures to guarantee road construction, for instance, providing acquisition right for land necessary for new road construction.

### 6.1.5 Measures for Control of Traffic Generator

Floor Area Control measures and Traffic Impact Assessment procedures are generally recommended for the purpose of regulating excessive urban development which may add heavy vehicular traffic to the roads in CPA. The Structure Plan, which has been carried out by DBKL, should include such the policy measures as part of the plan.

### 6.1.6 Truck Terminal

With regard to goods vehicle traffic, little problem has been recognised to date except for heavy lorries to/from construction sites in the City. However, likely future urban area expansion will raise issues concerning the efficient distribution of everyday goods and many small consignments. When goods transport increases in the future, transhipment facilities will be necessary for efficient goods transport. Goods transported by heavy lorries, which are considered as the object of long distance inter-city transport, are subdivided into small lots and transhipped there to small vans to deliver them to their final destination. At present, these transhipment facilities are owned and operated by individual firms and trucking companies. However, it will be necessary to construct some large public truck terminals in the future, in order to tranship the goods collectively and efficiently.

Maritime containers, which arrive at Port Klang, have not been generating serious problems, as most of them are opened in the Shah Alam area. However, for the north-south commodity flows, some freight terminals for the purpose of goods transhipment will be necessary, when the Middle Ring Road (II) opens. The candidate locations for the truck terminals, will be along the Middle Ring Road (II) (refer to Figure 6.1.5).


**Figure 6.1.5**
**Master Plan ( Road Facility Development )**

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## 6.2 Public Transport Development Plan

### 6.2.1 Railway, Bus and Taxi Transport Development Plan

(1) Components of Public Transport Enhancement

1) New Bus Operations

It is recommended that new types of bus service be introduced, namely, a Commuter Express Bus and a CBD Circular Bus.

a) Commuter Express Bus will provide speedy services with limited stops for commuters to the CBD.

b) A CBD Circular Bus will serve people moving around between various places within the CBD. Moreover, the number of buses entering the district can be reduced with introduction of this bus service. Two CBD Circular Bus services are proposed to connect the major destinations in the CBD, namely City Centre North, City Centre South, Chow Kit and Golden Triangle.

2) Bus Transport Preferential Facility (Bus Priority Lane)

The middle part of the roadway is more appropriate for the bus priority lane, although it conflicts with the left-turning traffic at intersections. Moreover, a one lane reduction out of two lanes would result in not 50 percent reduction but 60 to 75 percent reduction of road capacity, according to traffic characteristics and land use along streets. Therefore, it is recommended that, in principle, bus exclusive lanes be located on six lane streets or multiple lane one-way streets. However, most radial streets in the CPA are four-lane streets, and it seems difficult to accommodate bus exclusive lane. Thereby it is recommended that reversible lanes be introduced on radial streets in the CPA with one lane assigned as a bus priority lane.

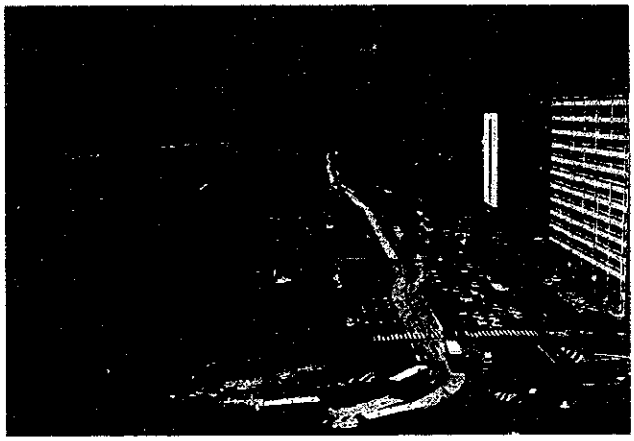
**Table 6.2.1 Bus Transport Preferential Facility**

| Type of Bus Transport Preferential Facility | Description |
|---|---|
| Exclusive bus lane coupled with reversible flow lane in the CPA | Exclusive bus lanes on four-lane streets will be introduced, coupled with reversible flow lanes in the morning and afternoon peak periods. (Details on reversible flow lanes will be described in Chapter 7.) |
| Exclusive bus lane in the middle of roadway (Trunk Bus System) | Exclusive bus lane in the middle of six-lane streets is used for trunk bus system. |
| Exclusive bus lane on the multiple-lane one-way street | Exclusive bus lane on the multiple lane one-way street e.g. Jalan Laut, Jalan Tuanku Abdul Rahman. |
| Bus priority lane | Priority is given to buses on the bus priority lane, but cars are allowed to pass the lane when buses do not run on the street. The bus priority lane will be applied on the four-lane streets, where exclusive bus lanes are difficult to be placed. |

3) Trunk Bus System

a) Characteristics of Trunk Bus System

A trunk bus system has railway-like characteristics providing a shuttle service from the origin to the destination of a route. Examples of a trunk bus system operating in Nagoya City, Japan, are shown in Figure 6.2.1. Buses run through exclusive bus lanes in the middle of the roadway, which are separated from the lanes for other vehicles. Since buses use the middle of the roadway, conflicts between buses and traffic accessing buildings along the street are avoided.



Buses on the trunk bus system are allowed to stop for passengers' embarking/ disembarking only at designated bus stops and bus terminals. The Interval between bus stops should be around 1.0 km to 1.5 km, which is longer than that for conventional bus operations.

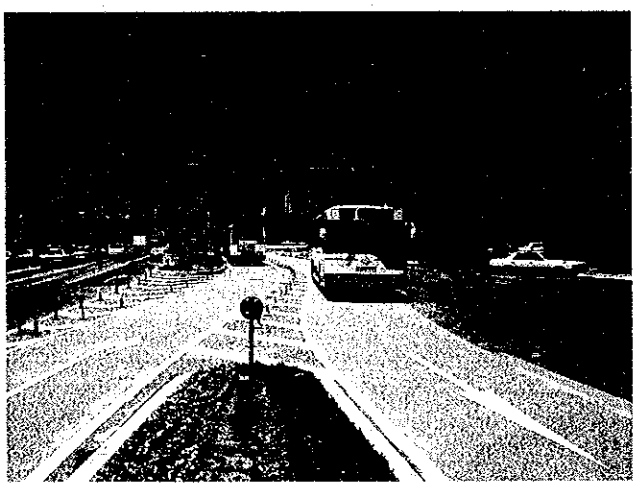


**Figure 6.2.1 Trunk Bus System (Nagoya City)**

b) Facilities for Trunk Bus System

At initial stage, buses are operated at grade, and a layout of bus stops near signalised intersections and those between intersections are illustrated in Figure 6.2.2.

In the intermediate term, it is necessary to construct flyovers or underpasses at major intersections to segregate bus operation from other traffic flows in order to achieve a more efficient operation.

c) Institutional Set-up for Trunk Bus System

A new agency should be established to deal with the development and maintenance of trunk bus system infrastructure since the trunk bus system will serve the metropolitan-wide trip demand. Buses on the trunk bus system may be operated by either the existing bus operators or new ones. The agency will collect charges from the bus operators according to their operation, and the collected charge will be allocated for relevant expenditure.

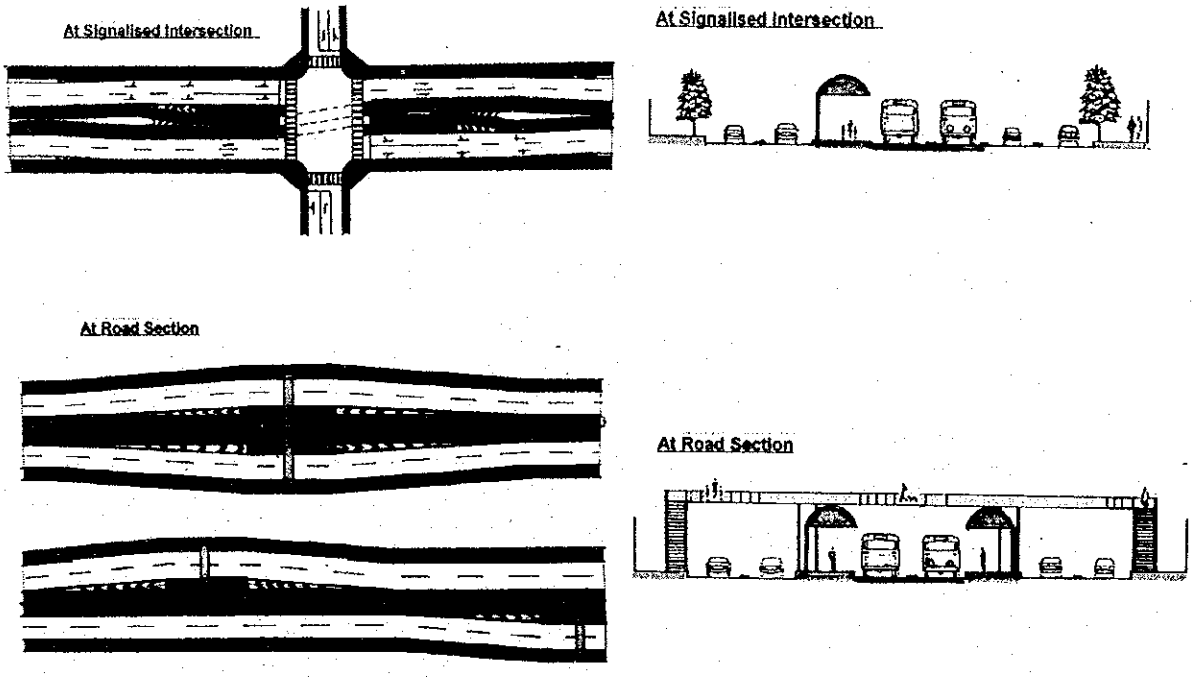



**Figure 6.2.2 Layout of Bus Stops for Trunk Bus System**

4) Relocation of Inter-City Bus Terminals

At present, four inter-city bus terminals are utilised for bus passengers going out of the City. Among the four terminals, the Puduraya terminal is the largest bus terminal. The buses arriving at/departing from this terminal, however, cause traffic congestion on Jl. Pudu. Since the urbanised area has already extended, the final destination of the inter-city bus passengers are distributed throughout the metropolitan area. Thus the inter-city bus terminal does not have to be located in the heart of the City. Plaza Rakyat, which is to be developed next to the Puduraya bus terminal as an alternate inter-city bus terminal, will cause the same problem as the existing bus terminal.

The criteria for selecting location for inter-city bus terminals are:

- Along circumferential roads such as Middle Ring Road (I)/(II) or other circumferential expressways for efficient distribution of passengers to various final destinations within the City
- Good connection with rail-based transport system, and
- Outside the CBD to avoid traffic congestion

Based on the criteria above, two inter-city bus terminals are recommended; one is the development of Sentul bus terminal, and another is the Bandar Tasik Selatan terminal as illustrated in Figure 6.2.3.

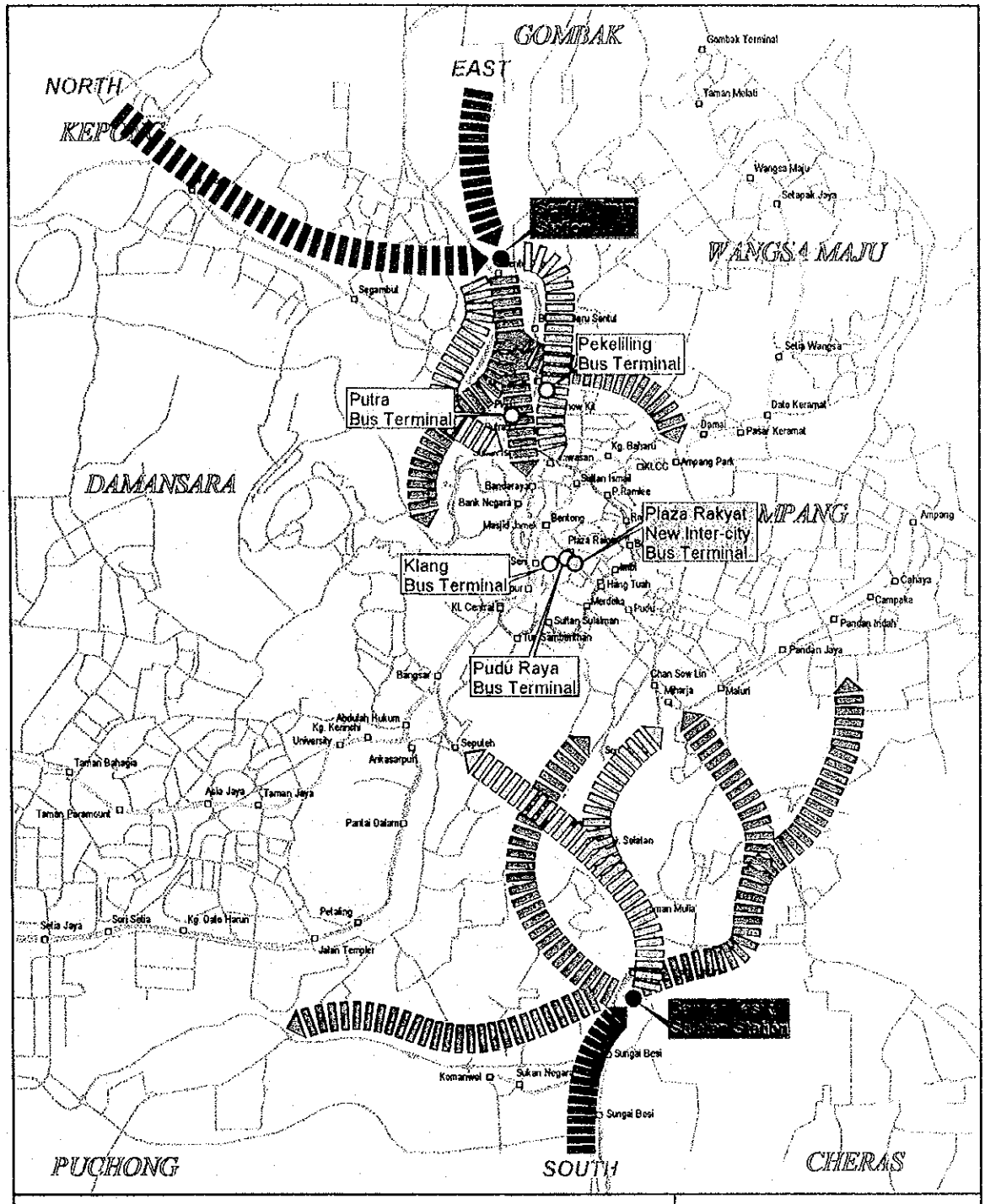



Figure 6.2.3
Inter-city Bus Terminal Development Plan

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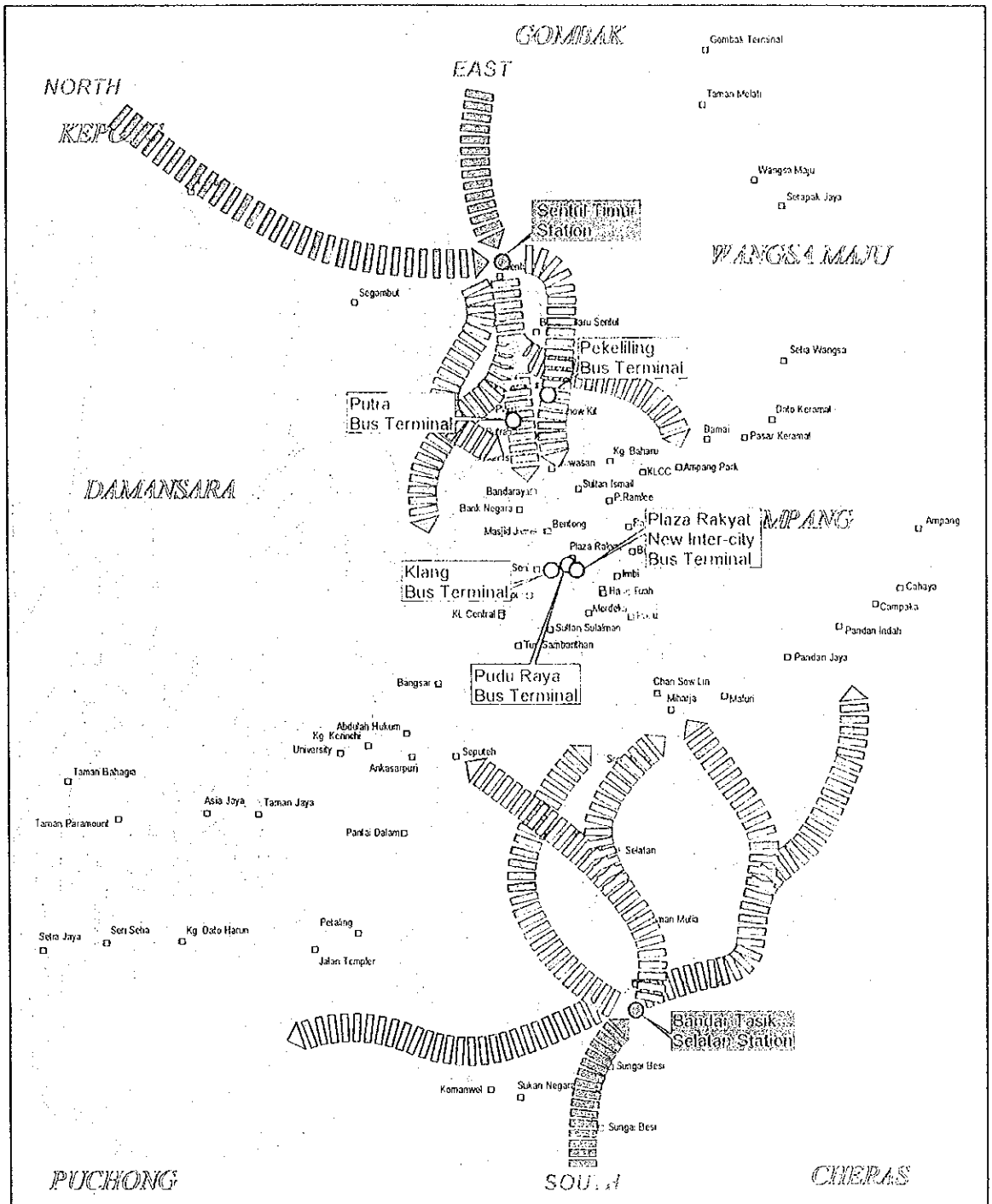


LEGEND

KTM
LRT(STAR)
LRT(PUTRA)
Monorail(PRT)
Station
Road

Existing Bus Terminal
On-going Terminal Development
New Bus Terminal

Inter-city Bus
Distribution (Rail)
Distribution(Road)

Figure 6.2.3
Inter-city Bus Terminal Development Plan

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a) North Inter-City Bus Terminal : Development of the Sentul Bus Terminal

At present, north-bound and east-bound bus trips account for 358 trips and 281 trips respectively. The new north inter-city bus terminal should be established for the buses bound for the north and east. The desirable location for the north inter-city bus terminal is near the Sentul station of KTM or the Sentul Timur station of LRT System(I) and the planned KL North-East Highway, which can be regarded as being a part of the circumferential road outside of the Middle Ring Road (I). The proposed terminal should be, therefore, developed after the construction of the KL North-East Highway. This bus terminal will be connected with the LRT System (I) and/or KTM Komuter Sentul Line, so that bus passengers can go to their home or the other final destination easily.

b) South Inter-City Bus Terminal : Bandar Tasik Selatan

Currently, 525 buses are operated toward the southern direction and all the buses depart from the Puduraya terminal. The terminal for the buses to the south should be relocated to Bandar Tasik Selatan, located about 7 kilometres south of the CBD and which is to be an integrated station for KTM Kommuter, LRT System(I) and ERL. This station is located along Jalan Sungai Besi, and it also has an easy access to the Middle Ring Road (II).

5) Taxi Transport

Taxis are one of the public transport modes, which supplement mass transit by providing door to door services. In 1997, the share of person trips made by taxis accounted for a mere 1 percent of all motorised transport modes; thus, the role of taxi transport is limited in terms of volume.

Currently, taxis are not heavily used for business trips; more than 80 percent of business trips are made by cars. Since many people use cars for commuting, subsequent non-home based trips, such as trips for business meetings from offices, are also made by car. However, this does not mean that the taxi is not a significant mode of public transport. When people shift from cars to public transport, taxis will provide a more flexible transport service than rail-base transport and buses. In addition, taxis should also support rail-based transport, and the trunk bus system by providing feeder services.

(2) Staged Public Transport System Development

1) Short-Term Public Transport Development Plan (Year 2000)

In the short term, bus transport should continue to play a significant role to supplement the rail-based transport system because the rail-based transport system will not cover the whole metropolitan area and the current fare level of rail-based transport is not affordable for the low and lower middle income groups. Therefore, emphasis should be placed on improvements, which can be implemented immediately and at moderate costs. This includes the development of a trunk bus system on six lane streets, such as Jln Syed Putra, Jln. Ipoh and a part of Jln. Pudu. It requires merely the construction of bus stops on the median with marginal road widening at bus stops. This development should be coupled with the introduction of exclusive bus lanes supported by reversible flow lanes in the CPA.

It is desirable to introduce exclusive bus lanes on the roads which are currently managed by a private highway operator such as Jln. Pahang, and on roads to be improved or developed under privatisation schemes such as Jln. Damansara and Jln. Cheras. However it requires the Government to negotiate with the concessionaire companies regarding the condition of concessions since they would lose toll revenue to some extent. If the companies do not agree with the scheme, another way would be to add one lane in each direction along the existing carriageway, and ask that the lane next to the median be used, as an exclusive bus lane. In the latter case, as it cannot be achieved in the short term, and the plan should be for the intermediate term.

Other improvements include re-arrangement of bus routes by cross-linking the existing routes, and introduction of new bus services. The bus transport network for the year 2000 is shown in Figure 6.2.4.

2) Intermediate-Term Public Transport Development Plan (Year 2010)

Over the intermediate term up to the year 2010, facilities for the enhancement of the public transport should be constructed. This includes extension of the trunk bus system for which road widening works is required, and relocation or redevelopment of inter-city bus terminals.

3) Long-Term Public Transport System Development Plan (Year 2020)

In the year 2020, person trip demand will continue to increase and trip attraction to the CBD area will be further increased. On the other hand, increased road network capacity in the CBD will be marginal under the road network development plan. Thus, in order to maintain the current level of roadways service, about 40 percent of person trips should be made by public modes of transport. Therefore, the public transport system will have a significant role in providing people with means of transportation, and will also have to have sufficient capacity to meet the increasing travel demand.

Among several trunk bus lines, the Damasara - Cheras line via Jalan Raja Chulan has a potential passenger demand for converting into LRT lines as shown in Figure 6.2.5. The other trunk bus lines coupled with rail-based transport should be maintained to serve the public transport passenger demand. A proposed staged public transport development plan is summarised in the Table 6.2.2. the predicted passenger demand under a traffic demand restraint scheme is illustrated in Figure 6.2.6.

**Table 6.2.2 Staged Public Transport System Development Plan**

| Period | Bus | Rail |
|---|---|---|
| Short term<br>(Year 2000) | • Develop trunk bus system on the six-lane streets<br>• Develop bus exclusive lanes coupled with reversible lanes<br>• Extend bus priority lanes<br>• Improve the level of bus service in terms of frequency and punctuality by re-organizing bus routes<br>• Introduce new type of bus services, Express Bus Services for commuters and CBD Circular Bus Services | • Complete on-going rail-based transport project, in particular, PRT, as soon as possible<br>• Provide efficient feeder bus services for KTM Commuter |
| Intermediate term<br>(Year 2010) | • Extend trunk bus system by road widening at several road sections<br>• Construct fly-overs or underpasses for trunk bus system at major intersections<br>• Relocate inter-city bus terminals<br>• Introduce Bus Location System | • Develop inter-modal facility<br>• Improve access roads to railway stations |
| Long term<br>(Year 2020) | • Supplement rail-based transport | • Convert trunk bus system into LRT when passenger demand increases<br>• Achievement of high density development in the surrounding area of the stations |

Source: SMURT-KL

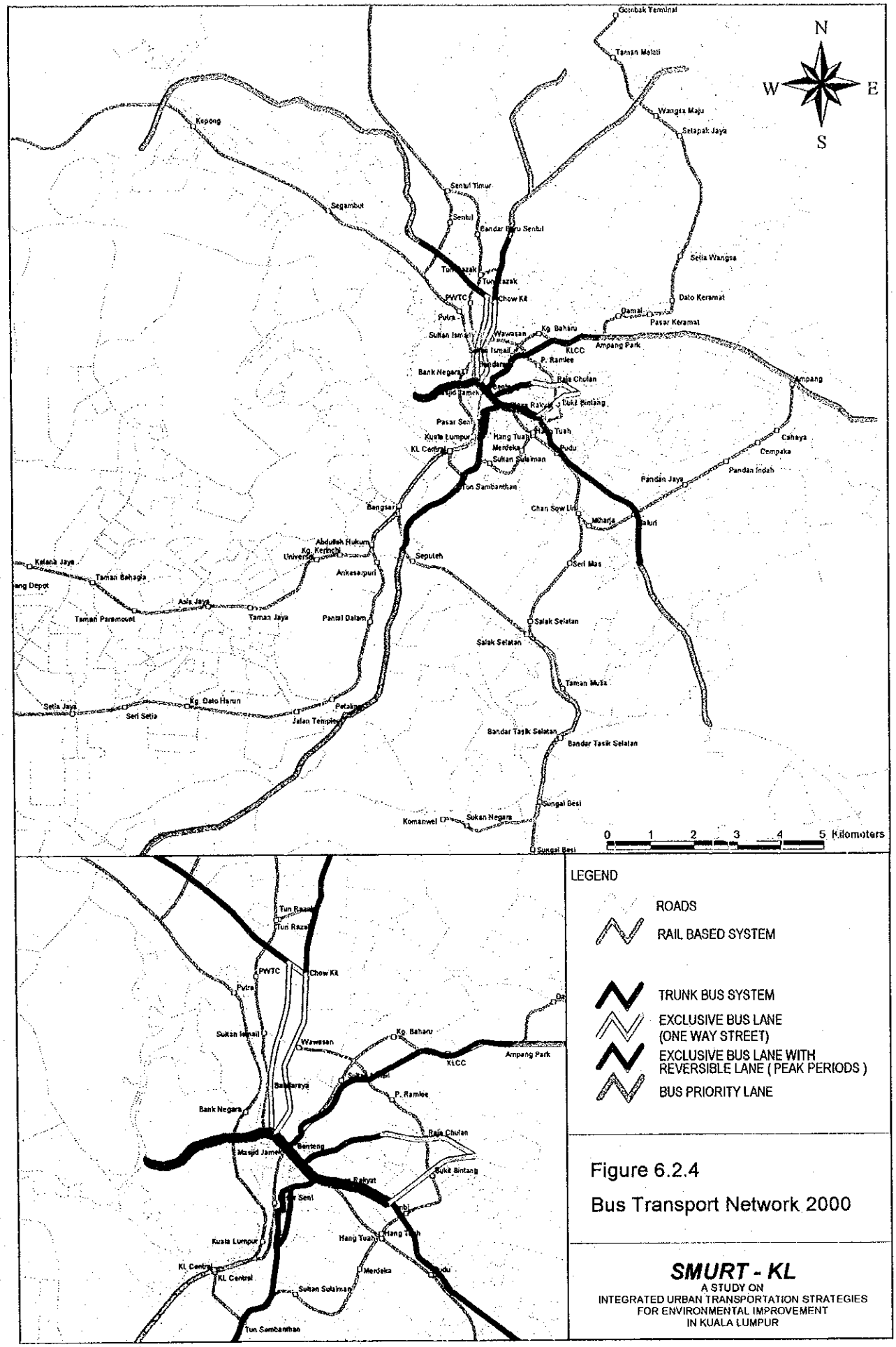


Figure 6.2.4

Bus Transport Network 2000

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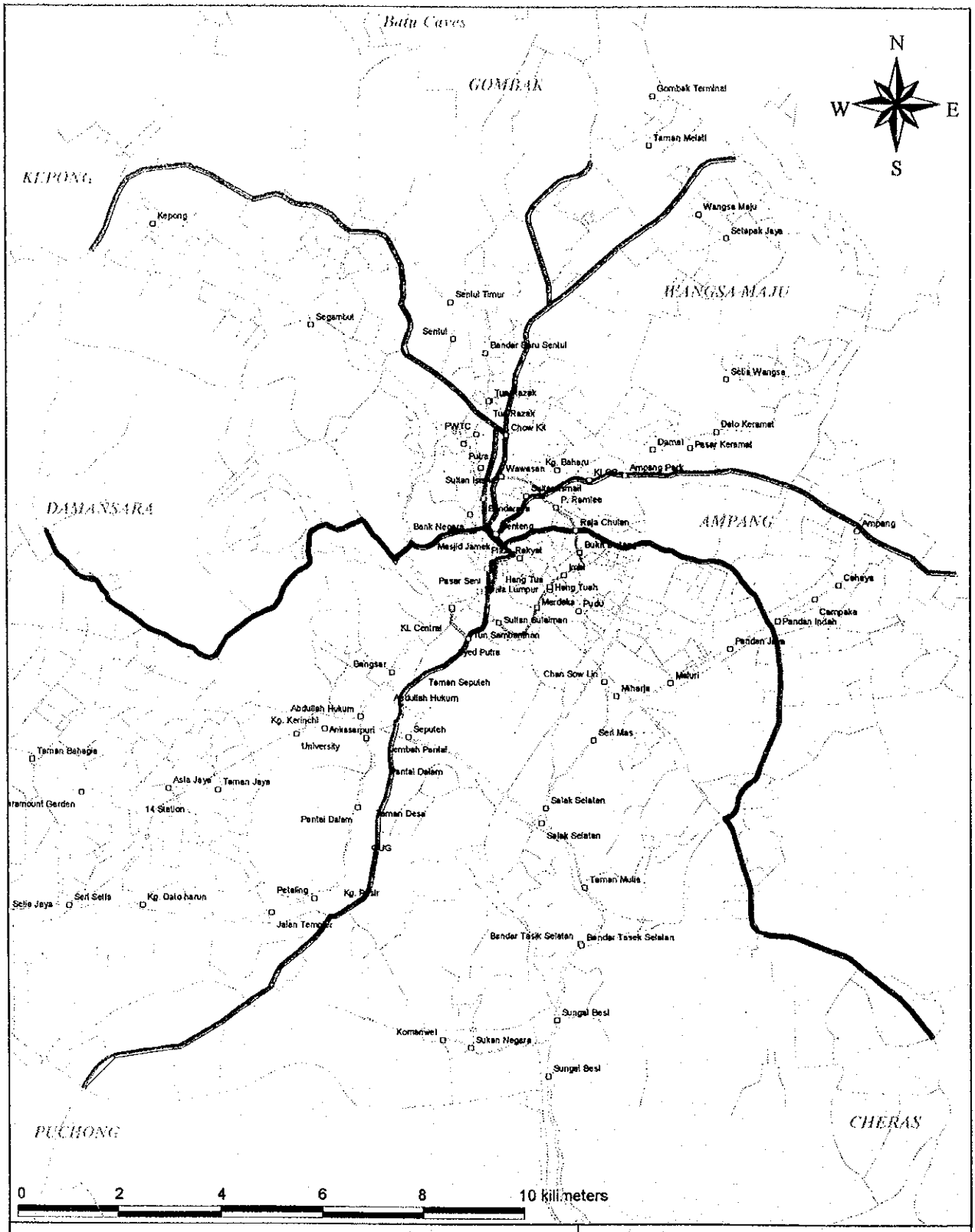


LEGEND

- KTM
- LRT SYSTEM I ( STAR )
- LRT SYSTEM II ( PUTRA )
- MONORAIL
- NEW LRT(PROPOSED)
- TRUNK BUS

Figure 6.2.5
Public Transport Network in 2020

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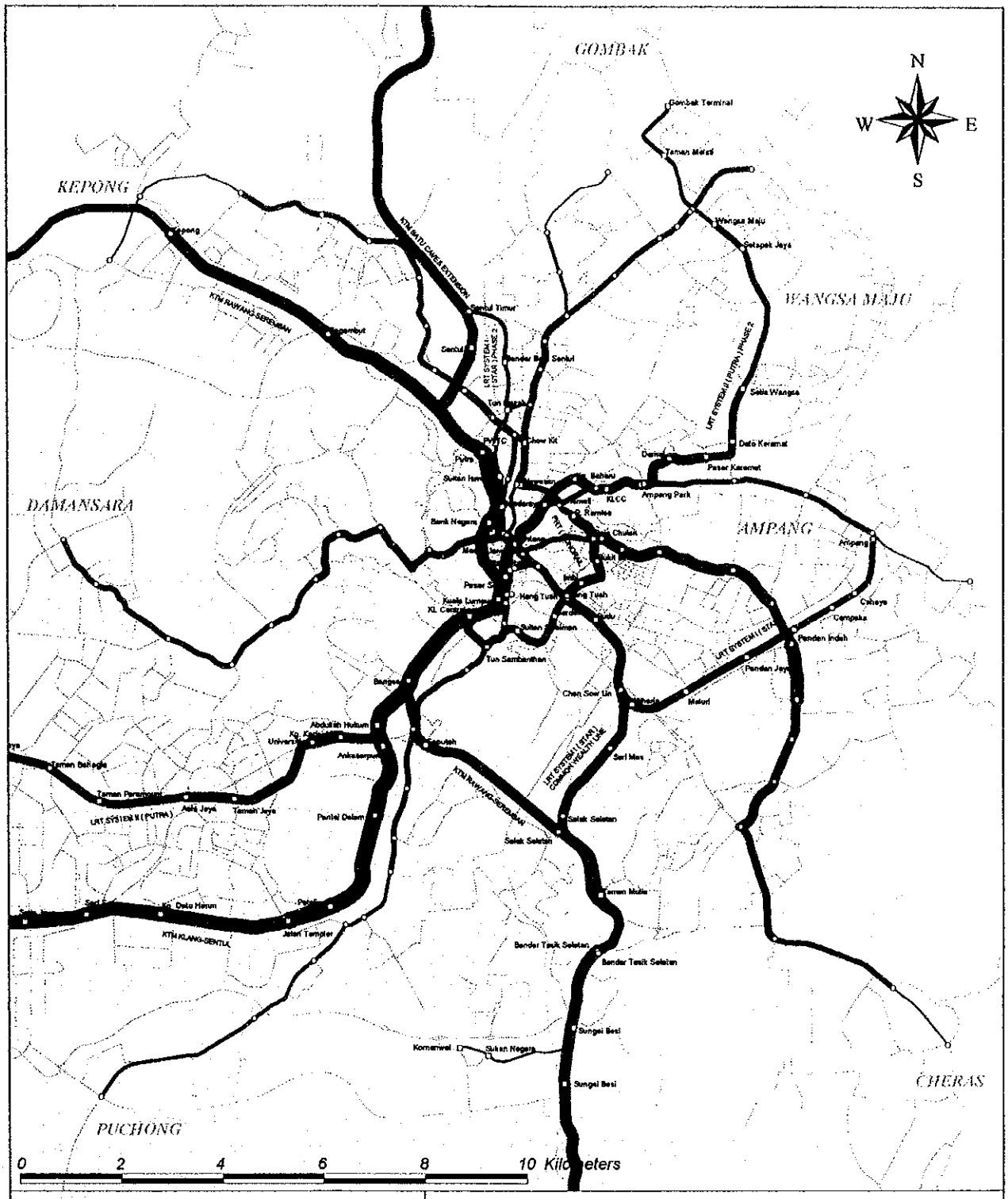


LEGEND

| | |
|---|---|
| 0 - 10000 | 60001 - 80000 |
| 10001 - 20000 | 80001 - 100000 |
| 20001 - 40000 | 100001 - 150000 |
| 40001 - 60000 | 150001 - 200000 |
| passengers / day | |
| Trunk Bus, New LRT | |
| Railway | |

**Figure 6.2.6**

**Public Transporation Passenger Demand ( Railways and Trunk Bus System) Year 2020**

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### 6.2.2 Inter-modal Facility Plan

(1) Necessity of Inter-modal Facility

According to the traffic demand forecast, high vehicular traffic growth is estimated in the Study Area even after the completion of the rail-based system with the additionally proposed line for the Cheras area. On the other hand, the road facility cannot afford to cater for such large traffic, even if the new planned road network were to be established in future. This implies that public transport has to play an important role in absorbing vehicle trips.

The overall rail-based system complise different systems, such as KTMB, LRT System I, LRT System II and PRT (monorail), so that users have to transfer to another rail-based system when they cannot reach to final destination by using one line only. This transferring is very inconvenient for users and will, without doubt, discourage the users from using the rail-based system.

The current and planned rail-based system might encounter big problems in promoting the utilisation of public transport on inter-modal facilities. It is necessary to improve the current and future planned public transport facilities in order to enhance their smooth utilisation.

(2) Transferring Among Rail-based System

Intensive development including rail-based stations can be observed at the KL Central development project in Brickfield. KTMB, PRT, LRT system II and Express Rail Link (ERL) will be put together at this project site. Users can change transportation here according to their destinations without transfering many times here and there. This is one of the very preferable instances of providing an inter-modal facility.

On the other hand, although PRT (monorail) has a very important role and function in connecting the LRT System I, II and PRT itself, the transfers at the Sultan Ismail Station on LRT System II and Wawasan and P. Ramlee on PRT monorail is very inconvenient under the current plan. Utmost efforts should be made to provide effective transfer facilities among these rail stations, including moving belt walk or other means.

(3) Park and Ride

Usage of park and ride depends heavily on the characteristics of rail stations. Facilities for park and ride shall be provided at rail stations with less frequent feeder bus operation.

(4) Pedestrian Facility for Public Transport

Another key issue to promote public transport is in order to provide comfortable walkways for long walking distances. This will help to increase utilisation of public transportation and reduce short vehicle trips. In addition, rail stations cover around 80% of the CPA, where the most densely built area is located. Another emphasis has to be placed on the creation of a pedestrian-friendly environment in the CPA. This will help realise a better quality better quality of life in future.

### 6.2.3 Public Transport Fare System Improvement

A transfer discount system should be introduced in order to vitalise the public transport network, which has been extensively developed in recent years, and which will be completed in a few years time. The number of public transport systems, such as rail-based system, trunk bus system, conventional line-haul bus system and feeder bus system, are increasing. Therefore, the transfer discount system should be introduced in order to fully utilise the developed urban public transport network.

The common ticket system is being materialised in the Klang Valley region. The Common Clearing House is in operation to adjust fare revenues, including highway toll revenue. The system should be expanded to all public transport modes with a view to encourage public transport usage after due consideration on its compatibility and expansion potential of the current system.

Taking these factors into consideration, it is desirable to bring about the following measures:

- Expand the common ticket system to all public transport operators after due considerations mentioned above
- Introduce season tickets at all public transport modes; and
- Introduction of a transfer discount ticket among different public transport modes.

## 6.3 Integrated Transport Information System

It is very difficult to satisfy future vehicle traffic demand completely in the Kuala Lumpur conurbation area, even with strong measures, such as the extensive increase of reversible lane, improvement of traffic signal control phasing, and the Purtra Jaya new administration centre project, which intends to move the federal government administration functions away from congested Kuala Lumpur.

Therefore, a strong proposal is made to develop advanced transport information systems, by applying information technology, in order to cope with future traffic problems, as well as in order to promote enhanced public transport usage.

The Transport Information System will be effective in utilising the existing transport infrastructure resources under restrained development condition. The system should become an Integrated Transport Information System in the future by linking independent information systems.

### 6.3.1 Basic Concept

The purpose of the transport information system is to realise traffic safety and improved urban living environmental through rational and smooth traffic flows derived by providing appropriate transport information mainly to the administrators and the road users.

Currently, the transport information system for road-based transport is developed than that for the railways. Three reasons for the resulting situation are considered as follows:

- Uncontrollable demand;
- Unpredictable vehicle activity; and
- Undeveloped information technology.

Some countries have developed advanced transport information systems in order to attain more efficient and effective use of road network, although efforts have been made independently. For example, a parking information system provides information on empty parking lots and its route information, though the system has no relation to other information systems and/or traffic control systems.

In recent years, however, efforts to integrate the transport information systems has progressed remarkably, with the assistance by state-of-the-art information technology development. An Intelligent Transport Information System (ITIS) is an advanced system now being developed in many countries that covers safety, improvement of traffic efficiency and comfort, preservation of the environment and so on.

According to "ITS Hand Book in Japan" issued by the Highway Industry Development Organisation, ITIS will be developed in four phases as identified below:

- First Phase (Around 2000)

  Beginning of ITIS: leading systems, including a navigation system, will put in service.

- Second Phase (Around 2005)

  Traffic system revolution: beginning of user services

- Third Phase (Around 2010)

  Realization of a Dream: Advances in ITIS and enhanced social system – Automated Highway Systems, and

- Fourth Phase (After 2010)

  Maturity of ITIS: Innovation of social systems.

Furthermore, a standard, which will ensure future integration of ITIS, is now under discussion by the Technical Committee Working Groups (TC204) in the International Standardisation Organisation (ISO).

Therefore, it will take more than ten years from now for the ITIS to materialise as an integrated intelligent transport information system.

In Japan, quite a number of transport information systems have been developed and implemented simultaneously. It has caused confusion in terms of system integration, because some are incompatible with each other. As mentioned before, standardisation of each information system is in progress by ISO. Therefore, it is proposed that the Transport Information System in Malaysia should be developed by taking the future direction and world standards into consideration.

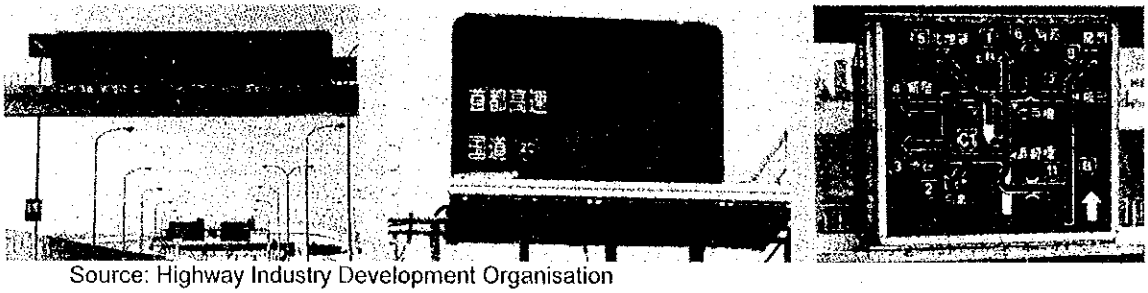
### 6.3.2 Transportation Information System Development Plan

Based on the above consideration, a Transport Information System Development Plan for the Study area was formulated as shown in Table 6.3.1.

(1) First Stage

In the first stage, modernisation and improvement of current transport information systems are considered to be the major targets.

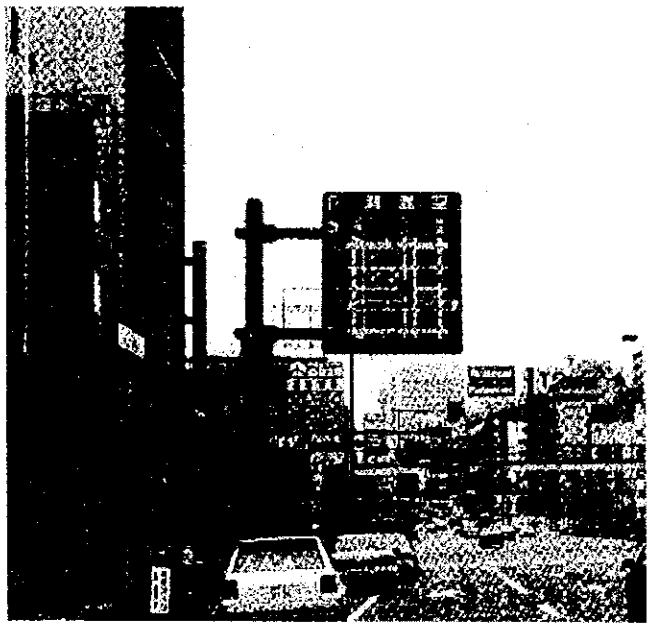
Road traffic information systems should be equipped with traffic congestion information board showing nearby road network situation, weather forecast signboard and so on. Drivers can choose less congested roads to arrive at their destinations, thus jams will be minimized by the utilisation of less congested roads. Figure 6.3.1, below shows examples of information boards. The left board displays earthquake information, while the middle one shows the time required to reach certain destination. The right board illustrates a road congestion information map.



Source: Highway Industry Development Organisation

**Figure 6.3.1 Examples of Traffic Information Boards**

A parking information system will also help traffic congestion caused by vehicles looking for vacant parking lots. This system is relatively simple and easy to develop. It displays vacancy of parking lots and routes to the parking areas. Figure 6.3.2 shows the display of parking area and vacancy information.



Source: "Urban Transport Facilities in Japan 1993", City Bureau Ministry of Construction and Japan Transportation Planning Association

**Figure 6.3.2**
**An Example of Parking Information System**

In terms of public transport, public transport service information such as route, network, transfer points and operation is considered to be important for users. This information system does not alleviate traffic jams directly, but indirectly by encouraging people to use public transport mode.

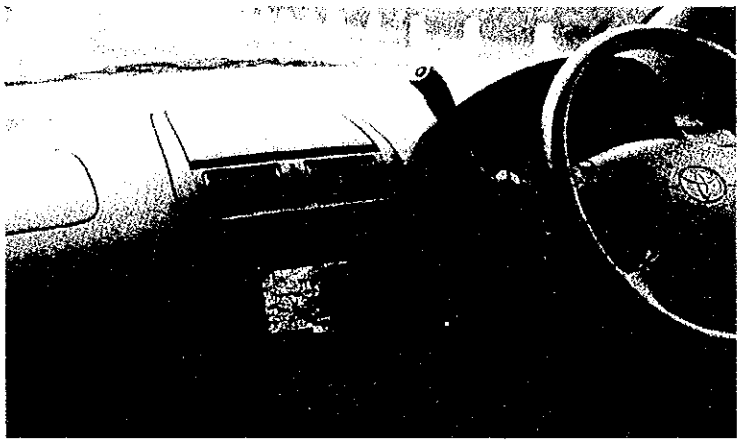
The Touch'N Go smart card is now becoming popular in Klang Valley. The card will be a common means to pay fares and tolls to buses, railways and toll for highways. It will decrease resistances to use various modes of transport. Therefore, extensive use of the card should be encouraged.

In the first stage of the development plan, the transport information systems will be introduced and improved independently, since the initial integration of the systems would normally have some technical difficulties. However, it should be noted that compatibility and extendibility are the most important issues in introducing and/or improving the information systems for the purpose of future integration of the information systems.

(2) Second Stage

In the second stage, major attention should be paid to the navigation system and the route guidance system for vehicles (refer to Figure 6.3.3). The traffic signal control system and the road traffic information system would have reached maturity.

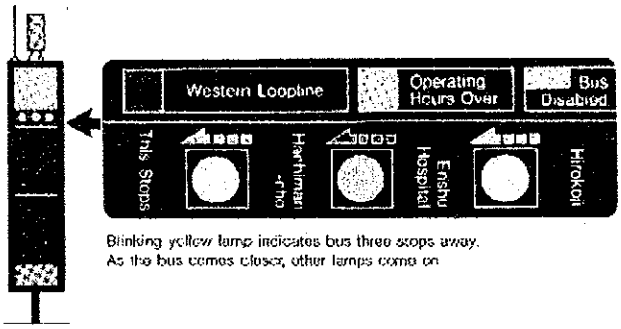
As for public transport, an introduction of the Automatic Vehicle Monitoring System or Bus location system would be important. The system will enable public transport operators to manage and control their business operations effectively and efficiently.

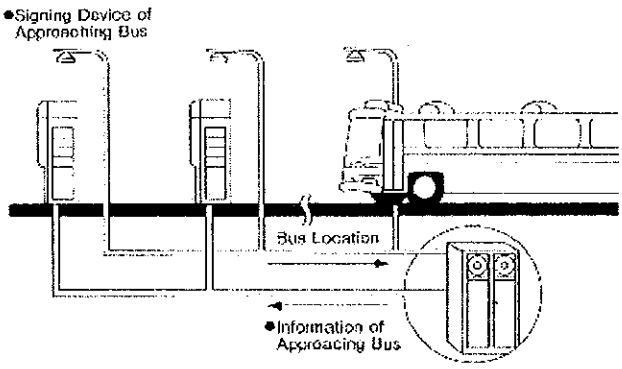


Source: Highway Industry Development Organization

**Figure 6.3.3 Car Navigation System**

Furthermore, the system will alleviate users' frustration towards unreliable services by displaying relatively accurate bus arrival schedule at bus stops. The system, therefore, is expected to increase public mode users extensively. Figure 6.3.4 shows an information board of the system and a mechanism of the system.




Source: "Urban Transport Facilities in Japan 1993", City Bureau Ministry of Construction and Japan Transportation Planning Association

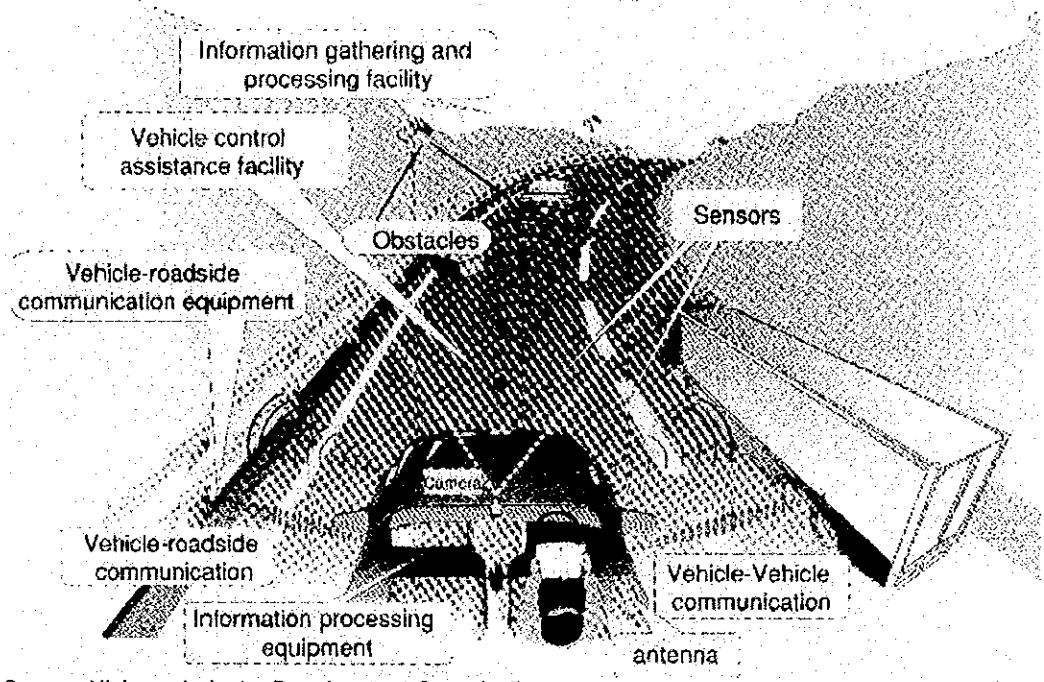
**Figure 6.3.4 Bus Location System**

(3) Third Stage

The third stage is the final stage of the transport information system development plan. An automated driving system (refer to Figure 6.3.5) will be introduced based on the Intelligent Transport Information System technology and the advanced transport information systems for road transport, and reliable public transport will ultimately be realised based on the technology and other efforts explained in the former chapters.

In conclusion, the most important matter would be the integration of the various information system including the transport information systems and the Intelligent Transport Information System. The Integrated

Transport Information System, therefore, would be a system which enables both transport operators and users to enjoy better transport services by sharing common transport information through advanced communication technique between operators and users. Further study is deemed necessary, as the technologies are progressing at a marvellous pace.




Source: Highway Industry Development Organisation

**Figure 6.3.5 Automatic Driving System**

**Table 6.3.1 Transport Information System Development Plan**

| Transport Information System | First Stage | Second Stage | Third Stage |
|---|---|---|---|
| Road Transport | | | |
| Traffic Signal Control System | ■ | ■ | □ |
| Road Traffic Information | ■ | ■ | □ |
| Electronic Toll Collection System | ■ | □ | □ |
| Parking Information System | ■ | □ | □ |
| Navigation System | □ | ■ | ■ |
| Route Guidance | □ | ■ | ■ |
| Automated Driving | □ | □ | ■ |
| Public Transport | | | |
| Public Transport Service Information (Network, Service, Transfer, Operation) | ■ | □ | □ |
| SMART Card | ■ | ■ | □ |
| Automatic Vehicle Monitoring System (Bus Location System) | □ | ■ | ■ |
| Integrated Transport Information System | - | □ | ■ |

Source: SMURT-KL

# Chapter 7

# Transportation Demand Management and Traffic Control System

# Chapter 7 Transportation Demand Management and Traffic Control System

## 7.1 Transportation Demand Management Plan

This section addresses the issue of Transportation Demand Management (hereinafter referred to as TDM) for the Kuala Lumpur urban transportation as one of the important components of the Master Plan planning study.

### 7.1.1 TDM Measures in the Context of KL

(1) Objectives of TDM

Two major objectives can be defined in formulating a TDM strategy for the KL metropolitan area. As stated in the objectives, TDM in KL will be applied not only as a technique for mitigating traffic congestion but also as a very important policy to change the current society into a better world for the people.

- To remove excessive vehicular trips (especially SOV) during peak periods, in order to avoid economic losses or to achieve economic efficiency over the short- to medium-term, and
- To alter the direction of society from a "Car driven Society" to an "Environment-friendly (Public transport advantageous) Society".

It should be noted that there are two premises underlying the application of TDM in KL, these are as follows:

- Maximum utilisation of the existing facilities should be achieved through traffic control techniques before applying TDM (few additional infrastructure is assumed within the CBD).
- Alternative transport modes, both for commuting (peak-hours) and for intra-CPA travel (business communication) should be provided at the same time.

(2) Preliminary Appraisal of TDM Techniques

Based on the above objectives and premises, a preliminary appraisal of TDM techniques for KL was made. TDM techniques are categorised into five fields: 1. Peak-period Dispersion Technique, 2. Ride-sharing Technique, 3. Parking Demand Control Technique, 4. Public Transport Improvement Technique, and 5. Traffic Restraint Technique.

1) Peak-period Dispersion Technique

Flexible working hours in government should be maintained and expanded into the private sector.

2) Ride-sharing Technique

Car-pooling should be promoted through the dissemination of public information for raising public awareness of traffic congestion.

3) Parking Demand Control Technique

An on street parking restriction policy should be maintained for smooth traffic flow (especially for buses). Parking supply control should not be applied because it is necessary to remove on-street parking. Parking pricing policy can be one of the components of a pricing policy. However, visitors and short-time parking should not be affected. Car use during off-peak periods should be supported by providing parking spaces at low costs.

4) Public Transport Improvement Technique

All the efforts of the operators should be maintained/enhanced. The government should support them thorough the dissemination of public information to raise public awareness of public transport. Joint-efforts by the government and operators should be carried out in the following fields:

- Route integration among different operators.
- Installation of exclusive bus lanes and operation of trunk buses.
- Combination discount ticket (e.g. PUTRA feeder buses & PUTRA LRT) can be introduced by each operator independently, and
- Transport allowance for public mode users (employees) should be promoted by providing employers with a preferential taxation scheme.

5) Traffic Restraint Technique

After completion of the proposed rail system (year 2000), the introduction of traffic restraint via pricing technique is necessary in order to reduce excessive vehicular demand, and in order to improve public transport.

### 7.1.2 Area Pricing

(1) Justification for Introducing an Area Pricing Policy

Characteristics of traffic congestion in the CBD and the necessity for introducing TDM measures are summarised as follows:

1) Congestion

A congestion phenomenon will be observed within the next five years only during the morning / evening peak-hours. There will be enough road capacity during the off-peak period.

2) Urban Structure

Commercial / business functions are concentrated in the CBD, while residential areas are located outside the CBD. In addition, more radial roads will be introduced into CPA.

3) Demand Side

People prefer to use private modes of transport, due to the low level of service of the existing public transport system.

4) Supply Side

Limited road space inside the CBD. (New road construction in CBD seems difficult)

5) Characteristics of Workers in the CBD

Car users are wealthier people in comparison with other transport mode users. Time saving is not a major factor in their modal choice, On the contrary, cost increase is one of the influential factors (RM125 - 175 is critical for car users). The level of service of public transport should be high in order to attract private mode users.

Public Mode Users are likely to switch to private modes of transport as real household income increase.

Thus, to mitigate the traffic congestion problem effectively, commuting trips made by private modes of transport during the peak hours should be focused on at first. Among the TDM measures, a type of sending price signal with physical constraint would be the most effective technique.

(2) Preliminary Assessment of Alternatives for Pricing Scheme

Three alternatives of pricing techniques have been scrutinised in order to make a preliminary assessment on the impact of the pricing scheme: "Overall Area Pricing in CBD", "Preferential HOV + Cordon Toll Gate", and "Simple Cordon Toll Gate".

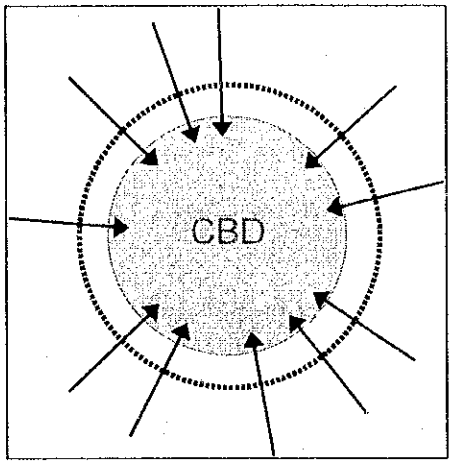
Table 7.1.1 summarises advantages and disadvantages of each pricing scheme. Among them, the issue of inequity between residents inside the CBD and those outside the CBD is critical in ALT 2 and ALT 3. In both cases, residents inside the CBD are given preferential treatment, that is, they need not to pay any money when they go to a place inside the CBD from their residence. In case of ALT 2, a negative impact on bus transport is anticipated. Car users may invite bus passengers as their fellow passenger to escape the payment imposed on SOV. ALT 3 has a severe technical problem in the collection of the toll fee. Since the amount of traffic bound for the CBD is so huge, a long traffic queue may occur at the gates. A new technology termed Electronic Toll Collection (ETC) might be effective in such cases, however, a considerable amount of investment is required. ALT 1 seems to be the severest policy for the public, because nobody (no vehicle) has a chance to escape from payment. In other words, this is the most fair scheme. Furthermore, this technique can designate the specific congested roads where the pricing policy is applied. In the end, an overall area pricing technique (ALT1) would be preferable.

**Table 7.1.1 Comparison of Pricing Technique Alternatives**

| | Pros | Cons |
|---|---|---|
| ALT 1<br><br>Overall Area Pricing in CBD | • Reduce SOV(Promote HOV indirectly).<br>• Equity between residents in side the CBD and those outside the CBD.<br>• Any passenger cars are allowed to enter the CBD if they pay the charge.<br>• Encourage people to use public mode. | • Strong opposition from the public.<br>• Enforcement is required. |
| ALT 2<br>Preferential Treatment for HOV | • Reduce SOV directly.<br>• Lower Income people can escape from payment by arranging to be fellow passengers. | • Inequity between residents inside the CBD and those outside the CBD.<br>• Reduce bus passengers, as they will be invited to be fellow passengers.<br>• Enforcement is required.<br>• Operation at the gates is not simple. |
| ALT 3<br>Cordon Toll Gate | • Violation of the rule is avoided by physical gate.<br>• Proposed toll highway plunging into CBD could be used as a part of toll gates.<br>• Encourage people to use public modes of transport. | • Inequity between residents inside the CBD and those outside the CBD.<br>• Additional infrastructure (ETC gates) is necessary.<br>• Traffic congestion at the gates. |

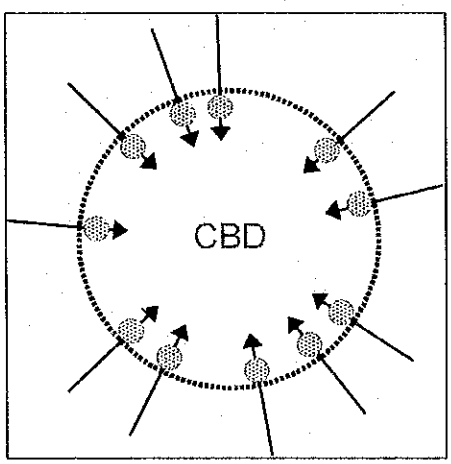
Source : SMURT-KL

## ALT 1 Overall Area Pricing in CBD



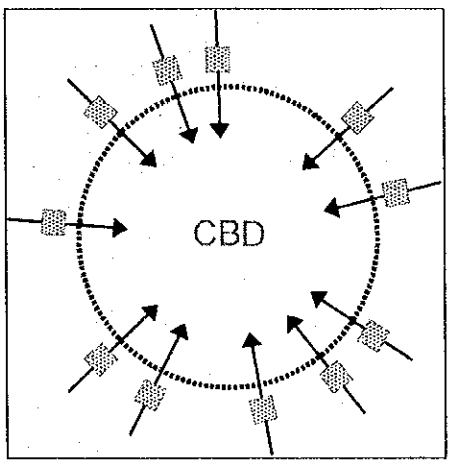

**General:**
Charges are applied to all cars that are using congested arterial road segments in CBD during peak period.
**Exemption:**
Buses, emergency vehicles, vehicles with handicapped drivers, government utility vehicles.
**Payment & Enforcement:**
- Sticker (no gate installed)
- Visual check by policemen at designated road segments.
- ETC in future

## ALT 2 Preferential Treatment for HOV




**General:**
Charges are applied to SOV entering CBD during peak period.
**Exemption:**
HOVs (Cars with more than 2 persons), Buses, emergency vehicles, vehicles with handicapped drivers, government utility vehicles.
**Payment & Enforcement:**
- SOV Sticker (no gate)
- Visual check by policemen at the cordon line.

## ALT 3 Cordon Toll Gate




**General:**
Charges are applied to all vehicles entering CBD during peak period.
**Exemption:**
Buses, emergency vehicles, vehicles with handicapped drivers, government utility vehicles.
**Payment & Enforcement:**
- At the gate (ETC in future)
In the case of manual toll collection, a preferential treatment can be applied to HOV.

(3) Predicted Changes in Modal Share

The three cases which were tested are as follows:

Case 1: Impose RM100/month on car users with HBW purpose;

Case 2: Impose RM150/month on car users with HBW purpose;

Case 3: Impose RM200/month on car users with HBW purpose; and

A summary of the simulation is presented below:

**Table 7.1.2 Modal Shares of Workers in the CBD**

(unit : percent)

| | MC | CAR | BUS | RAIL |
|---|---|---|---|---|
| No Policy | 29.0 % | 41.4 % | 17.2 % | 12.5 % |
| Case 1 | 29.9 % | 38.2 % | 18.5 % | 13.4 % |
| Case 2 | 30.3 % | 36.6 % | 19.2 % | 14.0 % |
| Case 3 | 30.7 % | 35.0 % | 19.9 % | 14.5 % |

Source : SMURT-KL Estimate

**Table 7.1.3 Increase of Trips from No Policy Case in the CBD**

(unit : person trips)

| | MC | CAR | CAR (veh) | BUS | RAIL |
|---|---|---|---|---|---|
| Case 1: RM100 | 2,327 | - 7,992 | - 6,324 | 3,285 | 2,381 |
| Case 2: RM150 | 3,312 | - 11,958 | - 9,490 | 5,016 | 3,630 |
| Case 3: RM200 | 4,197 | -15,883 | - 12,605 | 6,783 | 4,903 |

Source : SMURT-KL Estimate

As shown in Table 7.1.3, if one desires to remove around 10,000 cars in the year 2000, an amount of around RM150/month charge would be effective.

(4) Area Pricing Implementation Plan

1) Objective

The objective of the area pricing is to use the road space more efficiently in order to alleviate traffic congestion, and thereby reduce travel time and air pollution caused by the exhaust gas of vehicles.

2) Target

The target is to maintain (possibly improve) the present service level of roads and promote public transport use.

3) Implementation Schedule

Area pricing shall be employed after all the on-going rail-based systems have inaugurated their operations and supplemental bus transport services are provided for the areas left out by the rail-based transport services.

- LRT System (I) STAR (existing)
- LRT System (II) PUTRA
- PRT (Monorail)
- KTM Commuter (existing)

4) Restricted Area (Areas where Area Pricing would be employed)

Area pricing would be employed on the congested streets in the CPA as shown in Figure 7.1.10.

5) Operation Period

a. Monday to Friday

Morning Peak Period - 7:00 to 9:00

Afternoon Peak Period - 16:30 to 18:30.

b. Saturday

Morning Peak Period - 7:00 to 9:00

Afternoon Peak Period - 12:00 to 14:00.

6) Charge Level

Charges are to be differentiated by vehicle type according, to the occupied road space of vehicles. Rates should be determined with a view to maintain the target service level of road condition in the area. For instance, projected traffic demand in the CPA will increase by 15 percent in the year 2000. Thus, the charge for a car should be around RM 150 per month in order to reduce traffic demand by 15 percent based on the analysis.

7) Payment & Enforcement

Vehicle drivers passing the streets in the restricted area must buy a sticker in advance at the stores that have a contract with the agency concerned. At the initial stage no gate is prepared for control purposes but violation of the rule shall be checked by control officers.

8) Monitoring and Modification of Area Pricing Scheme

It is of great importance for the relevant agency to monitor the change in traffic condition and to modify the restricted area, charge level, vehicles to be charged, and so on, according to the changes in traffic conditions.

9) Agency in Charge of Area Pricing Scheme

It is recommended that a new Klang Valley Transport Authority should deal with the implementation of an area pricing scheme. (Issues of the Klang Valley Transportation Authority will be discussed in details in Chapter 12) The agency will collect the area pricing charge from the vehicles passing through the restricted streets. The revenue may amount to around RM 1.3 million at the charge level of RM 150 per month in 2000. This revenue will be allocated for the operational costs of the Area Pricing scheme cars, and the remainder will be utilised for the improvement of urban transportation facilities.

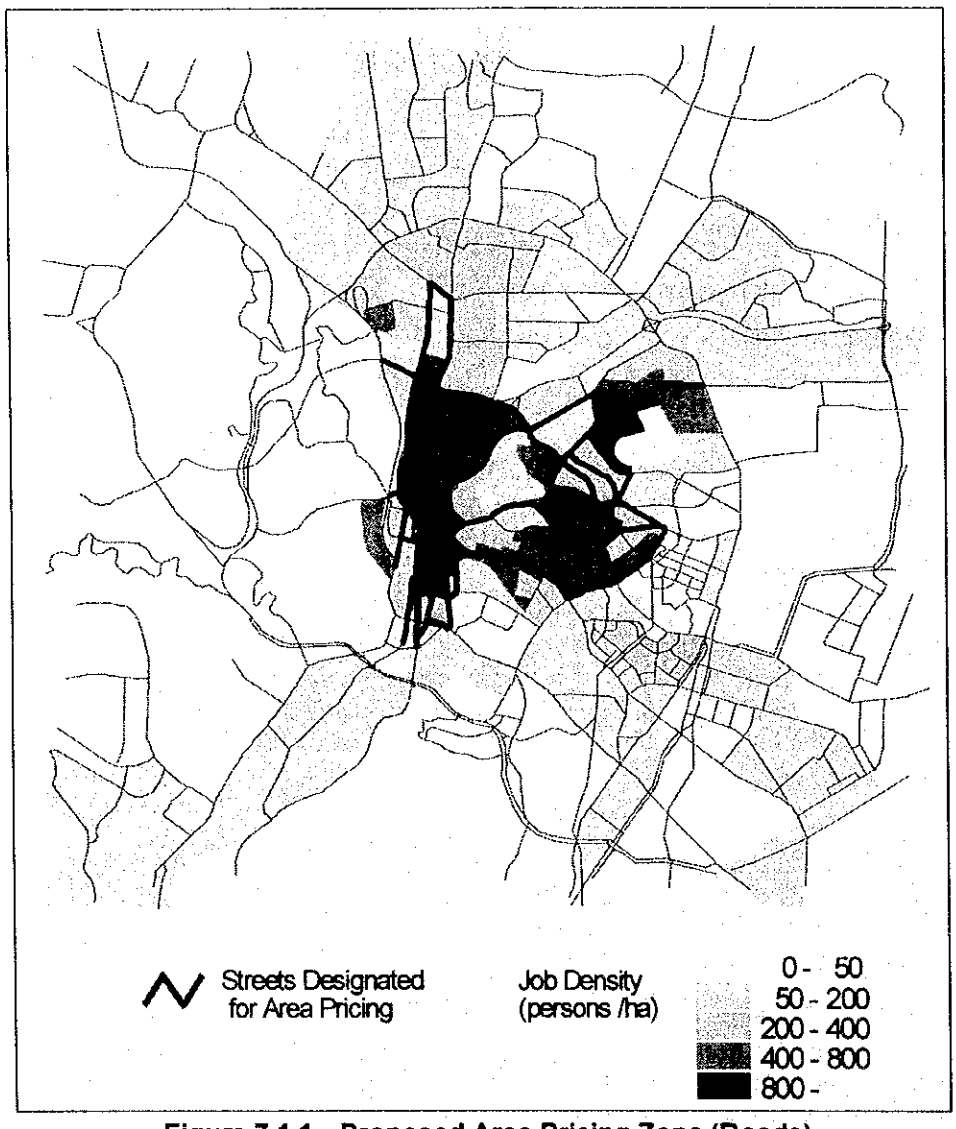



**Figure 7.1.1 Proposed Area Pricing Zone (Roads)**

## 7.2 Short-term CPA Packaged Action Plan

(1) Objectives

The CPA, the area inside the Middle Ring Road (I), is the area where economic and social activities are highly concentrated in the Kuala Lumpur metropolitan area, thus various transport problems are observed. The most urgent task is the alleviation of the current traffic congestion in the area. The following four targets were identified in order to examine an action plan in terms of traffic management:

- Improvement of bus services;
- Smooth traffic flow;
- Easing traffic congestion; and,
- Traffic accident reduction.

(2) Current major problems and countermeasures

Table 7.2.1 summarises the current traffic problems and countermeasures.

**Table 7.2.1 Current Problems and Countermeasures**

| Current Problems | Countermeasures |
|---|---|
| 1. Traffic congestion at signalised intersections | Improvement of traffic signal control system<br>1) Traffic response system in over-saturated condition<br>2) Co-ordination system of traffic signals<br>3) Improvement of signal phasing system |
| 2. Traffic congestion at no-signalised roundabout | Improvement of roundabout<br>1) Traffic signalised roundabout<br>2) Improved channelisation system |
| 3. Traffic spill-back associated with bottlenecks (lack of capacity) | Improvement of road traffic capacity<br>1) Reversible flow lane system |
| 4. Traffic congestion of buses | Improvement of level of services of buses<br>1) Bus priority lane system |
| 5. High rate of traffic accidents involving pedestrians and lack of pedestrian friendliness of crossing / sidewalk | Improvement of pedestrian facilities<br>1) Signalised pedestrian crossing<br>2) Pedestrian crossing bridge<br>3) Scramble pedestrian crossing<br>4) Pedestrian friendly sidewalk |

Source : SMURT-KL

(3) Improvement of Traffic Signal Control System

An area traffic signal control system has been installed in the City of Kuala Lumpur. However, the system has few traffic detectors to cope with over-saturated intersections. Thus it is necessary to upgrade the current system into a more elaborate system by expanding the control area and by increasing the number of detectors with extensive countermeasures for over-saturated situations.

Furthermore, it is important to make the control efficient by adopting a co-ordinated traffic signal control system on arterial roads, which is hardly seen in the city at present (refer to Figure 7.2.1).

With regard to the signal phase, a multi-phase system, which sets one phase for one-direction, is installed at major intersections at present. However, it is desirable to improve the phase to one phase for two-direction to deal with the traffic efficiently.

(4) Improvement of non-signalised roundabouts

Some non-signalised roundabouts are traffic bottlenecks because of heavy traffic volume. It would be effective to improve such roundabouts, the Puduraya roundabout for instance, into ordinary signalised intersections (refer to Figure 7.2.1).

(5) Introduction of extensive reversible flow lanes

To cope with both the growing road traffic and public transport reinforcement, the introduction of the reversible flow lane would be effective, as it enables the installation of bus priority lanes without reducing the road traffic capacity. The traffic volume in the peak hours is shown in Figure 7.2.2. Based on the analysis of peak-hour traffic, several candidate arterial roads were selected where the reversible flow lane ought to be introduced. Figure 7.2.3 exhibits the final plan for the installation of reversible flow lanes.

(6) Improvement of bus transport service

A bus priority lane is to be established in the extra lane, which was obtained by installing the reversible flow lane. A bus priority lane network is to be established covering the whole metropolitan area by extending the lanes to the area outside of the CPA (refer to Figures 7.2.4).

(7) Improvement of pedestrian facilities

The Kuala Lumpur metropolitan area is expected to be the political, cultural and commercial centre in the future as well. Creation of a comfortable and safe pedestrian environment is indispensable as one of the traffic environment improvements. Pedestrian facilities should be developed based on the following strategies:

- To reduce "jay-walking" of pedestrians
- To ensure a safe pedestrian environment; and
- To create "pedestrian-friendly" facilities all over the area.


**LEGEND**

- Existing Singnalised Intersection
- Traffic Response System in an Over-Saturated Condition
- Co-ordination System of Traffic Signal Light
- Signal Phase Improvement (highly effective intersections)
- Traffic Signalised Roundabout and Channelization

**Figure 7.2.1**
**Improvement of Traffic Signal Control System and Non-Signalised Roundabouts**

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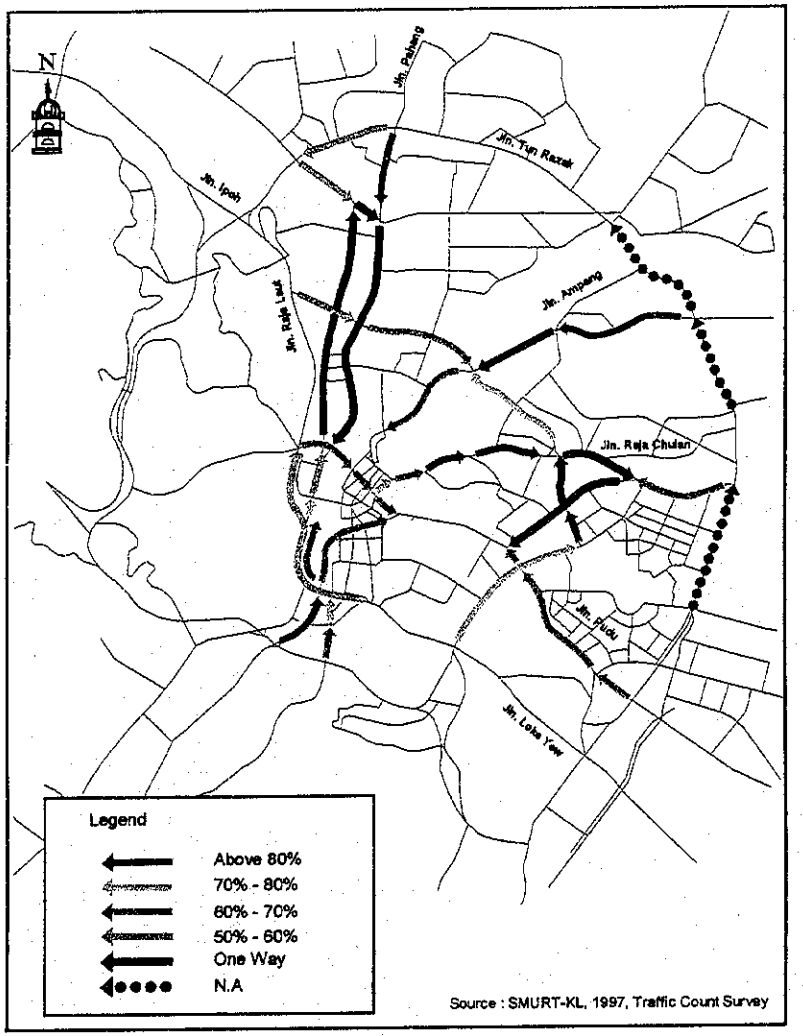
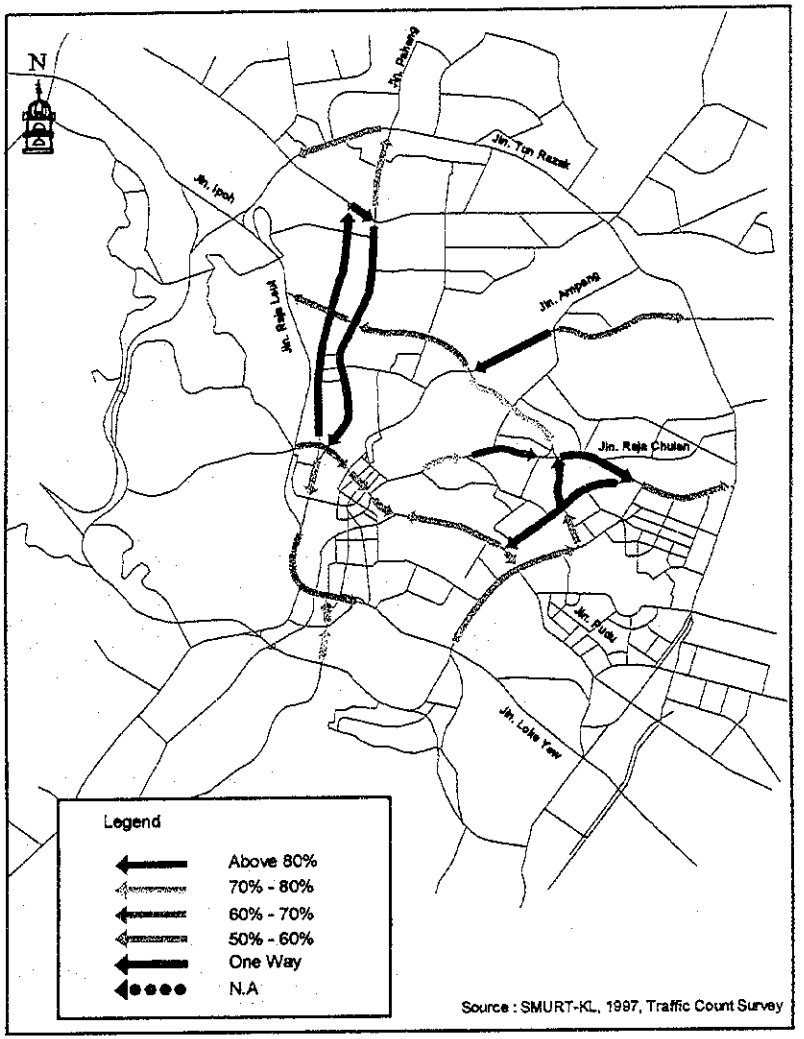
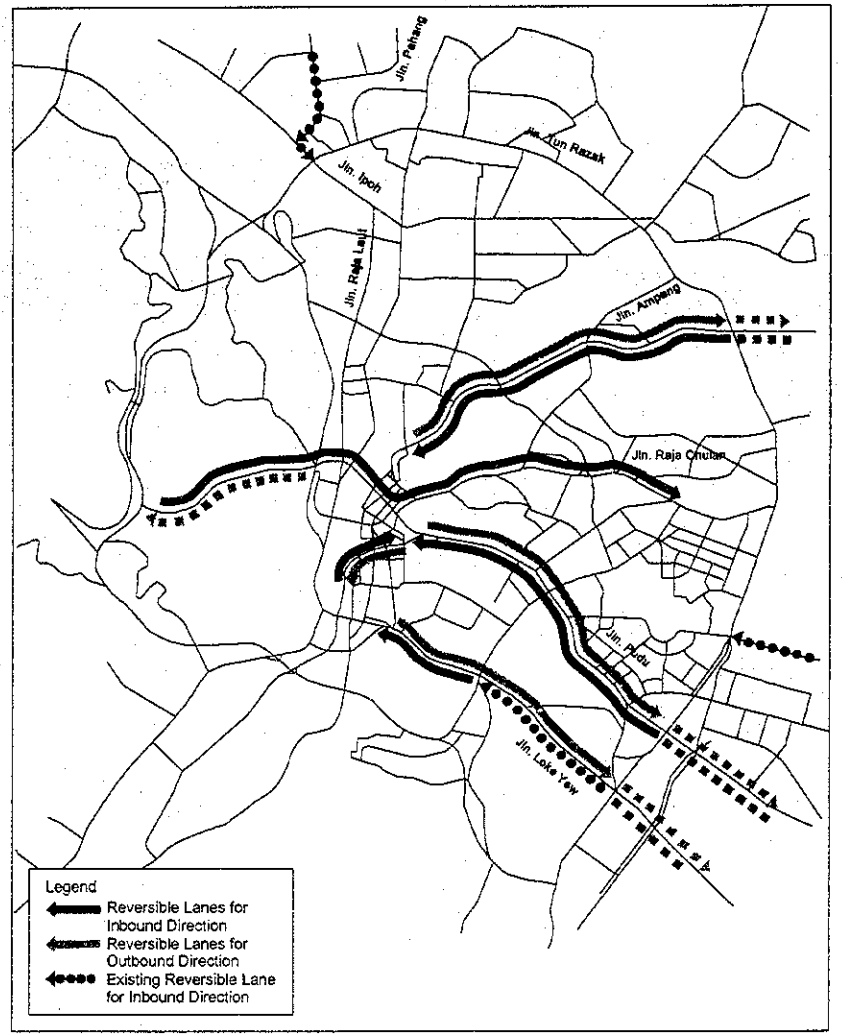



Ratio of Main Directional Traffic Volume on Congested Segments in Morning Peak Hour

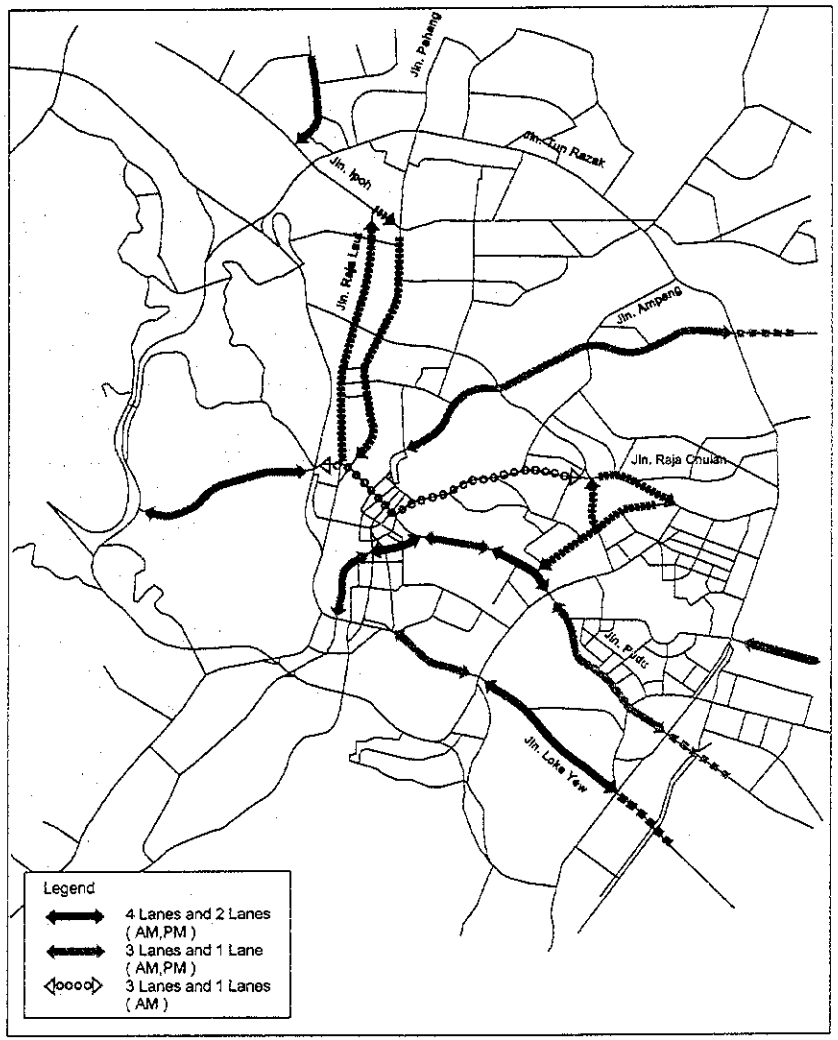



Ratio of Main Directional Traffic Volume on Congested Segments in Evening Peak Hour

**Figure 7.2.2 Ratio of Main Directional Traffic Volume on Congested Segments in Peak Hours**

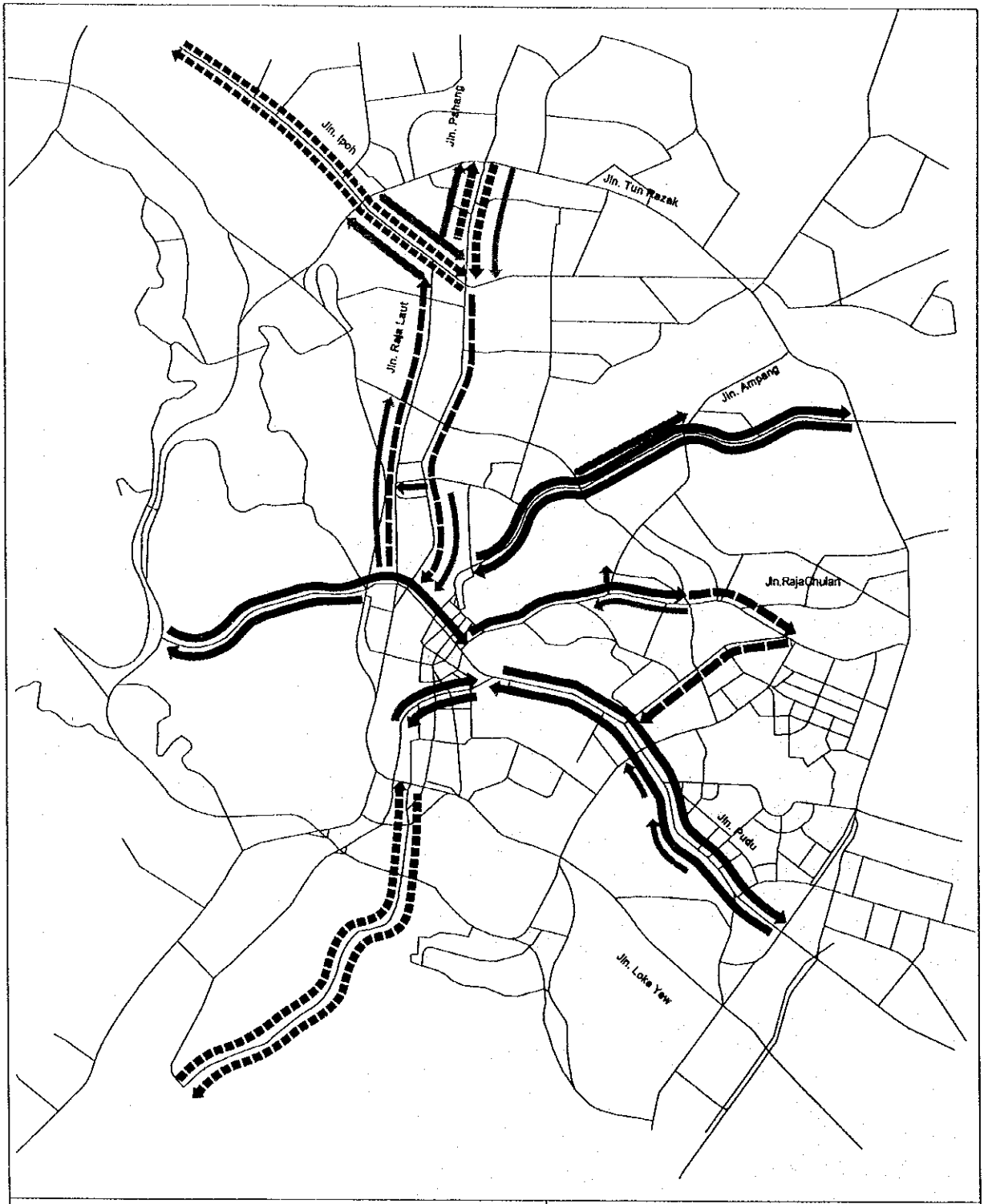



Effective Reversible Flow Lane Roads




Number of Lanes on Reversible Lanes Roads

**Figure 7.2.3 Subject Segments for The Reversible Flow Lane System and Number of Lanes**




Legend

- Existing Bus Priority Lane
- Bus Priority Lane on Reversible Lane System
- Bus Priority Lane on one-way
- Bus Exclusive Lane

**Figure 7.2.4**
**Plan Locations for**
**Bus Priority Lane System**

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1) Signalised pedestrian crossing

According to the SMURT-KL pedestrian survey, people can walk about one hundred meters without discomfort. Therefore, to secure the pedestrian's safety, signalised pedestrian crossings and intersections should be planned at intervals of less than 200 meters (refer to Figure 7.2.5).

2) Pedestrian crossing bridge

Pedestrian crossing bridges should be installed at proper segments on dual way roads which have more than six lanes, by considering factors such as number of pedestrians (refer to Figure 7.2.5).

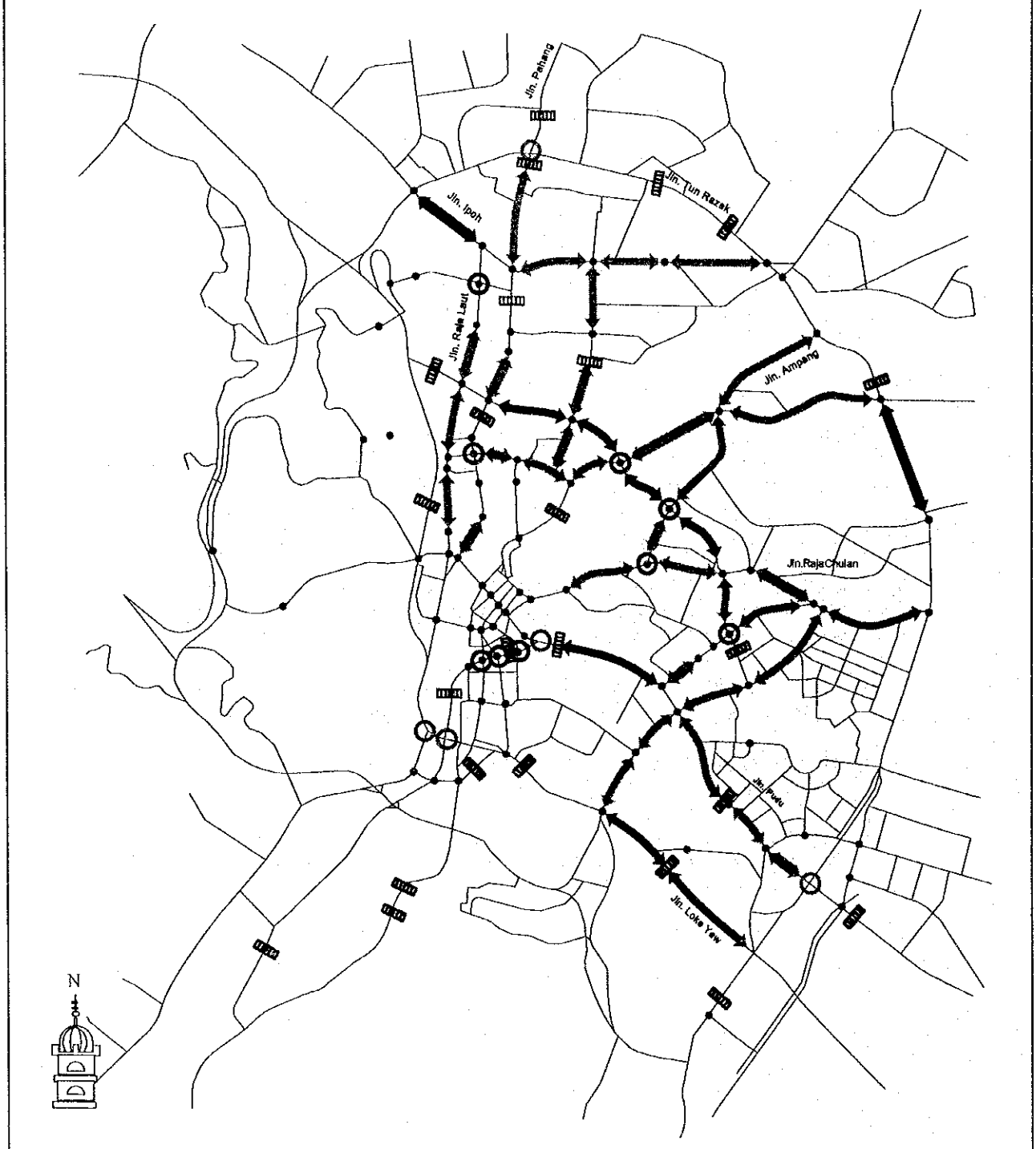
3) Introduction of scramble pedestrian crossing

To secure a safe and convenient traffic environment for pedestrians, scramble pedestrian crossings should be introduced at intersections, where many pedestrians cross the roads, for example, in front of the Sogo Department Store. (refer to Figure 7.2.5).

4) Sidewalk improvement

In order to reduce traffic accidents involving pedestrians, and in order to create a more pedestrian friendly environment, sidewalks on major roads should be improved. The following are the focal points ( see Figures 7.2.6 and 7.2.7).

- Sidewalk and other pedestrian facility improvement at commercial centres, such as Sogo Department Store, where many pedestrians concentrate;
- Segments where passengers of rail-based transport systems have to walk for transfer; and
- Road segments where many passengers walk for access/egress to stations and roads, which stretch parallel to the rail-based transport systems.




**LEGEND**

- Existing Signal Light
- Newly Signalised Intersections
- Existing Pedestrian Bridges
- Segments for Signalised Pedestrian Crossing
- Pedestrian Bridges
- Scramble Pedestrian Crossing

**Figure 7.2.5**
**Pedestrian Crossing Facility Development Plan**

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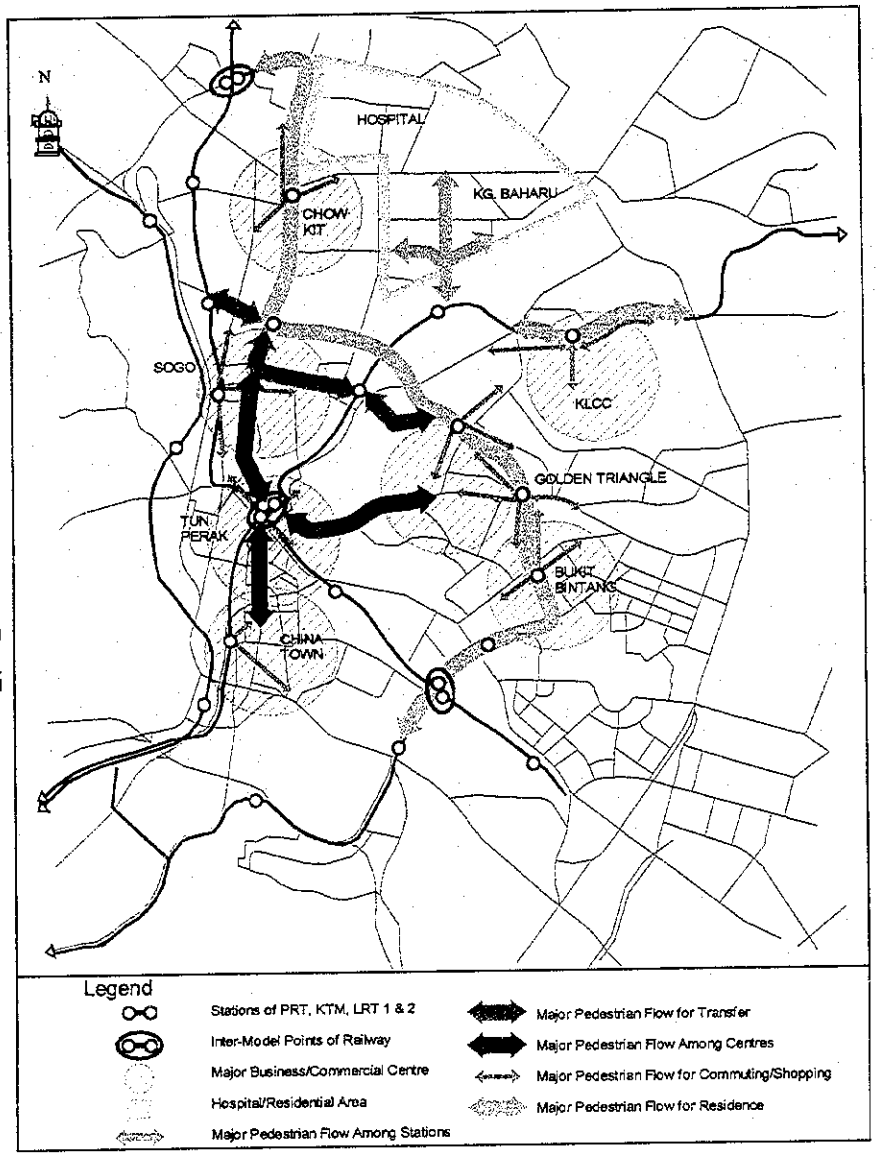


Figure 7.2.6 Concept of Major Pedestrian Flow

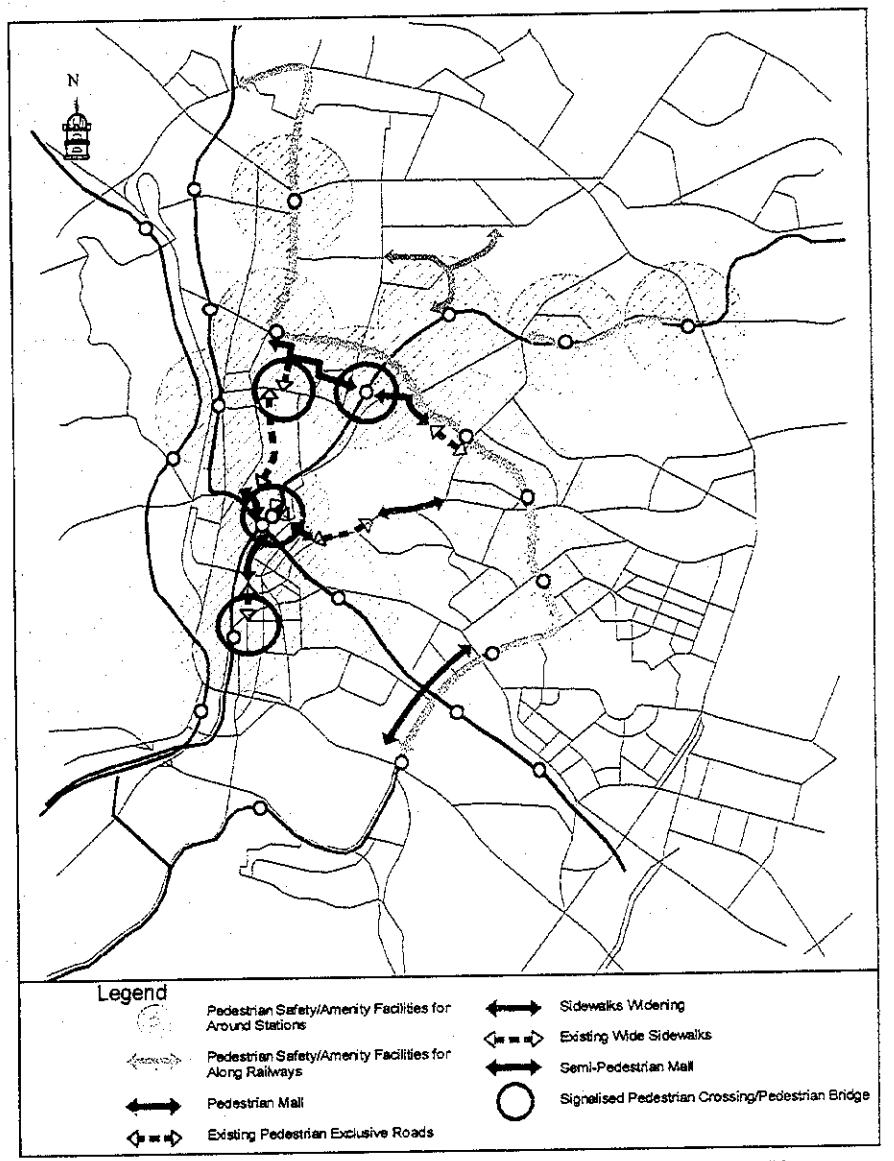


Figure 7.2.7 Sidewalk and Pedestrian Mall Improvement Plan

(8) Evaluation of the package plan

Table 7.2.2 shows the travel speed increase as a result of the package plan in 2000. The plan was evaluated by comparing the "with package plan" case with "without the plan" case, using the dynamic simulation model.

It is estimated that travel speed increases by around 4 to 5 km/h as a result of implementing the plan.

**Table 7.2.2 Travel Speed Increase by the Package Plan**

**(Morning Peak 7:30-8:30 a.m. in Year 2000)**

[Unit: km/h]

| Streets | Direction | Without Any Plans | | With Package Plans | |
|---|---|---|---|---|---|
| | | Cars | Buses | Cars | Buses |
| Parlimen | inbound | 13 | | 18 | 30 |
| | outbound | 19 | | 31 | |
| Tun Perak | inbound | 10 | | 18 | 29 |
| | outbound | 14 | | 16 | |
| Raja Chulan | inbound | 16 | | 25 | 28 |
| | outbound | 22 | | 33 | |
| Ampang | inbound | 12 | | 27 | 32 |
| | outbound | 18 | | 18 | |
| Pudu | inbound | 5 | 6 | 7 | 18 |
| | outbound | 20 | | 12 | |
| Cheng Lock | inbound | 12 | 19 | 11 | 26 |
| | outbound | 26 | | 21 | |
| Loke Yew & Maharajalela | inbound | 18 | | 18 | 35 |
| | outbound | 43 | | 23 | |
| Pahang & Raja Laut & T. Abdul Rahman | inbound | 10 | 20 | 9 | 24 |
| | outbound | 15 | 28 | 9 | 27 |
| Sultan Ismail | eastbound | 10 | | 16 | |
| | westbound | 10 | | 10 | |
| Hang Tuah & Imbi | northbound | 17 | | 16 | |
| | southbound | 16 | | 23 | |

Source: SMURT-KL Estimate