4.7 Foreseeable Future Transport Problems

(a) With the present population expected to increase by 1.6 times in 1995 and more than double in 2005, employment and vehicle ownerships are also expected to increase rapidly in the coming two decades. Consequently the daily number of person trips in Klang Valley is expected to grow from 6.4 million in 1985 to 10.2 million trips by 1995 and 14.6 million trips by 2005 at an average annual growth rate of 4.7% from 1985 to 1995 and 3.7% from 1995 to 2005.

However the supply of road space to meet this ever increase in demand is limited in the highly built-up urban area due to Government financial constraint. Traffic congestion will worsen inevitably.

(b) In 1985 the mode share by people using motorized vehicle is 66% for private mode and 34% for public mode. Based on the increasing household income, vehicle ownership is expected to increase. Without any deterrent towards private vehicle usage, the private mode share is expected to form 70% of mode choice while the public transportation's share will be reduced to 30% in 2005. It is thus clear that the lack of any policy to encourage the use of public transportation will cause its mode share to decrease while private vehicles will continue to create massive congestion in the road network system.

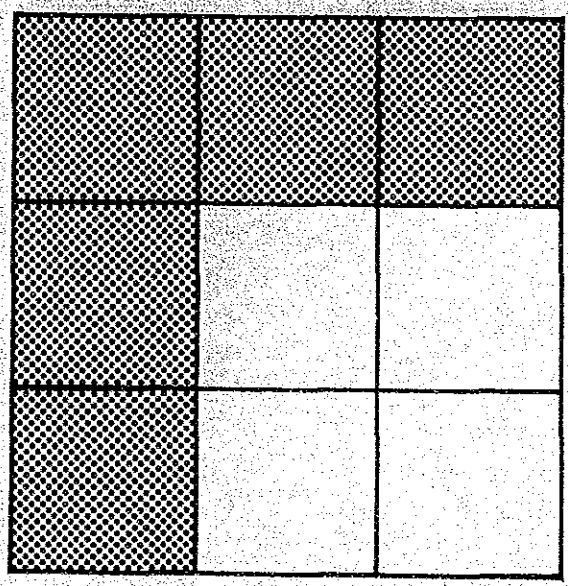
(c) On the other hand, the total number of public transportation trip is expected to increase from 1.6 million trips in 1985 to 3.5 million trips by 2005. It is doubtful that under the "do-nothing" situation for the public transportation systems, the expected public transportation demand can be handled satisfactorily. Lack of bus route coverage in the newly developed residential areas will cause commuters to walk longer distances to reach the bus stop.

(d) Under the "do-nothing" situation, the average trip length per person trip in Klang Valley is expected to increase from 12.2 km in 1985 to 13.6 km in 1995 and 15.2 km in 2005. It is anticipated that further urbanization of the region in the coming two decades will cause travel distance to increase thereby increasing road traffic demand measured in vehicle kilometer. Thus increasing trip length in the future will cause greater congestion in the existing road network system.

(e) In the Klang Valley the amount of road traffic measured by vehicle kilometer is expected to grow from 24.9 million passenger car unit.km (PCU·km) in 1985 to 48.9 million PCU·km by 1995 and 87.0 million PCU·km in 2005. Under the "do-nothing" case this rapid increase in road traffic demand will cause the congestion degree of 0.98 in 1985 to reach 1.83 in 1995 and 3.26 in 2005. As such it is forseeable that the existing road network in Klang Valley will be very much over burdened by the travel needs of its residents by 1995 and 2005. An average congestion degree of 3.26 indicates that most of the roads will not be able to discharge traffic throughout most part of the day.

(f) Under the "do-nothing" case, the Federal Territory of Kuala Lumpur is expected to see its present traffic demand of 11.7 million PCU·km in 1985 increase to 19.6 million PCU·km by 1995 and 30.6 million PCU·km by 2005. The congestion degree will increase from the present 1.1 to 1.83 in 1995 and 2.86 in 2005 (see Figure 4.19). It is obvious then that under the "do-nothing" case, the existing road network in Kuala Lumpur will not be able to cater for the traffic demand by 2005. Road traffic will be paralysed during peak hours. The Kepong area, Cheras area and Damansara area will be the regions most severely affected by traffic congestion.

(g) In the rest of Klang Valley, the present traffic volume of 13.2 million PCU·km is to increase to 29.3 million PCU·km by 1995 and 56.4 million PCU·km by 2005. The present congestion degree of 0.9 will worsen to 3.52 by then (see Figure 4.18). In Petaling Jaya, the traffic demand will reach 8.36 million PCU·km by 2005 compared to 3.35 million PCU·km at present and the congestion degree worsen from 0.8 to 1.19 by 1995 and 2.0 by 2005. In Klang the traffic demand by 2005 will be 3.8 times that of 1985 reaching a total of 9.12 million PCU·km in 2005. Traffic flow along the Federal Highway II will be paralysed by the tremendous demand. Other areas such as Gombak West (Selayang), Klang Central (Klang Old Town and South Port Area) and Petaling Jaya will also be severely affected under the "do-nothing" case.



CHAPTER 5 : TRANSPORTATION ALTERNATIVES

5. TRANSPORTATION ALTERNATIVES

5.1 General

In preparing the long term transportation plan, various possible transport solutions to the existing and future transport problems identified previously and the transport goals and objectives have to be explored and hence tested for their performance.

The methodology used to establish the long term transportation alternative is illustrated in the simplified flowchart shown in Figure 5.1.

The process of identifying various alternative transport solutions and plans involve: –

(a) Identification of goals and objectives for transportation development

(b) Review of previous proposals made in various studies

(c) Long term transportation alternatives
   1. Overall transportation plan
   2. Alternative road development plans
   3. Alternative public transport development plans

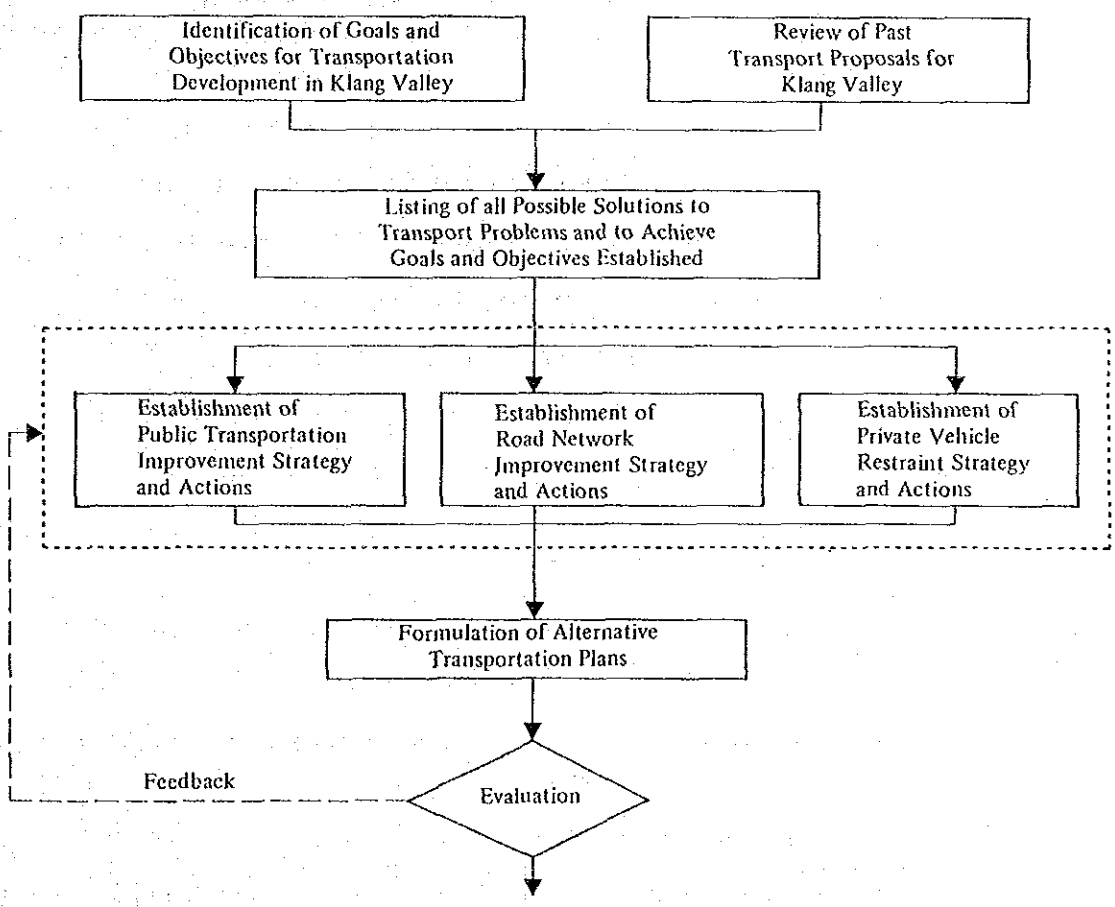


Figure 5.1 : Procedure For Establishment of Transportation Alternatives

5.2 Goals and Objectives for Transportation Development in the Klang Valley Region

The goals and objectives for transportation development in Klang Valley are formulated within the broad framework of the National Development Policy, in particular the New Economic Policy (NEP) and the regional development objectives spelled out in the Klang Valley Perspective Plan.

TG-1 To meet and to promote economic and regional development of the Klang Valley Region

- Provision of an effective transportation system compatible with the national and regional economic development plan
- Improvement of access to the six (6) growth centres namely Kuala Lumpur, Shah Alam, Petaling Jaya, Klang, Bangi and Selayang with Bukit Tinggi Twin City and the existing urban and rural development areas
- Provision of access to the newly developed areas
- Provision of an economical and efficient transportation system

TG-2 To provide maximum mobility for people and goods

- Reduction of traffic congestion by increase in traffic capacity, dispersing traffic away from the congested roads and promotion of modal-shift.
- Provision of good quality and affordable public transport systems
- Introduction of alternative routes or more efficient modes

TG-3 To provide a safer, pleasant and more efficient transportation system

- Reduction of the occurrence of traffic accidents
- Minimization of severity of traffic accidents
- Provision of safer facilities for pedestrians and motor cyslists

TG-4 To minimize resource consumption of the transportation system

- Conservation of energy by promoting the use of public mass transport
- Effective utilization of land space especially in the urbanized area

TG-5 To enhance environmental and community quality

- Minimization of negative environmental impacts including noise, vibration, emission, etc.
- Minimization of community disruption and displacement
- Provision of an adequate transportation system compatible with landuse plan

5.3 Review of Previous Transportation Alternative Proposals and Performance

In the Second and Third Kuala Lumpur Transportation Study conducted in 1974 and 1981, various transport alternative measures to solve the transport problems identified by these studies were proposed. Table 5.1 shows the type of transport policy/measures proposed in these two studies.

Table 5.1 : Transport Policy/Measures Proposed In The Second and Third K.L. Transportation Studies

Transport Policy/Measures	2nd K.L. Transportation Study '74	3rd K.L. Transportation Study '81
A. Road Construction/Improvement		
1. New Road Constructions	X	X
2. Construction of Interchanges	X	X
3. Improvement of Existing Roads	X	X
B. Private Vehicle Restraint Measures		
1. Parking Control	X	X
2. Parking Charge Structure	X	
C. Traffic Engineering and Management Measures		
1. Central Area Circulation Plan	X	
2. Traffic Signals	X	
3. Traffic Dispersal Scheme	X	
4. HOV Streets (High Occupancy Vehicle)		X
5. Area Licencing Scheme		X
D. Public Transport Improvement Measures		
1. Exclusive Busways	X	
2. Bus Only Streets	X	
3. Bus Priority Lanes	X	
4. Light Rail Transit (LRT)		X
E. Institution Reform		
1. Setting up a Public Transport Unit	X	X

Transport Development for Kuala Lumpur since the two Masterplan Studies has been mainly concentrated at new road construction and road improvement projects (Table 5.2).

The construction of the Middle Ring Road with the proposed interchanges as well as those for the Inner Ring Road are important achievements in traffic dispersal for Kuala Lumpur. However both ring roads now carry very high traffic volume. In contrast, radial road improvement is delayed (eg. Jalan Pahang, Jalan Ampang).

Although 11 major interchanges have been completed, many others are still waiting to be constructed. The more conspicious bottlenecks caused by this are the roundabouts at the Inner Ring Road (Edinburgh Circle) and Middle Ring Road (Jalan Pahang Circle).

Parking control in discouraging the use of private vehicles in the central area was never carried out. So are the major bus improvement measures such as the construction of exclusive bus-ways, designation of bus-only streets and HOV streets. Though bus priority lane was tried on one arterial road, the scheme was never expanded nor any follow-up study conducted to assess its performance.

The area licencing scheme was shelved due to great opposition from the public. Traffic signals, markings have greatly improved but traffic control system is becoming ineffective as it was not expanded since its installation.

The proposed public transport planning and administrative unit was set up in 1975 which introduced the mini bus system to Kuala Lumpur. However it lacked the autonomy needed to plan and implement and without which it was resolved in 1978.

Table 5.2 : Stage Of Implementation For The Previous Proposed Transport Measures

	Measures/Proposal	Stage of Implementation
A. Road Construction/ Improvement	1. Construction of the missing links to complete the Middle Ring Road	• Implemented under the TDS scheme except for the missing link between Jalan Sg. Besi and Istana
	2. New Klang Valley Expressway	• To be implemented under 5th Malaysia Plan
	3. Outer Ring Road	• Under Study
	4. The Northern Route	• Under Study
	5. Improvement on Existing Roads	• Largely Implemented
	6. Construction of 30 interchanges	• 11 Completed with 1 under construction
B. Private Vehicle Restraint	1. Parking Control in Central Area	• Not Implemented
	2. Parking Charge Structure Change	• Implemented on some public parking lot
C. Traffic Engineering & Management	1. Central Area Circulation	• Partly Implemented
	2. Traffic Signals/Markings	• Partly Implemented
	3. Traffic Dispersal Scheme	• Implemented
	4. HOV Streets	• Not Implemented
	5. Area Licencing Scheme	• Not Implemented
D. Public Transport Improvement Measures	1. Busways	• Not Implemented
	2. Bus Only Streets	• Not Implemented
	3. Bus Priority Lanes	• Experimental Stage on 1 road only
	4. Light Rail Transit (LRT)	• Under Review
	5. Aerobus	• Under Review
E. Institution Reform	1. Setting up of a Public Transport Planning and Administrative Unit	• Set up in 1975 but resolved in 1978

5.4 Alternative Transport Solutions

The alternative transport solutions will be discussed in this section with the objectives of the development of the transport system in mind. As described in Section 4.6 of Chapter 4, the two major foreseeable transport problems in Klang Valley under the "do-nothing" situation in 2005 are massive traffic congestion due to the limitation of the existing road network to meet the future demands and the deterioration of the public transportation system. There are a wide range of transport solution to these problems and these are comprehensively listed up as a form of solution-pool. Furthermore these solutions to the future transport problems can be approached by two basic directions, viz supply augmentation and demand modification.

The supply augmentation approach advocates the construction and improvement of transport facilities to meet growing traffic demands. The strategy in this approach is to increase the supply of transport facilities by construction of more highways or to introduce innovative transit systems which can move greater volume of traffic at faster speed. Alternative measures which can be taken to solve the future transport problems under the supply augmentation approach are listed as follow: –

1. Construction and improvement of highway and roads
2. Introduction of innovative transit system
3. Improvement of bus transport system
4. Improvement of mode transfer facilities
5. Construction of parking facilities
6. Improvement of facilities for non-motorized mode
7. Improvement of facilities related to freight transport
8. Improvement of traffic management

On the other hand, the demand modification approach advocates to change the travel pattern of the people to achieve a spreading out of peak hours traffic demands over the day or to achieve a more balanced utilization of private vehicles and public transportation. The following alternative measures can be implemented to encourage changes to the travel pattern.

1. Total travel demand modification/control
2. Modal choice modification
3. Private car use control
4. Effective usage of vehicle

Details of these measures are listed up in Table 5.3.

Table 5.3 : Comprehensive Supply Augmentation and Demand Modification Strategies And Actions

A. Supply Augmentation Measures

1. Construction and Improvement of Highways and Roads
   - Construction and improvement of highways/roads
   - Construction and improvement of intersection/interchange
   - Construction and improvement of motor cycle lane

2. Introduction of Innovative Transit Systems
   - Construction of Light Rail Transit (LRT) System
   - Construction of Mass Rapid Transit (MRT) System
   - Construction of Guide Rail Transit (GRT) System

3. Improvement of Bus Transport Systems
   - Area bus service
   - Bus Routing/Bus Fare Structuring
   - Bus service frequency/scheduling improvement
   - Bus fleet improvement
   - New concept of bus system
   - Bus Lanes/Busways

4. Improvement of Mode Transfer Facilities
   - Bus stops
   - Bus terminals
   - Park-and-ride facilities
   - Freight Terminals

5. Construction of Parking Facilities
   - Off-street parking terminals
   - On-street parking control
   - CBD Fringe parking

6. Improvement of facilities for Non-motorized Mode
   - Pedestrian malls
   - Bicycle paths
   - Sidewalk widenings
   - Pedestrian grade-separation provisions
   - Pedestrian Deck/Network

7. Improvement of facilities for Freight Transport
   - Construction of Freight terminals
   - Increase in truck lot sizes
   - Off-street loading facilities
   - Exclusive Truck Lanes

8. Improvement of Traffic Management
   - Signal timing optimization
   - Area Traffic Control (ATC) System
   - Traffic surveillance system

B. Demand Modification Measures

1. Travel Demand Modification
   - Landuse changes/density control
   - Staggered commuting hours
   - Population/Employment distribution/dispersion
   - Substitution of communication methods by tele-communication or circuit T.V. System

2. Mode Choice Modification

- Pricing policy on private modes
- Introduction of innovative transit system
- Improvement of bus transport system

3. Private Car Use Control

- Control of car ownership
- Pricing policy
- Parking control
- Entry control
- Curb control

4. Effective Usage of Vehicle

- Share-riding
- Car pool/van pool
- High Occupancy Vehicle (HOV) Lane
- Taxi Deregulation
- Bus incentives
- Goods distribution system

From the above solution check list, the most applicable and realistic solutions are short-listed. Three major supply augmentation strategies and one demand modification strategy were selected for further detail analysis on the financial, functional and economic feasibility and impact on the overall transportation system in Klang Valley.

The three supply augmentation strategies are: –

(a) Construction and improvement of highways and roads

(b) Introduction of innovative transit system

(c) Upgrading the conventional bus transport system

The demand modification strategy selected for detail analysis is: –

(a) Private Vehicle Usage Restraint in Kuala Lumpur

Because some of these strategies can either be implemented alone or in combination, these strategies are grouped into packages before formulating the actual alternative transport plans for further analysis (Table 5.4).

Package I

- 'Do Nothing' Case or Base Plan

Package II

- Construction and Improvement of Highway and Roads
- Improvement of Bus Transport

Package III

- Construction and Improvement of Highway and Roads
- Introduction of Innovative Transit System
- Improvement of Bus Transport

Package IV

- Construction and improvement of Highway and Roads
- Improvement of Bus Transport
- Private Vehicle Usage Restraint

Package V

- Construction and Improvement of Highway and Roads
- Introduction of Innovative Transit System
- Improvement of Bus Transport
- Private Vehicle Usage Restraint

Before the alternative transport plans are established, each of the strategies selected has to be examined further in exploring the actual strategy or actions to be implemented. The introduction of innovative transit system strategy for example may incorporate different transit systems (LRT or MRT or GRT) or different network configurations.

Table 5.4 : Packaging Of Selected Strategies

Alternative Packages	'Do Nothing'	Construction and Improvement of Highway and Roads	Introduction of Innovative Transit System	Improvement of Bus Transport	Private Vehicle Restraint
I	O	–	–	–	–
II	–	O	–	O	–
III	–	O	O	O	–
IV	–	O	–	O	O
V	–	O	O	O	O

5.5 Road Network Improvement Strategy

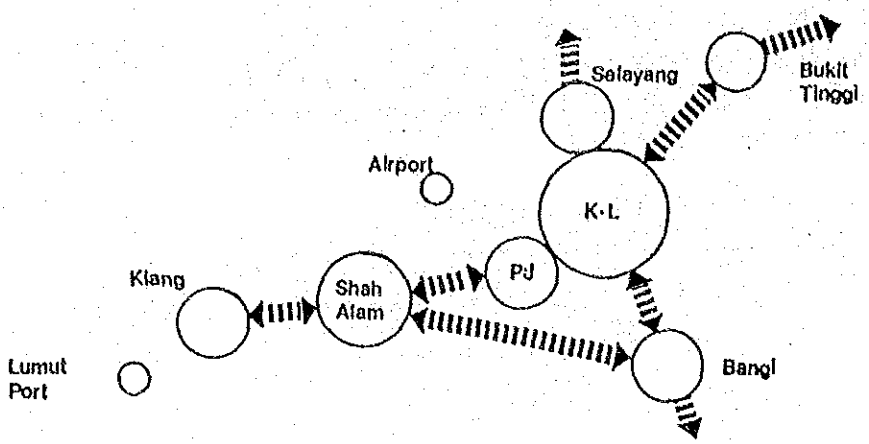
5.5.1 Road Network Planning Concept

The proposed future road network is one that is capable of providing different level of travel by vehicles. Inter-city travel between the six growth centres and Bukit Tinggi will be provided by expressways and primary distributors. Within each urban centre, there will be individual network of primary distributors and district distributors for the dispersal of localised urban traffic. Roads aim at dispersal of traffic at special focal points namely Subang Airport and National Lumut Port are also planned.

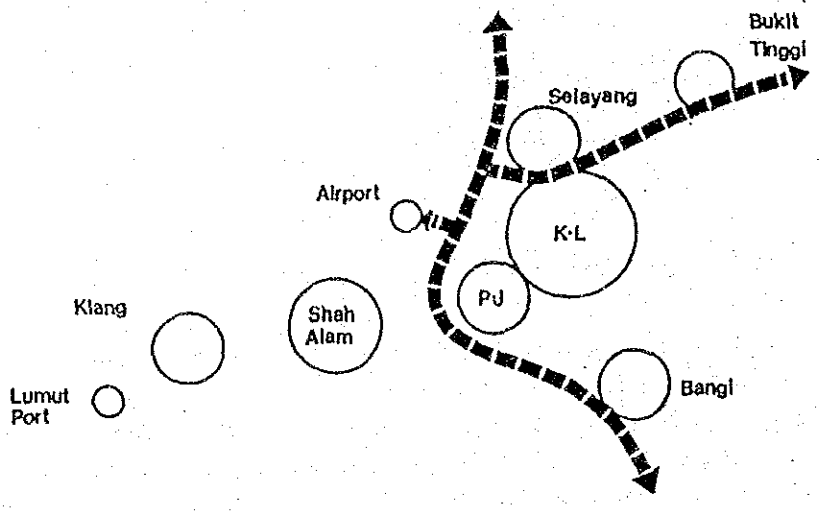
Alternative routes are always provided in parallel to any expressways. This is to ensure that transport communication between centres will not be cut-off in cases where traffic on the expressways are paralysed because of unavoidable circumstances. Moreover, if the expressways are tolled, alternatives are available for road users.

The expressways especially along the North-South direction in the Klang Valley are planned with the aim of directing the North-South through traffic away from localised urban traffic (Figure 5.2).

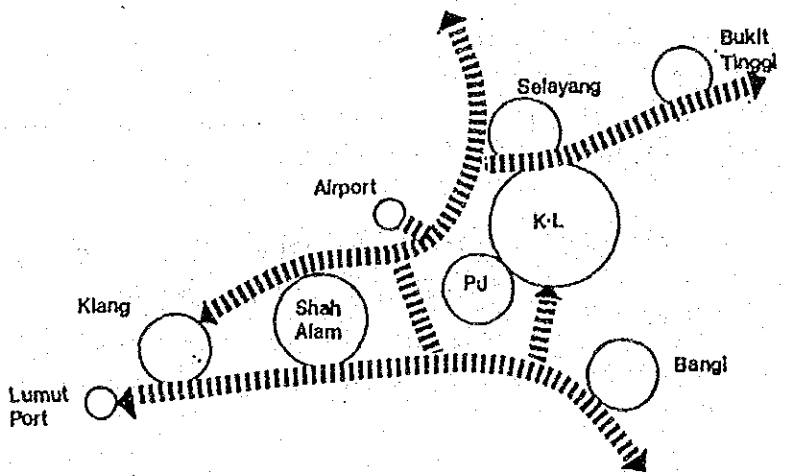
The various types of road planned in the network are to have clear hierarchy and functions.



(a) Inter-city Traffic Between the Growth Centres



(b) North-South Regional Through Traffic



(c) Freight Traffic Movement

Figure 5.2 : Conceptual Network And Traffic Flow

(1) Expressway
Expressway is a divided highway for through traffic with full or partial control of access. The design is for long trip, continuous route traffic and a high design speed is required. Generally, they are grade separated at major intersections.

(2) Primary Distributors
These roads are designed to provide a high level of service and a large traffic capacity since they are used to distribute long trip, inter-city and intra-city traffic. All long distance traffic to, from and within the town should be channelled to these distributors.

(3) District Distributors
These roads distribute traffic within the main residential, industrial and business districts of the town while forming the link between the primary network and the roads within the surrounding areas. It performs a vital function of accomodating maximum traffic movement during peak periods and serves the general circulating and land service functions of the community during off-peak periods.

(4) Local Distributors
Although these roadways are sometimes used for traffic movements through the city, they are generally utilized for local circulating purposes within the surrounding areas and form a necessary link between district distributors and access roads.

(5) Access Roads
The major function of these roads is to give direct access to residents, business or land in the surrounding areas. These should be concentrated close together and through traffic kept to a minimum.

(6) Bicycle and Pedestrian Path
These roads are used exclusively by pedestrians, cyclists and riders of non-motorized vehicles. Cycling paths, pedestrian malls and shopping malls are included in this category.

The road network plan proposal in this Regional Masterplan Study however will not include those in categories 4, 5 and 6. These local raods will have to be taken up when preparing local transport/local development plan by local authorities.

In the Klang Valley Area, lorry transport is quite predominant as a freight transportation means. Therefore, in this study, multi-modal freight transportation system is not considered. Improvement of freight transport is therefore a parcel of the improvement to the highway and road network strategy.

5.5.2 Committed Projects

There exists many road projects within the Klang Valley Region which are either at the feasibility study or detailed engineering design stage. However, a project can be said to have been committed by the Government at various planning stages from the conceptual design to the final implementation of project. In this study, a committed project is defined as one which has reached any one of the following stages, viz completion of detailed engineering design or completion of tender decuments or inclusion into the Fifth Malaysia Plan. The major committed road projects are as follows: –

(1) The New Klang Valley Expressway

(2) Toll Expressway between Kuala Lumpur and Tanjung Malim

(3) Widening of Federal Route II from Sungei Way to Klang

(4) Improvement to Karak Highway

The road network that comprises of the existing roads and the committed road projects form the road network for the 'Do-Nothing' case (Figure 5.3).

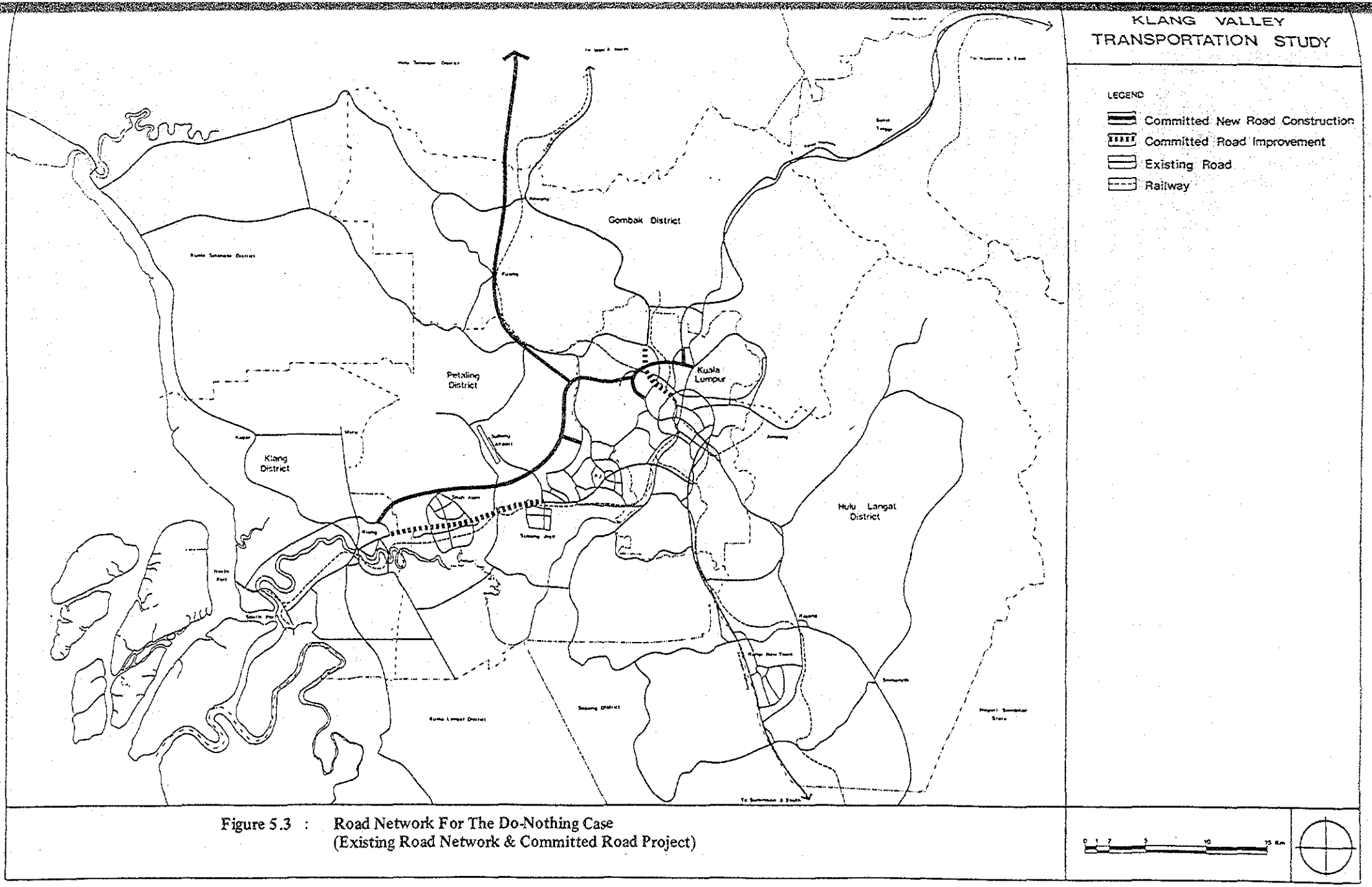


Figure 5.3 : Road Network For The Do-Nothing Case
(Existing Road Network & Committed Road Project)

5.5.3 The Proposed Alternative Road Network in Klang Valley

The inter-city expressway netwrok consists of three expressways along the Klang-Shah Alam-Petaling Jaya-Kuala Lumpur corridor, one between Bangi-Shah Alam, one for Kuala Lumpur-Rawang North, one for Kuala Lumpur-Selayang-Bukit Tinggi-East, and one Kuala Lumpur-Bangi-South corridor. With these, travel between all the six growth centres and Bukit Tinggi will be facilitated.

The road network within Kuala Lumpur is a combination of radial and ring road. There will be four circumferential roads and ten major radial roads.

The road network configuration in Klang has a radial and ring road pattern. The ring road will be completed with the completion of the southern portion of the Klang Straits Bypass. Road networks in the other centres are made up of ladder or grid patterns.

Two alternative road networks are proposed for analysis. Alternative 1 (Figure 5.4) proposes an extensive road programme for Bangi-Semenyih area while Alternative 2 (Figure 5.6) has lesser road proposal for Bangi area.

Within Kuala Lumpur Conurbation, Alternative 2 proposes to have a major distributor along Segambut-Damansara sector joining Jalan Kepong to the Federal Highway, extending Jalan Keramat to join with Jalan Gombak (Figure 5.7).

Table 5.5 shows the total road length by classification for the two alternative networks.

Table 5.5 : **Alternative Road Plan**

Type of Road	Road Length (km)		
	Do-Nothing Situation	Alternative 1	Alternative 2
Expressway	153 km	205 km	207 km
Primary Distributor	240 km	386 km	409 km
District Distributor	395 km	589 km	597 km
Local Distributor	31 km	22 km	22 km
Total	819 km	1,202 km	1,235 km
Total Project Cost (M$ Million)	1,247	4,080	4,330

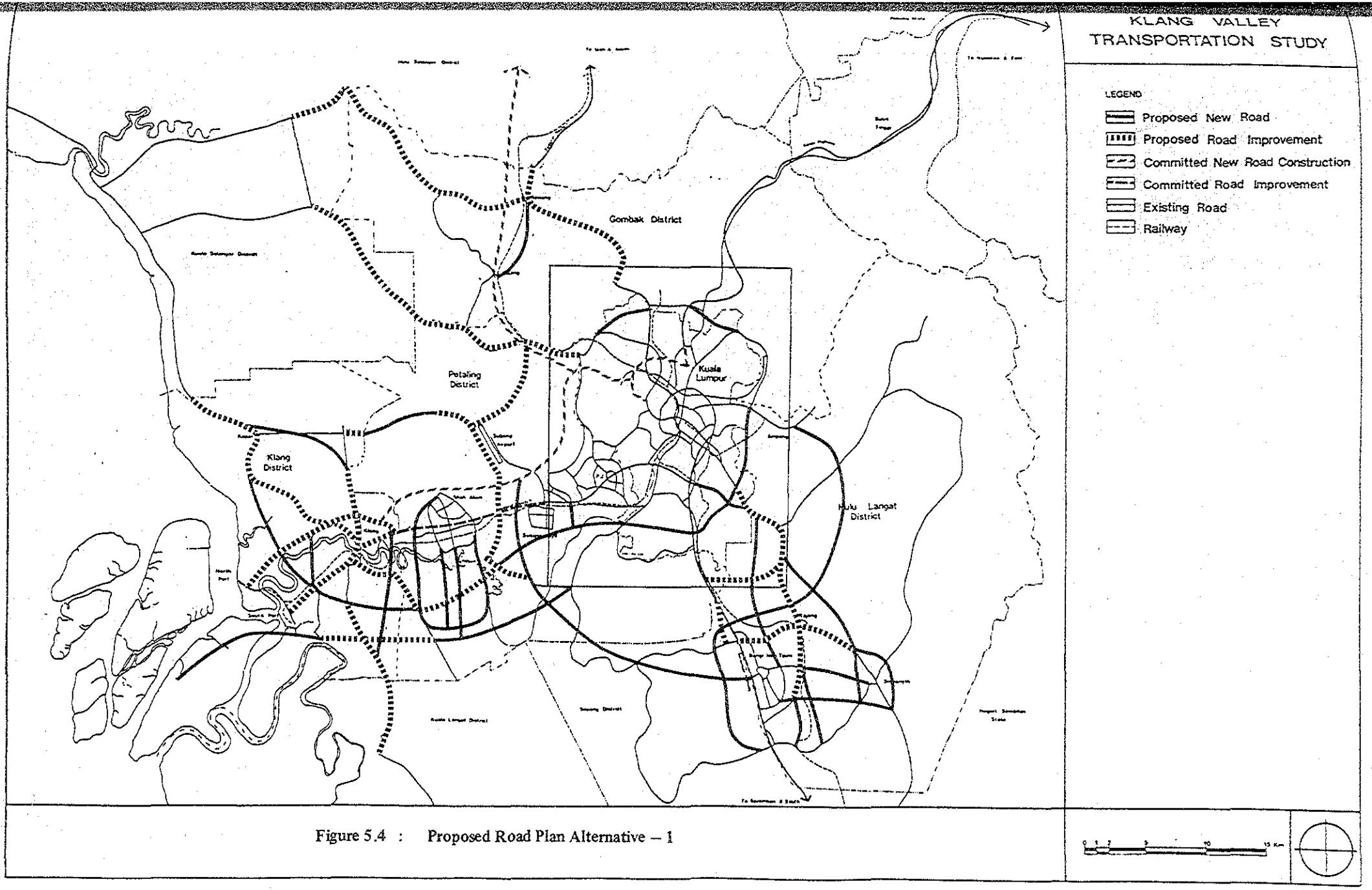
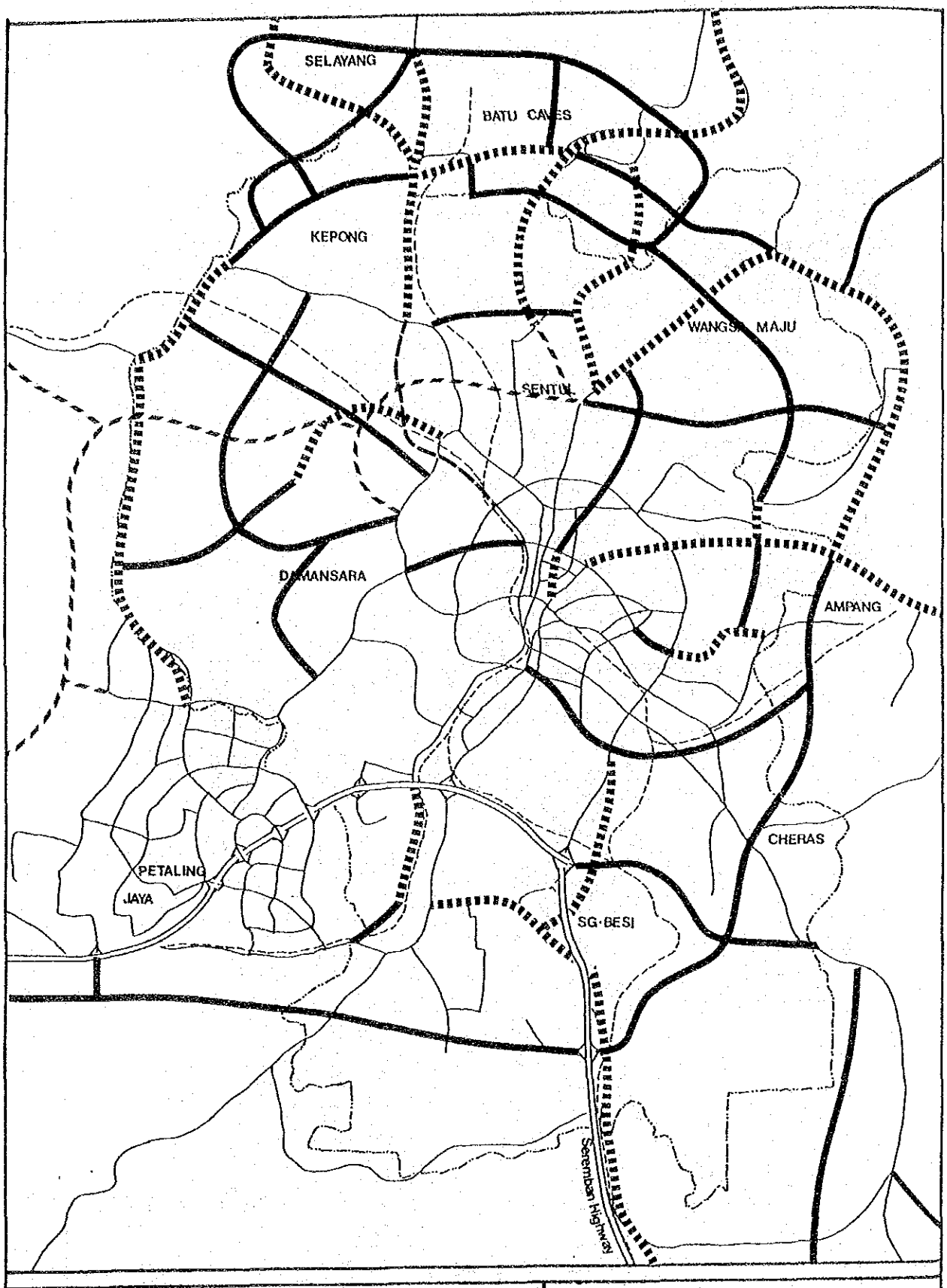


Figure 5.4 : Proposed Road Plan Alternative – 1



LEGEND

- Proposed New Road
- Proposed Road Improvement
- Committed New Road Construction
- Committed Road Improvement
- Existing Road
- Railway

Figure 5.5 :
PROPOSED ROAD PLAN
ALTERNATIVE-1
(KL CONURBATION AREA)

SCALE
0 1 2 3 4 5Km

KLANG VALLEY
TRANSPORTATION STUDY

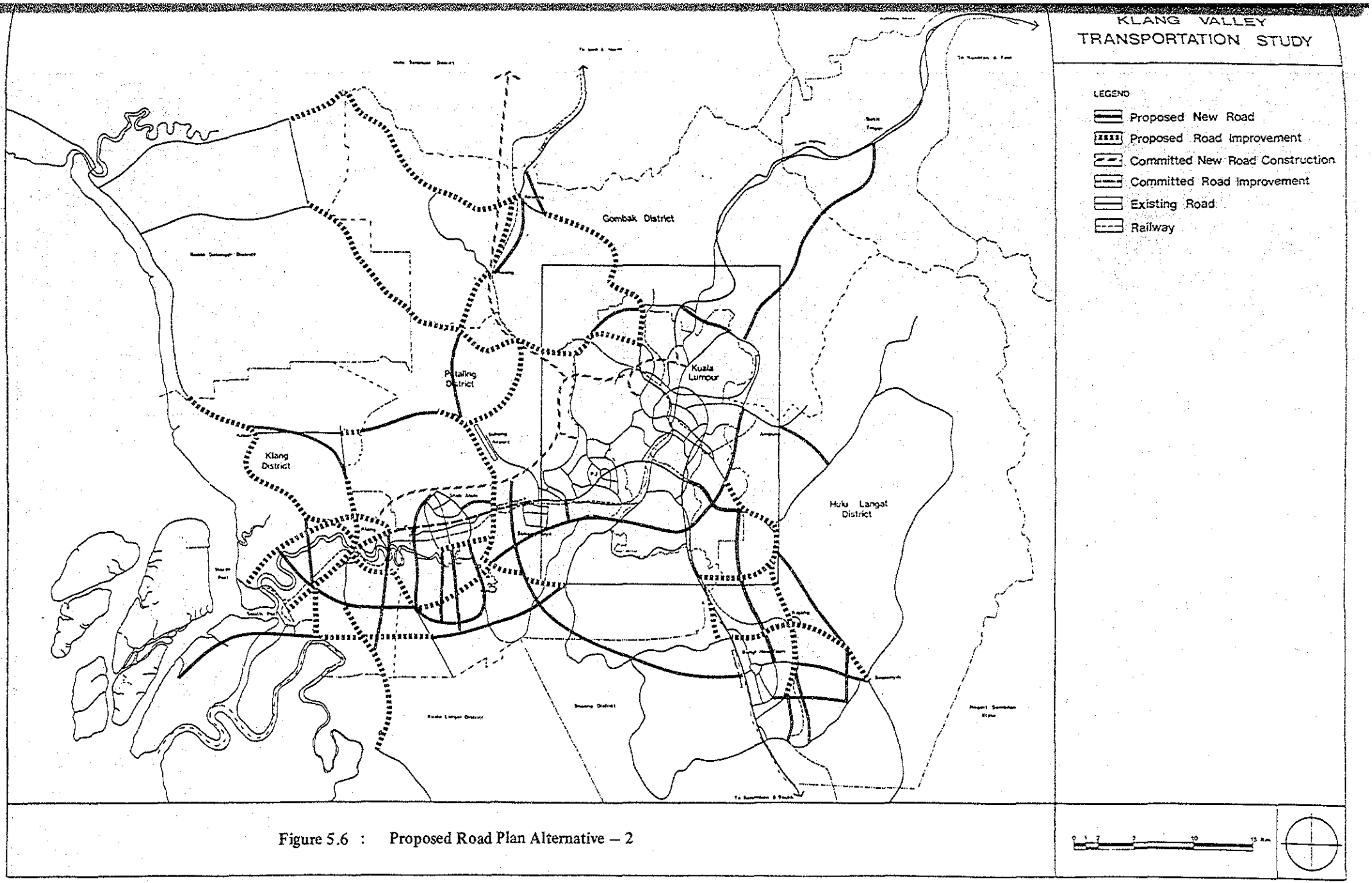
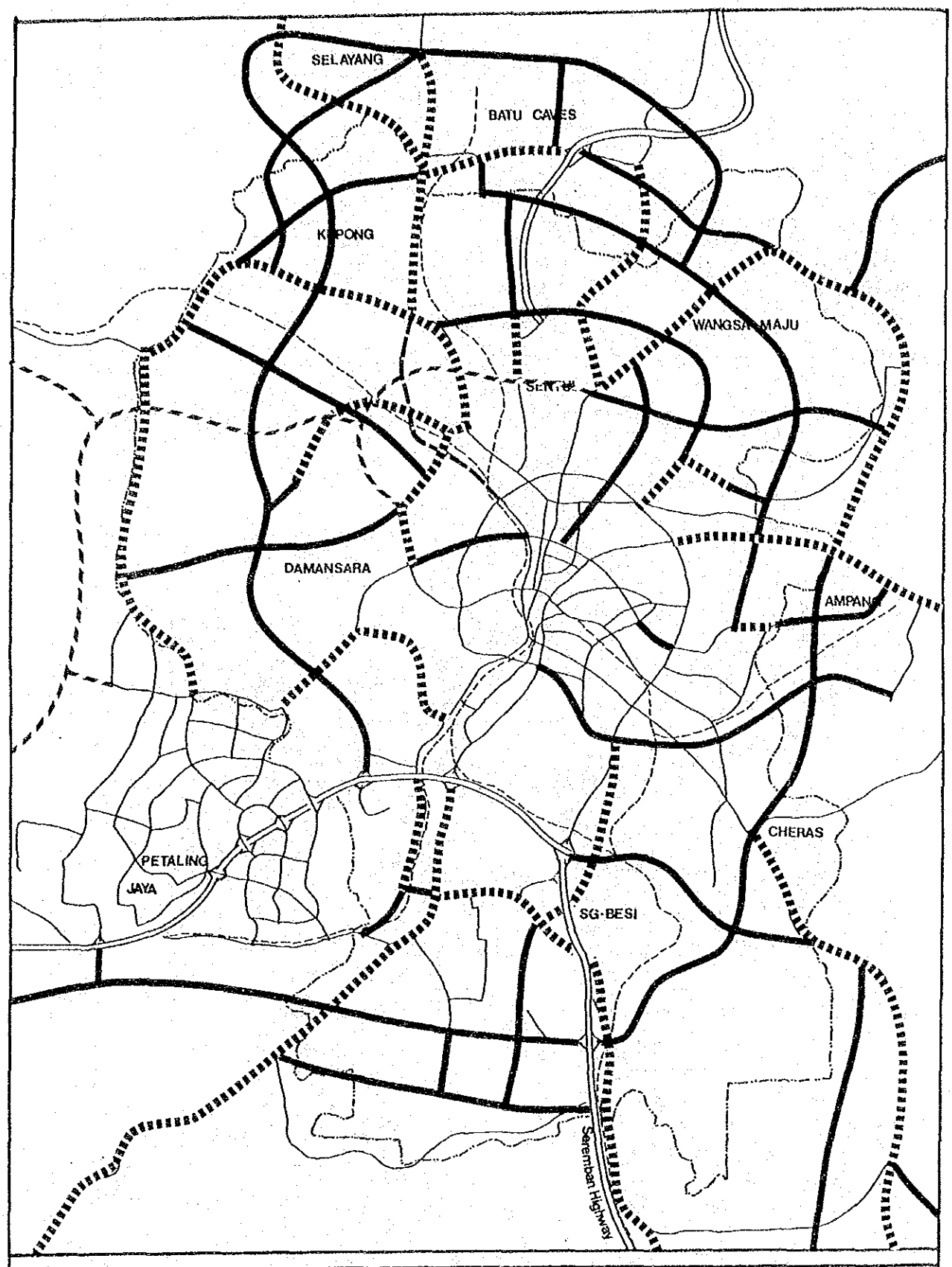


Figure 5.6 : Proposed Road Plan Alternative – 2



LEGEND

- Proposed New Road
- Proposed Road Improvement
- Committed New Road Construction
- Committed Road Improvement
- Existing Road
- Railway

Figure 5.7 :
PROPOSED ROAD PLAN
ALTERNATIVE - 2
(KL CONURBATION AREA)

SCALE
0 1 2 3 4 5Km

KLANG VALLEY
TRANSPORTATION STUDY

5.6 Public Transportation Improvement Strategy

5.6.1 Planning Concept

In order to create a better transportation system the public transportation system should be developed together with the road system.

Innovative transit systems of greater transportation capacity compared to the bus transport system will be required as part of the medium and long term public transportation plan if the public transportation system in Klang Valley is to be expected to cope with the tremendous increase in passenger travel demand. Figure 5.8 shows the optimum hourly passenger load for each type of public transport mode. The minibus is used to transport an optimum load of 100 – 150 person per hour if the headway is between 3 – 15 minutes. Depending on its capacity, the stage bus can transport some 300 – 3,000 persons per hour if the headway is between 2 – 10 minutes. For passenger demand of about 3,000 – 10,000 persons per hour, the LRT running with headway between 2 – 7 minutes is desirable while for passenger demand between 10,000 – 55,000 persons per hour the MRT running with a headway between 1.5 to 6 minutes will be desirable.

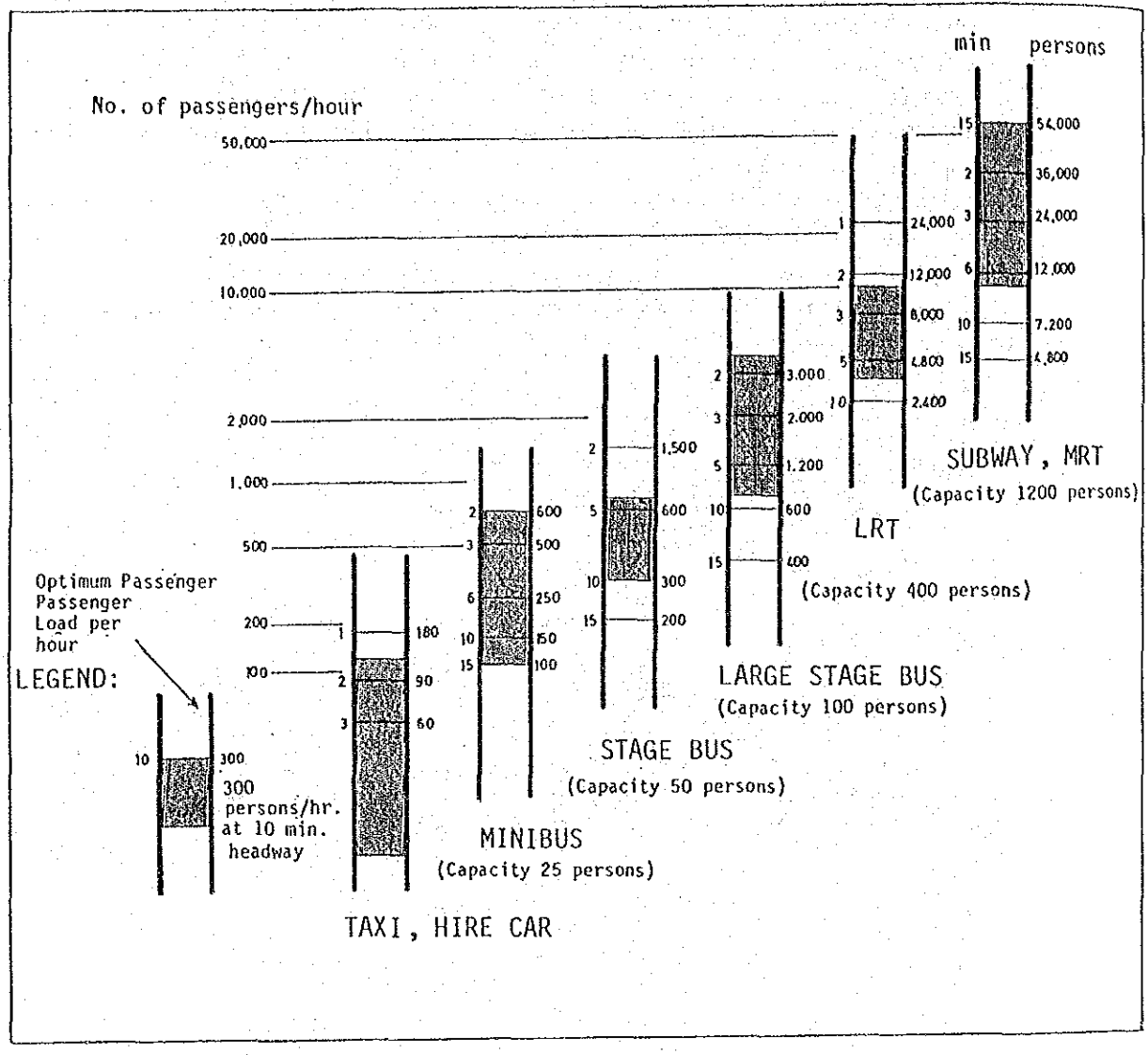


Figure 5.8 : Optimum Passenger Load By Public Transport Modes

5.6.2 Public Transportation Improvement Option in Klang Valley

Two major options stand out for the public transportation improvement in Klang Valley to meet the large increase in travel demand as forecasted in Chapter 4 and to bring about some possibly shift of transport mode from the private modes to the public modes.

These two options are: –

(1) Improvement of Existing Bus Service

(2) Introduction of Innovative Transit Systems

The bus transport system can be sub-divided into the following: –

(i) Stage Bus System

(ii) Mini Bus System

(iii) Factory/School Bus System

Improvement to the existing bus transport system should be a continuous process and in response to needs created by changes of other public transport modes in the whole system of public transportation. With the possibility of implementing the LRT system for example, bus routes will have to be rerouted and a systematic feeder bus system must be planned to avoid duplication and competition while at the same time to reinforce the LRT partronage.

Improvement measures to the existing bus system in Klang Valley to be incorporated into the tesing of alternative plans encompass the improvement of bus fleets (increasing bus fleet to avoid overcrowding, low-floor and stronger body buses), higher frequency service and wider route coverage. Other improvements include the provision of better transfer points (bus terminals, bus-stops).

The Travellers' Attitude Survey conducted by the Study Team in gauging the extent private vehicle users in the Klang Valley are willing to shift to public modes indicated that: –

(a) Private vehicle usage in the Central Area of Kuala Lumpur can infact be modified using a road pricing policy

(b) Mode change to public mode will positively occur if a more competitive public transport mode is made available

The most suitable innovative transit system to be introduced in Klang Valley may take the form of: –

(a) Light Rail Transit (LRT) System

(b) Mass Rapid Transit (MRT) System

Light Rail Transit is most suitable for short-distance sub-urban travel (5 – 15 km) and with passenger loading 8,000 to 20,000 passenger/hr. LRT trains operate between 20 – 40 kph.

Mass Rapid Transit trains can run faster at 40 – 60 kph and carry more passengers/hr. MRT is more suitable for longer distance travel (10 – 50 km).

Table 5.6 shows the comparison difference between LRT and MRT Systems.

Table 5.6 : Comparison Of Difference Between The Characteristics Of The MRT And LRT System

Item	MRT	LRT
1) Function	Rapid suburban type with mass or medium transport capacity.	Intra urban type with medium transport capacity.
2) Railway System	Transporting mass or medium volume of passengers rapidly for the long trip length between the central city terminal and the suburban city.	Forming a denser network in the urban city area and transporting medium volume passengers with comparatively short trip length and various OD (Origin and Destination).
• Transportation Range :	Klang Valley Area within radius of 10 to 50 km.	Kuala Lumpur Area within radius of 5 to 15 km
• Average Trip Length :	L = 13 to 14 km	L = 4 to 6 km
• Railway Transport Capacity :	*50,000 pass/hr*	*18,000 pass/hr*
• Train Operation Speed :	Vmax = 80 to 90 km/h Vope = 40 to 60 km/h	Vmax = 75 km/h Vope = 20 to 40 km/h
3) Crossing Condition at Roadway	The main roadways will cross over the railway track by grade-separated crossings. Crossing alarms and gates with automatic control are installed at level crossings for local roads.	All the railway track will cross over or under the roadway as continuous elevated bridges or box culverts.
4) Alignment, Locomotive and Train Operation for Mass Rapid Transit	The railway alignment connects the regional urban centres and the stations are provided at comparatively long spaces apart. To achieve a high operation speed, the alignment consists of curvatures with large radius and slight gradient. The composition of the cars are set up according to the traffic demand. A large number of cars for denser transit area or a smaller number of cars for less dense transit can be composed.	The space between stations is short and the alignment is restricted by small curvatures Vehicles with high power for acceleration/decelaration and capable of achieving high speed at the small curvatures are used. Cars with semi-long or long seats are adopted to increase passenger capacity per car so as to meet the short trip length mass transit demand.
• Space Between Stations :	L = 2000 to 6000 m	L = 400 to 2000 m
• Maximum Radius in Curve :	R = 600 m	R = 150 m
• Maximum Gradient :	G = 1.5%	G = 4%
• Maximum Train Composition :	L = 20 m x 10 cars per train	L = 22.3 m x 3 cars per train
• Type of Car :	Rigid Type	Flexible Type
• Headway :	t = 3 to 9 min at peak hour	t = 2.5 to 6 min at peak hour

Item	MRT	LRT
5) Function of the Station	The suburban station has a bus terminal and parking facility so that passengers can move continuously and smoothly to their destinations in the city.	The stations are located close together spreading over the metropolitan area in order to meet the traffic demand from the various generators and attractors in the culverts.
	The shopping centre and public facilities located around the main stations enable the people to shop conveniently and to enjoy other amenities of city life.	All station facilities function to meet the location conditions around the station and will be the support of amenities of culverts.
	Stations are large or medium scale.	Stations are small scale.
6) Strategy of Urban Development	The railway system promotes housing development in the suburban area.	The railway system promotes convenient urban transportation between the main growth centres in the conurbation area and the redevelopment of city centre.
7) Construction Cost	In this project, this railway shall basically use the existing railway system (Malaysian Railway) and is low cost.	Land acquisition in city area for the LRT project is expensive and the construction cost is reduced by use of elevated or underground track on or under the roadway, river or other public land.
	Construction cost is estimated as 10 to 15 million Rgt/km.	Construction cost is estimated as 30 to 35 million Rgt/km

The Light Rail Transit (LRT) system has been examined by the Government of Malaysia for sometime now but the actual implementation is still under review. The original LRT system plan consists of five lines within Kuala Lumpur Conurbation (Kuala Lumpur and Petaling Jaya) in providing short-distance (8 – 15 km) urban commuter services. Further examination of the original line from the perspective of future landuse and urban development pattern in the Kuala Lumpur Conurbation area warrants some re-consideration of the route alignment. For example, the development areas of Ampang and Damansara which are expected to generate a considerable amount of travel demand were not given consideration (Figure 5.9).

The Mass Rapid Transit (MRT) system is aimed at providing intermediate distance (15 – 25 km) commuter services within Klang Valley. MRT system can take advantage of the existing KTM track with some improvement to it. Within Klang Valley, five possible MRT lines can be identified (Figure 5.10). The Kuala Lumpur-Port Klang Line of about 43 km in length, a Northern line from Rawang-Kuang-Kuala Lumpur of about 32 km, Batu Caves line from Kuala Lumpur-Batu Caves and extended to Selayang of about 17 km, a southern line from Kuala Lumpur-Sungei Besi-Kajang-Bangi New Town of about 26 km, and Ampang line from Kuala Lumpur to Ampang of about 11 km.

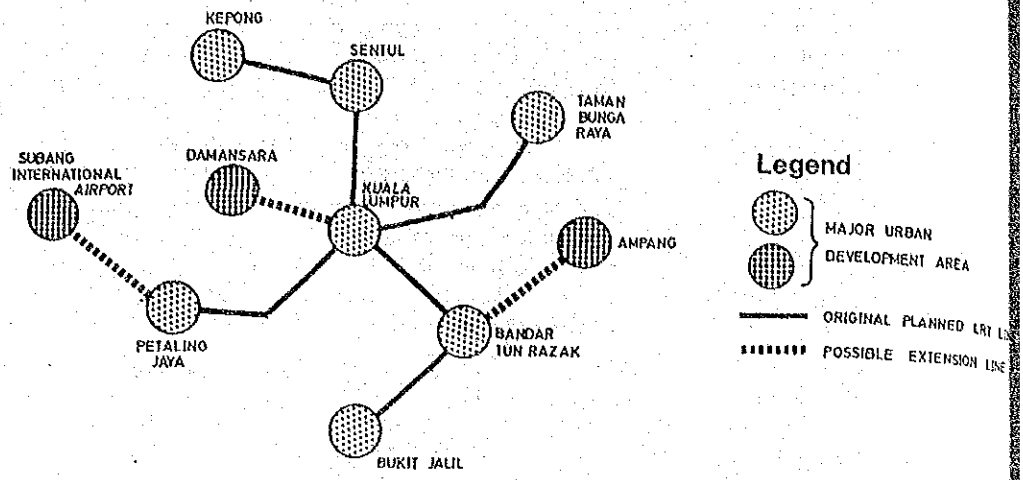


Figure 5.9 : The Original LRT System Proposed In Kuala Lumpur Transport Masterplan Study And It's Possible Extension

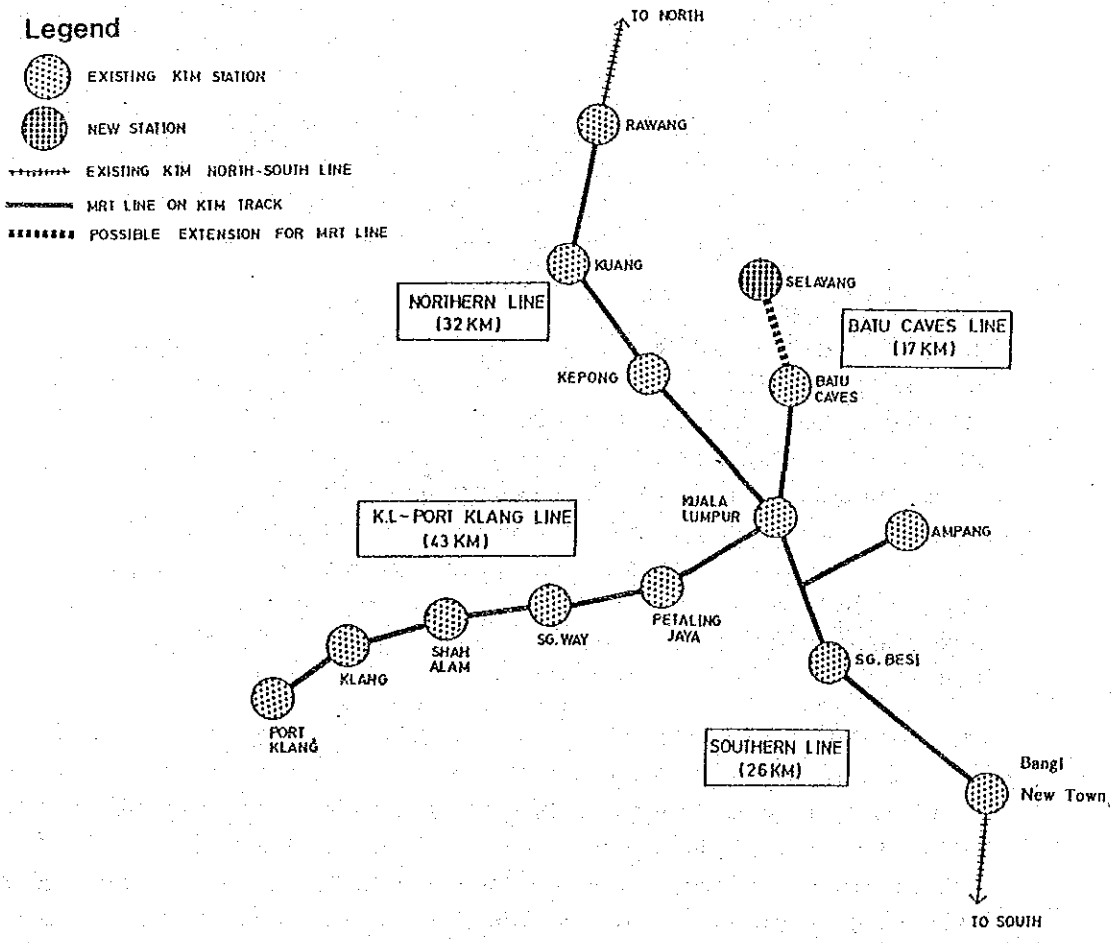


Figure 5.10 : The Five Possible MRT Lines On Existing KTM Tracks

When the two systems (LRT and MRT) are combined, however, considerations will have to be given to routes that are overlapped or duplicated. There is no need to have for example both LRT and MRT lines for Ampang and Kepong. Depending on judgement on economic impact such as need for tunnelling or overhead lines, as well as the volume of travel demand, one of which will be selected in such cases.

Many alternative transit plans could be generated through different combination of lines, or systems mentioned above. However four cases of transit plans are generated for further analysis and evaluation in the Study.

Case 1 comprises of the proposed MRT Network consisting of Port Klang Line, Northern Line, Southern Line and Batu Caves Line totalling 124 km in length and the extended LRT system consisting of Petaling Jaya Line, Kepong Line, Bukit Jalil Line, Damansara Line, Taman Bunga Raya Line and Ampang Line totalling 78 km in length. The transit network plan as Alternative Case 1 is shown in Figure 5.11.

Case 2 consists of the four MRT lines, the Northern Line, Southern Line, Batu Caves Line and Port Klang Line, together with a spur to Subang Airport and three LRT lines, Taman Bunga Raya Line, Bukit Jalil Line and Ampang Line (Figure 5.12). Case 2 has a total of about 130 km of MRT and about 36 km of LRT.

Case 3 consists of only the proposed MRT network described in the above cases plus an additional Ampang Line as indicated in Figure 5.13. The total length for the MRT System is 141 km.

Case 4 consists of only the LRT lines, three of which (Kepong to Sentul and Sentul to People's Park, Taman Bunga Raya Line) are from the original LRT plan while the fourth line runs along Jalan Cheras to Taman Connaught (Figure 5.14). The total length of LRT in Case 4 is 50 km.

These four cases will be evaluated in combination with the other strategies as alternative transport plans in the next chapter.

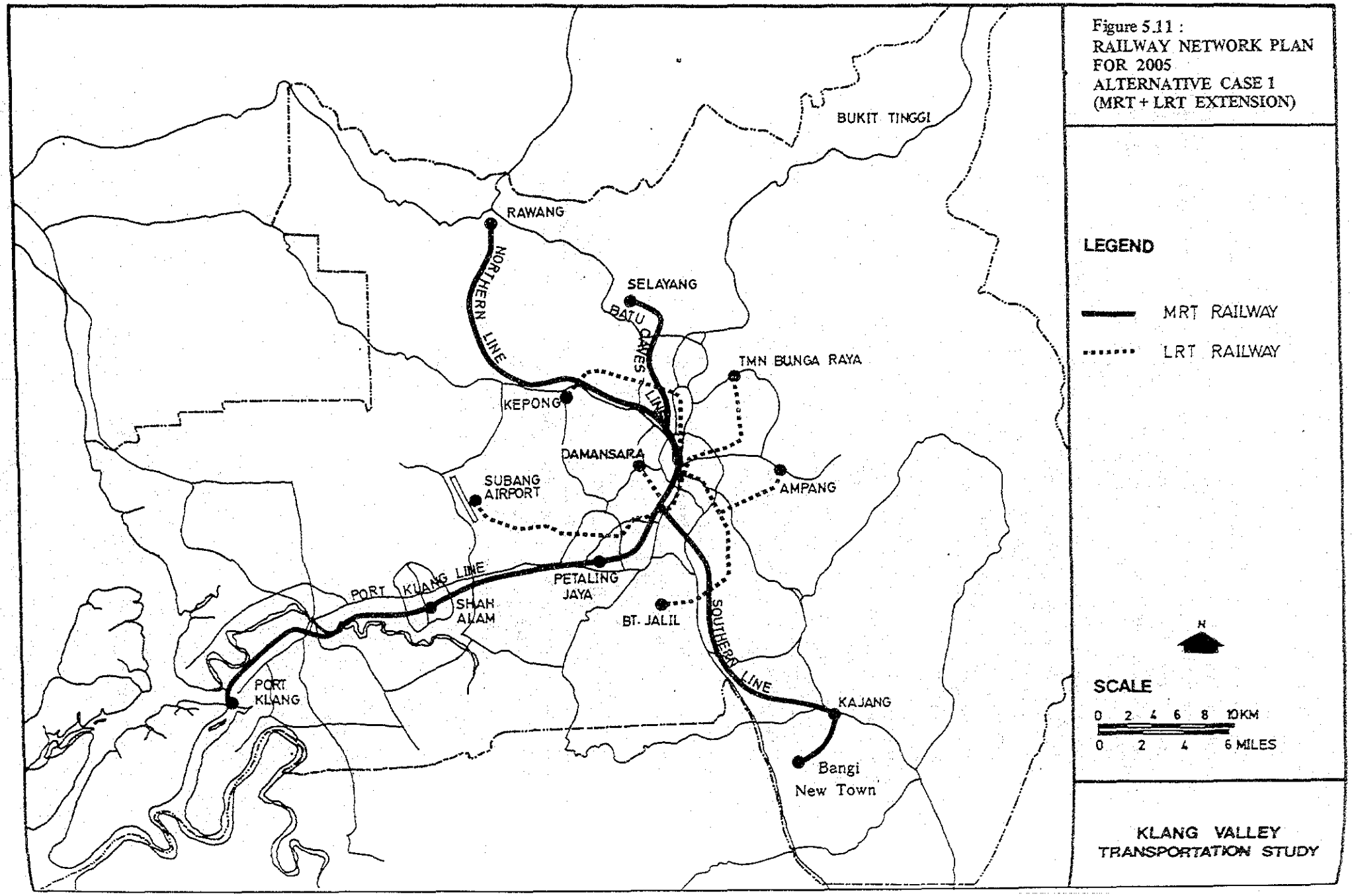


Figure 5.11 :
RAILWAY NETWORK PLAN
FOR 2005
ALTERNATIVE CASE 1
(MRT + LRT EXTENSION)

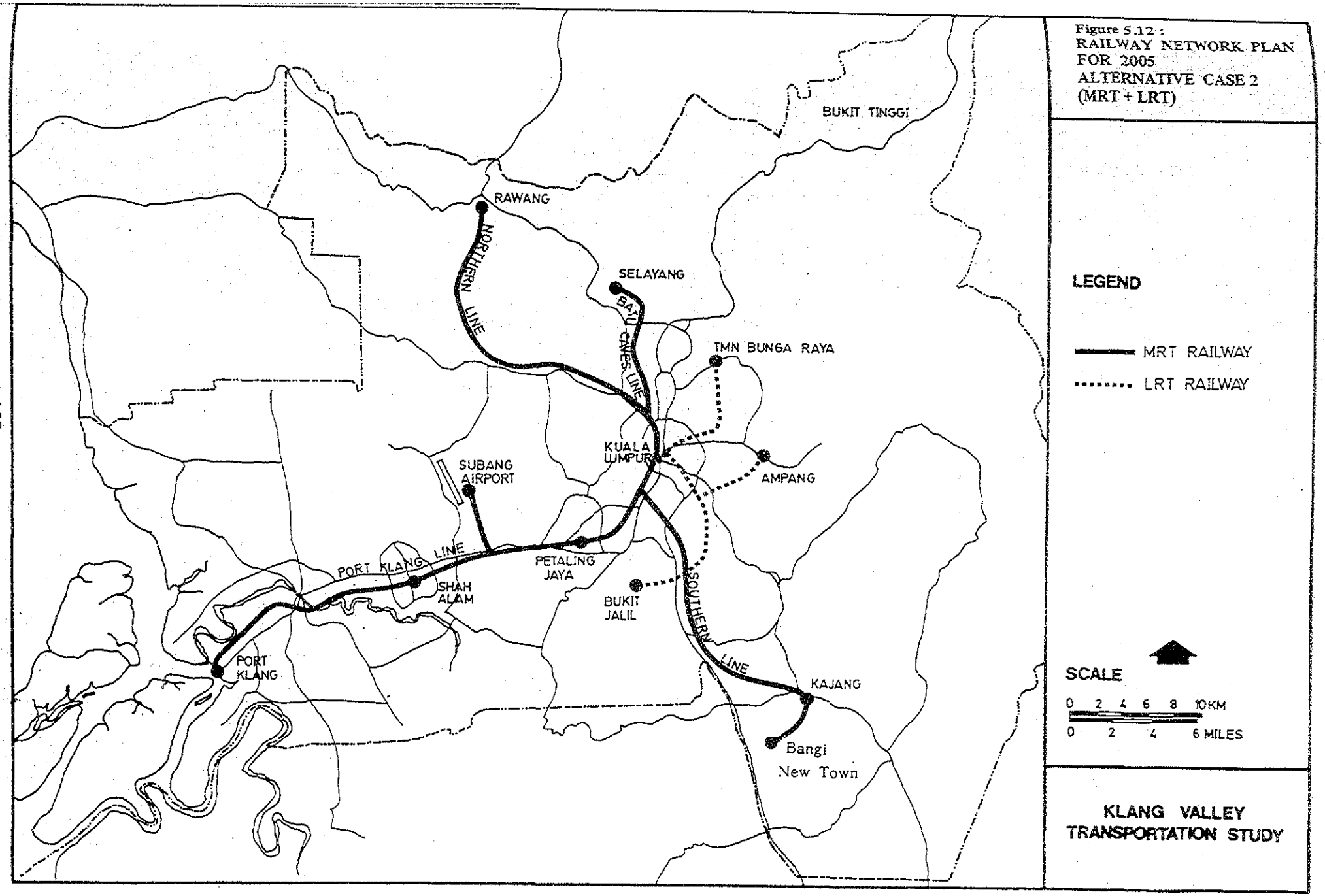


Figure 5.12 :
RAILWAY NETWORK PLAN
FOR 2005
ALTERNATIVE CASE 2
(MRT + LRT)

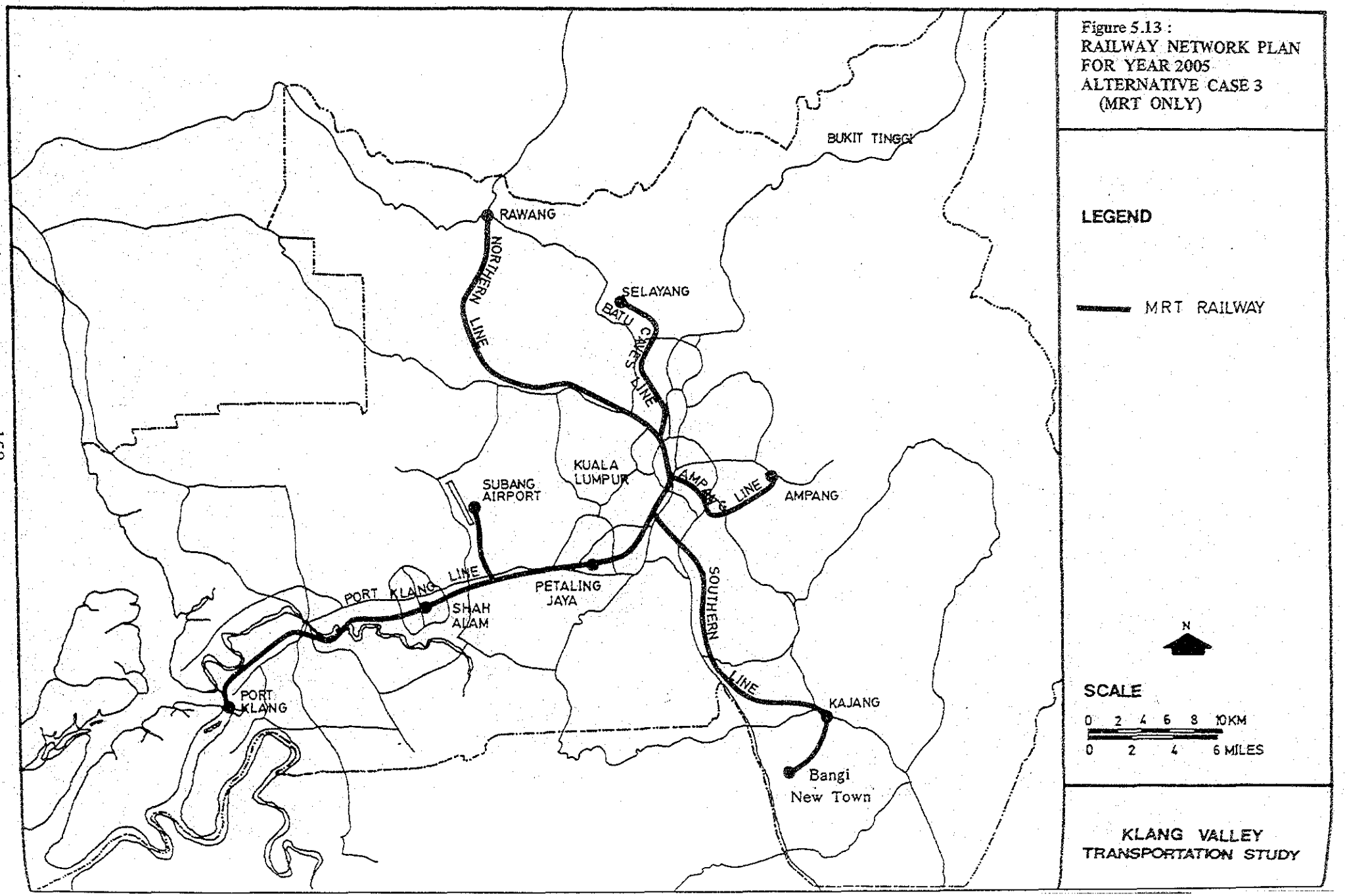


Figure 5.13 :
RAILWAY NETWORK PLAN
FOR YEAR 2005
ALTERNATIVE CASE 3
(MRT ONLY)

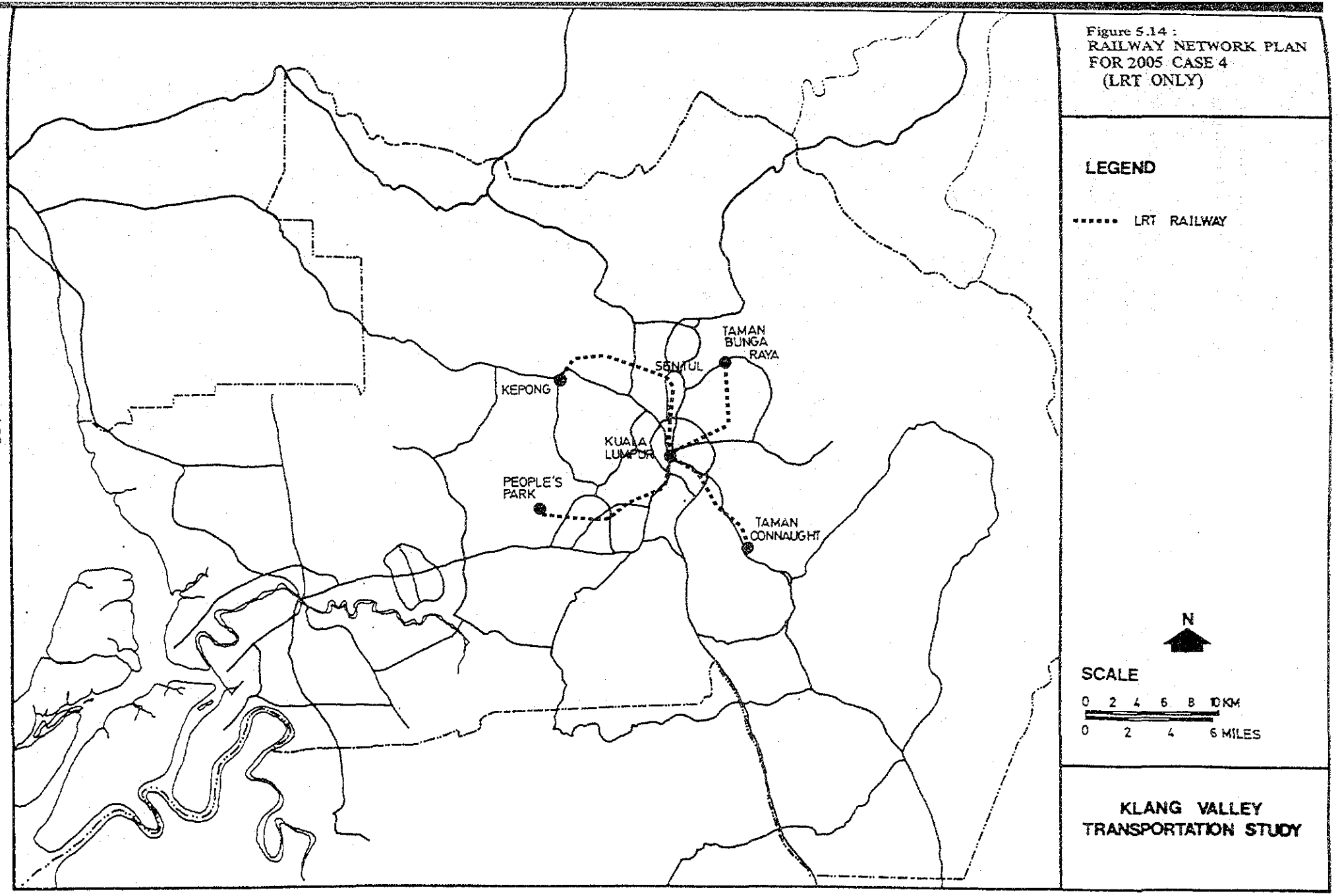


Figure 5.14 :
RAILWAY NETWORK PLAN
FOR 2005 CASE 4
(LRT ONLY)

The engineering standards for the MRT System to be considered here is based on the standards for railway infrastructure used by KTM because the MRT System is planned to utilize the KTM facilities as far as possible.

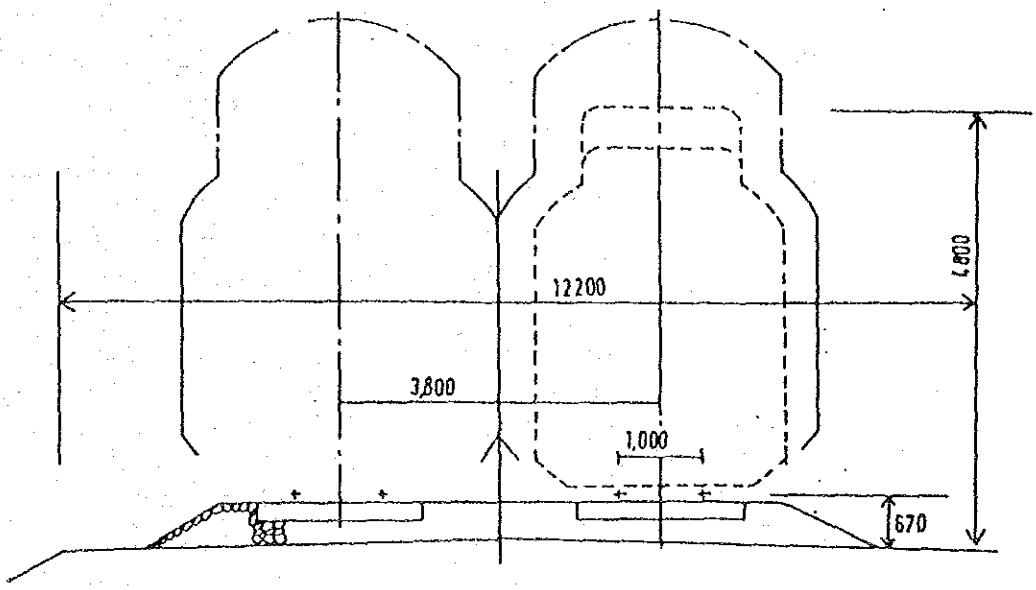
The engineering standard for the LRT System has already been studied by the Belgian Consortium and accepted by the Malaysian Government.

The basic specifications for both the MRT and LRT Systems are as follows: –

Items	MRT System	LRT System
Maximum Train Composition	10 Vehicles	3 Vehicles
Vehicle Length	20 m.	22 m.
Vehicle Capacity	250 Passengers/veh.	247 Pass/veh.
Maximum Speed	85 kph	75 kph
Operating Speed	40 – 60 kph	20 – 40 kph
Frequency	20 trains/hr	24 trains/hr
Capacity	50,000 Pass/hr	18,000 Pass/hr
Live Load	120 ton/veh.	50 ton/veh.
Station Spacing	2000 – 4000 m.	800 – 2000 m.
Platform Length	200 m.	75 m.
Track Width	1.000 m.	1.435 m.
Minimum Horizontal Curve Radius	600 m.	150 m.
Maximum Gradient	1.5%	4%
Electrification	1500 Volts (DC)	750 Volts (DC)
Carriageway	Principally at-grade and double track	Partially elevated and partially at-grade, double tracks

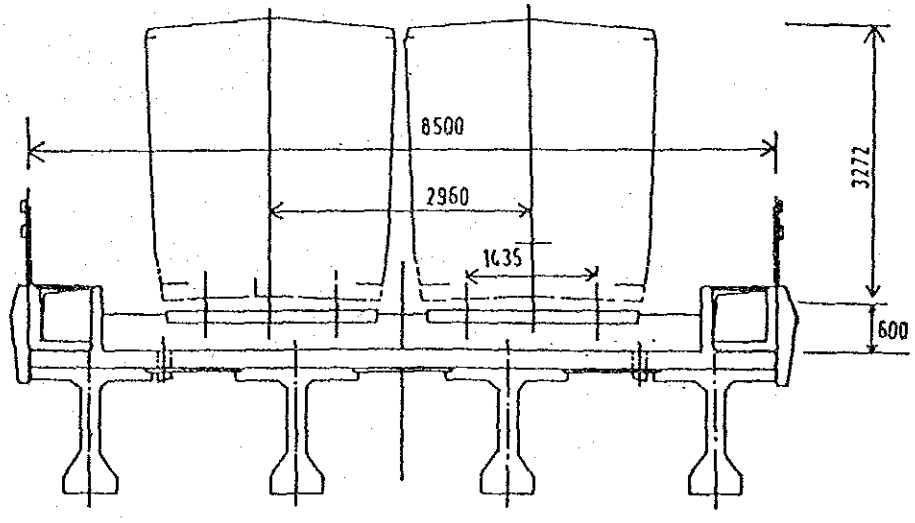
The typical section for the MRT and LRT vehicles and tracks are shown in Figure 5.15.

TYPICAL CROSS SECTION



MASS RAPID TRANSIT (MRT)

Source : JICA RAILWAY STUDY REPORT



LIGHT RAIL TRANSIT (LRT)

Source : LRT STUDY REPORT BY BELGIAN CONSORTIUM

Figure 5.15 : Typical Section of the MRT and LRT Systems

5.7 Private Vehicle Restraint Strategy

Private vehicle restraint strategy is applicable to Kuala Lumpur within the Klang Valley Region. Private Vehicle Restraint may infact take the following specific forms: –

(a) Restrain on vehicular ownership

(b) Restrain on private vehicle usage within specific areas and time

Ownership restraint works in conflict to other economic policies and may involve implementation difficulties and opposition. More practical form of restraint is limiting or controlling the use of private vehicle within certain areas or time periods or trip purpose. This form of restraint could be effected by direct method such as the area licencing scheme in Singapore or an indirect method as road pricing scheme in Hong Kong. The former is the designation of a restricted zone (usually the busiest CBD area) and private vehicles are not allowed entry unless they meet certain conditions or pay a penalty. The latter method involves extra charge levied on vehicles running on certain stretches of roads through meters installed on the vehicles. This extra charges will discourage vehicles to enter such areas or roads.

The Singapore model was infact considered for implementation at one time in Kuala Lumpur as it was recommended by the previous Kuala Lumpur Transportation Masterplan Study. Such a scheme is again taken up as a possible private vehicle restraint strategy to be tested for its economic and traffic impacts in the alternative plans.

The area to be 'cordoned-off' as restricted zone is shown in Figure 5.16. It encompasses the area within the Middle Ring Road of Kuala Lumpur. The area may be defined as within the Inner Ring Road and between the Inner and Middle Ring Roads for a two stage implementation of such a transport measure.

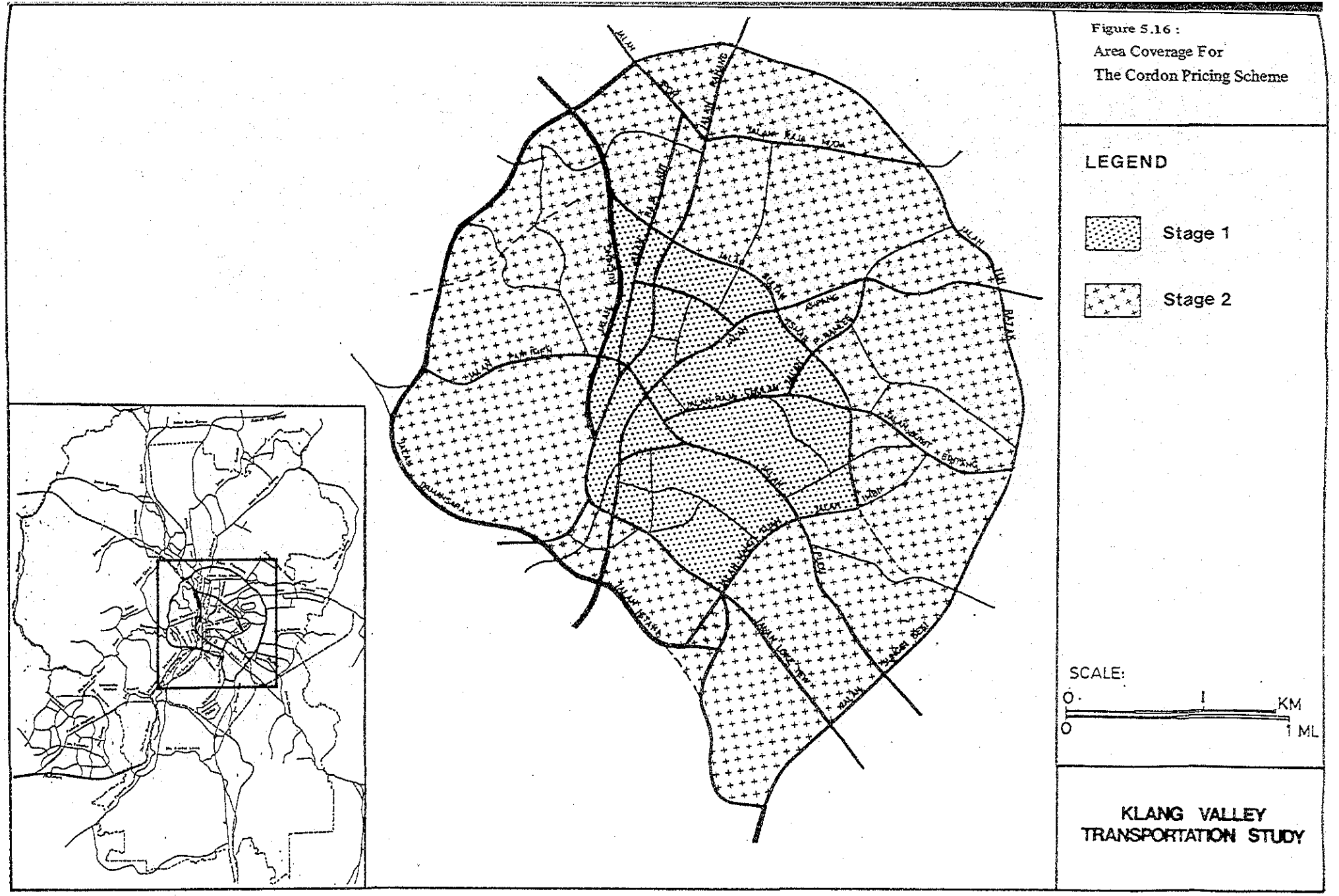


Figure 5.16 :
Area Coverage For
The Cordon Pricing Scheme

5.8 Formulation of Alternative Transportation Plan

From the above discussion on the selected strategies and practical measures for Klang Valley, a total of seven different alternative transportation plans are formulated for further analysis and evaluation. These seven alternative plans are established by the different combination of the first four strategies and options (Figure 5.17). The private vehicle usage restraint strategy is applicable only to Kuala Lumpur CBD area and it is evaluated at a later step on the last six alternatives as with or without restraint cases (Figure 5.17). The rational in establishing the seven alternative plans is elaborated below.

(1) 'Do-Nothing' or Base Plan : This is the 'do-nothing' case where no further improvement to the existing transportation system is assumed. This would present the worst possible outcome if travel demand keeps increasing to the year 2005 while no action is being implemented. This alternative functions as a 'control or bench mark' against which we evaluate the other alternative plans.

(2) Alternative Plan 1-1 : This alternative plan comprises of road improvement and construction according to the Road Plan Alternative 1 (Figures 5.4 and 5.5) together with improvement to the existing bus system.

(3) Alternative Plan 1-2 : This alternative is similar to Plan 1-1 except that the road network is according to Road Plan Alternative 2 (Figures 5.6 and 5.7). Together with Plan 1-1, these two alternative plans are very similar to the past strategy adopted in the Klang Valley. These alternatives will act as "representative cases" for comparing the merits of present development trend to those advocating changes.

(4) Alternative Plan 2-1 : In addition to those proposed in Plan 1-2, this alternative proposes an extensive transit network consisting of four MRT lines and seven LRT lines. This alternative hence advocates an extensive public transit development in the Klang Valley. This alternative will serve as the "upper limit" in the derivation of benefits in transit development in Klang Valley (see Figure 5.11).

(5) Alternative Plan 2-2 : This alternative plan comprises of Plan 1-2 together with a more realistic network for the public transit system in Klang Valley. The transit system consists of four MRT lines and three LRT lines (see Figure 5.12).

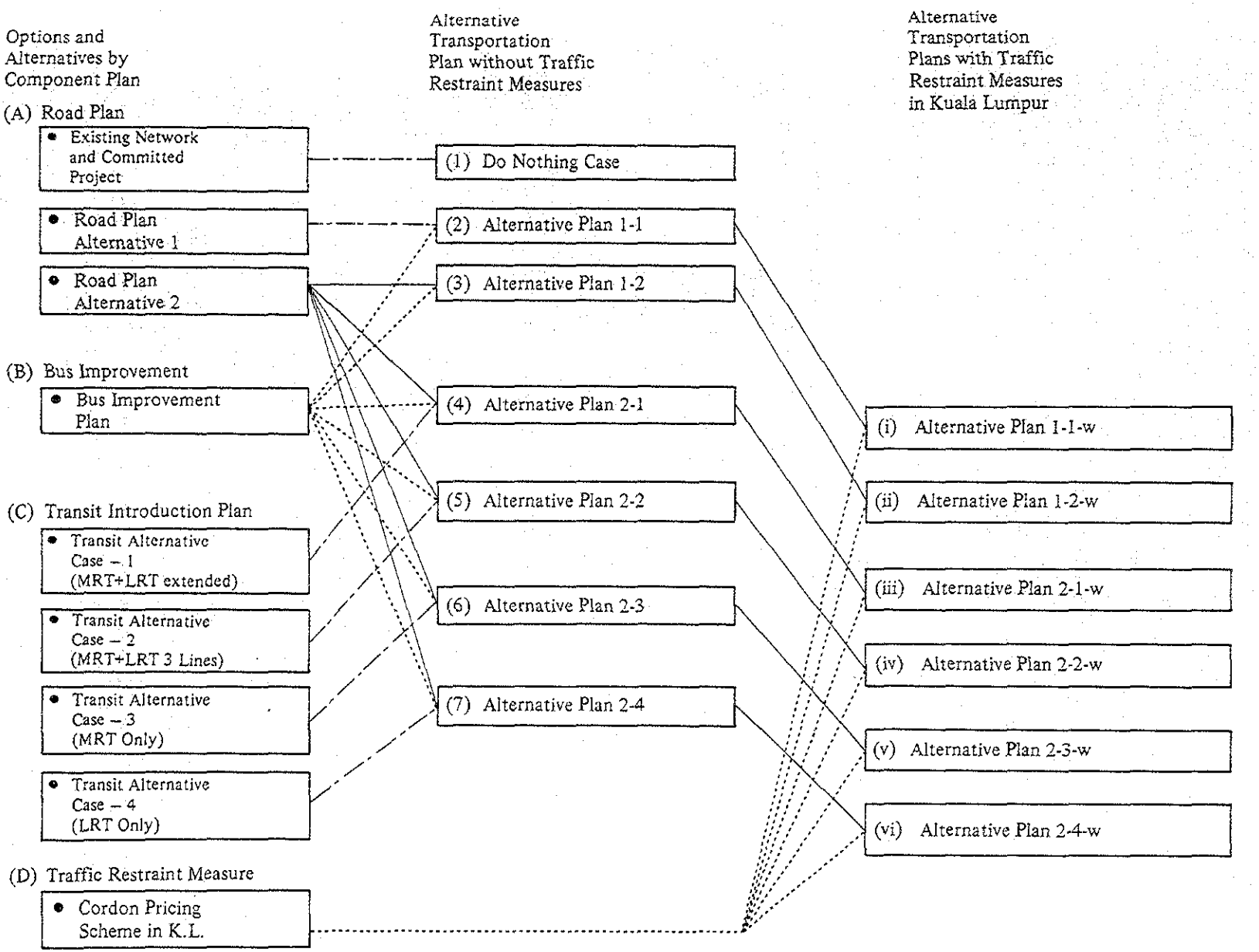


Figure 5.17 : Formulation of Alternative Transport Plans

(6) Alternative Plan 2-3 : This alternative plan besides proposing the road network and bus system improvement as in Plan 1-2, it represents a plan that advocates MRT development only as the transit system for Klang Valley, doing away with the more expensive LRT system. The transit plan for this alternative (see Figure 5.13) consists of the four MRT lines on the existing KTM tracks together with the Ampang-Puduraya Line being extended to the Kuala Lumpur main KTM railway station from Puduraya. This alternative hence represents a more 'economical' strategy in developing transit system in the Klang Valley.

(7) Alternative Plan 2-4 : This alternative plan comprises of Road Improvement and the LRT System with a modified south bound line (see Figure 5.14).

At the last stage of the evaluation, the option of private vehicle usage restraint in the CPA of Kuala Lumpur is applied to Alternative Plan 1-1, Plan 1-2, Plan 2-1, Plan 2-2, Plan 2-3 and Plan 2-4 to compare these alternative plans with or without the 'soft-policy' measure (Table 5.8).

(i) Private Vehicle Usage Restraint Measure on Alternative Plan 1-1 (Plan 1-1-w)

This is the case where the private vehicle restraint measure in the CPA of Kuala Lumpur is applied in addition to those proposed as Alternative Plan 1-1. This alternative hence represents the continuation of past transport development strategy 'plus' a soft policy measure. We shall see if this soft policy measure has considerable impact on the traffic movement from Plan 1-1.

(ii) Private Vehicle Usage Restraint Measure on Alternative Plan 1-2 (Plan 1-2-w)

Similar to the above, this plan seeks to test the impact of the soft policy on traffic movement from Plan 1-2.

(iii) Private Vehicle Usage Restraint Measure on Alternative Plan 2-1 (Plan 2-1-w)

The addition of Kuala Lumpur CPA vehicle restraint measure to Alternative Plan 2-1 makes up this case. We shall see whether the soft-policy measure has any considerable further advantage in travel demand changes when an extensive transit system has been incorporated.

(iv) Private Vehicle Usage Restraint Measure in Alternative Plan 2-2 (Plan 2-2w)

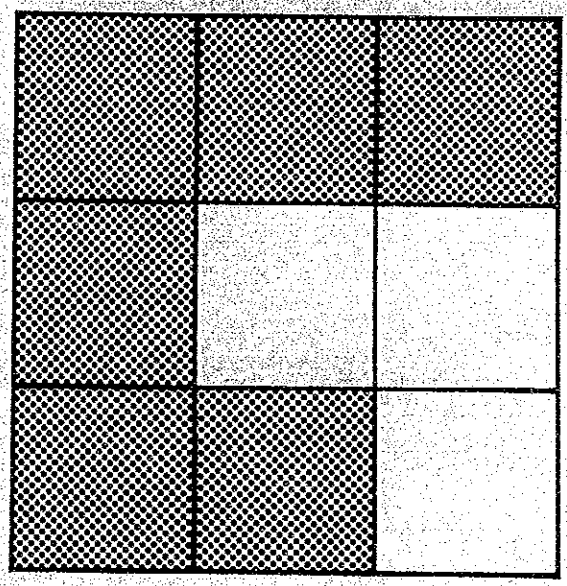
This case attempts to find out the impact of the soft-policy measure in addition to the transit plan as proposed in Plan 2-2.

(v) Private Vehicle Usage Restraint Measure on Alternative Plan 2-3 (Plan 2-3w)

This case will provide a measure to any further advantage in travel demand changes if the soft-policy of vehicle restraint is implemented together with road construction, bus improvement and a MRT only transit plan in Klang Valley.

(vi) Private Vehicle Usage Restraint Measure on Alternative Plan 2-4 (Plan 2-4w)

Similar to the above, this case attempts to find out the impact of the soft-policy measure in addition to the LRT only transit plan as proposed in Plan 2-4.



CHAPTER 6 : IMPACTS OF THE ALTERNATIVE PLANS ON FUTURE TRANSPORT SITUATION

6. IMPACTS OF THE ALTERNATIVE PLANS ON FUTURE TRANSPORT SITUATION

6.1 General

Future transport demands are expected to be varied according to which of the alternative transportation plans formulated in Chapter 5 is chosen for implementation. Consequently, the traffic flow situation on the future transportation network for Klang Valley will also vary from plan to plan. Therefore, in this chapter, the impacts of each of the alternatives described in the previous chapter on future transport situation will be evaluated and their differences elucidated.

The methodology used in the estimation of the impacts of alternatives on future transport situation is illustrated in the simplified flowchart shown in Figure 6.1. As illustrated in Figure 6.1, the estimated person trip OD tables for 2005 already described in Chapter 4 will form the basic inputs for the traffic assignment to each alternative transportation plan. The contents of each alternative plan predetermine the modal split model from which future person trip OD tables by mode are estimated. Public transport passengers are then assigned to each of the alternative public transport network using the Public Transport Passenger Assignment Model. The future vehicle trip OD developed endogenously from the inputs of future person trip OD by mode, future lorry trip OD and future external vehicle trip OD are assigned to each of the alternative road network using the Highway Network Traffic Assignment Model.

The results of the traffic assignments to each alternative plan will be discussed in the following sections.

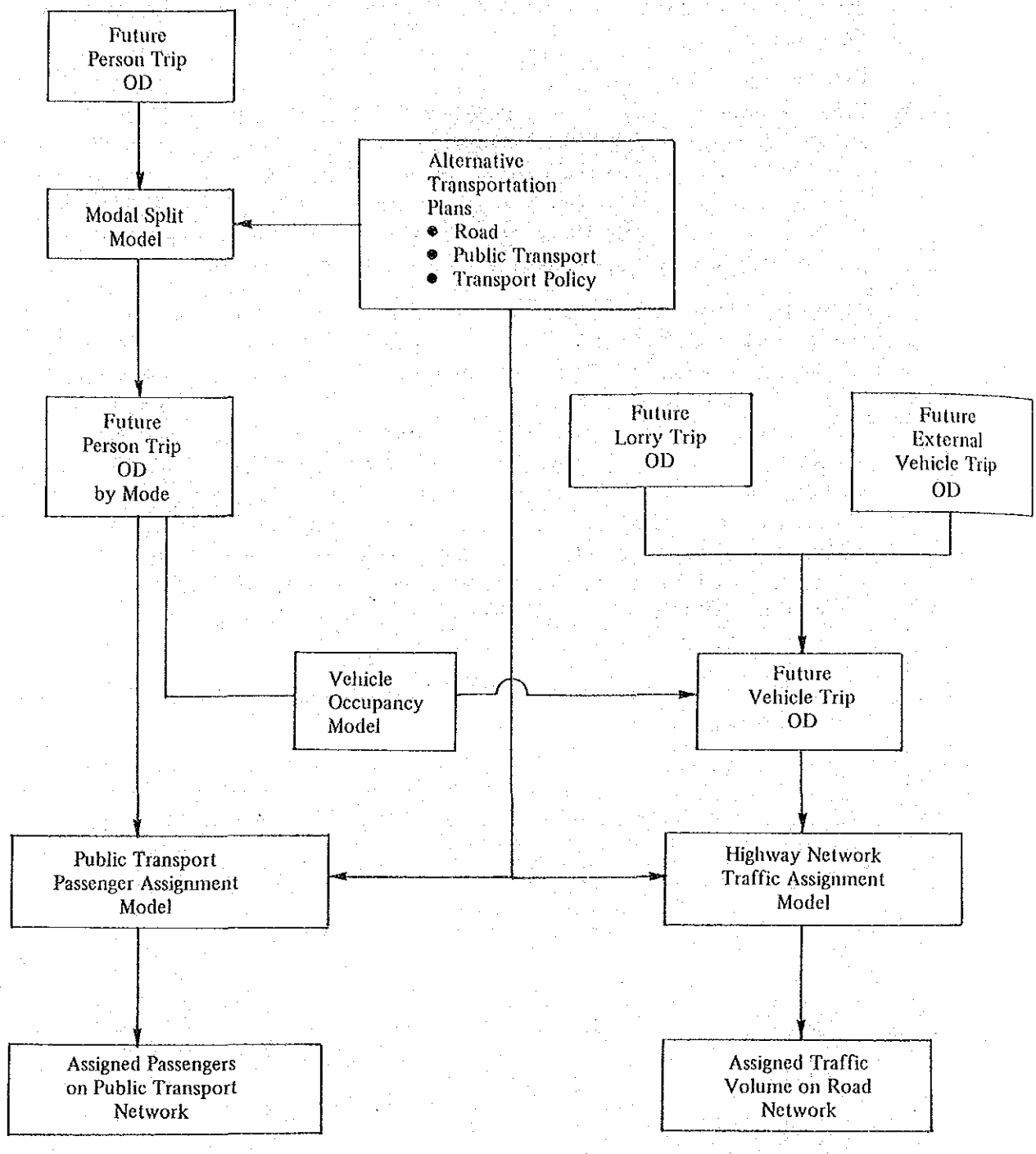


Figure 6.1 : Simplified Flowchart for Estimation of the Impacts of Alternative Plans

6.2 Transport Demands of Alternative Plans

Table 6.1 shows a summary of the future transport demands by mode in each of the alternatives evaluated. The following observations can be made.

(a) The modal share of person trips in Plan 1-1 and Plan 1-2 which are road oriented is 30% for public transportation and 70% for private vehicle usage. The percentage share of car usage in these plans which have no rail services is 54%. The percentage share of motorcycle usage is 16%.

(b) The modal share of person trips in Plan 2-1 is 36% for public transportation and 64% for private vehicle usage. With the introduction of LRT and MRT services in this plan, the percentage share of car usage is 49% while bus usage and LRT/MRT usage are 24% and 12% respectively. The percentage share of motorcycle usage is 15%.

(c) In Plan 2-2 where the LRT has a smaller network compared to Plan 2-1, the public to private modal share is 35% to 65%. Car usage remains at 49% while bus usage and LRT/MRT usage are 25% and 10% respectively. The percentage share of motorcycle usage is 16%.

(d) In Plan 2-3 where only MRT service is available, the public to private modal share is 34% to 66%. Half of all person trips is by car, 16% by motorcycle, 26% by bus and 8% by MRT.

(e) In Plan 2-4 where only LRT service is available, the public to private modal share is 34% to 66%. Half of all person trips is by car, 16% by motorcycle, 28% by bus and 6% by LRT.

(f) The introduction of rail services through the implementation of LRT and MRT systems has effectively changed the pattern of person trip movement by 4% to 6% from private mode to public mode. The amount of mode shift depends on the availability of LRT/MRT services.

(g) The LRT/MRT riderships are derived mainly from persons who gave up using car mode or others who shift from bus to LRT/MRT. The percentage of LRT/MRT passengers who have given up using motorcycle is small.

Table 6.1 : Summary Of Modal Share Of Person Trips By Alternative Plans, Klang Valley, 2005

		Public			Private			Total
		Bus	LRT/MRT	Sub Total	Motor Cycle	Car	Sub Total	
Base Plan/ Plan 1-1/ Plan 1-2	No ('000)	3490.8	0	3490.8	1956.1	6331.1	8287.2	11778.0
	Share (%)	30	0	30	16	54	70	100
Plan 2-1	No ('000)	2840.4	1337.2	4177.6	1806.7	5793.7	7600.4	11778.0
	Share (%)	24	12	36	15	49	64	100
Plan 2-2	No ('000)	2994.6	1135.1	4129.7	1819.0	5829.3	7648.3	11778.0
	Share (%)	25	10	35	16	49	65	100
Plan 2-3	No ('000)	3125.0	945.3	4070.3	1844.0	5863.7	7707.7	11778.0
	Share (%)	26	8	34	16	50	66	100
Plan 2-4	No ('000)	3315.8	670.8	3986.6	1857.3	5934.1	7791.4	11778.0
	Share (%)	28	6	34	16	50	66	100

Notes : 1. These trips are linked trips
2. These trips include both inter and intra zonal trips

6.3 Traffic Assignment to Transportation Network

The impacts on traffic assignment to the transportation network of alternative plans are evaluated from two different viewpoints. Firstly the impacts on the traffic flow in the road network in each alternative plan will be evaluated. The results of the traffic assignment to the road network in each plan are summarized as Table 6.2. Secondly the impacts on the public transportation passenger flow will be evaluated and a summary of the passenger assignment to the public transport system in each plan is shown in Table 6.6.

6.3.1 Traffic Assignment to Road Network

Table 6.2 shows a summary of traffic assignment to the road network in the alternative plans. The road network in Plan 1-1 and Plan 1-2 has a total road capacity of 64.6 million PCU.km and 66.2 million PCU.km respectively compared to the Base Plan ('Do-nothing' Case) which has only 26.7 million PCU.km. This increase in road capacity by 2.4 to 2.5 times could be expected to reduce the congestion degree from 3.26 in the Base Plan to 1.16 and 1.09 in Plan 1-1 and Plan 1-2 respectively.

The same road network in Plan 1-2 is also applied to Plan 2-1, Plan 2-2, Plan 2-3 and Plan 2-4. It is observed that in each of these alternative plans the introduction of LRT/MRT services could bring about a decrease in the number of assigned trips to road network and reduction of vehicle hours thereby further reducing the congestion degree on the road network in these plans by 5% to 9% compared to Plan 1-2 without the transit system.

Comparisons of road length by congestion degree between alternative plans in Klang Valley, Kuala Lumpur and Other Klang Valley Area are shown in Tables 6.3, 6.4 and 6.5 respectively. It is observed that in the Base Plan, 80% of the total road length in Kuala Lumpur has congestion degree above 2.0 while in the Other Klang Valley Area about 86% of the total road length would have congestion degree above 2.0. The rail introduction plans could successfully improve the congestion degree in Kuala Lumpur by 7% to 11% compared to Plan 1-2 and that in the Other Klang Valley Area by 3% to 8%.

Table 6.2 : Summary Of Traffic Assignment To Road Network

Indicators	Base Plan (Do-Nothing)	Plan 1-1	Plan 1-2	Plan 2-1	Plan 2-2	Plan 2-3	Plan 2-4
No. of Assigned Trips ('000 PCU)	5,723	5,723	5,723	5,340	5,372	5,398	5,460
Vehicle Kilometers ('000 PCU.km)	86,962	74,717	72,148	66,117	66,707	67,020	68,840
Vehicle Hours ('000 PCU.Hr)	7,580	3,441	2,962	2,411	2,450	2,486	2,639
Capacity Kilometers ('000 PCU.km)	26,698	64,564	66,171	66,171	66,171	66,171	66,171
Congestion Degree	3.26	1.16	1.09	1.00	1.01	1.01	1.04

Note : Exclusive of Intrazonal Trips

Table 6.3 : Summary Table Of Road Length By Congestion Degree, Klang Valley, 2005

Alternative Plans	Congestion Category				Total Length (km)	Average Congestion Degree
	Below 1.00	1.00 – 1.50	1.51 – 2.00	Above 2.00		
Base Plan	30	34	66	689	819	3.26
%	3.7	4.2	8.1	84.0	100.0	
Plan 1-1	466	389	347	0	1202	1.16
%	38.8	32.4	28.8		100.0	
Plan 1-2	545	402	288	0	1235	1.09
%	44.1	32.6	23.3		100.0	
Plan 2-1	630	366	239	0	1235	1.00
%	51.0	29.6	19.4		100.0	
Plan 2-2	615	392	228	0	1235	1.01
%	49.8	31.7	18.5		100.0	
Plan 2-3	607	398	230	0	1235	1.01
%	49.1	32.2	18.7		100.0	
Plan 2-4	589	393	253	0	1235	1.04
%	47.7	31.8	20.5		100.0	

Table 6.4 : Summary Table Of Road Length By Congestion Degree, Kuala Lumpur, 2005

Alternative Plans	Congestion Category				Total Length (km)	Average Congestion Degree
	Below 1.00	1.00 – 1.50	1.51 – 2.00	Above 2.00		
Base Plan	9	13	25	182	229	2.86
%	3.9	5.7	10.9	79.5	100.0	
Plan 1-1	92	131	107	0	330	1.28
%	27.9	39.7	32.4		100.0	
Plan 1-2	114	169	70	0	353	1.18
%	32.3	47.9	19.8		100.0	
Plan 2-1	159	151	43	0	353	1.07
%	45.0	42.8	12.2		100.0	
Plan 2-2	157	153	43	0	353	1.08
%	44.5	43.3	12.2		100.0	
Plan 2-3	144	164	45	0	353	1.09
%	40.8	46.5	12.7		100.0	
Plan 2-4	145	159	49	0	353	1.11
%	41.1	45.0	13.9		100.0	

Table 6.5 : Summary Table Of Road Length By Congestion Degree, Other Klang Valley Area, 2005

Alternative Plans	Congestion Category				Total Length (km)	Average Congestion Degree
	Below 1.00	1.00 – 1.50	1.51 – 2.00	Above 2.00		
Base Plan	21	21	41	507	590	3.52
%	3.6	3.6	6.9	85.9	100.0	
Plan 1-1	374	258	240	0	872	1.10
%	42.9	29.6	27.5		100.0	
Plan 1-2	431	233	218	0	882	1.04
%	48.9	26.4	24.7		100.0	
Plan 2-1	471	215	196	0	882	0.96
%	53.4	24.4	22.2		100.0	
Plan 2-2	458	239	185	0	882	0.99
%	51.9	27.1	21.0		100.0	
Plan 2-3	463	234	185	0	882	0.97
%	52.5	26.5	21.0		100.0	
Plan 2-4	444	234	204	0	882	1.01
%	50.3	26.5	23.2		100.0	

The impact of Plan 2-3 on the traffic volume across the six (6) major corridors in the Klang Valley is shown in Figure 6.2. With Plan 2-3, the congestion degree in the Kuala Lumpur-Karak Corridor could improve from 7.40 in Base Case to 1.67, Kuala Lumpur-Rawang Corridor from 3.80 to 1.23, Kuala Lumpur-Kajang Corridor from 2.84 to 0.98, Kuala Lumpur-Petaling Jaya Corridor from 3.19 to 1.18, Petaling Jaya-Shah Alam Corridor from 3.49 to 0.85 and Shah Alam-Klang Corridor from 2.94 to 0.85.

Figures 6.3 and 6.4 illustrate the vehicular traffic flow volume on the roads in Kuala Lumpur Conurbation and the Other Klang Valley Areas respectively under Plan 2-3. It is observed that the concentrated flow in the Federal Route II has been effectively dispersed by the additional new construction of the New Klang Valley Expressway and Shah Alam Highway. Furthermore the circumferential roads of Kuala Lumpur Conurbation have to some extent dispersed the through traffic carried by the radial roads to Kuala Lumpur away from the central area.

The congestion degree on the roads under Plan 2-3 for Kuala Lumpur Conurbation and Other Klang Valley Area are also shown in Figures 6.5 and 6.6.

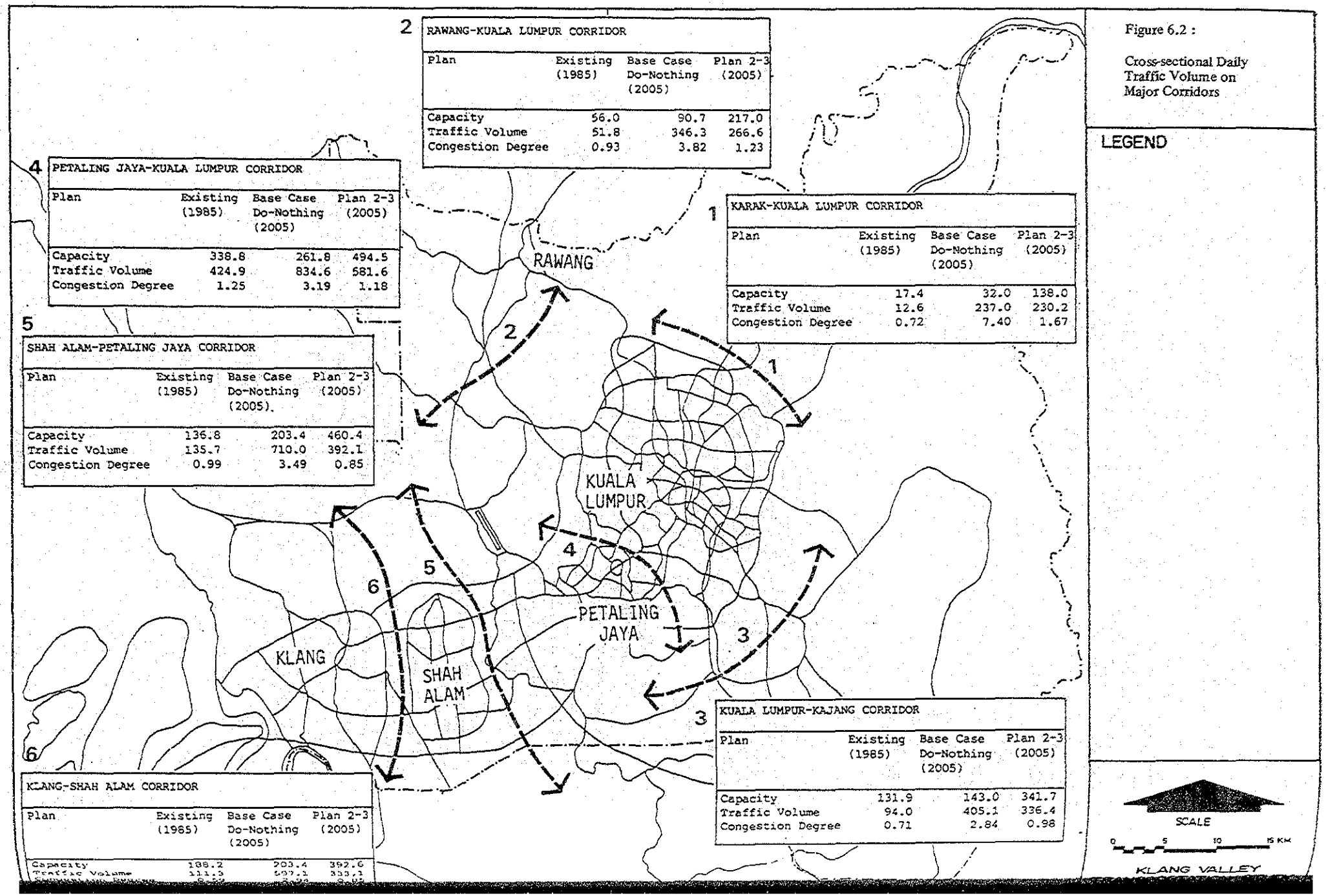
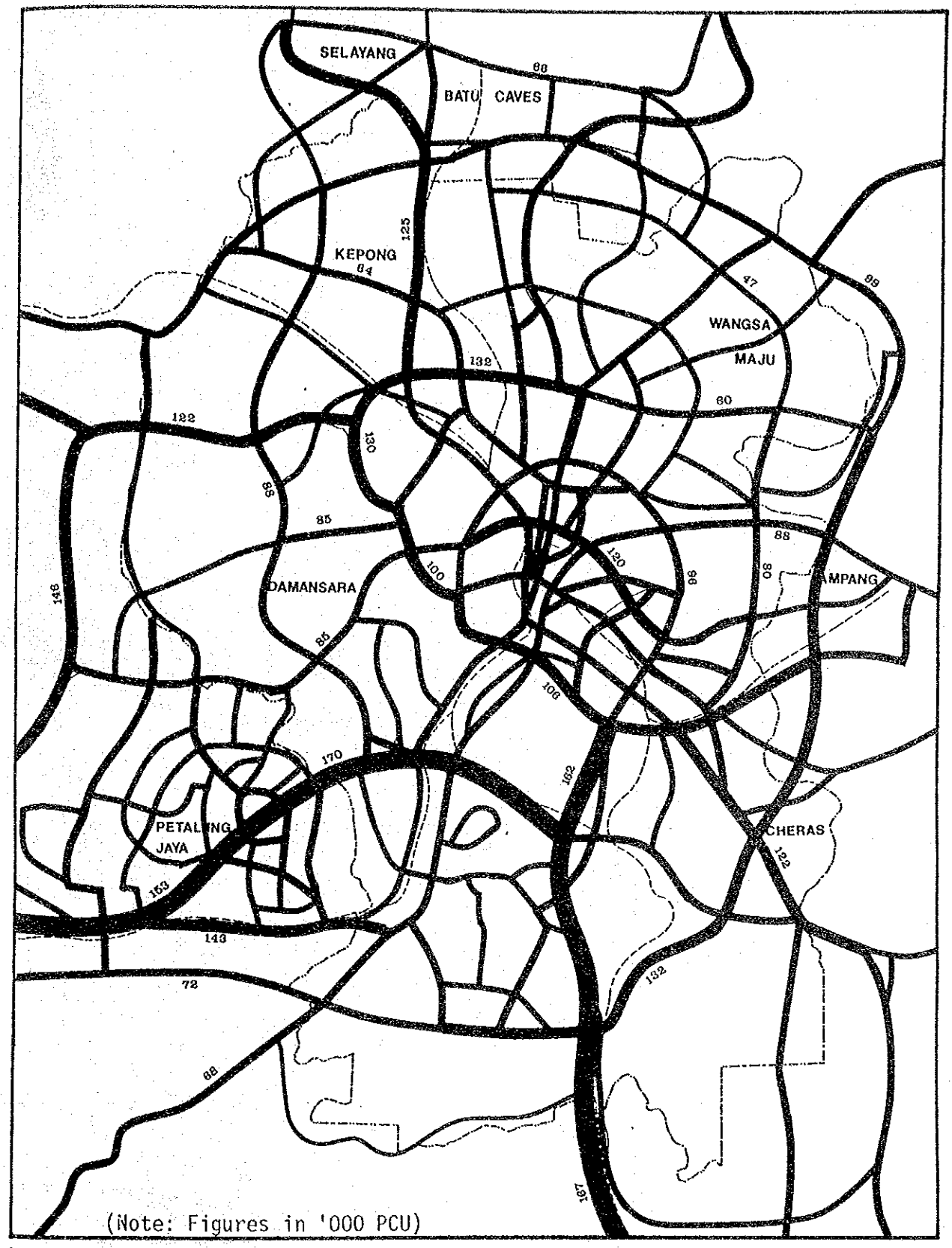


Figure 6.2 :

Cross-sectional Daily Traffic Volume on Major Corridors



LEGEND VOLUME IN PCU

- LESS THAN 10,000
- 10,000 - 50,000
- 50,000 - 100,000
- 100,000 - 150,000
- 150,000 - 200,000

Figure 6.3 :

Traffic Assignment Under Plan 2-3, Kuala Lumpur Conurbation, 2005

SCALE 0 1 2 3 4 5Km

KLANG VALLEY TRANSPORTATION STUDY

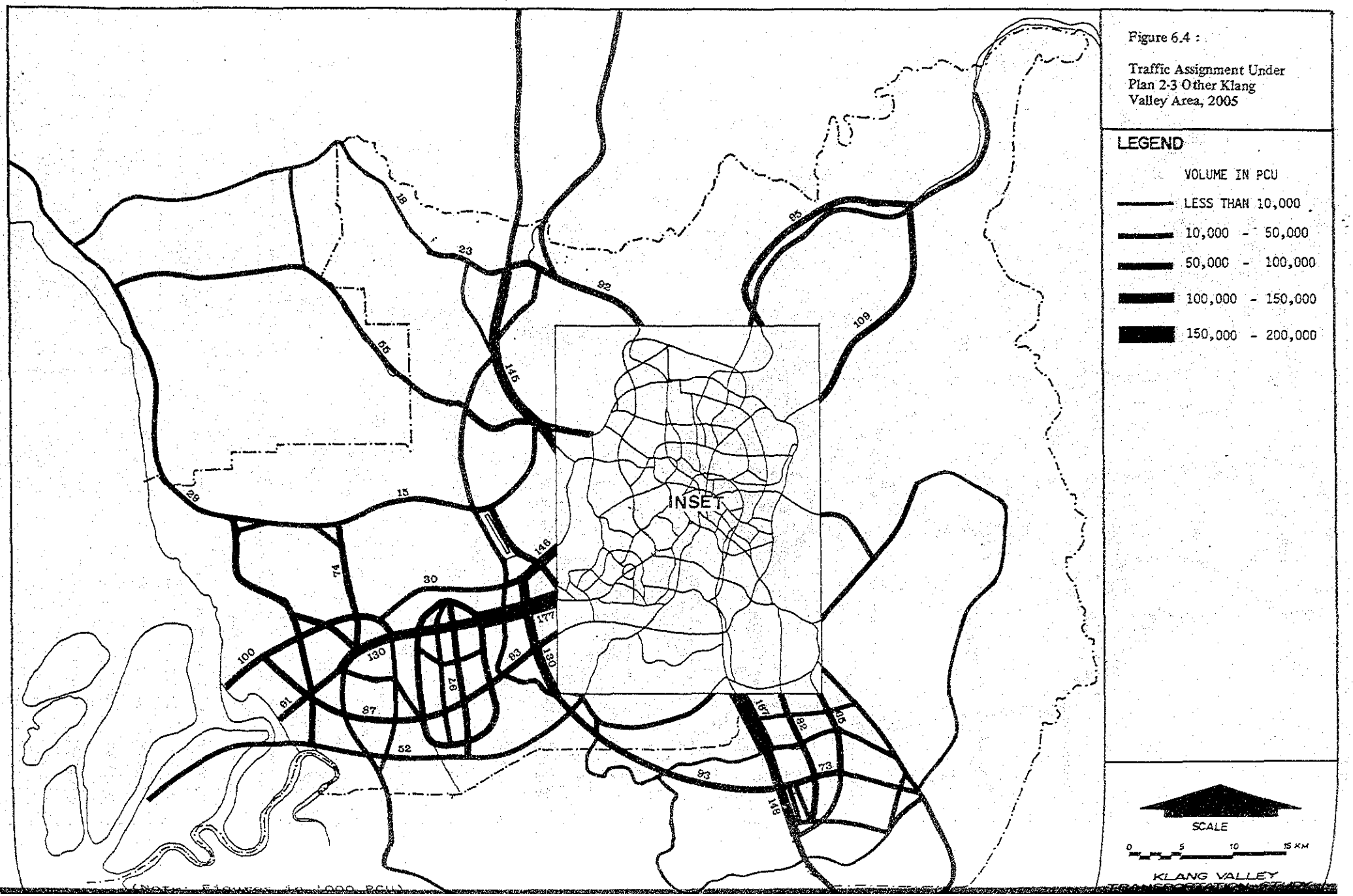
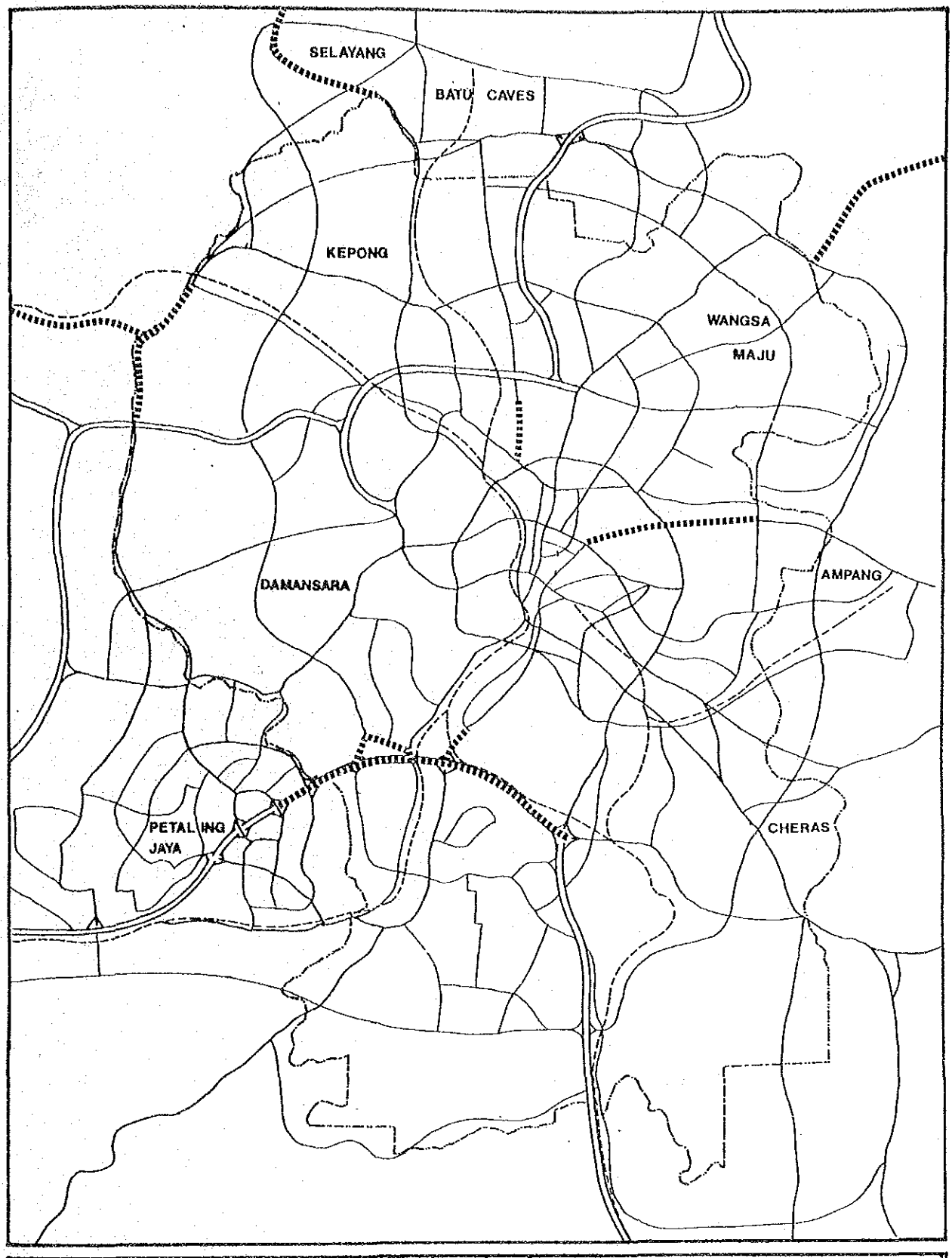


Figure 6.4 :

Traffic Assignment Under Plan 2-3 Other Klang Valley Area, 2005



LEGEND

▪▪▪▪▪▪▪▪▪▪ CONGESTION DEGREE ABOVE 1.5

Figure 6.5 :

Traffic Condition Under Plan 2-3
in Kuala Lumpur Conurbation, 2005

SCALE

0 1 2 3 4 5Km

KLANG VALLEY
TRANSPORTATION STUDY

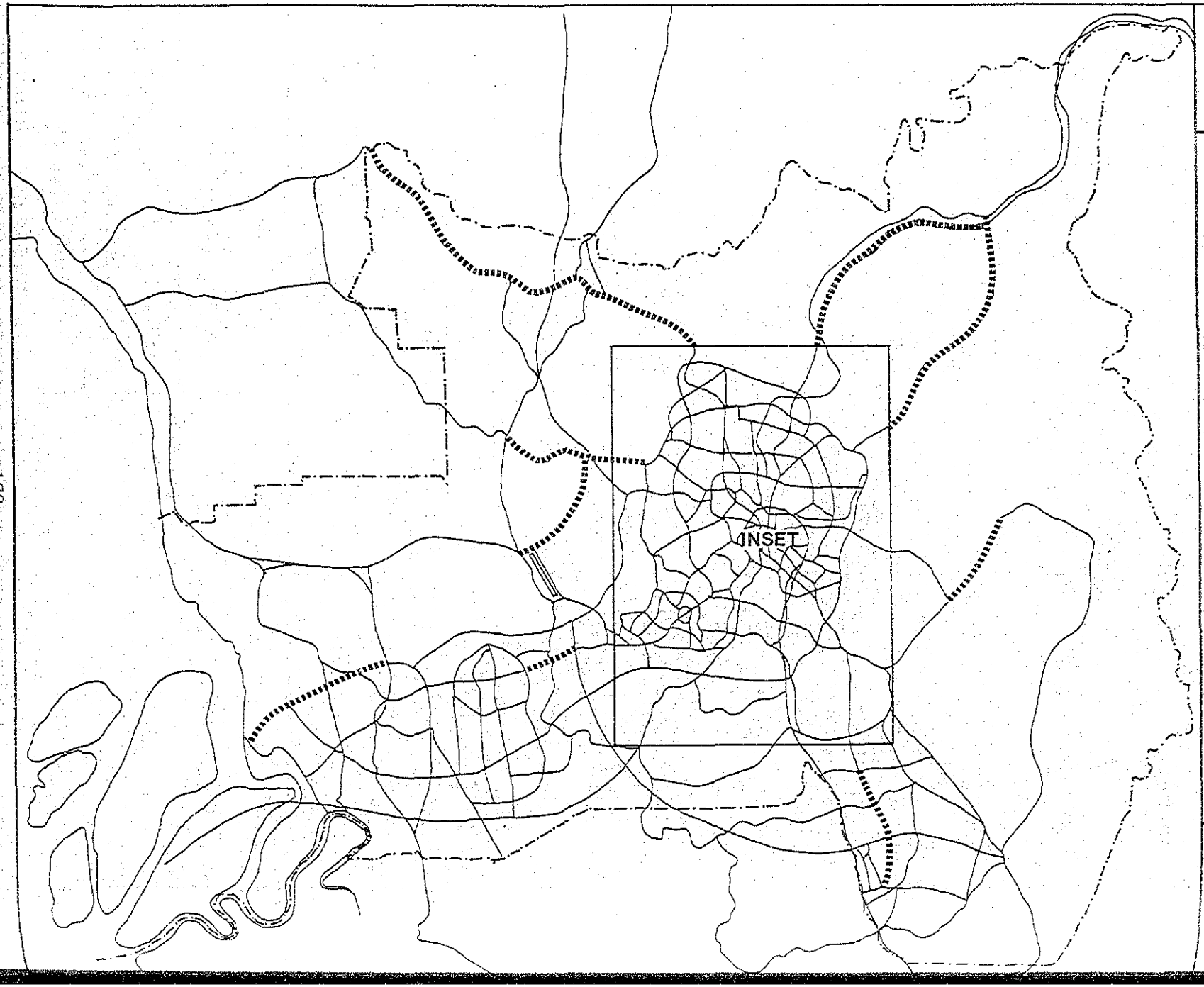


Figure 6.6 :

Traffic Condition Under Plan 2-3 in The Other Klang Valley Area, 2005

LEGEND

CONGESTION DEGREE ABOVE 1.5

SCALE

0 5 10 15 KM

KLANG VALLEY TRANSPORTATION STUDY

6.3.2 Passenger Assignment to Public Transport System

A comparison of the passenger assignment to public transport system in each alternative transportation plan is shown in Table 6.6. Without the LRT/MRT transit system, the number of assigned passenger in Plan 1-1 and 1-2 is about the same as in the Base Plan. However with the inclusion of an extensive LRT and MRT network in Plan 2-1, the number of assigned passengers increases by 23% compared to Base Plan. In Plan 2-2 which has a smaller LRT network than Plan 2-1, the number of assigned passengers increases by only 21%. In Plan 2-3 an increase of 20% is observed and in Plan 2-4 with only LRT network an increase of 17% is observed.

It is also observed that in the introduction of transit system the bus passenger demand in terms of passenger kilometer could be reduced from Plan 1-2 by 30% in Plan 2-1, 23% in Plan 2-2, 19% in Plan 2-3 and only 2% in Plan 2-4. In terms of passenger hours, a reduction from Plan 1-2 by 34% could be achieved by Plan 2-1, 27% by Plan 2-2, 23% by Plan 2-3 and only 4% by Plan 2-4.

Table 6.7 shows a summary of some statistical data on the operation of LRT/MRT system in the alternative plans. It is observed that the transit system in Plan 2-4 has the largest average passengers per kilometer of track length with 13,420 passengers per kilometer followed by Plan 2-1 (8380), Plan 2-2 (8320) and Plan 2-3 with 6,680 passengers per kilometer respectively. A comparison of the average trip length per passenger for the three plans reveals that the LRT is expected to be utilized for shorter trips within Kuala Lumpur Conurbation while the MRT is expected to be used more for the longer inter-town travel within Klang Valley.

Table 6.6 : Summary Of Passengers Assigned To Public Transport System By Alternative Plans, Klang Valley, 2005

Alternative Plan	No. of Assigned Person Trip (1000 Persons)			Passenger km (1000 pass.km)			Passenger hour (1000 pass.hr)			% Increase of Total Assigned Person Trip from Base Plan	% Decrease of Pass.km from Plan 1-2	% Decrease of Pass.hr from Plan 1-2
	Bus	Transit	Total	Bus	Transit	Total	Bus	Transit	Total			
Base Plan	3034	–	3034	34366	–	34366	4187	–	4187	–	–	–
Plan 1-1	3046	–	3046	33180	–	33180	2505	–	2505	–	–	–
Plan 1-2	3046	–	3046	33180	–	33180	2379	–	2379	–	–	–
Plan 2-1	2395	1337	3732	23313	20228	43541	1565	577	2141	23	30	34
Plan 2-2	2549	1135	3684	25597	17130	42727	1730	447	2177	21	23	27
Plan 2-3	2697	945	3639	26952	15183	42135	1843	435	2278	20	19	23
Plan 2-4	2870	671	3541	32485	5981	38466	2292	207	2499	17	2	4

Note : These trips are linked trips exclusive of intrazonal trips

Table 6.7 : Summary Of Transit System Operational Data, Klang Valley, 2005

Item	Plan 2-1			Plan 2-2			Plan 2-3			Plan 2-4		
	MRT	LRT	Total	MRT	LRT	Total	MRT	LRT	Total	MRT	LRT	Total
Route Length (km)	124	78	202	130	36	166	141	–	141	–	50	50
No. of Passengers ('000)	894.5	799.2	1693.7	861.8	519.4	1381.2	945.3	–	945.3	–	670.8	670.8
Passenger Km ('000)	12557.9	4561.9	17119.7	12034.8	2696.0	14730.8	12548.0	–	12548.0	–	4685.0	4685.0
Transit Fare (MS '000)	651.2	300.5	956.7	622.6	189.6	812.2	651.5	–	651.5	–	298.0	298.0
Average Passengers Per Length (pass/km)	7210	10250	8380	6630	14430	8320	6680	–	6678	–	13420	13420
Average Trip Length (km)	14.0	5.7	10.1	14.0	5.2	10.7	13.3	–	13.3		7.0	7.0
Average Transit Fare (MS/pass)	0.73	0.38	0.56	0.72	0.36	0.59	0.69	–	0.69	–	0.44	0.44

Note : 1. All above figures are due to daily unlinked person trips

Figure 6.7 shows the daily bus passenger demand volume on six (6) major corridors and the screenline around the CPA of Kuala Lumpur for Plan 2-3 compared to the existing situation and the Base Plan or 'Do-nothing' case in 2005. The bus passenger demand on all screenlines except that over the Karak-Kuala Lumpur Corridor could be expected to be reduced compared to the Base Plan.

Figures 6.8 to 6.11 show the daily transit passenger flow of major cross-sections or the LRT/MRT lines in each alternative plan. All four plans have a similar general pattern of passenger flow. In Plan 2-3, it is observed that without the LRT network, there is a substantial increase in passengers on the MRT lines compared to the other two cases. For example, the passengers at the section near Kuala Lumpur station is observed to be 123,000 passengers per day in Plan 2-1 but in Plan 2-3, this is increased by more than 50% to 189,000 passengers per day. This increase is seen to be from the passengers who would have used the LRT when it was available.

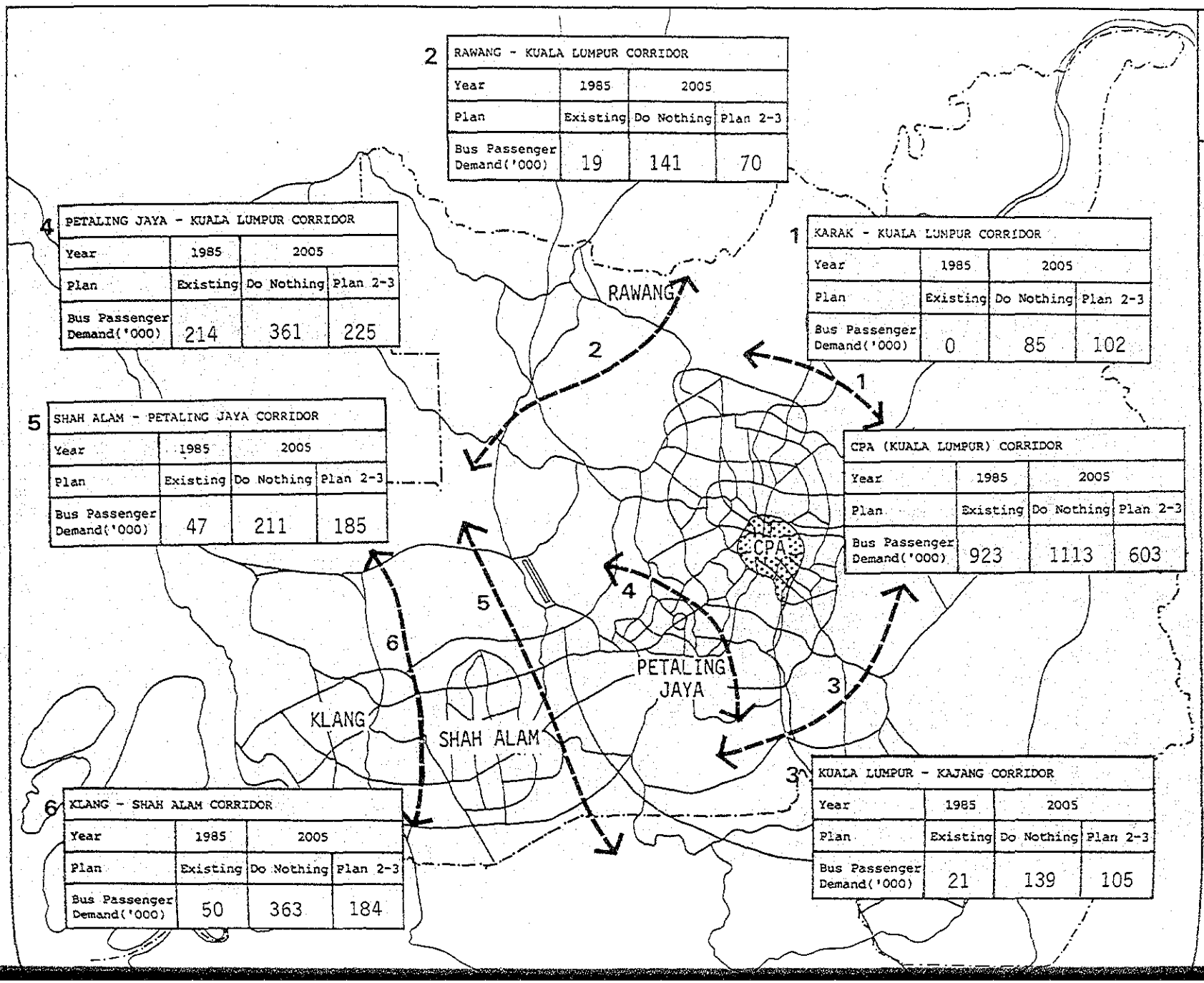
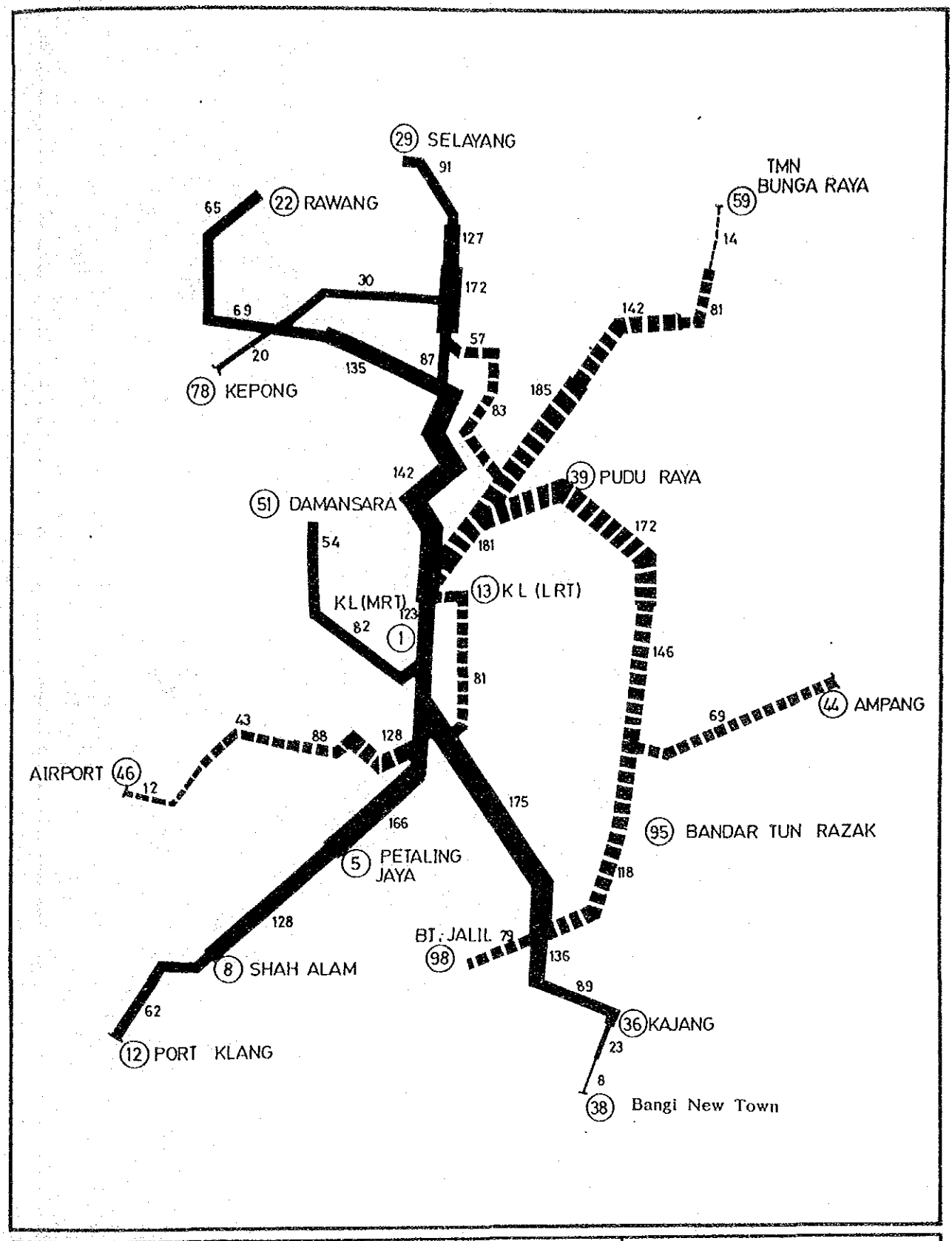


Figure 6.7 :

Cross-sectional Daily Bus Passenger Demand on Major Corridors



LEGEND

Volume of railway passengers ('000 persons /day)

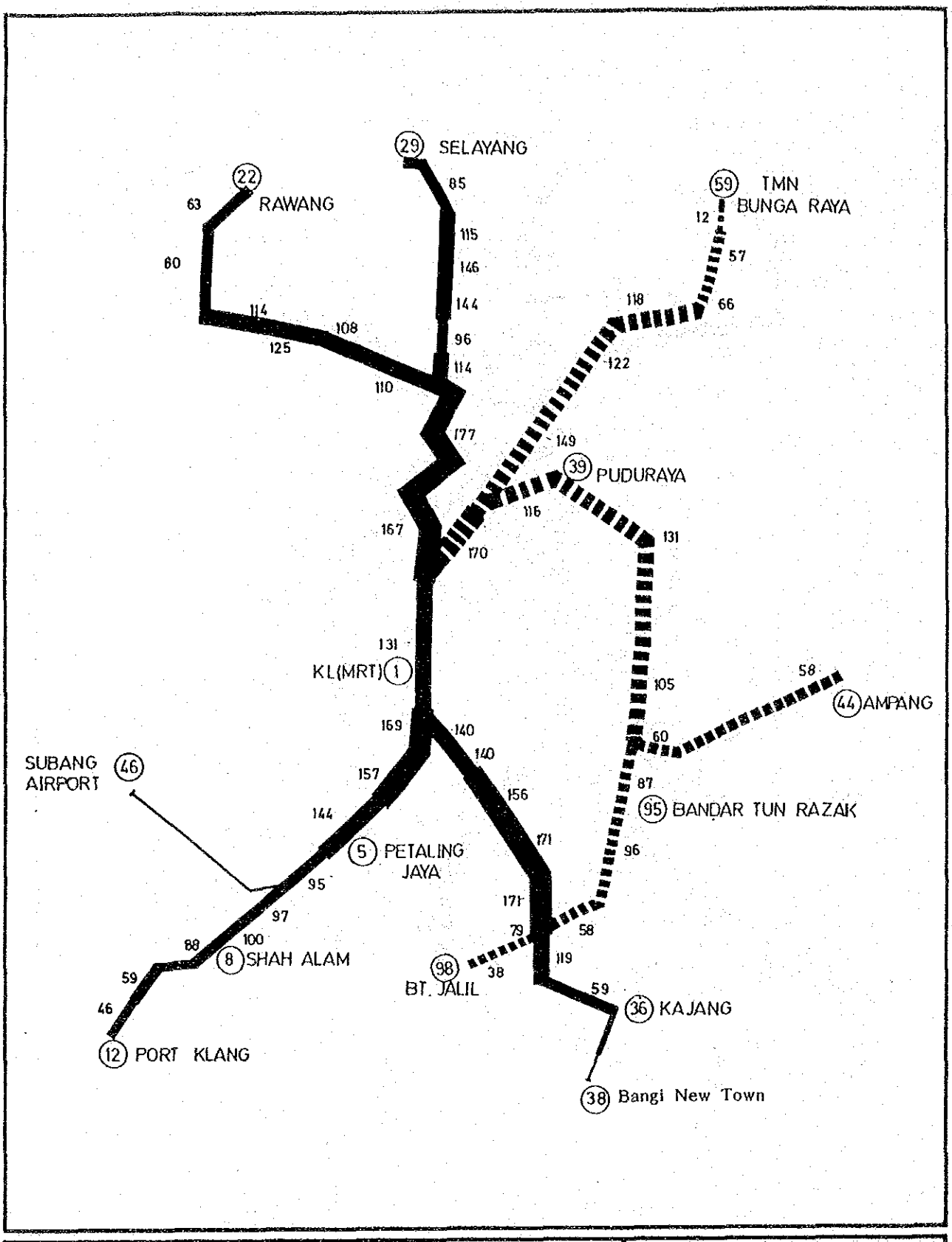
MRT	LRT	
	- - - -	Less Than 10
	▬ ▬ ▬	10 - 25
	▬ ▬ ▬	25 - 50
	▬ ▬ ▬	50 - 100
	▮ ▮ ▮	100 - 150
	▮ ▮ ▮	150 - 200

5 STATION NO

Figure 6.8 :

Railway (Plan 2-1)
Traffic Assignment
in 2005

KLANG VALLEY,
TRANSPORTATION STUDY



LEGEND

Volume of railway passengers ('000 persons/day)

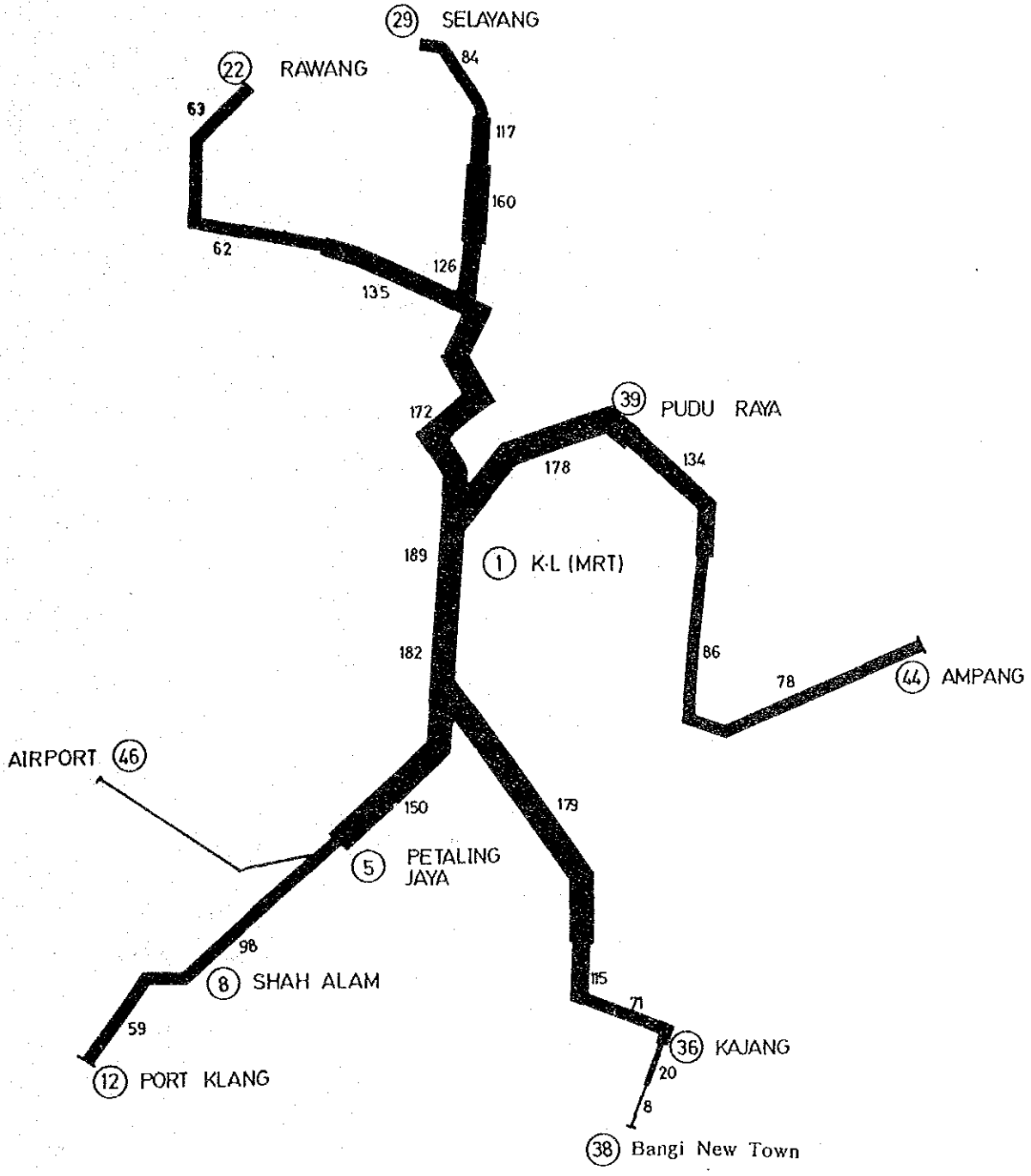
MRT	LRT	
		Less Than 10
		10 - 25
		25 - 50
		50 - 100
		100 - 150
		150 - 200

(5) STATION NO

Figure 6.9 :

Railway (Plan 2-2)
Traffic Assignment
in 2005

KLANG VALLEY
TRANSPORTATION STUDY



LEGEND

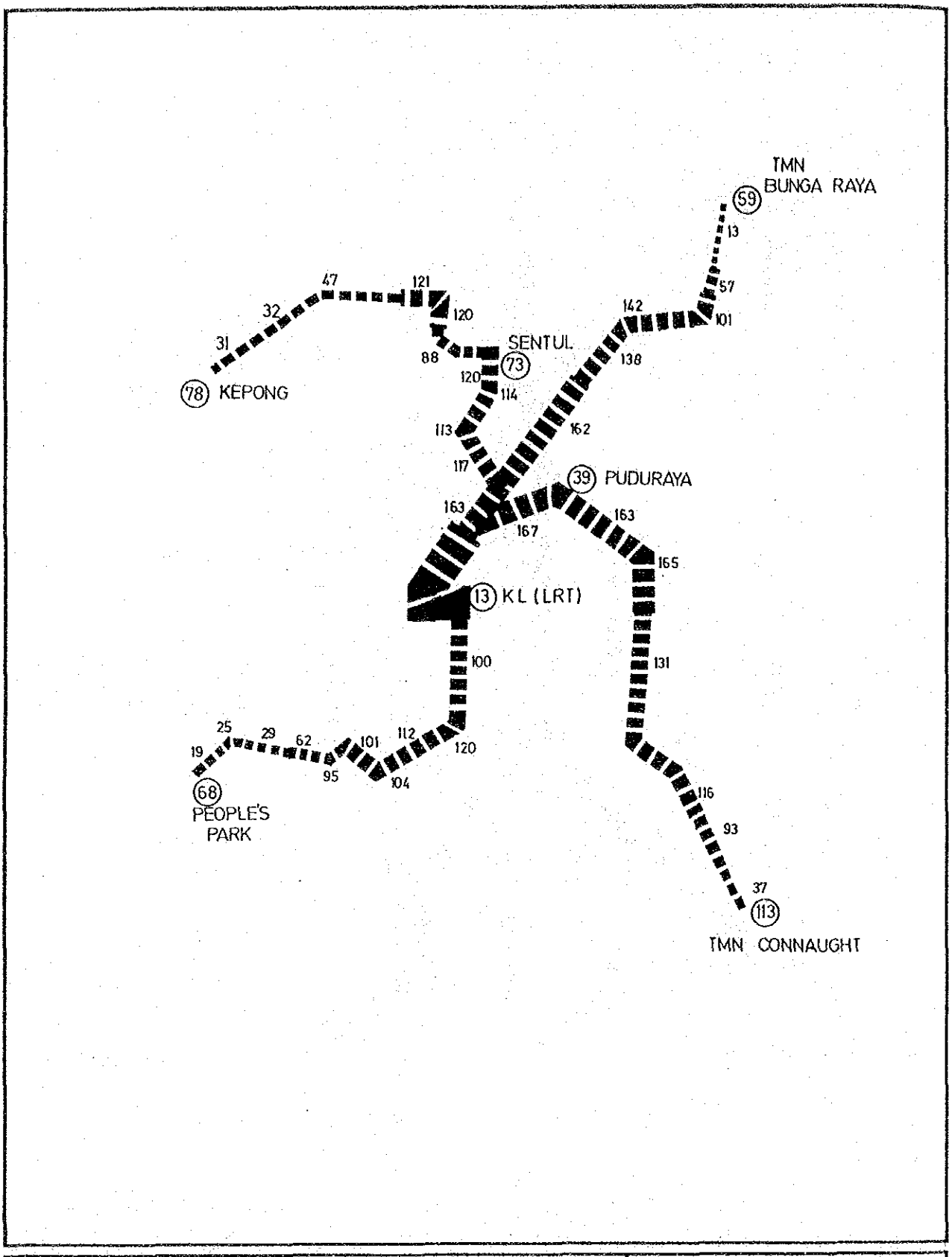
Volume of railway passenger ('000 person/day)

- Less Than 10
- 10 - 25
- 25 - 50
- 50 - 100
- 100 - 150
- 150 - 200
- (5) Station No.

Figure 6.10

Railway (Plan 2-3)
Traffic Assignment
in 2005

KLANG VALLEY
TRANSPORTATION STUDY



LEGEND

Volume of railway passengers ('000 persons /day)

LRT

- Less Than 10
- 10 - 25
- 25 - 50
- 50 - 100
- 100 - 150
- 150 - 200

13 STATION NO

Figure 6.11 :

Railway (Plan 2-4)
Traffic Assignment
in 2005

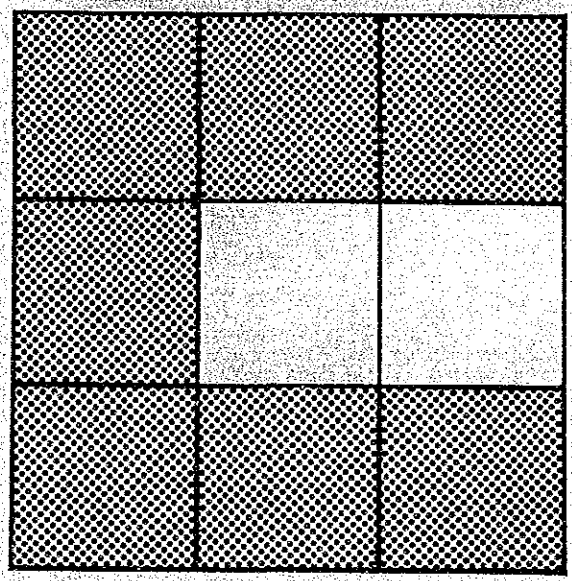
KLANG VALLEY
TRANSPORTATION STUDY

6.3.3 Impact on Traffic Volume by the Vehicle Restraint Measure

The option of cordon pricing as a possible traffic limitation measure to the vehicle usage is evaluated in six plans, i.e. Plan 1-1w to Plan 2-4w. Cordon pricing is assumed to be implemented on all vehicles except motorcycle and buses during the time period 6.00 am to 10.00 am. A cordon fee of M$2.00 per entry is levied on vehicles entering the CPA of Kuala Lumpur. Based on the Traveller's Attitude Survey, a 20% reduction in the vehicle trips during the cordon pricing time period can be expected. Table 6.8 shows the reduction in vehicle trips per day due to introduction of cordon pricing in each alternative plans.

Table 6.8 : Reduction In Daily Vehicle Trips By Plans Due To Cordon Pricing, 2005

Alternative	No. of Vehicle Trips Reduction (PCU)
Plan 1-1-w	41,240
Plan 1-2-w	41,240
Plan 2-1w	37,680
Plan 2-2w	37,950
Plan 2-3w	38,273
Plan 2-4w	38,368



CHAPTER 7 : EVALUATION OF ALTERNATIVE TRANSPORTATION PLANS

7. EVALUATION OF ALTERNATIVE TRANSPORTATION PLANS

7.1 General

This chapter describes the evaluation of the alternative transportation plans established in Chapter 5. In order to formulate the transportation plan which consists of multi-mode transportation systems it is necessary to evaluate the plans comprehensively. Hence the evaluation procedure as illustrated in Figure 7.1 is employed in this Study.

The evaluation of the alternative transportation plans is principally to make a judgement of one of these plans being superior to the others taking into consideration one or multiple criteria.

The criteria that are mainly used for the evaluation of the plans are:–

(a) Functional Suitability of Transportation Systems

(b) Financial Analysis of Private and/or Public Enterprises

(c) Economic Evaluation

These criteria will be explained below.

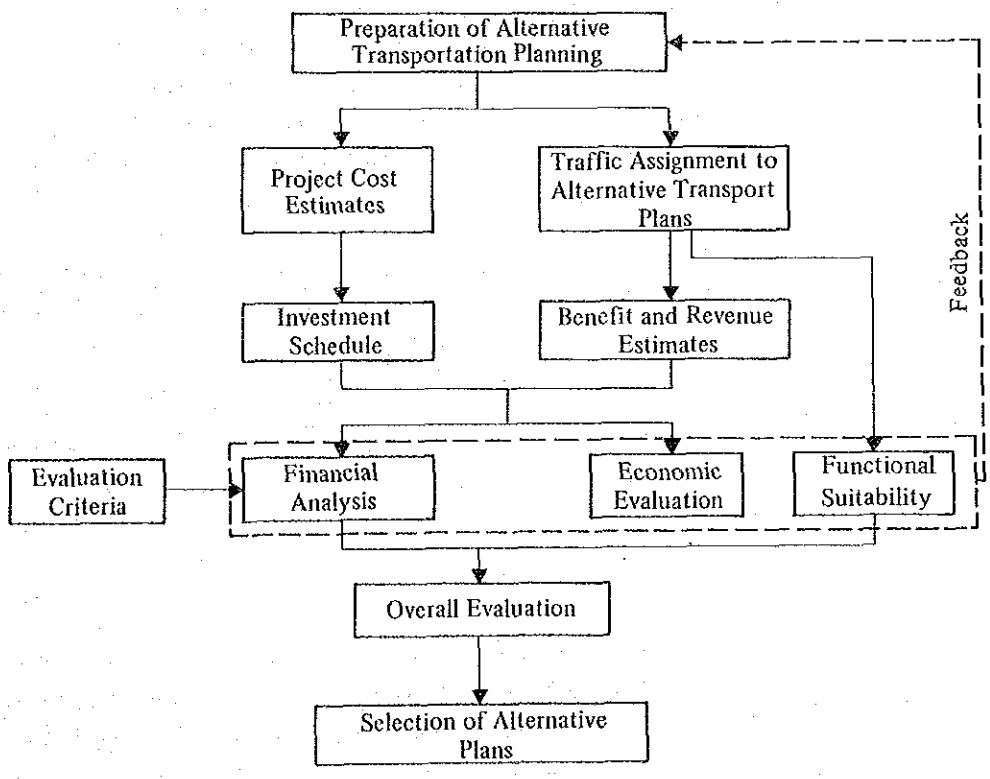


Figure 7.1 : Procedure For Evaluation Of Alternative Plans

(a) Functional Suitability Analysis

The functional suitability evaluation criterion is concerned with how well or how poorly a transportation plan is likely to work as the future transportation system for the region. This criterion is concerned only with the level of services provided.

The following indicators will be used to compare the level of service affordable by alternative plans.

(i) Volume/Capacity Ratio

For the road transport system an important consideration in the evaluation of its functional suitability is the ability of the proposed plan to be able to adequately carry the forecasted travel demands. As in the 'Do-nothing' case, each alternative plan will be assessed at the outset to carry the forecased road traffic at level of service 'D'. This level of service is the representative of operation at 80% of capacity condition when the volume/capacity ratio is 1.0. A volume/capacity ratio below 1.0 indicates that the road transport system is functioning at a better service level, while a ratio over 1.0 indicates capacity is insufficient or conversely, demand is too great.

(ii) Travel Speed

A comparison of travel speed indicates functional ranking of alternative plans. Vehicle running speed will change in every instance from reduced congestion, the removal of serious capacity deficiencies and a general improvement in traffic flow.

(iii) Trip Length

Traffic demand on the road is also a function of trip length per vehicle trip. The longer the trip length, the greater is the traffic demand on the road network. Therefore, a plan capable of reducing trip length is also capable of reducing the traffic congestion.

(iv) Travel Time

This factor is one of the elements determining the transport cost of an alternative plan. A reduction in travel time implies savings to the time cost incurred by trip makers.

(v) Public Transport

As described in Chapter 5, the desirable transportation plan for the Klang Valley should be able to provide a balanced modal share between public and private modes. To this end the functional suitability of an alternative plan also needs to be evaluated in terms of the enhancement of public transport demand and the level of service provided to public transport users. In each alternative plan, all other public transport operation factors being kept equal, the comparison of travel time per person trip stands out as a good measure of the public transport service provided.

(b) Financial Analysis

Financial analysis ought to be conducted in cases where the enterprises or projects generate income and are required to be forecasted as an individual accounting system. The financial analysis is essentially to determine the viability of the enterprises and projects. In the Klang Valley Transportation Study, the LRT/MRT System which will be operated by an agency or private enterprise in future will be evaluated financially.

It is possible to evaluate individual enterprises from the financial viewpoint. However in the formulation of a Transportation Masterplan for Klang Valley, only one representative enterprise is assumed in the analysis.

Similar to a private enterprise, the financial analysis operator LRT/MRT can be done by a cash flow analysis and/or the financial rate of return analysis. In this Study, the financial rate of return analysis is used.

(c) Economic Evaluation

The implementation of transportation plans involve substantial capital expenditure. Such expenditure has to be justified by an economic evaluation. The economic evaluation procedure employed in the Study is designed to estimate the costs and benefits derived from as many alternative transportation plans as possible and is aimed at providing sufficient data for important decision making. The economic evaluation will determine whether or not the economic benefit of the proposed transportation plan justifies its implementation as compared to the implementation of other transport alternatives.

The economic evaluation procedure involves a comparison of the costs of supplying transport services in each alternative plan and the benefits derived from these services. The comparison is expressed as:–

(a) Benefit-Cost Ratio (B/C Ratio)

(b) Internal Rate of Return (IRR)

(c) Net Present Value (NPV)

These indicators are used to determine the economic feasibility of each alternative plan. In comparison to evaluation of a single transport project, the evaluation of a multi-modal transportation system plan from an economic view point is often more complicated due largely to the involvement of many beneficiaries and impacts. The beneficiaries considered in this Study can be listed as below.–

(i) Users

* Car Users
* Motor cycle Users
* Bus Users
* LRT/MRT Users

(ii) Operators
   * Bus Operators
   * LRT/MRT Operators
   * Truck Operators

(iii) Government

Table 7.1 shows the beneficiaries and their benefits. Out of pocket expenses such as bus fare, toll charges, etc. are in fact transfer of payment as fare revenue to the transport operators. The costs to one is revenue to the other. In the economic evaluation therefore out of pocket expenses of users are not accounted.

Table 7.1: Beneficiaries and Their Benefits

Beneficiaries	Benefits
(1) USERS	
(a) Car Users	* Saving on Vehicle Operating Cost * Saving on Time Cost
(b) Motor Cycle Users	* Saving on Vehicle Operating Cost * Saving on Time Cost
(c) Bus Users	* Saving on Time Cost
(d) LRT/MRT Users	* Saving on Time Cost
(2) OPERATORS	
(a) Bus Operators	* Saving on Capital Cost * Saving on Operating Cost
(b) LRT/MRT Operators	* Saving on Capital Cost * Saving on Operating Cost
(c) Truck Operators	* Saving on Capital Cost * Saving on Operating Cost
(3) GOVERNMENT	* Saving on Capital Cost * Saving on Operating Cost

7.2 Functional Suitability Analysis

The alternative transportation plans are evaluated first from the functional suitability perspective. In this analysis the indicators describing the service level on the road transport system and the public transport service are used to compare the performance of the six alternative plans with the Base Plan.

Comparing the results tabulated in Tables 7.2 and 7.3, the following observations are made:–

(a) With regard to congestion degree compared to the Base Plan, all the other alternative plans display significant improvement of the overall average congestion degree on roads in Klang Valley. Among these plans, however, only Plans 2-1, 2-2 and 2-3 have a congestion degree of 1.0 which is the acceptable level in transportation planning.

(b) It is observed that compared to the Base Plan, the average travel speed per vehicle in all the other alternative plans increases by two fold and more. Among these plans, Plans 2-1, 2-2 and 2-3 allow the fastest traffic flow on the road network with 27 kph compared to 11 kph in the Base Plan.

(c) Compared to the Base Plan, the average travel time per vehicular trip and average trip length per vehicular trip in all the other alternative plans show improvement. Among these plans, Plan 2-1, Plan 2-2 and Plan 2-3 show significant improvement to the traffic flow on the road network with the average travel time being shortened by more than 50 minutes and the average trip length being reduced by 2.8 km.

(d) Compared to the Base Plan, the average travel time of the public transport passengers is observed to be shorter by 49 minutes in Plan 2-1, 48 minutes in Plan 2-2, 45 minutes in Plan 2-3, 41 minutes in Plan 2-4, 36 minutes in Plan 1-2 and 34 minutes in Plan 1-1.

(e) The introduction of transit system in the alternative plan could increase the number of public transport users by 17% to 23% as compared to alternative plans without transit system.

(f) The following conclusion in the functional suitability of the alternative plans can be deduced.

Although the road oriented plans, viz Plan 1-1 and Plan 1-2 are able to improve much the road traffic congestion that would occur in the case of 'Do-nothing' situation, the resulting level of congestion degree in both plans is still slightly below the service level 'D'. The inclusion of Mass Transit System into Plan 1-2 would bring the congestion degree to this level as indicated in Plan 2-1, Plan 2-2, Plan 2-3 and Plan 2-4.