Chapter 5 ALTERNATIVE TRANSPORT PLANS

5. ALTERNATIVE TRANSPORT PLANS

5.1 Planning Goals

5.1.1 Background

By the year 2000 the population of the State of Penang will have increased to about 1.6 million and about 6,000 hectares of land will have been developed for urban activities in the Study Area. This economic growth will result in a large increase in transport demand to threefold the present trip production. In addition, the basic transport structure of the State will be changed after completion of the Penang Bridge and the New Federal Route I. Thus, improvements in the transport network are urgently needed to meet future demand.

5.1.2 Policy for the Improvement of the Transport System

The team identified the following goals for the future transport system.

* To maintain a high quality urban environment.
* To maximize the benefits of the urban transport economy.
* To maximize resource consumption.
* To provide a safe means of transport.

In order to achieve these goals, the following should be planned.

* The establishment of the future road network.
* The improvement of the public transport system.
* The improvement of traffic management and operations.

The following items should also be taken into account in order to obtain better results.

* The continued preservation of historical places and their environs in George Town itself is seen as part of the maintenance of the good quality of life and urban environment.
* The future transport system should correspond to the changes in land use, such as the development of Bayan Lepas and Prai, as well as to the changes in road network, as in the construction

of the Penang Bridge, the Dispersal Roads and New Federal Route I.

5.2 Road Network Plan

5.2.1 The Premise

Prior to the formulation of the transport plan, the committed development projects within the Study Area are as follows:-

* Federal Route No. 1 and two (2) of its related intersections.
* Penang Bridge which connects Province Wellesley and Penang Island.
* Disperal Road connecting with the Penang Bridge.

5.2.2 Examination of Transport Demand

In order to develop the guidelines for road network planning, the results of the land use plan and the traffic demand estimation were reviewed.

The expected changes estimated in the study area from 1977 to the year 2000 are summarized as follows:-

A. Change of Urban Structure

* The population increase of about 483,000 in the Study Area will be absorbed mainly in Bayan Lepas and the area along the Federal Route I between Butterworth and Bukit Mertajam. Accordingly, in the year 2000, there will be two (2) urban corridors: between George Town and Bayan Lepas and Butterworth and Bukit Mertajam.
* Employed population will increase mainly in Bayan Lepas and Prai; thus, there will be four (4) major employment areas. In the C.B.D of George Town, the population is expected to decline and this will further characterize it as a C.B.D.

B. Change in Transport Demand

* Total number of trips will increase to about triple the present number. Especially in Bayan Lepas and Prai, a very large number of trips will be produced.

* Main desired traffic flow will be as follows:-

  . Between Penag Island and Province Wellesley.

  . Between George Town and Bayan Lepas.

  . Between the Parai-Butterworth urban coridor and that of Bukit Mertajam.

* Corresponding to the expansion of residential areas and urban functions, trips will be longer and the pattern of commuting trips will change to that which is shown in the following figures.

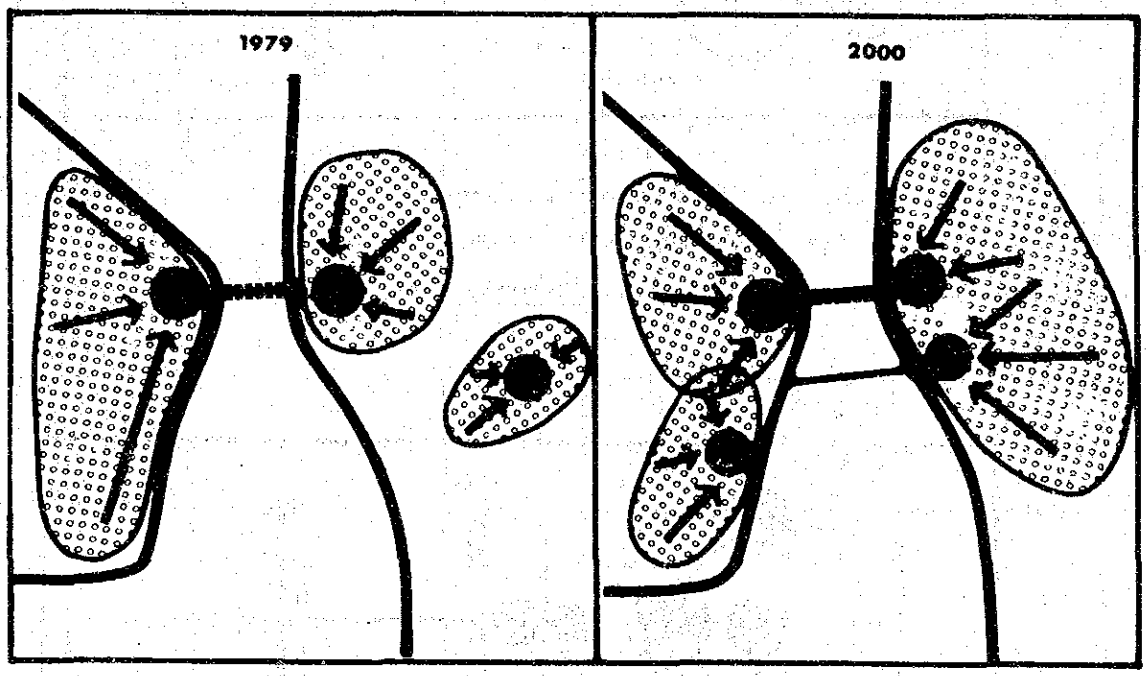
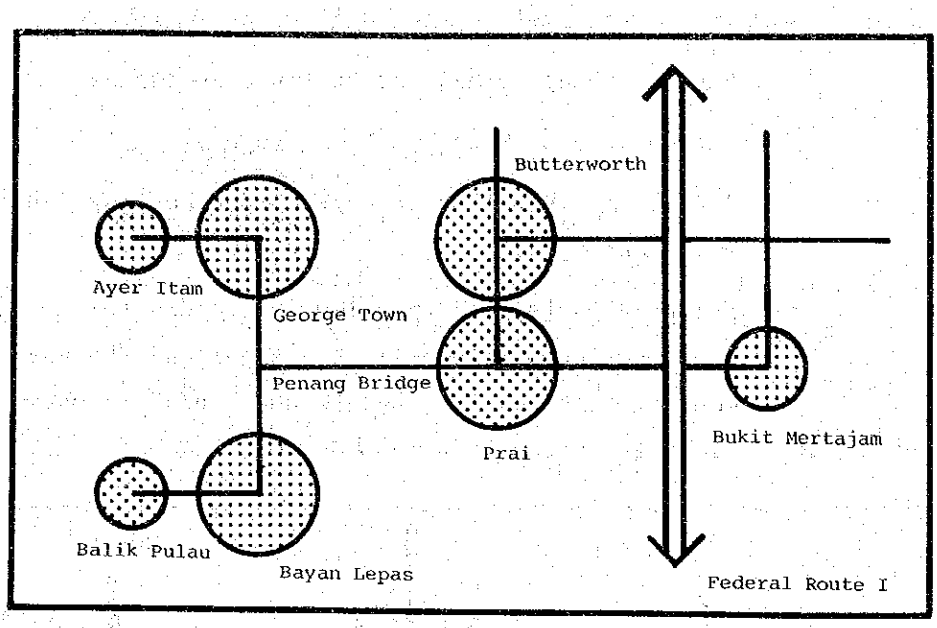


Fig. 5.1 Commuting Trip Territories

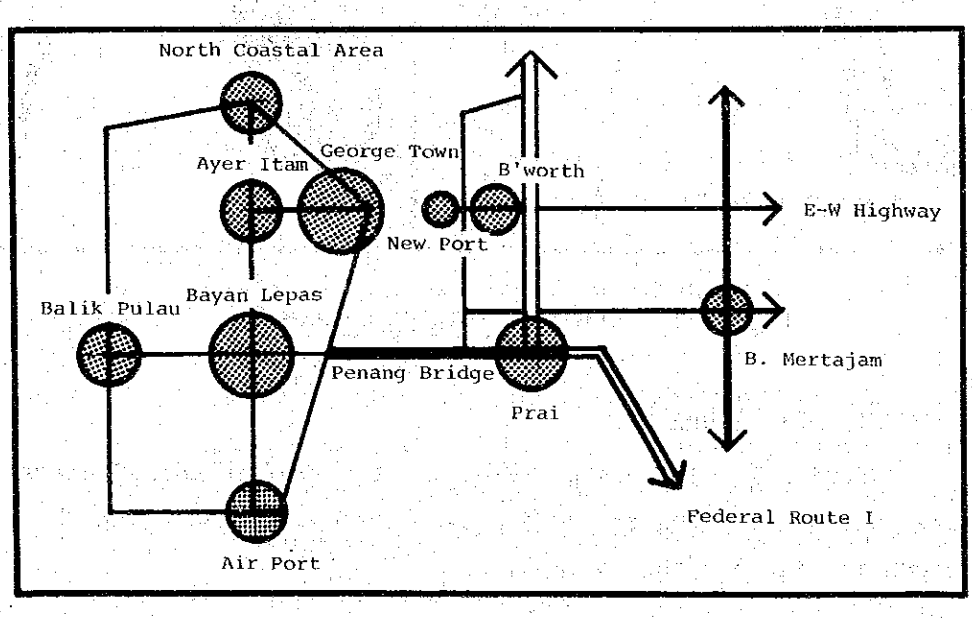
5.2.3 Conceptual Planning

Bearing in mind the policies and the traffic demand characteristics, the conceptual plans for road network were prepared using the steps shown in Fig. 5.2 to 5.4 below.



* Connect the major regional cores
* Establish the functional network

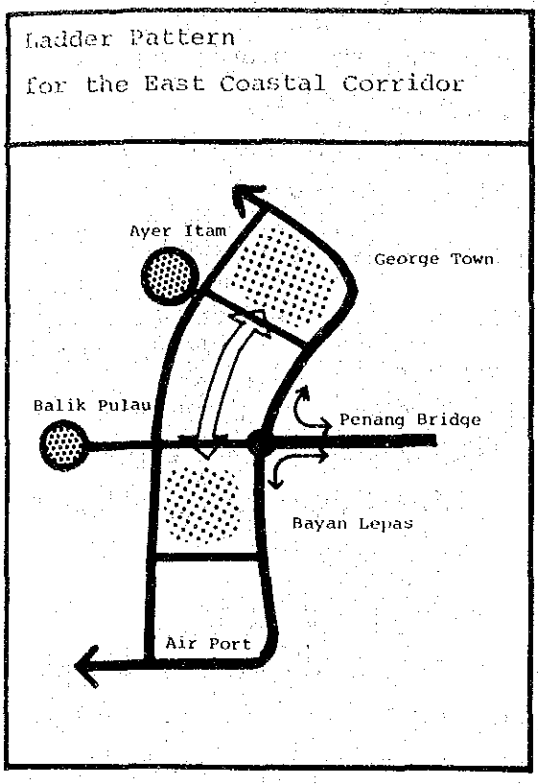
Fig. 5.2 Planning Step I

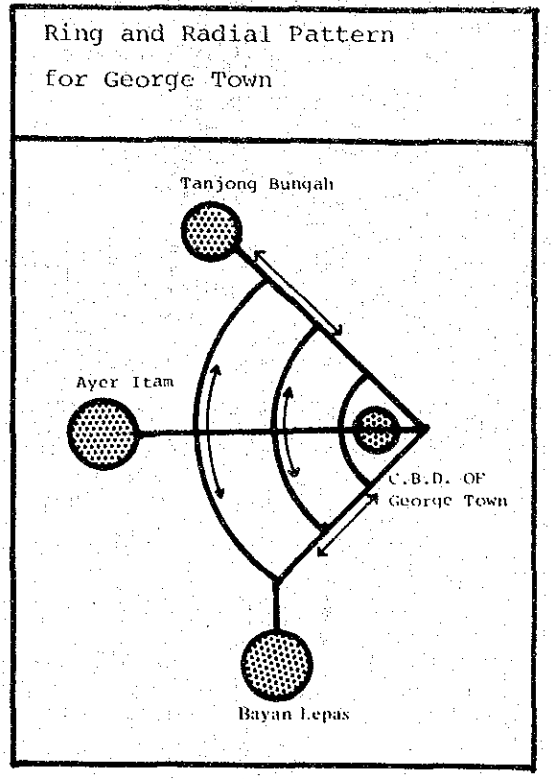


* Identify the basic road network

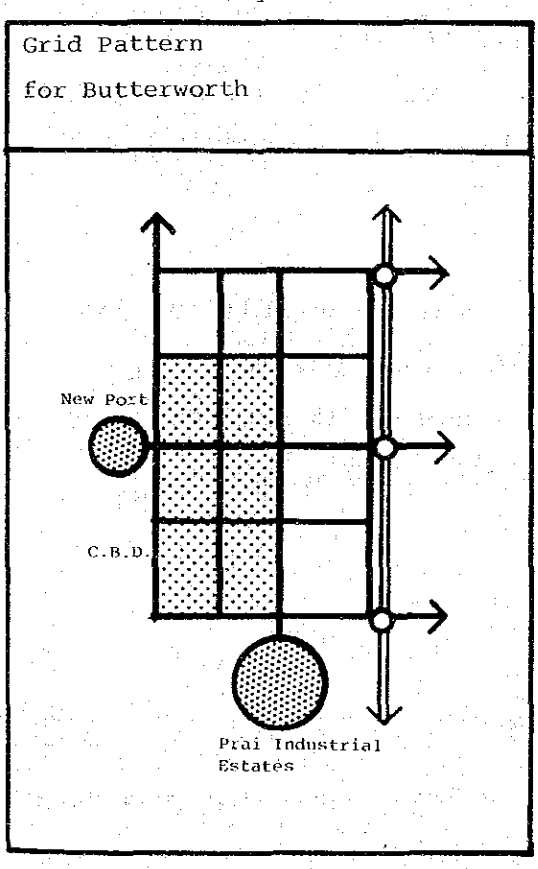
Fig. 5.3 Planning Step II

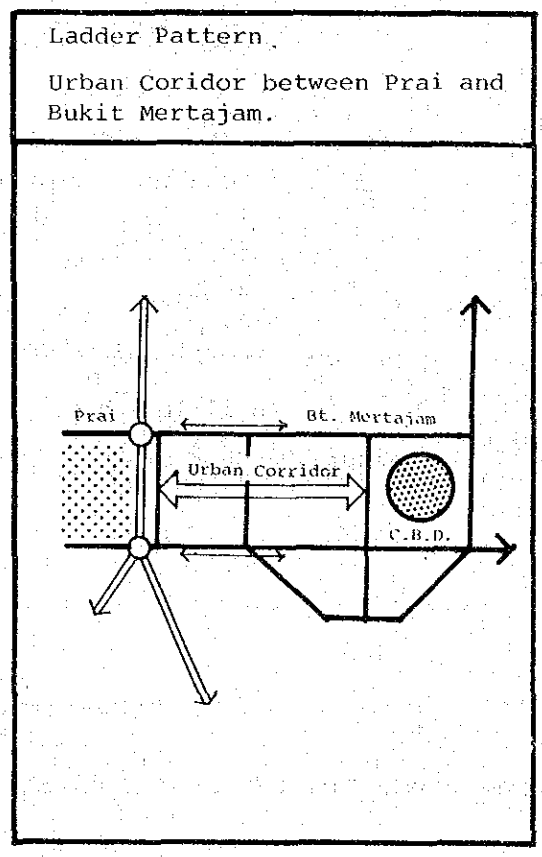
a. Penang Island





b. Province Wellesley





* Identify traffic circulation in the Urban Areas.

Fig. 5.4 Planning Step III

5.2.4 Road Network Plan

Considering the various local conditions, the future road network plan was prepared to follow the pattern proposed in the planning steps. Primary distributors and district distributors, which are defined in the following four (4) categories of roads, were proposed.

a) Primary distributors (Planning Steps I and II)

These roads form the primary network for the town as a whole. All long-distance traffic movements to, from and within the town should be channeled to the primary distributors. The primary distributors may be divided into two (2) types: one type between urban areas (inter-urban) while the other within the urban areas (intra-urban).

b) District distributors (Planning Step III)

These roads distribute traffic within the residential and industrial areas and principal business districts of the town. They form the link between the primary network and the roads within the surrounding areas.

c) Local distributors (Planning Step III)

These roads distribute traffic within the surrounding areas. They form the link between district distributors and access roads.

d) Access roads

These roads give direct access to buildings and land within the surrounding areas.

The total length of proposed road networks is 102.3 Km for Penang Island and 85.8 Km for Province Wellesley. (Table 5.1, 5.2).

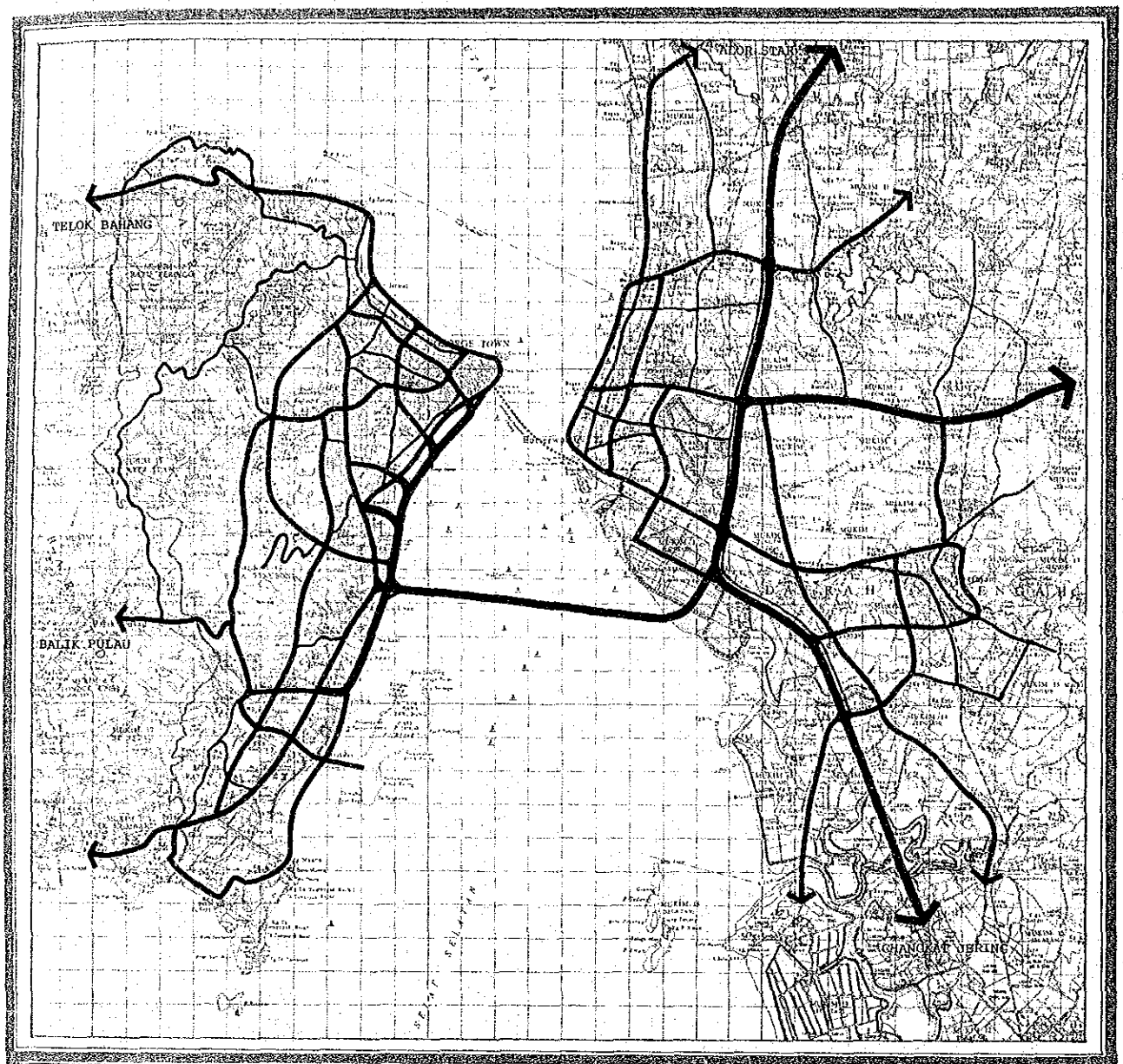


Fig.5.5 Proposed Road Network

NORTH

Primary Distributor (Inter-Urban)

Primary Distributor (Intra-Urban)

District Distributor

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URBAN TRANSPORT STUDY IN GREATER METROPOLITAN AREAS OF GEORGETOWN, BUTTERWORTH AND BUKIT MERTAJAM

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Table 5.1 Construction and Improvement of Roads on Penang Island

Name of Roads	Total Length (Kms)		
	Improvement Section	New Construction Section	Total
1. Gurney Drive Extension	1.5	3.1	4.6
2. Outer Ring Road from Bagan Jermal to Ayer Itam	1.5	4.0	5.5
3. Outer Ring Road from Ayer Itam to Green Lane	0	9.5	9.5
4. Green Lane from Ayer Itam Road to Roundabout	5.0	0	5.0
5. Scotland Road from Ayer Itam Road to Western Road	1.4	0	1.4
6. Western Road from Scotland to Gottlieb	1.5	0	1.5
7. Middle Ring Road (Perak Road, Pangkor Road)	2.4	0	2.4
8. Weld Quay Extension	0	4.0	4.0
9. Paired Road from Ayer Itam to Outer Ring Road	0	5.3	5.3
10. Paired Road from Outer Ring Road to Dispersal Road	0	3.5	3.5
11. Bayan Lepas Road	0	3.6	3.6
12. East Coastal Road	0	5.8	5.8
13. North Coast Road from Tanjong Bungah to Batu Feringgi	5.4	6.1	11.5
14. Penang Island Road from Airport to Telok Kumbar	4.6	0	4.6
15. Penang Hill Road Section 1	0	5.0	5.0
16. Penang Hill Road Section 2	0	13.0	13.0
17. Penang Hill Road Section 3	0	2.0	2.0
18. Jelutong Road	0.3	0	0.3
19. Leboh Mc. Nair	0.2	0	0.2
20. Maxwell Road	0.9	0	0.9
21. Dato Keramat-Ayer Itam Road to Ayer Itam Intersection	2.2	0	2.2
22. Ayer Itam Road from Ayer Itam	4.0	0	4.0
23. Penang View Road	0	6.5	6.5
Total	30.9	71.4	102.3

(refer to Fig. 5.6)

Table 5.2 Construction and Improvement of Roads in Province Wellesley

	Name of Roads	Total Length (Kms)		
		Improvement Section	New Cosntruc-tion Section	Total
1.	S. Dua Road from Kg. Bagan Ajam to S. Dua	4.5	0	4.5
2.	West Coastal Road from Kg. Bagan Ajam to New Port	0	5.5	5.5
3.	West Coastal Road from New Port to intersection at Alor Star - Changkat Jering Highway	2.0	3.0	5.0
4.	Federal Route I of Intersection at Alor Star - Changkat Jering Highway and Jalan Methopalaniapa	7.5	0	7.5
5.	Ring Road in B. Mertajam from Kg. Uma to P. Jatoh	0	2.5	2.5
6.	Ring Road in B. Mertajam from P. Jatoh to Alor Star - Changkat Jering Highway	0	5.5	5.5
7.	Permatang Pauh Road from Kg. Sama Cagah to S. Ampat	6.5	0	6.5
8.	B. Tengah Road from S. Ampat to Kg. Bukit Minyak	5.0	0	5.0
9.	Bukit Minyak Road to Alor Star - Changkat Jering Highway	0	3.9	3.9
10.	Jalan Mohamed Saad - Jalan Bagan Lalang	0	4.0	4.0
11.	Road from S. Puyu to Mak Mandin	0	3.7	3.7
12.	Road from Mak Mandin to Chain Ferry Road	0	1.8	1.8
13.	Heng Choon Thiam Extension	0	3.8	3.8
14.	Prai Road	2.6	0	2.6
15.	Permatang Pauh Road	5.0	0	5.0
16.	Frontage Road from Kg. Tok Hamid to K. Bagan Serai	0	4.0	4.0
17.	Frontage Road from Kg. Bagan Serai to Kg. Telok	3.9	0	3.9
18.	Frontage Road from Prai Industrial Estate to Kg. Tok Kangar	0	5.8	5.8
19.	Jalan Raja Uda - Jalan Siram - Jalan S. Nyior	0	2.5	2.5
20.	Sg. Nyior, Siram, Raja Uda Road	2.8	0	2.8
	Total	39.8	46.0	85.8

(see Fig. 5.6)

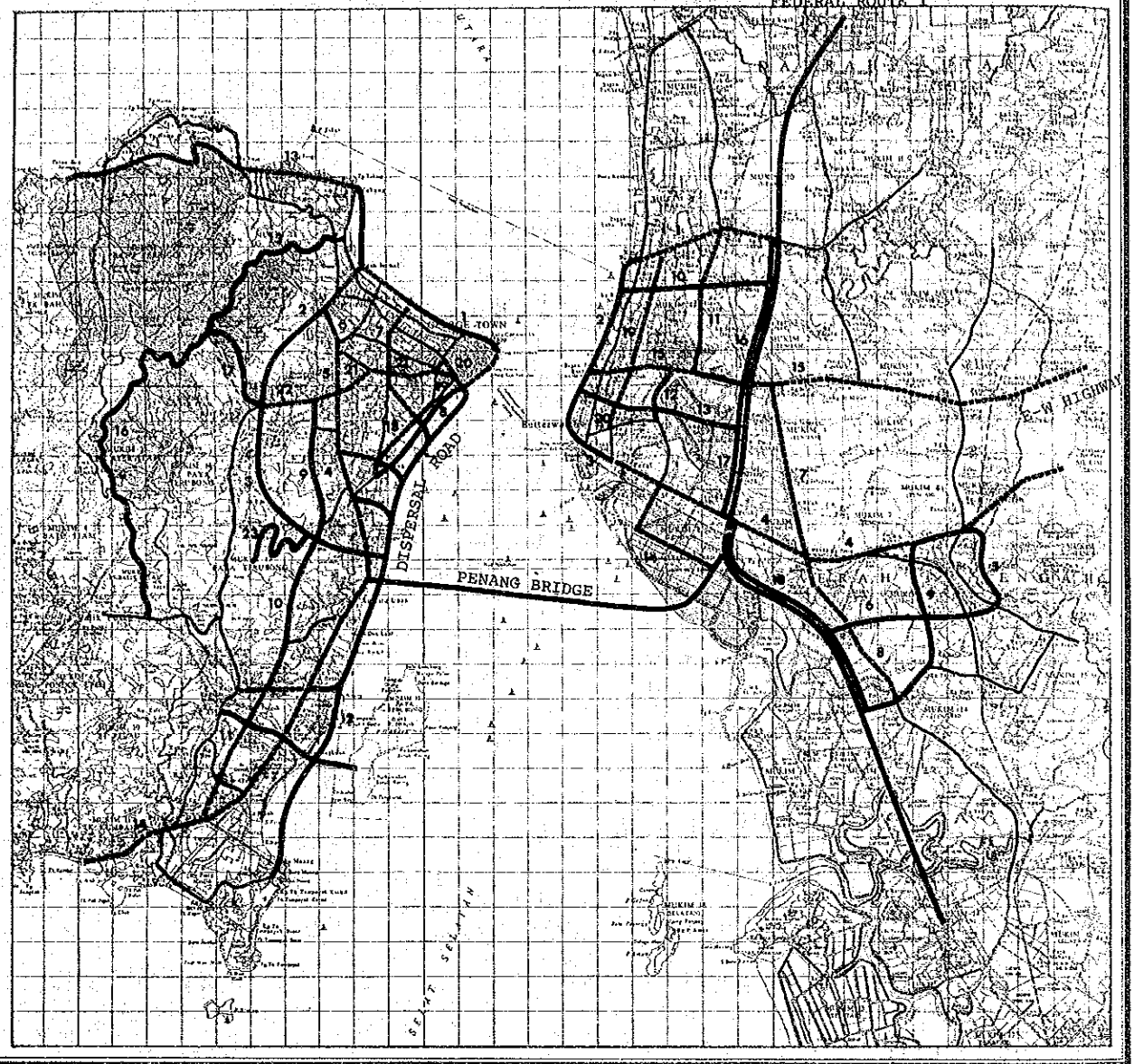

Fig.5.6: ROAD SYSTEM MAP

NORTH

Construction

Improvement

Existing Roads

Note: Numbers correspond to tables 5.1 and 5.2 respectively

PENANG URBAN TRANSPORT STUDY

URBAN TRANSPORT STUDY IN GREATER METROPOLITAN AREAS OF GEORGETOWN, BUTTERWORTH AND BUKIT MERTAJAM

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5.3 Transport Strategies

5.3.1 General Considerations

In most large cities, there are two (2) strategies for dealing effectively with a very rapid increase of traffic volume: to improve the capacity of the transport system and/or to control the transport demand.

The former strategy involves the improvement and construction of roads or introducing a mass transit system which however requires a large outlay in cost and time to meet the demand with the result that sometimes broad spaces of the road causes social or environmental problems.

Accordingly, the strategry of restraining traffic demand should be adopted simultaneously with the former strategy. In the case of the State of Penang, such strategies will be necessary to meet the projected traffic demand, especially in the C.B.D of George Town.

Although there are many types of restraint measures, as shown in Table 5.3, they are for large cities, and it should not be necessary to adopt so many intensive measures for a medium size city like George Town.

Table 5.3 Possible Traffic Restraint Measures

Type of Restraint Measures	Restraint Applicability		
	Entire Urban Area	Parts of Urban Area	Specific Streets
Restrain Vehicle Ownership:			
Registration Fees	X		
Import Taxes	X		
Purchase Taxes	X		
Drivers Licence Taxes	X		
Numerical Ceiling	X		
Vehicle Road Worthiness	X		
Restrain Vehicle Use:			
Fuel Taxes	X		
Mileage Taxes	X		
Tolls		X	X
Zonal or Area Permits		X	X
Vehicle Metering		X	X
Zonal or Area Licences		X	X
Parking Charges		X	X
Parking Rate Structure		X	X
Parking Controls		X	X
Road Closure		X	X
Vehicle Prohibition		X	X
Road Restriction		X	X
Planned Congestion	X	X	X
Rationing of Fuel	X		
Improve Other Modes:			
Low Public Transport Fares	X	X	X
Improve Public Transport Service	X	X	X
Improve Public Transport Amenities	X	X	X
Improve Pedestrian Facilities	X	X	X
Improve Bicycle Facilities	X	X	X
Trip Reduction Through Planning:			
Car Pooling	X		
Staggered Work Hours	X	X	
Proximity of Like Functions	X	X	
Land Use Densities	X	X	
School Location/Enrolment Policies	X		
Location of Home to Work/shopping	X		

Source: Kuala Lumpur Urban Transport Planning Study.

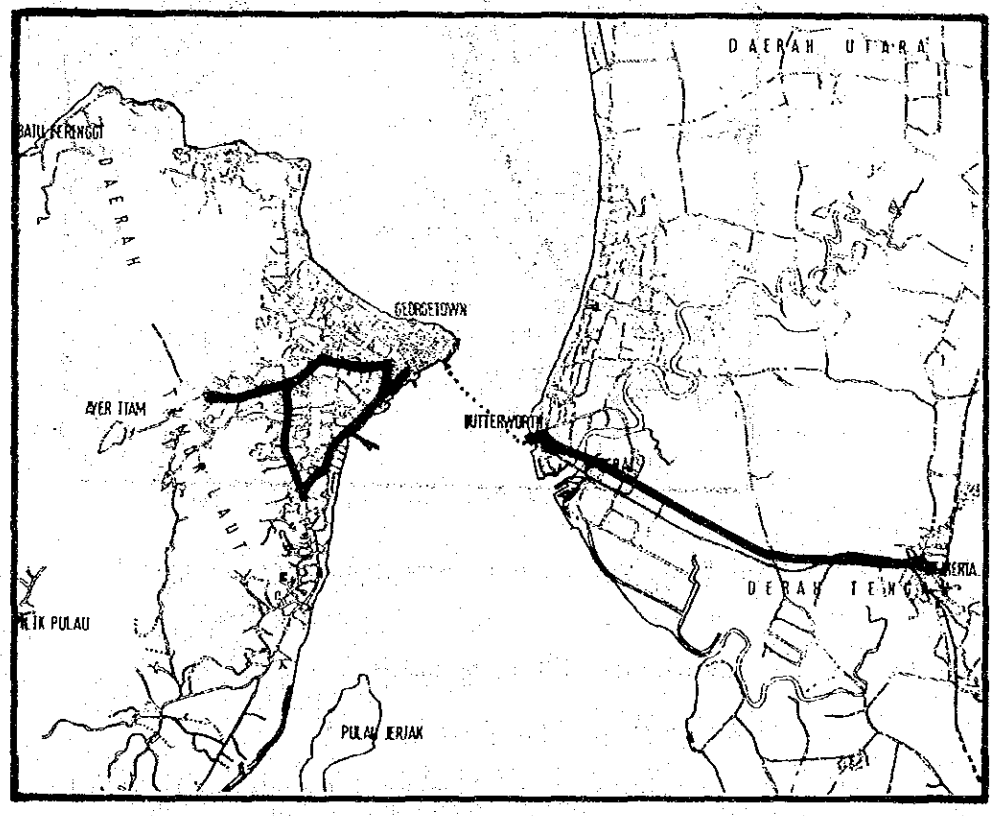
5.3.2 Transport Strategies

Besides the improvement of road network which was planned in the previous section, the following transport strategies were prepared as a major means of coping with the increase of transport demand, with due considerations given to the actual transport conditions of the Study Area and the effects of the strategies. All of these strategies are expected to reduce vehicle traffic volumes.

1. Public Transport Strategies

Strategy A. Introduction of Exclusive Bus Lane

To assure that the bus service can absorb more commuters, operations should be improved. For this purpose, exclusive bus lanes, where the average speed of the buses is 25 Km/hr., are to be introduced along the roads shown in Fig. 5.6 below.



(Note: The exclusive bus lanes are chosen as an example of bus priority measures.)

Fig. 5.7 Location of Exclusive Bus Lanes

Strategy B. Introduction of New Transport System

If an additional public transport system to the present bus services is necessary, the new transport system should be introduced. The proposed routes for the New Transport System are proposed as shown in Fig. 5.7 below.

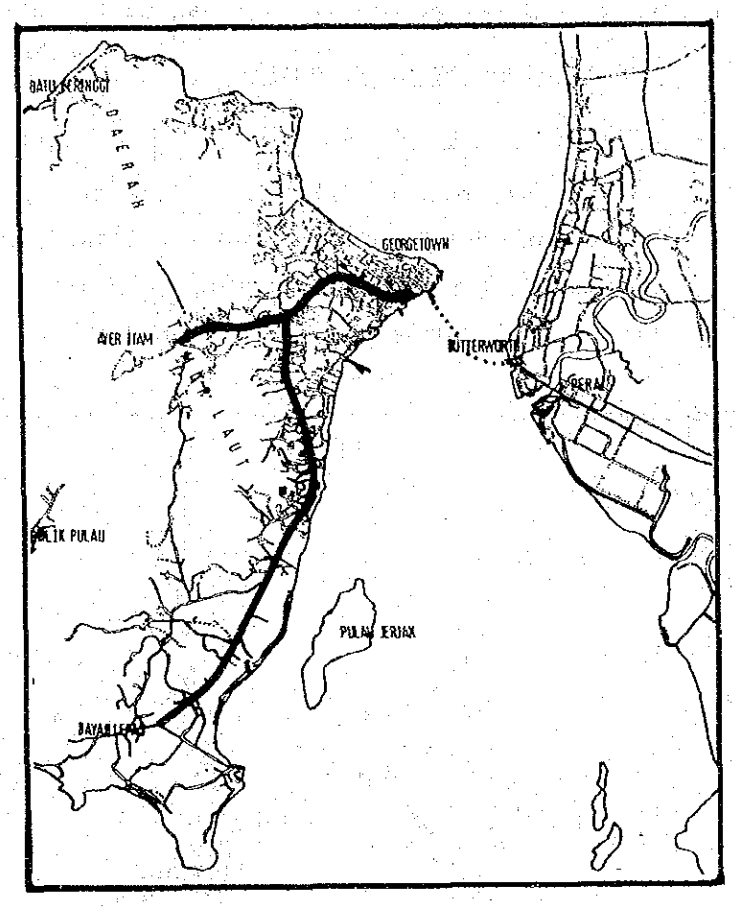


Fig. 5.8 Location of New Transport Routes

2. Demand Control Strategies

Strategy A. Parking Control

Prohibition of on-street parking is mainly aimed at achieving a smooth and safe traffic flow and providing space for sidewalks. However, regarding control of parking capacity in the C.B.D., the total required parking capacity in the

C.B.D of George Town was assumed to be 21,000 units in the year 2000 during peak hours in spite of an increase in off-street parking due to the sharp drop of on-street parking capacity. (see Fig. 5.9)

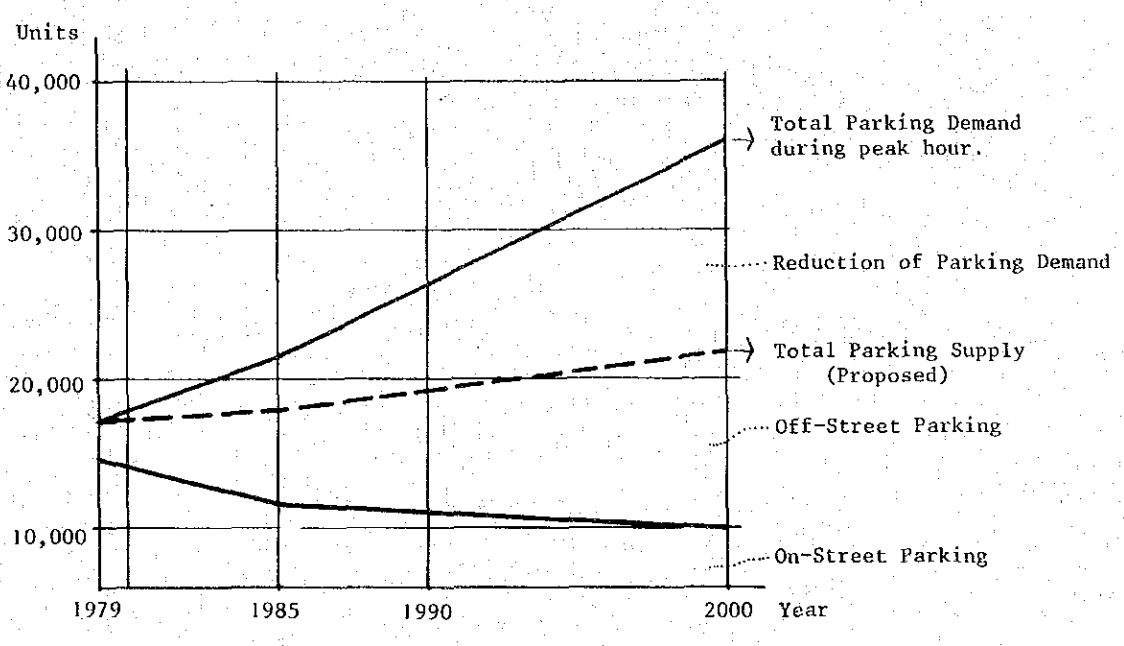


Fig. 5.9 Parking Demand and Supply

Strategy B. Car Pooling System

The car pooling system is devised in order to prevent traffic congestion caused by private cars entering the C.B.D.

The system planned is as follows:-

* The objective area ..... the C.B.D of George Town.

* Average number of passengers ..... 3 persons including the drivers.

(Note: The car pooling system is selected as an example of effective vehicle restraint measures.)

Chapter 6 EVALUATION OF LONG-TERM TRANSPORT PLANS

6. EVALUATION OF LONG-TERM TRANSPORT PLANS

6.1 Evaluation Overview

6.1.1 General

One of the principal objectives of this study is the formulation of a long-term plan to act as a framework for the envisaged changes. This section includes an evaluation of the following long-term transport plan elements:

1. The master plan of the road network
2. Transport strategies
3. Identification of priority projects in the transport system
4. The continued existence or termination of the present ferry system
5. Introduction of a mini-bus system

6.1.2 Evaluation Procedure

(1) Evaluation Viewpoits

The evaluation basically proceeds by comparative analysis to determine where the net benefit of one alternative plan is greater than that of another.

In this study, the evaluation of the transport plans will be made from the following points of view:

* Economic Evaluation
* Financial Analysis

1. Economic Evaluation

Economic evaluation involves a comparison between the costs of supplying the transport services in each plan and the benefits derived from these services. The benefits of each plan are then compared with the capital cost requirements to determine which plan can be expected to produce the better economic benefits. This comparison is described in a series of benefit/cost ratios which are used to determine the general priority among the various plans.

2. Financial Analysis

There are two (2) types of financial analysis: one is the estimation of the costs of supplying the transport services in each plan in view of the national revenue, while the other covers the analysis of the cash flow of centain transportation services. In this section, the latter type of analysis is adopted.

(2) Indicators of Economic Analysis

The net benefit in any single year is calculated as the balance of yearly benefits as a proportion of the capital costs.

The transport alternative plans producing a positive net benefit can be taken as economically feasible. Since the single year rate of return is also calculated as the comparison between benefits and costs in the year, these plans are also considered feasible if the single year rate of return of plans is over 12 percent, which is the current discount rate defined by the Economic Planning Unit for use throughout Malaysia in all public sector investments.

6.1.3 Cases for Evaluation

In order to structure alternative cases for evaluation, the following three (3) classes of factors were considered as described in the paragraphs which follow: Road projects, traffic control projects and the ferry system

1. Road Projects

The follow five (5) categories of roads were considered in formulating alternative plans of road construction.

a. Existing roads as of 1979

b. Committed roads: includes committed projects such as, the Penang Bridge, the New Federal Route I, the Penang Dispersal Roads and the supporting roads of the East-West Highway.

c. Road under planning by the Government

d. New Roads: the roads shown in Fig. 5.9 are the new roads to be added to the road network.

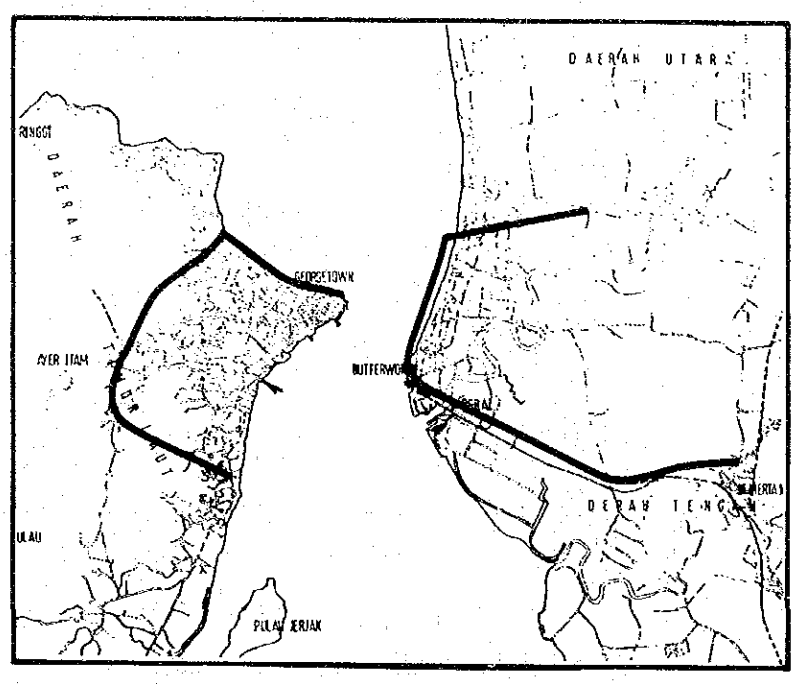


Fig. 6.1 Location of New Roads

e. Other New Roads: this includes all the other new roads which will form the ultimate road network.

Based on the above road categories, five (5) alternative road plans were formulated as shown below:

Road Categories	Alternative Road Plans				
	Base Plan	Plan-1	Plan-2	Plan-3	Plan-4
Existing Roads	X	X	X	X	X
Committed Roads	X	X	X	X	X
Roads under Planning		X		X	X
New Roads			X	X	X
Other New Roads					X

2. Traffic Control Projects

Four (4) plans for traffic control are considered to meet

objectives as follows:

Plan	Objective
a. Parking Control	- to control the traffic demands of work trips by reducing the numbers of possible parking spaces in the C.B.D.
b. Exclusive Bus Lane	- to divert the traffic demand from private vehicle transport to bus transport by improving bus service.
c. New Transport System	- to divert the traffic demands from private vehicle transport to the new transport system by introducing the new transport system.
d. Car Pooling	- to reduce the traffic demand of all trip purposes by encouraging high-occupancy rates of vehicles.

The traffic plans were further grouped to form four (4) packages for evaluation as shown below.

Traffic Control Projects	Alternative Packages			
	A	B	C	D
Parking Control		X	X	X
Exclusive Bus Lane		X	X	
New Transport System			X	
Car Pooling				X
No Traffic Control Projects	X			

3. Ferry System

In addition to the above projects, the evaluation of the continued existence or termination of the present ferry system is also to be considered for some cases.

On the basis of the above classes of factors, nine (9) alternative cases were structured; the details of each are listed below and grouped by road projects.

Table 6.1 Alternative Plans for Evaluation

Road Projects		Traffic Control Packages			
		A	B	C	D
		No Projects	Parking Control Exclusive Bus Lane	New Transport System Parking Control Exclusive Bus Lane	Parking Control Car Pooling Exclusive Bus Lane
Existing + Committed Roads (Base Case)		1985 2000			
Plan-1	Base + Roads under planning	1985			
Plan-2	Base + New Roads	1985			
Plan-3	Base + New Roads + Roads under planning	1985[1)] 2000	1985 2000		
Plan-4	Other New Roads + Case 3	2000	2000[1)]	2000	2000

(Years indicated above are project target years)

Note 1) : Consideration of this case "with" and "without" the ferry system is also made.

6.2 Traffic Assignments to Alternative Transport Plans

6.2.1 Procedure

The method adopted in the traffic assignment is as follows:

1. For each link of the network to which vehicles are to be assigned, the relationship between traffic volume and travel time is established. In this relationship, the travel time increases according to the traffic volume. When the traffic volume exceeds the rated capacity, the travel time increases sharply which limits the further rise of traffic volume.

2. A specific O-D traffic volume is assumed on a route with the minimum travel time. Accordingly, the all-or-nothing method is applied to the road assignments.

6.2.2 Results of Traffic Assignments

The results of the traffic projections of the alternative plans are summarized in Table 6.2.

Table 6.2 Results of Traffic Projections

(1,000 trips in P.C.U.
1,000 persons)

	1985		2000			
	Plan 3-A	Plan 3-B	Plan 4-A	Plan 4-B	Plan 4-C	Plan 4-D
Vehicle Trips (Passengers)	776.6 (1159.5)	764.8 (1140.5)	1538.1 (2414.7)	1500.6 (2359.5)	1488.3 (2339.5)	1427.8 (2366.8)
Bus Passengers	249.1	268.1	296.4	351.6	279.1	344.3
N.T.S Passengers	-	-	-	-	92.5	-

The projected traffic demands were assigned to the road and public transport networks of each alternative plan. The detailed results of traffic assignments are shown in the Technical Report 11.

And the average travel speed in each alternative are summarized as below.

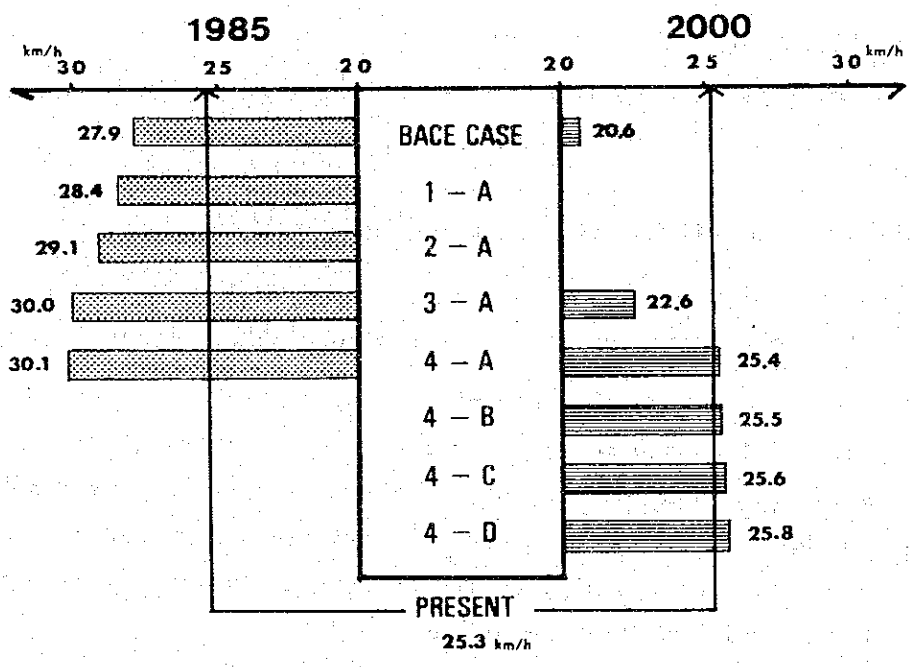


Fig. 6.2 The Comparison of Travel Speed

6.3 Cost Estimates of Alternative Plans

Table 6.3 summarizes the cost estimates of the alternative plans. Detailed cost estimates are described in the supplements, which are made on the basis of 1979 prices.

Table 6.3 Cost Estimates of Plans

(In thousand dollars at 1979 prices)

	1A	2A	3A	3B	4A	4B	4C	4D
Road Projects Under Planning	96,000		96,000	96,000	96,000	96,000	96,000	96,000
New Proposed 4-lane					213,424	213,424	213,424	213,424
Road (2-lane)		(124,226)	(124,226)	(124,226)	(124,226)	(124,226)	(124,226)	(124,226)
Other Proposed Road Projects					304,310	304,310	304,310	304,310
Intersection Improvements	38,741	38,741	38,741	38,741	60,672	60,672	60,672	60,672
Exclusive Bus Lane				78		78	78	78
Construction of New Transport System							317,600	
Introduction of Car-Pool System								45,600
Total	134,741	162,967	258,967	259,045	674,406	674,484	992,084	720,084

6.4 Benefit Estimates of Alternative Plans

6.4.1 Unit Traffic Cost

Among the various benefits discernible from the implementation of the improvement plans affecting transport policy and strategy, savings in travel time and running expenses are considered the most significant. These benefits are defined as the difference between the travel time and the running expenses of transport "with" and "without" the transport improvement plans.

The time value of each trip is calculated on the basis of the monthly income of households and the monthly working hours of car owners, motor-cycle owners and non-vehicle: The following time value for each vehicle type is converted to the time value of passengers in items of the average occupancy rate. The results are shown below.

	Value of Vehicles (M$/hour/car)	Value of Passengers (M$/hour/person)
1. Cars	3.70	2.64
2. Buses	23.00	0.77
3. Motor-cycles	1.30	1.00

Vehicle operating costs are composed of running costs which depend on distance and speed, and of fixed costs which depend on time. The unit running cost by travel speed and the fixed cost per operational hour are established as follows:

	Running Costs (¢/km)	Fixed Costs (M$/vehicle/hour)
1. Passenger car	10.67	1.13
2. Taxi	8.49	2.56
3. Truck	20.62	3.26
4. Bus	26.22	5.78
5. Motor-cycle	3.54	0.30

6.4.2 Benefit Estimates

On the basis of unit traffic cost and assigned traffic volume on the roads, the benefits are estimated by using the network model. The detailed description is in the Supplementary Volume.

The results of benefit estimates are shown in Appendix Tables.

6.5 Economic Evaluation

6.5.1 Ultimate Plan of Road Network

The ultimate plan of the proposed highway (Plan 4-A) is evaluated and the result is shown below for the year 2000.

(M$000 in 1979 prices)

	Plan 4-A
Benefit	307,231
Annualized Costs at 12%	80,929
Capital Cost	674,406
Net Benefit	226,302
Rate of Return	45.6%
B/C Ratio	3.80

Since the net benefit in the year 2000 is M$226 million, the rate of return and B/C ratio for that year are 45.6 percent and 3.80 respectively, therefore the ultimate plan of the proposed highway network is economically very feasible.

6.5.2 Proposed Transport Policy Measures

The alternative transport policy measures proposed in the previous chapter are evaluated economically in this section.

Table 6.4 shows the results of the economic analysis. In the year 1985, plan 3-B, which includes control of private car use and introduction of bus lanes, is economically more feasible than plan 3-A which is without any control. The net benefits of plan 3-B is over M$48 million, while that of plan 3-A is only M$32 million.

Table 6.4 Summary of Economic Indicators for Plans 3-A and 3-B in 1985

(In thousand dollars at 1979 prices)

	Plan 3-A	Plan 3-B
Benefits	62,868	80,316
Costs annualized at 12%	31,076	31,085
Capital Costs	258,967	259,045
Net Benefits	31,792	48,231
Rate of Return	24.3%	31.0%
B/C Ratio	2.02	2.58

For the year 2000, the team proposes an additional transport policy and public transport expansion measures to Plan B.

These are:

Plan C : to introduce new transport system

Plan D : to control private car use by car pooling system

According to the economic analysis, plan 4-D is the highest economic indicator among these alternative transport plans. For the year 2000 the second best is plan 4-B.

Table 6.5 Summary of Economic Indicators for Plans 4-B, 4-C, and 4-D in 2000

(In thousand dollars at 1979 prices)

	Plan 4-B	Plan 4-C	Plan 4-D
Benefits	348,136	371,145	373,476
Costs annualized at 12%	80,938	119,050	86,410
Capital Costs	674,484	992,084	720,084
Rate of Return	51.6%	37.4%	51.9%
B/C Ratio	4.30	3.12	4.32

6.5.3 High Prriority Projects in the Road Network

Acccrding to traffic volume assigned in both design years and growth rate of traffic volume, it is deemed necessary to improve or construct the following roads immediately: (see Fig. 6.3)

1. Penang Island

* Project 1 Outer Ring Road (From CBD to Ayer Itam)
* Project 2 Outer Ring Road (From Ayer Itam to North Coastal Road)
* Weld Quay Extension
* Widening of Green Lane
* Improvement of Jalan Prangin and Jalan Maxwell
* Construction of Bayan Lepas Road

2. Province Wellesley

* Project 3 West Coastal Road with Prai Bridge and Improvement of Jalan Permatang Pauh)

* Seberang Jaya Road
* Project 4 Widening of Existing Federal Route I
* Approach Roads

The high priority projects are evaluated economically and the results are presented in Table 6.6 on the basis of which the following observations can be made.

1. All the high priority projects are economically feasible except the 4-lane highway in Project 2.

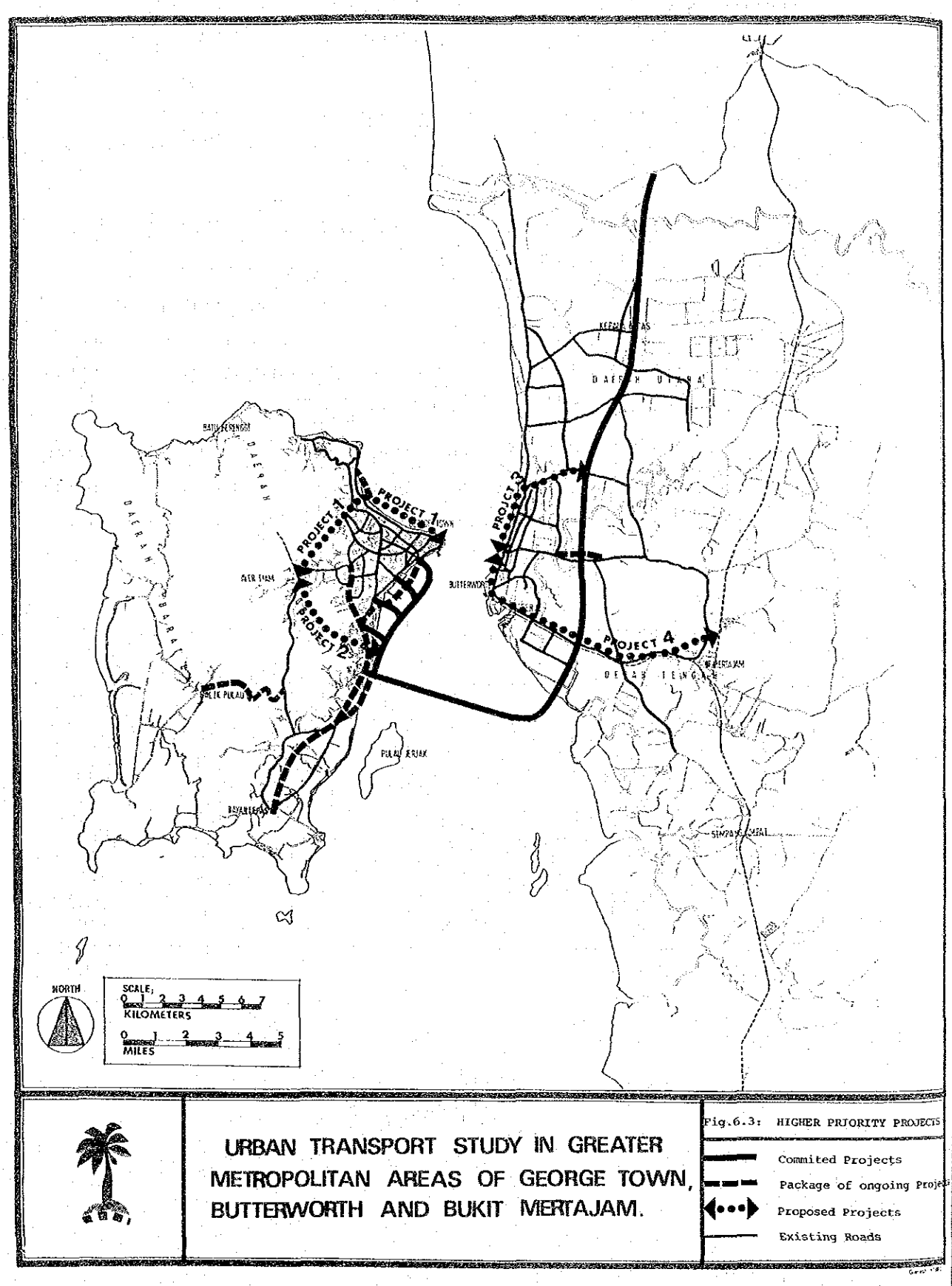
2. From the viewpoint of priority, project 4 (construction of the southern part of West Coastal Road with Prai Bridge and widening of the existing Federal Route I) has the highest economic indicators among high priority projects.

   The projects with the second highest rating are on-going projects such as the Weld Quay and Prai Barrage Approaches projects. The proposed projects have also high priority indicators in view of the net present worth in 1985.

Table 6.6 Economic Indicators of High Priority Projects

(In thousand dollars in 1979 prices)

		Benefits in 1985	Economic Cost	Cost Annualized at 12%	Net Benefit in 1985	B/C Ratio in 1985	First Year Rate of Return
Proposed Projects Total	4 - lane (2 - lane)	34,786	213,424 (124,226)	25,611 (14,907)	9,175 (19,879)	1.36 (1.75)	16.2 (28.0)
Project 1	4 - lane (2 - lane)	10,691	74,966 (41,176)	8,996 (4,941)	1,695 (5,750)	1.19 (1.86)	14.3 (25.9)
Project 2	4 - lane (2 - lane)	3,951	52,075 (28,736)	6,249 (3,448)	-2,298 (503)	0.63 (1.15)	7.6 (13.7)
Project 3	4 - lane (2 - lane)	3,272	21,846 (13,088)	2,622 (1,571)	650 (1,701)	1.25 (2.08)	14.9 (25.0)
Project 4	4 - lane (2 - lane)	15,535	64,537 (41,226)	7,744 (4,947)	7,791 (10,588)	2.01 (3.14)	24.1 (37.1)
On going and In-Planning Projects		27,082	96,000	11,520	15,562	2.35	28.2



URBAN TRANSPORT STUDY IN GREATER METROPOLITAN AREAS OF GEORGE TOWN, BUTTERWORTH AND BUKIT MERTAJAM.

Fig.6.3: HIGHER PRIORITY PROJECTS

- Commited Projects
- Package of ongoing Projects
- Proposed Projects
- Existing Roads

6.6 Financial Analysis

6.6.1 Bus Transport Operation

Table 6.7 summarizes the results of the financial analysis. According to the passenger projections, total passenger kilometers will be expanded from 532 million in 1979 to 765 million in plan A, 815 million in plan B in 1985, and to 973 million in plan A, 1138 million in plans B and D, and 921 million in plans C in the year 2000. It is necessary to expand the bus fleet in proportion to the passenger kilometers.

The income statement is based on two (2) fare levels: one is the 1979 fare level (3.9 cents per kilometer adult fare) and the other is a fare level 42 percent higher than the 1979 one. (5.5 cents per kilometer). The rate of return of capital investments was computed for each of the two fare levels.

If the existing fare level is maintained, most of the bus companies are expected to go into debt; if the 5.5 cents per kilometer fare level is imposed, the annual rate of return is expected to be 10.1 percent, provided that demand for bus services will not decrease even after the rise in fares.

Table 6.7 Annual Income Statement of Bus Transport

(1985 and 2000)

	1985		2000			
	Plan A	Plan B	Plan A	Plan B	Plan C	Plan D
Passenger Kms (1000 Kms)	765,442	815,317	973,273	1,138,362	920,968	1,138,362
Number of Buses	446	496	593	693	560	693
Fleet Kms (1000 Kms)	30,618	32,613	38,931	45,534	36,839	45,534
Cumulative Capital Investment (M$'000)	41,940	44,640	53,370	62,370	50,400	62,370
Existing Fare Level						
Revenue (M$'000)	30,728	32,730	39,071	45,699	36,971	45,699
Fare	29,546	31,471	37,568	43,941	35,549	43,941
Others	1,182	1,259	1,503	1,758	1,422	1,758
Expenditure (M$'000)	36,095	38,433	45,898	53,671	43,296	53,671
Operating Expenses	26,035	27,720	33,090	38,702	31,200	38,702
Depreciation	6,710	7,142	8,539	9,979	8,064	9,979
Interest	3,350	3,571	4,269	4,990	4,032	4,990
Net Operating Income (M$'000)	-5,367	-5,703	-6,827	-7,972	-6,325	-7,972
Fare 5.5 cents						
Revenue (M$'000)	43,783	46,636	54,631	65,114	52,679	65,114
Fare	42,099	44,842	53,530	62,610	50,653	62,610
Others	1,684	1,794	2,101	2,504	2,026	2,504
Expenditure (M$'000)	36,095	38,433	45,898	53,671	43,296	53,671
Net Operating Income (M$'000)	7,688	8,203	9,733	11,443	9,383	11,443
Income Tax	3,459	3,691	4,780	5,149	4,222	5,149
Net Income (M$'000)	4,229	4,512	5,353	6,294	5,161	6,294
Rate of Return	10.1%	10.1%	10.1%	10.1%	10.2%	10.1%

6.6.2 Introduction of New Transport System

Table 6.8 shows the results of the financial analysis for introduction of the new transport system. This investment is based on the guideway system.

In the income statement, the fare revenue is based on the 12 cents per kilometer (adult fare). Compared with the present bus fare, the new transport system is about three times higher.

Based on this assumption, return on investment is expected to be 1.4 percent which is not financially feasible. However, if the Government is prepared to subsidize the capital investment, it could be operational.

Table 6.8 Financial Summary of New Transport System

		(M$'000)
Capital Investment		317,600
Construction including Property	233,600	
Rolling Stock	84,000	
Annual Income Statement in 2000		
Operating Revenue		34,504
Passengers	32,879	
Others	1,625	
Operating Expense		29,961
Operations	6,797	
Depreciation	10,460	
Interest	12,704	
Net Operating Income		4,543
Rate of Return		1.4%

6.6.3 Continued Existence of Ferry System

Table 6.9 summarizes the results of the financial analysis for the ferry system. A detailed analysis is given in the supplements.

Table 6.9 Statement of Ferry Revenues and Expenditures in 1985 before Operation of the Bridge

Item	Amount (M$'000)
Revenue	29,036
Expenditure	20,300
Operating Income	8,736
Tax	4,805
Net Income	3,805
Percent of Revenue	13.5%

According to the above figures, the ferry system is expected to have a large amount of profit before operation of the bridge. However, after operation of the Penang Bridge, the traffic demand will decrease as follows:

(No. of Vehicles and Pass. per day in 1985):

	Before Operating	After Operating
M/cycles	14,400	6,500
Bicycles	2,150	2,150
Cars	12,170	1,400
Trucks	2,430	280
Passengers	66,080	46,230

Considering the decreased traffic demand, the following major assumptions are made.

1. In the expenditure, the depreciation cost will be nearly zero due to selling of the surplus ferries.
2. In proportion with the reduced number of ferries, the crew and personnel related to the ferry can also be reduced.

As a result, the following operating expenditures in 1985 will be needed.

	(M$'000)	
Operating Cost	7,501	
Wage	3,014	
Fuel & Oil	1,409	
Maintenance	2,004	
Others	1,074	
Depreciation	0	
Interest	750	(10% to Operating Cost)
Total	8,251	

On the other hand, the operating revenue of the ferry system will be 7,410 tnousand dollars in 1985. Therefore, the balance between the operating revenue and expenditure is as follows:-

	(M$'000)
Expenditure in 1985	8,251
Revenue	7,410
Net Income	-841

However, the revenue, even after operation of the Penang Bridge, is expected to increase at 5 percent per annum so that towards the end of 1988 a small profit can be expected.

6.6.4 Introduction of Mini-Bus System

The Government has already decided to introduce the mini-bus system in Penang. On the basis of this premise, the function of the mini-bus is analyzed from economical, operational and convenience viewpoints in this study.

The scheduled and mini-bus cost and productivity have already been studied in Kuala Lumpur. The study expresses the productivities of both bus systems as follows:

Measures		Indicator	Mini-bus performance (scheduled = 100)
(i)	Full cost	cost per seat mile	65 to 75
(ii)	Capital economy	seat miles per dollar initial cost over vehicle life	50
(iii)	Labour productivity	i) seats miles per employee per year	60 to 65
		ii) wage cost per seat mile	70
(iv)	Wage rates	average earnings	115 to 120
(v)	Fuel economy	oil cost per seat mile	65

The Kuala Lumpur experience shows that the mini-bus is a significantly more costly form of public transport in terms of resources and productivity.

Chapter 7 RECOMMENDED LONG-TERM TRANSPORT PLAN

7. RECOMMENDED LONG-TERM TRANSPORT PLAN

7.1 Recommended Policies and Strategies

The recommended transport plan represents a comprehensive scheme to achieve the objectives mentioned in Chapter 5. The plan is consistent with the financial and operational realities, both in the public and private sector.

The results of the economic and financial evaluation justify the adoption of the following strategies and plans.

1. Construction of the ultimate road network
2. Introduction of parking control in the C.B.D
3. Introduction of exclusive bus lanes
4. Introduction of a car pooling system in the C.B.D
5. Continuation of the ferry services
6. Expansion of bus fleets and raising of bus fares

However, economic or financial benefits are not the only objectives of transport development. Other factor such as consideration for lower income groups and the establishment of a safe traffic environment are also necessary.

For the long term transport plan as well as due consideration for economically improving everyones mobility while improving accessibity to all metropolitan areas, the following package of strategies are recomended.

1. Ensuring the effective use of the existing transport facilities.
2. Construction of new roads and the improvement of existing ones.
3. Expansion and Improvement of Public Transport.
4. Restraint of private vehicle use in the Central Business District (CBD) of George Town.
5. Construction of transport facilities such as a transport terminal complex.
6. Preservation and creation of a better urban environment.
7. Monitoring the effectiveness of the package of strategies.

The schedule for implementation of each strategy will differ since some strategies will be short term actions, some will be implemented continuously while others will be implemented on a long-term basis. The time schedule is roughly shown in Table 7.1.

In the C.B.D of George Town, it is necessary to use the exsisting transport facilities effectively while improving some roads as shown in the Figure below.

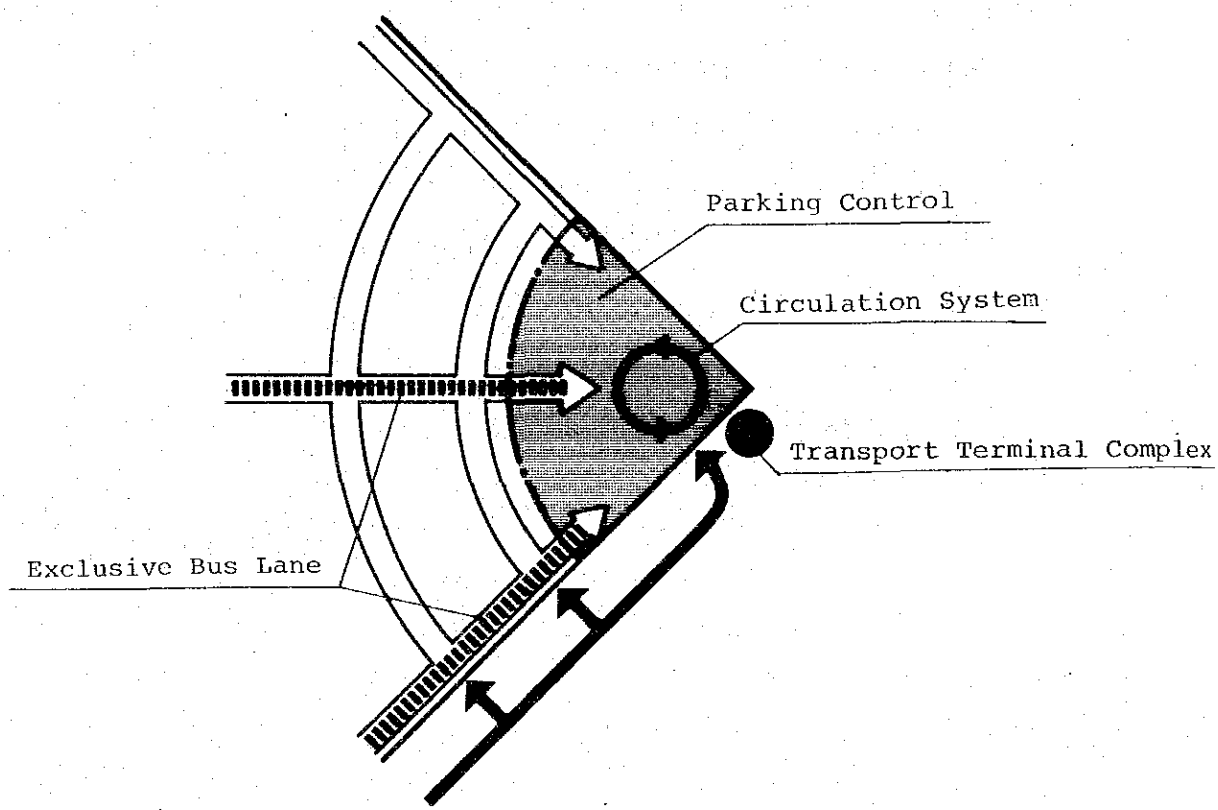


Table 7.1 Package of Strategies

	Long-Term	Short-Term
1. Construction and Improvements of Roads and Related Facilities		
a) New Construction of Roads	*	
b) Improvement of Roads	*	*
c) Intersection Improvements	*	*
2. Construction of Transport Facilities	*	*
3. Expansion and Improvement of Public Transport		
a) Expansion and Improvement of Routes and Schedules	*	*
b) Provision of Bus Stops and Bus Terminals	*	*
c) Provision and expansion of Bus Fleets	*	*
d) Revision of Bus Fare	*	*
e) Introduction of Exclusive Bus Lane	*	
f) Introduction of Mini-Bus System	*	*
4. Restraint of Private Vehicle Use		
a) Parking Control	*	*
b) Car Pooling	*	
5. Perservation of the urban green	*	*
6. Ensuring the effective use of the existing transport facilities	*	*
7. Monitoring the effectiveness of the package of strategies	*	*

7.2 Ensuring the Effective Use of the Existing Transport Spaces

One of the important policies and strategies is to ensure the effective use of the existing transport spaces, namely by implementation of traffic management and engineering.

Since this strategy deals mainly with short-term actions, a detailed description is given in Chapter 8.

7.3 Construction of New Roads and Improvement of Existing Ones

7.3.1 Introduction

The major aim of this study is to formulate the future road network as a master plan.

The road network plan was described and evaluated from an economic viewpoint in Chapter 5. The results indicate that the proposed road network for the year 2000 is economically feasible. On the basis of this, the following recommendations are made.

7.3.2 Recommended Road Network

The recommended plan seeks to make full use of the existing road pattern to form an adequate road system capable of serving the projected traffic demands in 1985 and the year 2000. This is accomplished by the following.

1. Construction of new roads
2. Widening and upgrading of existing roads
3. Constructing grade-separated interchanges at critically congested intersections.

Based on the evaluations, the road networks of Plan 3 in 1985 and of Plan 4 in the year 2000 are recommended with the summary of the ultimate road network being shown in Table 7.2.

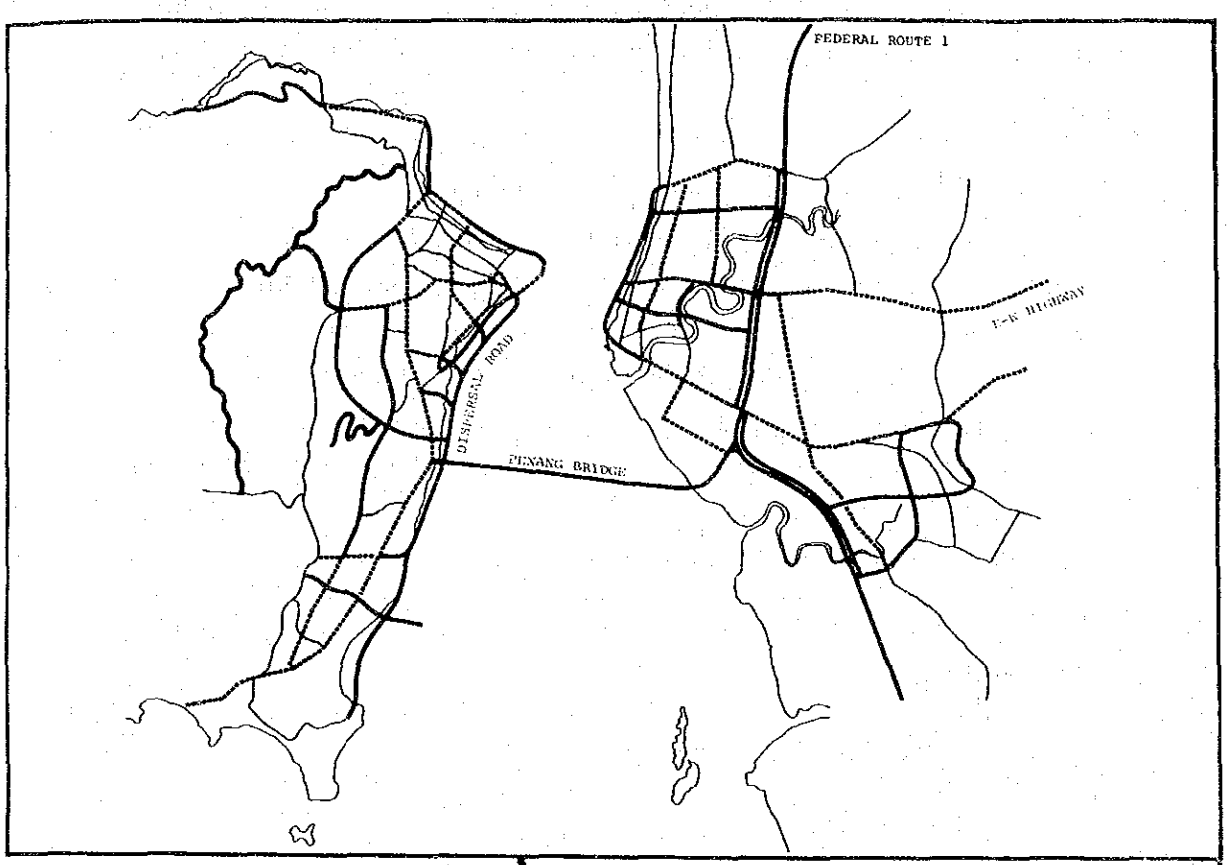


Fig.7.1 Recommended Road Construction Plan

Constraction

Improvement

Existing Roads

Table 7.2 Summary of Recommended Road Plan

	Number of Projects	Kilometers	Estimated Construction Costs (M$'000)
Improvement of Existing Roads	21	80.6	613,734
New Roads	25	110.6	
Grade-separated Interchanges	8	-	51,642
Improvement of Intersections	33	-	9,030

7.3.3 Restructuring the Road Network

As mentioned in Chapter 5, it is recommended that the road network be restructured in accordance with its functions as primary distributors, district distributors, local distributors and access roads.

7.3.4 Penang View Road

From the viewpoint of tourist attraction, a Penang View Road should be constructed after completion of the Penang Bridge. The objective of this project is to provide a wide-ranging view of the scenery. When the Penang Bridge is completed, most people are likely to regard the Penang Bridge as well as George Town as places of interest and the pheriphery of George Town as holiday and tourist resorts. In this connection, it will be necessary to construct this road by the year 1990. The outline of the project is as follows:

Location: as shown in following figure. (Fig. 7.2)

Length: 6.5 Kms.

Construction cost: M$20 million

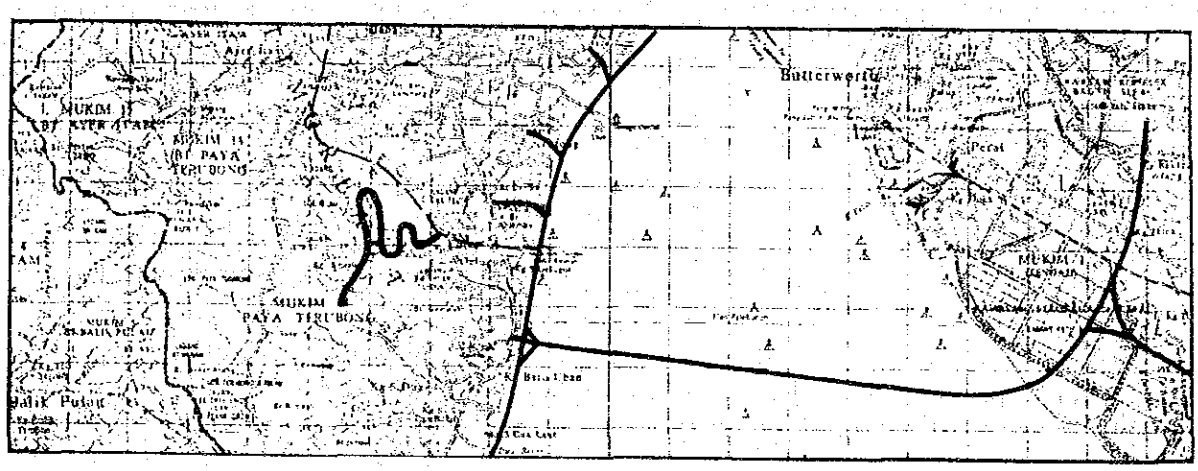


Fig. 7.2 Location of Penang View Road

7.4 Expansion and Improvement of Bus Transport

7.4.1 Rationale

The overall appraisal suggests that the bus transport should be expanded and improved for the following reasons.

1. To maximize the net benefits as a whole

Table 7.3 shows the net benefits of the alternative plans evidencing that the measures of expansion and improvement of public transport will contribute to the national economy.

Table 7.3 Estimated Net Benefits in 1985

(In thousand dollars at 1979 prices)

	Plan 3-A without Improvement of Public Transport	Plan 3-B with Improvement of Public Transport
Net Benefit (M$'000)	36,441	52,880

2. To maximize the benefits for the lower income groups

Table 7.4 shows the benefits for car-owner and non car-owner. It is clear that expansion and improvement of public transport will benefit the lower income groups, represented by non-vehicle owners.

Table 7.4 Estimated Benefits in 1985

(In thousand dollars at 1979 Prices)

	Plan 3-A	Plan 3-B
Car-Owners	54,058	64,647
Motor-cycle Owners	6,826	6,746
Non-Vehicle Owners	1,984	5,845

3. To maintain mobility even if restraining measures on private cars are introduced.

4. To promote a low cost solution for transport problems. In Penang

the land price is relatively high and so the construction of new roads requires huge investment.

7.4.2 Recommended Expansion and Improvement Plan

Resulting from the careful examination of the present bus transport conditions and the predicted bus transport demands, the following expansion and improvement plan is recommended.

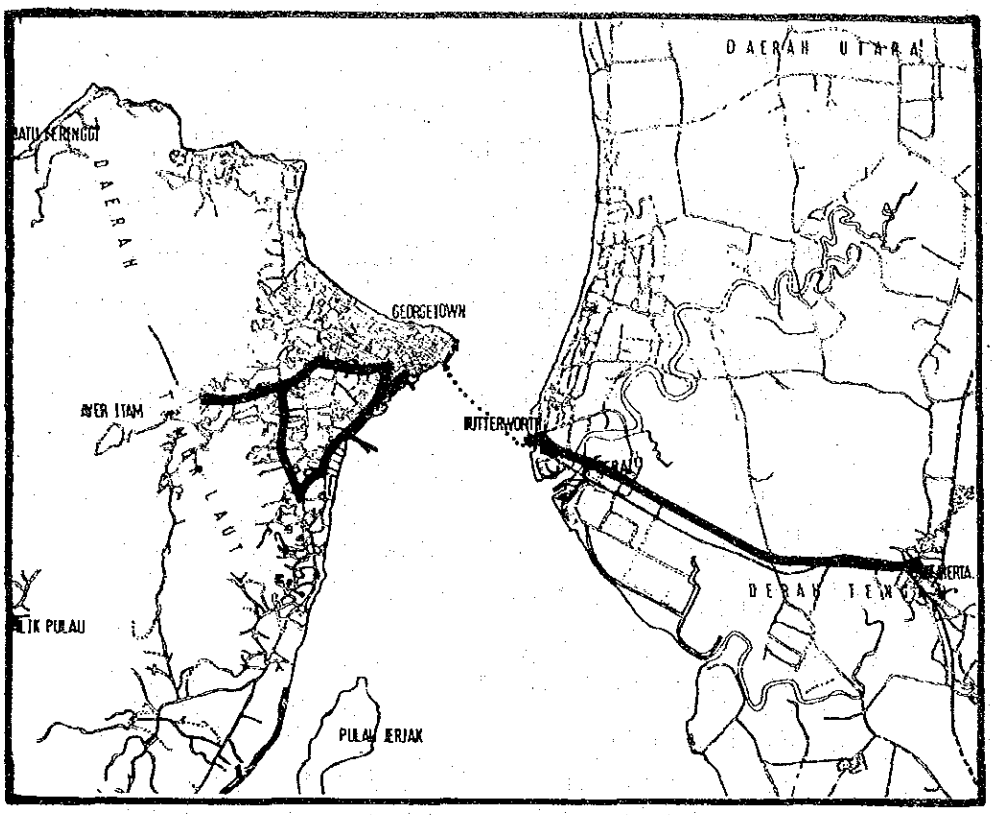
1. Introduction of Exclusive Bus Lane
2. Revision of Bus Fare structure
3. Establishment of a Bus Transport Committee
4. Introduction of Mini-Bus System
5. Expansion and Improvement of Routes and Schedules
6. Provision of Bus-Stops and Bus Terminals
7. Provision and Improvement of Bus Fleets

Among these measures, some will be implemented over a short-term period and others over a long-term period. In this section therefore, mainly items 1, 2 and 3 are described.

7.4.3 Introduction of Exclusive Bus Lane

Resulting from the overall evaluation, it is concluded that the exclusive bus lane should be introduced on the following streets. (Refer to the following Figure)

1. In George Town:
   a. Dato Kramat road and Ayer Itam road, from Magazine circus to the intersection of the Ayer Itam road and the Penang Hill Railway Station road.
   b. Green Lane
   c. Jalan Jelutong
2. In Province Wellesley
   a. Existing Federal Route I from Butterworth to the intersection with Jalan Rermatang Pauh, and Jalan Permatang Rawa toward Bukit Martajam.



(Note: The exclusive bus lanes are chosen as an example of bus priority measures.)

Fig. 7.3 Location of Exclusive Bus Lanes

The exclusive bus lane was selected as one of the bus priority measures, with typical implemental form shown in the following illustration.

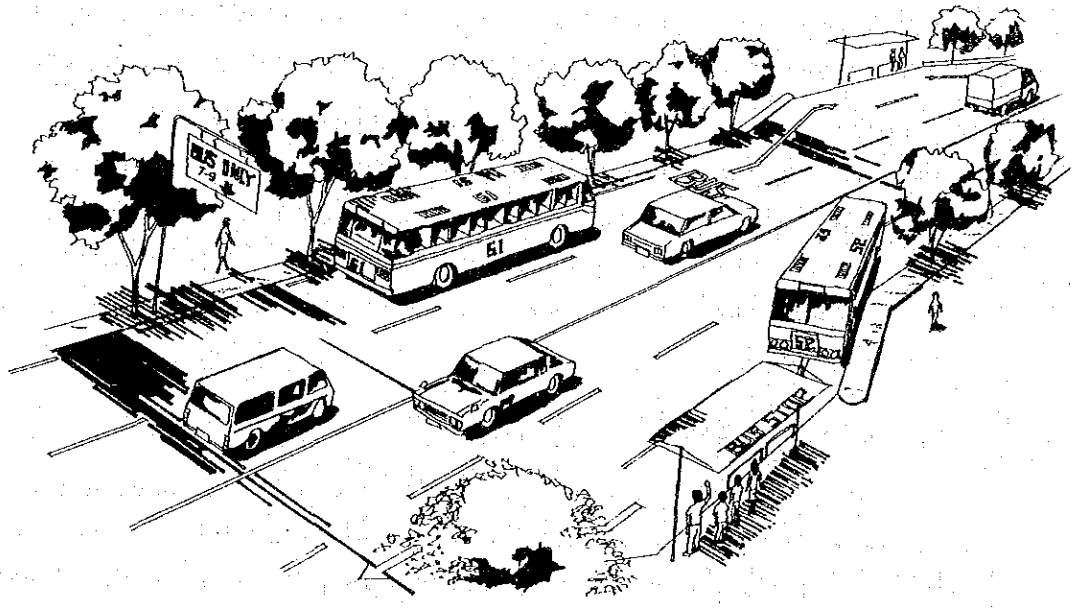


Image of Exclusive Bus Lane

In the case of 4 laned roads, the outside lane in major directions are provided exclusively for bus traffic, e.g. toward C.B.D in the morning and for the suburbs in the evening.

The practical usage of the exclusive bus lane should be flexible enough to cope with the local conditions, such as in the Study Area where it is feasable to use such lanes not only for buses but also for taxis. However, the taxi practice of indiscriminate picking up and dropping of passengers near the bus station needs to be avoided.

A total of 18,000 to 48,000 bus passengers (per day) along these major routes are estimated in the year 2000 as a result of demand forecasting, with 40 to 95 bases expected to serve along those exclusive lanes per peak hour.

7.4.4 Revision of Bus Fare Structure

The financial analysis shows that if the existing fare system is maintained, operational viability will disappear. In the package of transport strategies, it is necessary to have an incentive policy for bus transport, therefore from this viewpoint, the bus fare should be reviewed.

7.4.5 Establishment of Bus Transport Committee

At present, there are many problems underlying the bus transport system, one of which is the rising costs situation. To solve these problems, many measures are required such as establishment of a subsidy for bus transport and introduction of lower interest loans, etc.

However, at present, negotiations between Government and public or private operators are ineffective. Therefore, the team suggests that a bus transport committee should be established under the supervision of the Public Transport Licensing Board. This commitee should include government, public and private operators as well as consumer representatives.

7.4.6 Introduction of Mini-Bus System

Past trends of bus transport show that bus transport has been stagnating in terms of the number of passengers while the number of cars has increased. However, it is absolutely essential to develop

the public transport system in order to maintain the fundamental urban activities.

In the Study Area, it is necessary that a policy should be adopted whereby the share of private vehicle-use to total vehicle-use will be decreased by the provision of bus transport services that are of high quality and sufficient in quantity.

The Government has already decided to introduce a mini-bus system in George Town and as stated in this plan, the Government intends to operate a mini-bus system on major radial roads.

According to a mini-bus study in Kuala Lumpur, the running-kilometerage of scheduled-bus companies were reduced by one-third after the introduction of the mini-bus system.

This suggests that the scheduled bus companies in Kuala Lumpur were compelled to ristrict their rising costs by reducing the level of quality of the bus service.

The basic policy for bus transport should not only be advantageous to its users and management, but should also provide bus companies with some incentive to increase the level of bus services.

In this connection, it is suggested that the longer route line-haul services should be served mainly by the scheduled-bus system while the mini-bus system should be introduced relativcly as a feeder system.

7.4.7 Others

Other measures include short-term actions which will be described in Chapter 8.

7.5 Private Vehicle Restraints

7.5.1 Recommended Plans

In many countries and cities around the world, traffic restraint measures have been studied and examined in order to cope with the rapid increase of vehicles, especially in C.B.D of large cities where there is a concentrated rush of commuters at peak hours.

The following measures for the Study Area were selected and combined into Packages B, C and D.

(Note: Package A is omitted since it is the null case.)

Table 7.5 Selected Restraint Measures

Measures / Package	Demand Restraint Measures	Demand Conversion Measures
B	Parking Control	Introduction of Exclusive Bus Lane
C	Parking Control	Introduction of New Transport System
D	Parking Control and Car Pooling	Introduction of Exclusive Bus Lane

Both Plan B and Plan D are recommendable from a financial and economic point of view. (See Chapter 6). However, focusing on the C.B.D of George Town, measures taken in Plan B will be sufficient to prevent a worsening of traffic congestion of the road network by the year 2000. Plan B is also more desirable when we consider the numerous social and physical implications of a car pooling system. Plan D should therefore only be adopted if the completion of the future road network falls behind schedule as in that case, Plan D will produce the most effective drop in traffic volume in the C.B.D.

7.5.2 Parking Control

1. Objectives

Parking Control is a most practical restraint measure and helps, at the same time, to create a safe traffic environment.

Objectives of parking control are:

(1) To make traffic flow smoothly

(2) To secure sufficient space for carriage-ways even in narrow streets, not only for daily convenience, but also in case of an emergency.

(3) To reduce traffic volume

(4) To provide space for sidewalks

2. On-street Parking Control

Generally speaking, parking control consists of two (2) parts: to prohibit on-street parking and to limit the total capacity of

parking. In the case of Plan B, 21,000 lots of parking space are planned, which means that an intensive effort will be needed to develop off-street parking. Therefore, control of off-street parking is sufficient for the time being.

Offensive On-Steet Parking

The areas to be prohibited from parking are shown in Table.

Table 7.6 Areas for Parking Control

	30m from Intersec-tion	C.B.D.	Urbanized Area	Rural Area
Priamry Distributors	*	*	*	*
District Distributors	*	*		
Local Distributors	*	partly		
Access width of less than 10m	*	*	*	
Compulsory Garage Installation		*		

According to these controls, parking capacity in the C.B.D of George Town will be as follows:

Table 7.7 Parking Capacity in the C.B.D.

	1979	1985	2000
On-street	14,130	11,500	10,000
Off-street	3,490	6,500	11,000
Total	17,620	18,000	21,000

3. Parking Charge

The present parking charge in the C.B.D of George Town ranges from 20 to 60 cents/hr. However, the parking charge of 4-storied car parks is estimated to be about 40 percent to 50 percent higher than that of parking lots (if the land price does not increase by more than 50 percent). Therefore it is necessary to give some incentives and subsidies to developers of multi-storey car parks.

A rise of the present on-street parking charges is expected to produce the following effects.

* To reduce on-street parking demand in the C.B.D.

* To stimulate the supply of parking lots using vacant space.

* To incourage private sectors to develop multi-storey car parks.

Introduction of parking control should be combined with other parking control measures and its effects should be monitored.

4. Garage installation in the C.B.D of George Town

If on-street parking is prohibited in the evening, regulations for compulsory garage installation will be necessary for residents in the C.B.D of George Town in about 1985 due to the large increase in car-owners. (Fig. 7.3).

This measure will discourage people from owning cars. However, due consideration should be given to economic activities in the C.B.D, and relief measures for car owners, such as development of off-street parking or full utilization of road spaces should be adopted.

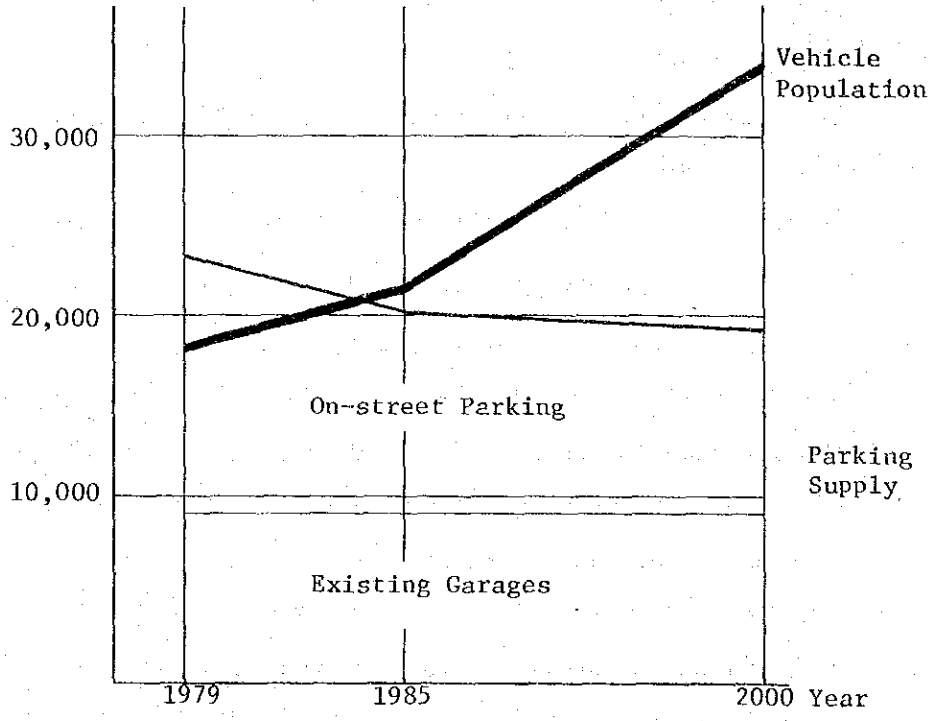


Fig. 7.4 Parking Demand and Supply During the Night

7.5.3 Car Pooling System

Car pooling is a system whereby cars are forced to carry a minimum number of passengers.

Penalties are charged according to the number of passengers on a specific route. San Francisco and Singapore have adopted this system. However, it has not been popular due to the difficulties of implementation and the undesirable effects on urban activities.

In the case of the C.B.D of George Town, difficulties of implementation are to be expected since too many roads connect the C.B.D and the outer areas. In any case, a car pooling or road pricing system will be unnecessary, with the completion of the ultimate road network.

7.6 Construction of Transport Facilities

7.6.1 Transport Terminal Complex

The team proposes a new transport terminal complex for the following reasons.

1. The terminal can facilitate the convenience of intre-modal trips.
2. The terminal can promote efficient bus services.
3. The terminal can meet future traffic demands on national and international levels in relation to future tourist development.

Its location is recommended at the north of the reclamation area, close to the center of George Town for the following reasons.

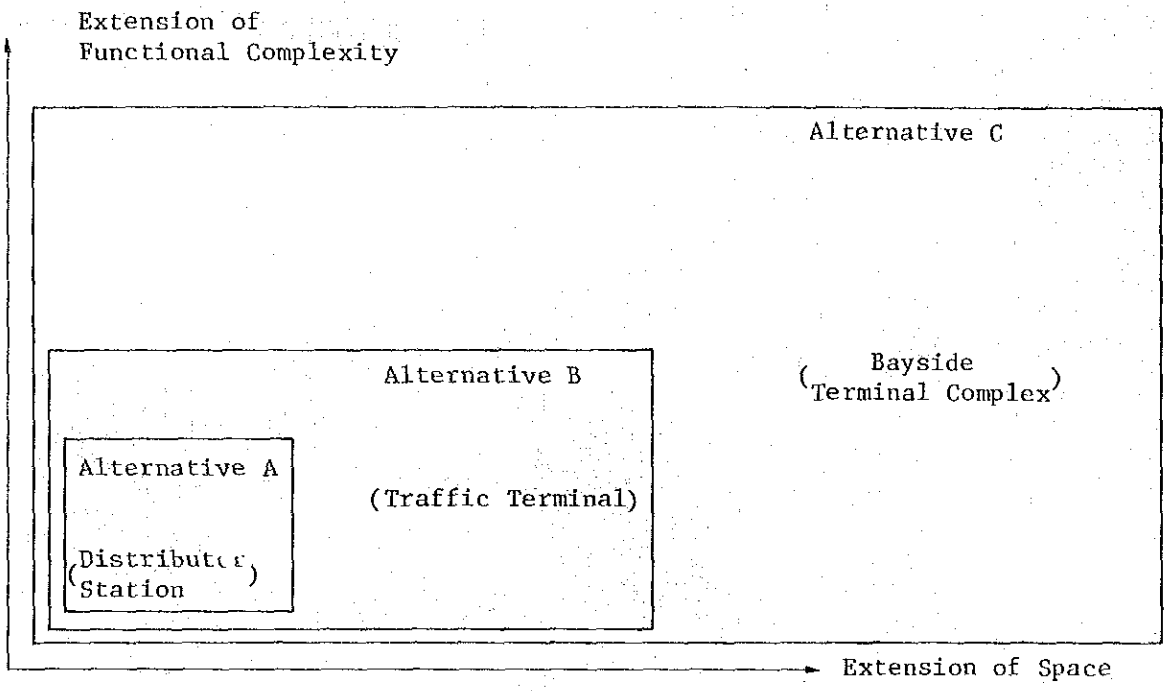
1. The area is seen as a strategic point by the State of Penang in line with the redevelopment program along Jalan Prangin.
2. The terminal can provide a connection with the ferry station.
3. The terminal can help to control the impact of future in-coming and out-going traffic generated by the construction of the Dispersal roads.

This project is initially located in the reclamation area, east of the C.B.D. as shown in Fig. 7.6. Because of its location which is close to the most active areas of George Town such as the KOMTAR area, the urban renewal plan in the neighbouring areas of the site should be studied and combined with this project. However, due to the limitation of time and cost, this study focuses on the terminal.

Based on the analysis for the function of traffic nodes, three (3) alternative development plans for the transport complex were formulated in accordance with the different development stages.

The comparative relationship between the three alternatives is illustrated in the conceptual diagram shown below.

Fig. 7.5 Three Alternative Concepts



(A) Alternative A : Plan for distributor station

* For minimizing the scale of new development in the preliminary stage, the plan for a passenger station should still unquestionably remain as a necessary facility in order that future traffic problems in the central area can be eased.

The main facilities can be planned as follows:

1. Bus terminals on the regional and inter-regional level.
2. Taxi terminals.
3. Car parks.
4. Approach network to the station.
5. Other minor facilities.

(B) Alternative B : Plan for traffic terminal

* With a more encouraging policy in the development of this

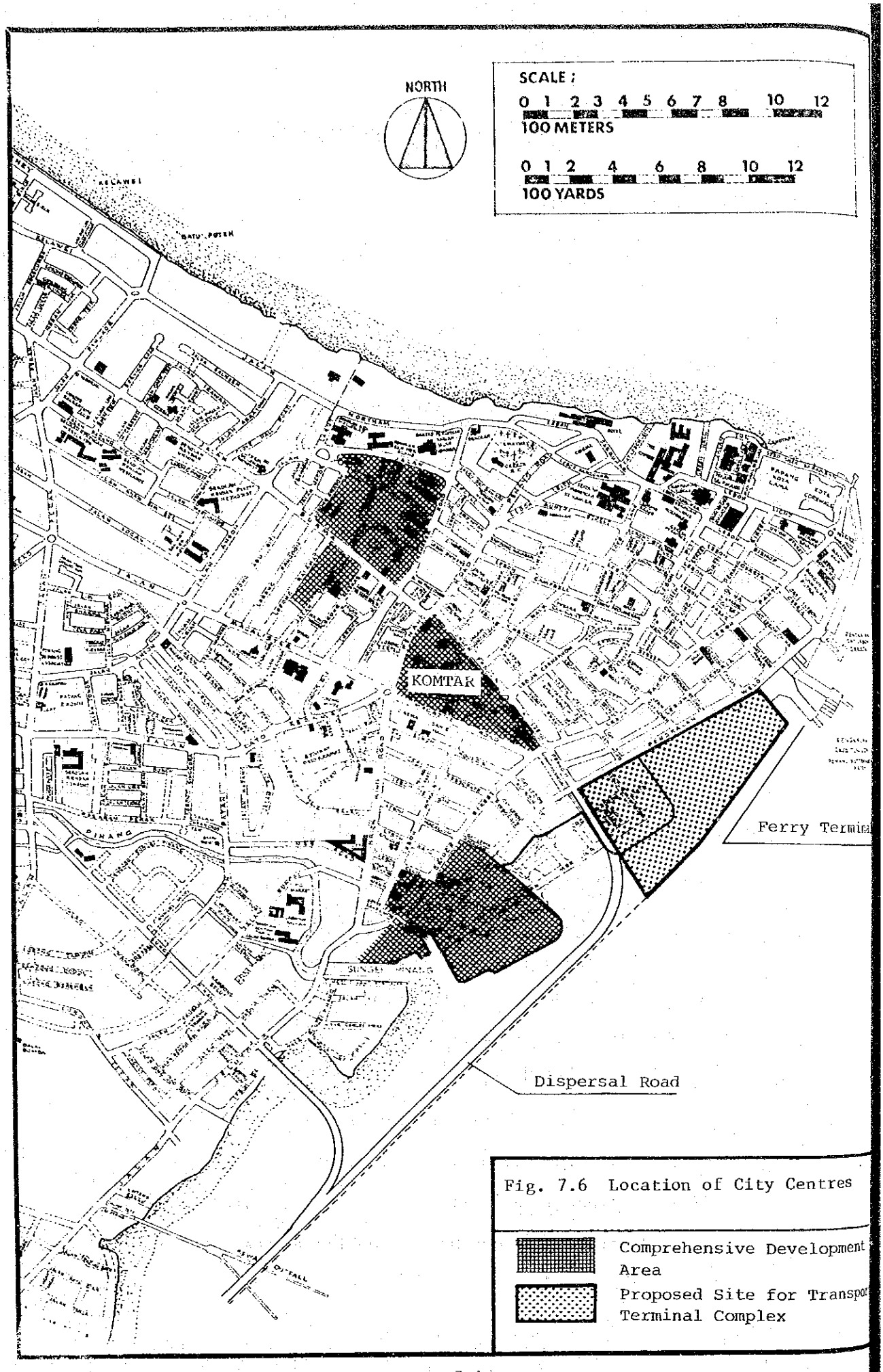


Fig. 7.6 Location of City Centres

Comprehensive Development Area

Proposed Site for Transpor Terminal Complex

area, there is a possibility that the area will have a multi-functional terminal, to be built in conjunction with the urban traffic projects and the urban renewal projects.

The main facilities will comprise;

1. Bus terminals on the regional and inter-regional level.
2. Taxi terminals.
3. Car parks.
4. Approach network to the station.
   (These are the same as in Alternative A)
5. Shops for passengers.
6. Passenger concourse.
7. Land use development to compensate the resettlers and land owners involved in the redevelopment projects in George Town.

(C) Alternative C : Plan for "Bayside Terminal Complex".

* This is the most exciting image in the future reclamation area. Maximizing the possibility of future demand and the spacial locational potential will allow formulation of an integrated comprehensive development plan which will contain various tourist oriented facilities as follows:

1. The same facilities as 'Alternative B' but quality of each facility and population served will vary from local passengers to international tourists.
2. A promenade will integrate the ferry terminal with the bus terminal.
3. Tourist commercial and recreational complex (mainly outdoor type), including international hotels.
4. International as well as local trading centres.

The development policy of this plan is to integrate the local and international transport networks on land

with the sea transport network situated the reclaimed land.

The construction cost of each alternative is estimated as follows:

Table 7.8 Construction Cost Estimates of Transport Terminal Complex

(In thousand dollars at 1979 Prices)

	Alternative A	Alternative B	Alternative C
Construction Costs (M$'000)	1,252	10,233	19,918

7.6.2 Traffic Amusement Park

1. Objectives

The objectives of this proposal are:

(1) to educate the public on traffic manners and regulations through various exhibitions which will be held at the proposed hall.

(2) to make the public aware of existing and future traffic problems through lectures and seminars regarding traffic matters.

(3) to educate the public - children, youngsters and adults - to the changing traffic system by introducing the Traffic Play Area.

2. Location of the Park

The Reclamation Area in George Town is planned with a width of about 500 metres along the North Coastal Road. The reclaimed land is commonly considered to have many economic advantages and to be free from constraints in physical planning and design, and in construction of traffic facilities. The Traffic Amusement Park will be located in this area near the proposed Transport Terminal Complex. The site is about 20,000 sq. metres (i.e 100 metres by 200 metres).

a Traffic Amusement Park in Tokyo

7.7 Preservation and Creation of a Better Urban Environment

7.7.1 Background

One of the important policies recommended in this study is the preservation and/or creation of a better urban environment since the Study Area, especially George Town has aesthetic value as can be seen from the existence and maintenance of its pleasant road-side trees, historical structures, landscape and beautiful natural scenery. Such an environment not only gives delight to inhabitants but also contributes to the tourist industry of Penang.

7.7.2 Policy

From these viewpoints a master plan for the preservation and creation of urban green should be formulated as soon as possible. As a tentative proposal, it is suggested that the environment of the

area shown in Fig. 7.7 should be preserved and improved.

On the other hand, as mentioned earlier, it is necessary to improve the road network corresponding to the rapid increase of traffic. In order to satisfy these two objectives, the improvements of roads should be designed in accordance with the following policies:

1. When the infrastructure projects are implemented, road-side trees should, as far as possible, not be cut down. If necessary, new road-side trees should be planted.
2. When infrastructure projects are implemented in areas which have aesthetic value, beautifying of areas along the roads should also be carried out simultaneously.

7.7.3 Environmental Impacts

In network planning, considerations were already given to the preservation and creation of a better urban environment on a macro level. When the transport project as well as the other infrastructure projects are implemented, an environmental assessment of the corridors of the project from the social and physical viewpoints should also be made.

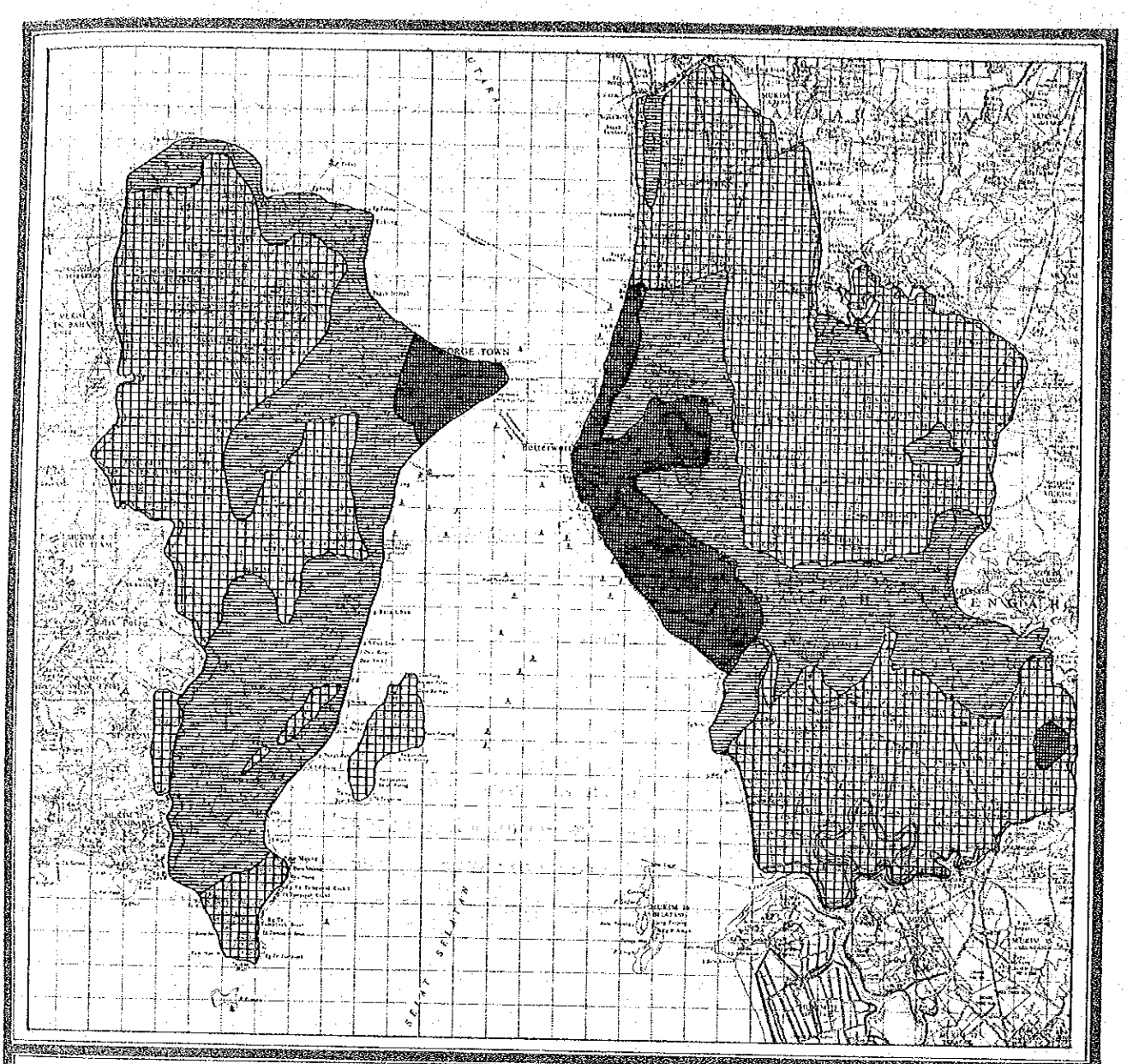


Fig.7.6 ENVIRONMENTAL REVIEW

NORTH

Areas of Fair Environmental Quality

Areas of Good Environmental Quality

Areas of Special Importance

PENANG URBAN TRANSPORT STUDY

URBAN TRANSPORT STUDY IN GREATER METROPOLITAN AREAS OF GEORGETOWN, BUTTERWORTH AND BUKIT MERTAJAM

Page.

7.8 Monitoring the Effectiveness of the Package of Strategies

The conditions of transport vary day by day and from year to year. Since projected traffic demands change according to the assumptions made, the monitoring system should be strengthened to continuously review and evaluate the results of this study.

In order to achieve this, the following suggestions are made:

1. Staff

   The following staff will be required upon completion of the project.

   1 - Traffic engineer

   1 - Physical engineer (Highway engineer)

   1 - Transport planner

   1 - Public transport planner

   1 - Transport economist

2. Data

   Substantial amounts of data are available, but collection and compilation of these are time-consuming tasks. All data relating to demography, land use, transportation, land costs, etc. should be colected and compiled with the help of the staff to evaluate and update this plan.