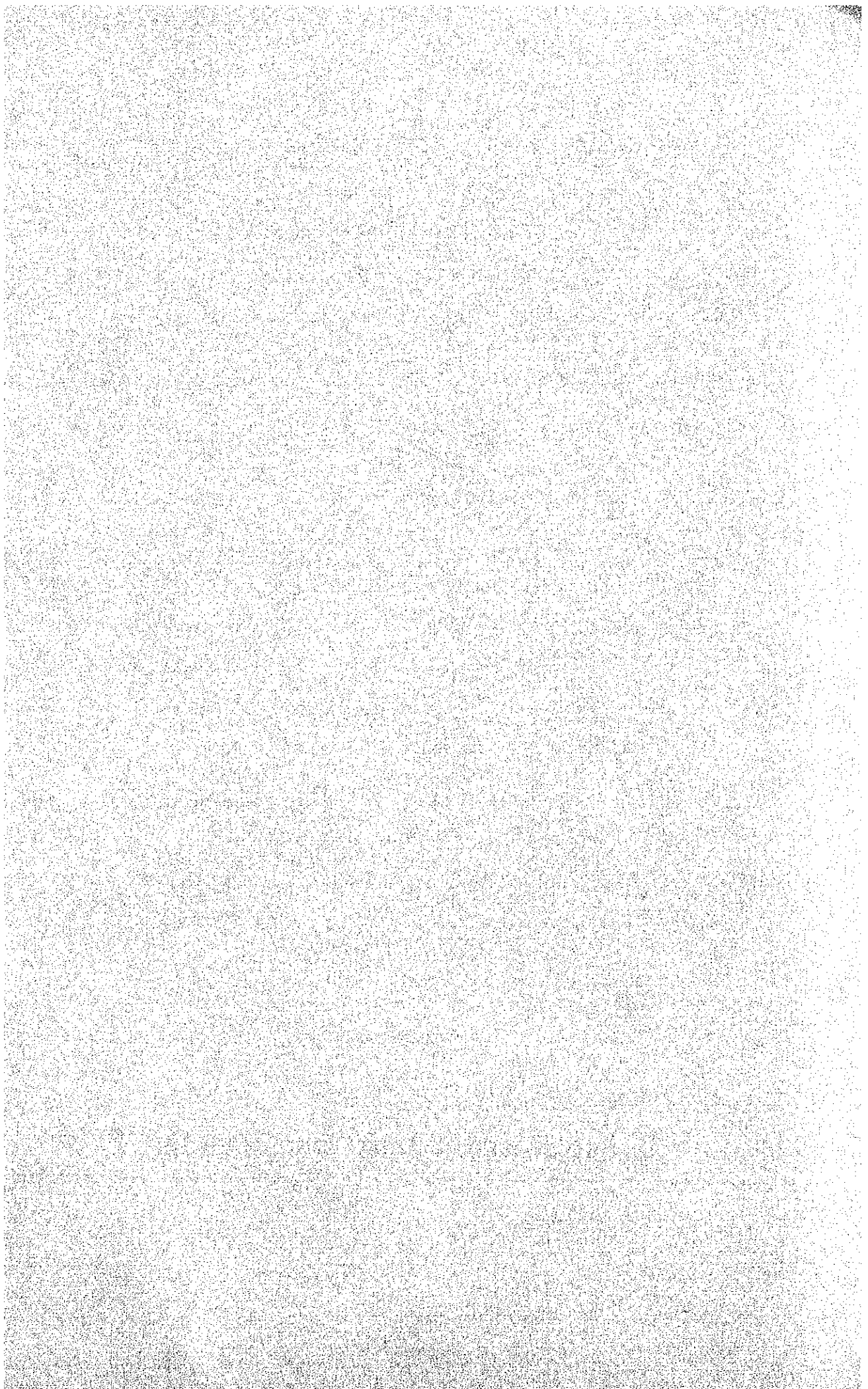


## **8. Recommended Long Term Transport Plans**

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RECOMMENDED LONG-TERM TRANSPORT PLANS

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## 8. RECOMMENDED LONG-TERM TRANSPORT PLANS

### 8.1 Recommended Policies and Strategies

The recommended transport plan represents a comprehensive scheme to achieve the objectives mentioned in Chapter 4. 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 to 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 factors such as consideration for lower income groups and the establishment of a safe traffic environment are also necessary.

For the long term transport plan and due considerations for economically improving everyones mobility and the accessibility to all metropolitan areas, the following package of strategies are recommended.

1. Expansion and Improvement of Public Transport.
2. Restraint of private vehicle use in the Central Business District (C.B.D.) of George Town.
3. Ensuring the effective use of the existing transport facilities.
4. Construction of new roads and the improvement of existing ones.
5. Preservation and creation of a better urban environment.
6. Construction of transport facilities such as a transport terminal complex.
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 and others will be implemented on a long-term basis. The time schedule is roughly shown in Table 8.1.

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

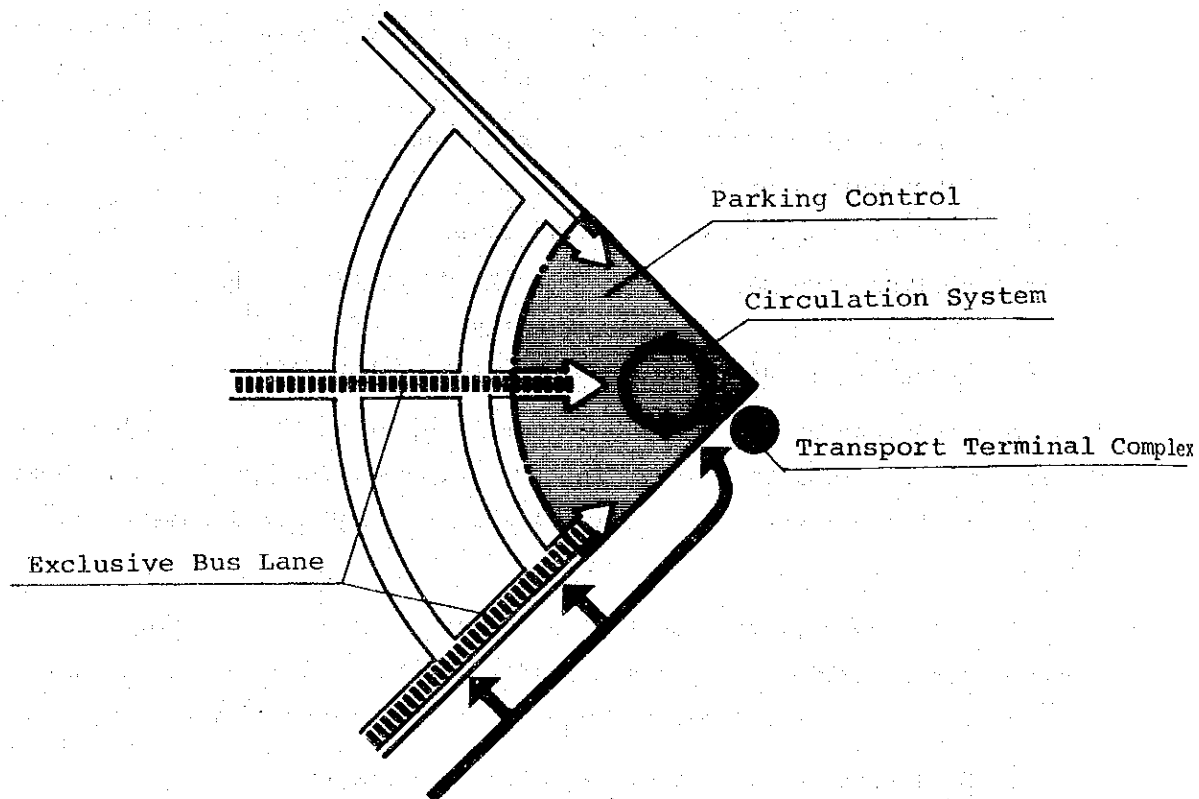


Fig. 8.1 CONCEPT OF THE LONG-TERM TRANSPORT PLAN

Table 8.1 PACKAGE OF STRATEGIES

	Long-Term	Short-Term
1. 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	*	*
2. Restraint of Private Vehicle Use		
a) Parking Control	*	*
b) Car Pooling	*	
3. Construction and Improvements of Roads and Related Facilities		
a) New Construction of Roads	*	
b) Improvement of Roads	*	*
c) Intersection Improvements	*	*
4. Construction of Transport Facilities	*	*
5. Ensuring the effective use of the existing transport facilities	*	*
6. Perservation of the urban green	*	*
7. Monitoring the effectiveness of the package of strategies	*	*

## 8.2 Expansion and Improvement of Bus Transport

### 8.2.1 Rationale

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

1. To maximize the net benefits as a whole

Table 8.2 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 8.2 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 8.3 shows the benefits for vehicle-owner and non vehicle-owner. It is clear that expansion and improvement of public transport will benefit the lower income groups represented by non-vehicle owners.

Table 8.3 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 investments.

#### 8.2.2 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 while others over a long-term period. In this section therefore, mainly items 1, 2 and 3 are described.

#### 8.2.3 Introduction of Exclusive Bus Lanes

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

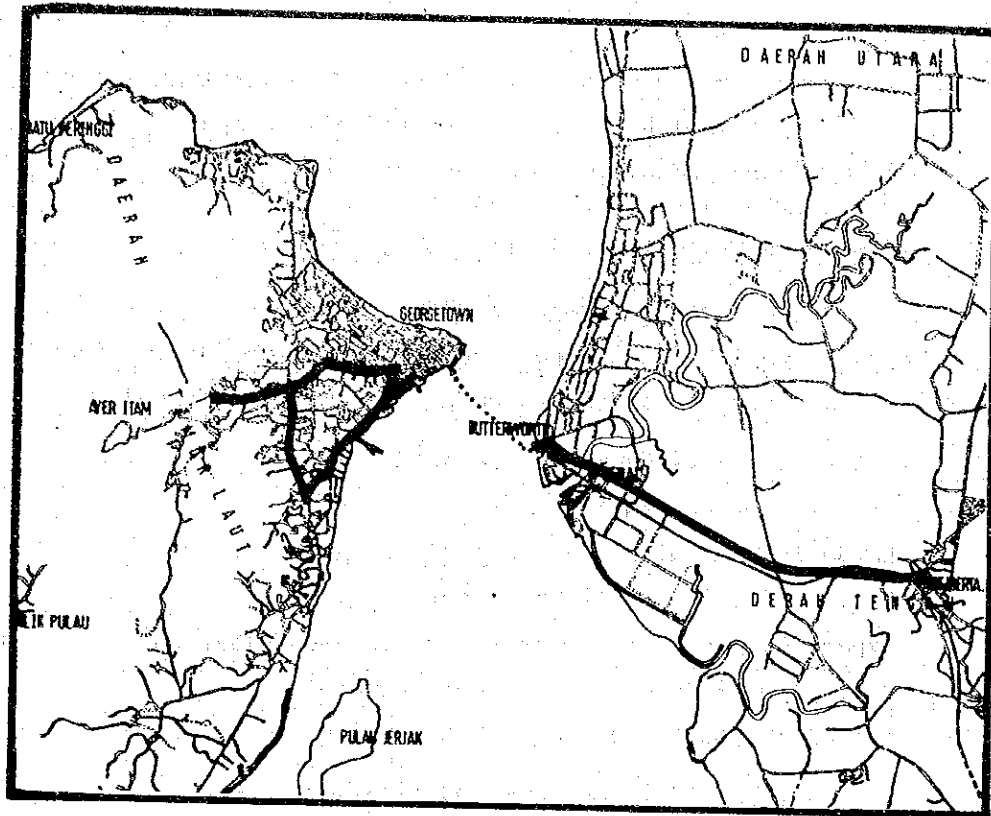
(Refer to the following Figure)

##### 1. In George Town:

- (a) Dato Kramat road and Ayer Ikam road, from Magazine circus to the intersection of the Ayer Ikam road and the Hill Railway Station road.
- (b) Green Lane
- (c) Jalan Jelutory

##### 2. In Province Wellesley:

- (a) Existing Federal Route 1, from Butterworth to the intersection with Jalan Reratang Pauh, and Jalan Permatang Rawa toward Bukit Mertajam.



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

Fig. 8.2 LOCATION OF EXCLUSIVE BUS LANES

Exclusive bus lane is selected as one of the bus priority measures, and typical implemental form is as shown in the following illustration.

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

The practical usage of the exclusive lane should be flexible enough to cope with the local conditions, and in the Study Area it is feasible 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.

An amount of 18 to 48,000 bus passenger (per day) along these major routes are estimated in the year 2000, as a result of demand forecasting with forty (40) to ninety five (95) buses expected to serve along those exclusive lanes in peak hours.

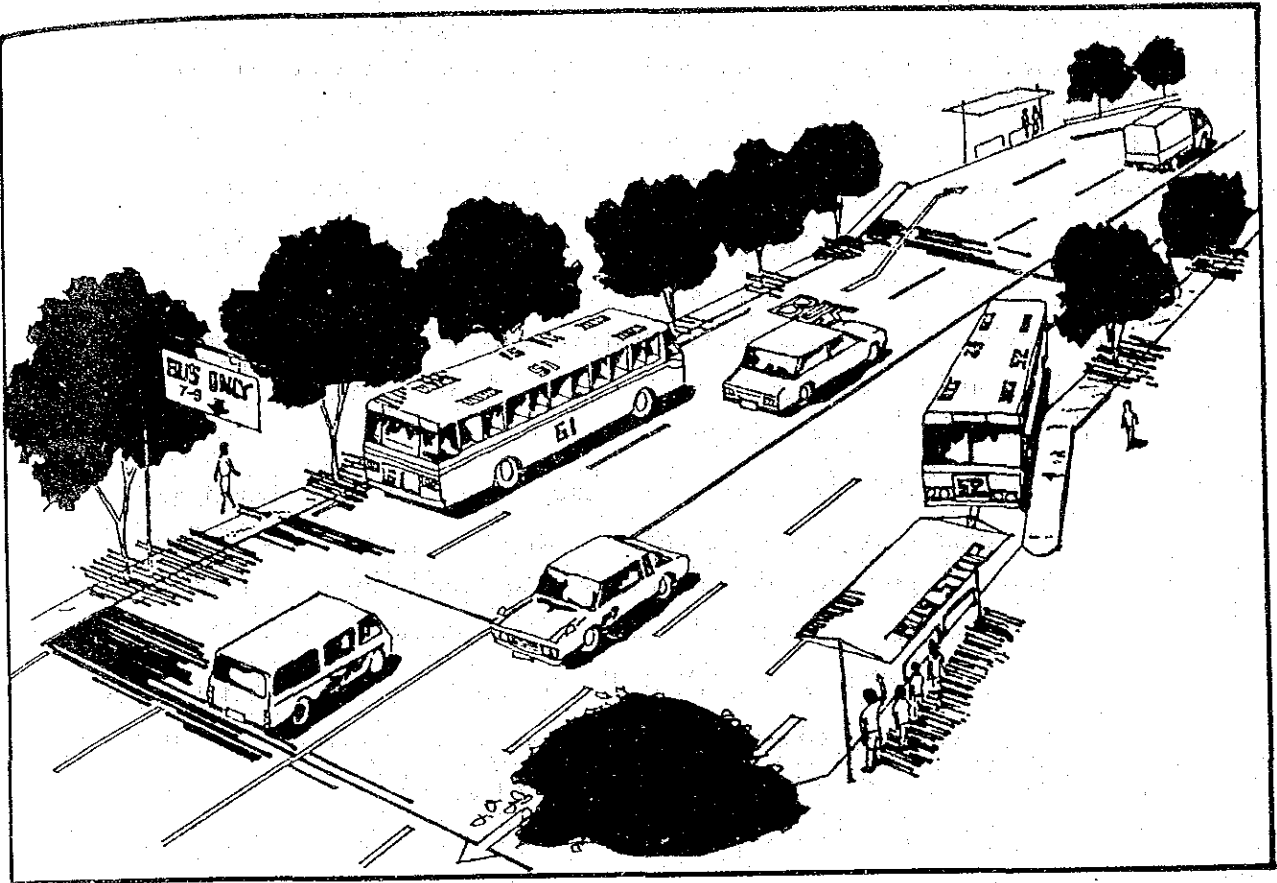


Image of Exclusive Bus Lane

#### 8.2.4 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. From this viewpoint, the bus fare should be reviewed.

#### 8.2.5 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 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 committee should include government, public and private operators and consumer representatives.

#### 8.2.6 Introduction of Mini-Bus System

Past trends of bus transport show that bus transport has been stagnating in terms of the number of passengers carried 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. According to this plan, the Government intends to operate a mini-bus system on major radial roads.

According to the mini-bus study in Kuala Lumpur, the running-kilometer age/of scheduled-bus companies were reduced by one-third (1/3) after the introduction of the mini-bus system.

This suggests that the scheduled-bus companies in Kuala Lumpur were compelled to restrict 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 relatively as a feeder system.

#### 8.2.7 Others

Other measures include short-term actions which will be described in Chapter 9 and 10.

### 8.3 Private Vehicle Restraints

#### 8.3.1 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 the 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 8.4 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 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 prevent a worsening of traffic congestion of the road network up to 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 because in that case, Plan D will produce the most effective drop in traffic volume in the C.B.D.

#### 8.3.2 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:

- (i) To make traffic flow smooth
- (ii) To secure sufficient space for carriage-ways even in narrow streets, not only for daily convenience, but also in case of an emergency.
- (iii) To reduce traffic volume
- (iv) 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.

The areas to be prohibited from parking are shown in Table 8.5.

Table 8.5 AREAS FOR PARKING CONTROL

	30m from Intersection	C.B.D.	Urbanized Area	Rural Area
Primary	*	*	*	*
District	*	*		
Local	*	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 8.6 PARKING CAPACITY IN THE C.B.D.

Year	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-storey 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-story 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 encourage private sectors to develop multi-story 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. 8.3)

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.

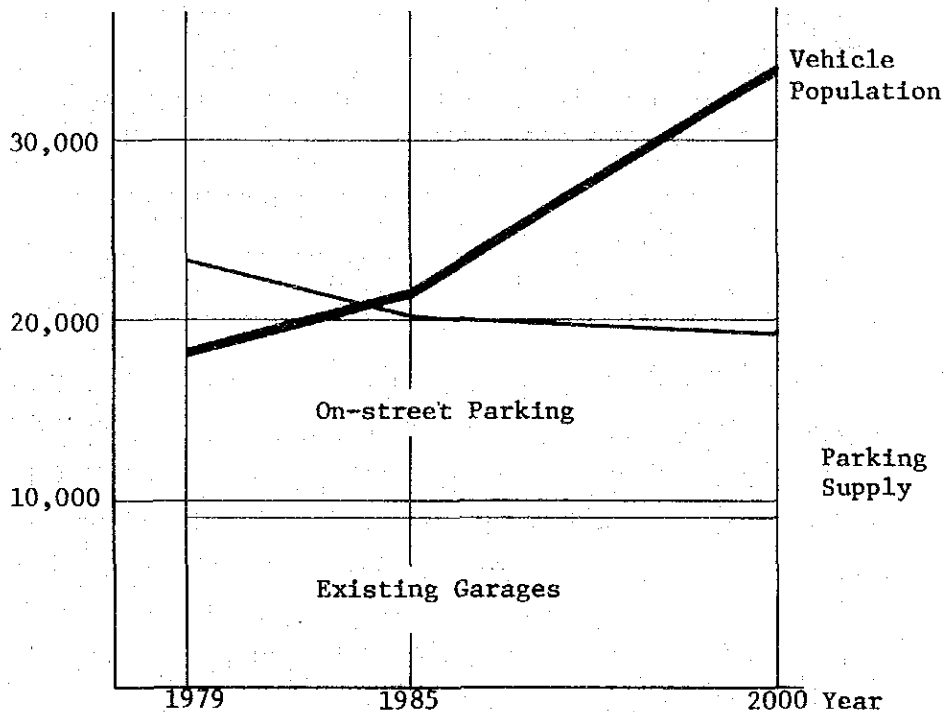


Fig. 8.3 PARKING DEMAND AND SUPPLY  
DURING THE NIGHT

### 8.3.3 Car Pooling System

A car pooling system 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. with the outer areas. In any case, a car pooling or road pricing system will be unnecessary, with the completion of the ultimate road network.



## **8.4 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 improvement of traffic management and engineering.

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

## **8.5 Construction of New Roads & Improvement of Existing Ones**

### **8.5.1 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 result indicate that the proposed road network for the year 2000 is economically feasible. On the basis of this, the following recommendations are made.

### **8.5.2 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 where needed
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. Table 8.8 shows the summary of the ultimate road network.

Table 8.7 SUMMARY OF RECOMMENDED ROAD PLAN

	Number of Projects	Kilometers	Estimated Construction Costs (M\$'000)
Improvement Existing Roads	22	70.7	} 629,291
New Roads	25	117.4	
Grade-separated Interchanges	9	-	62,652
Improvement of Intersections	35	-	2,874

### 8.5.3 Restructuring Road Network

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

### 8.5.4 Penang View Road

From the view-point 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 of the periphery 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. 8.4)

Length: 6.5 Kms.

Construction cost: M\$20 million.

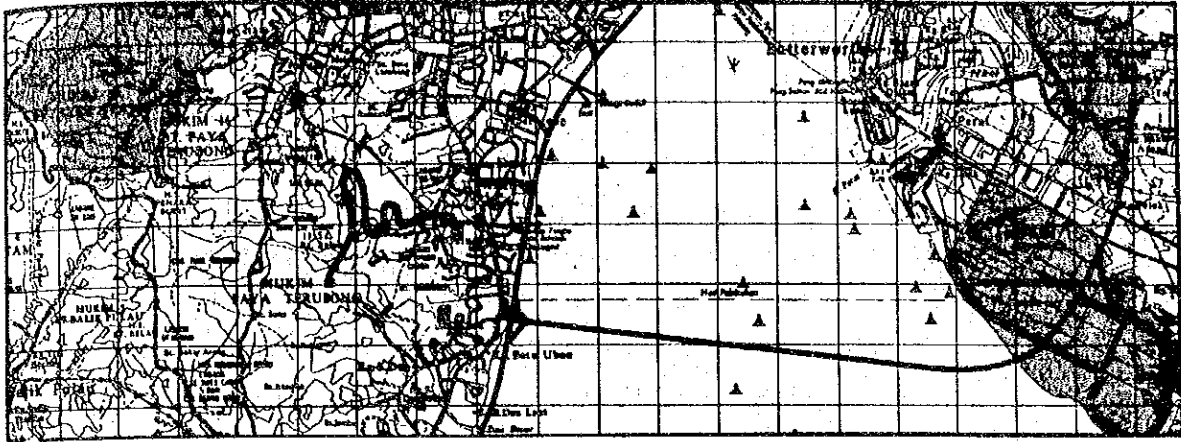


Fig. 8.4 LOCATION OF PENANG VIEW ROAD

## 8.6 Preservation and Creation of a Better Urban Environment

### 8.6.1 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 beautiful road-side trees, historical structures, landscape and beautiful natural scenery. Such an environment not only gives pleasure to inhabitants but also contributes to the tourist industry of Penang.

### 8.6.2 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. 8.5 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 (2) 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 an area which has aesthetic value, beautifying of areas along the roads should be carried out simultaneously.

### 8.6.3 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 be also made.

## 8.7 Construction of Transport Facilities

### 8.7.1 Transport Terminal Complex

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

1. The terminal can facilitate the convenience of intra 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.

The 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. 8.7. 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.

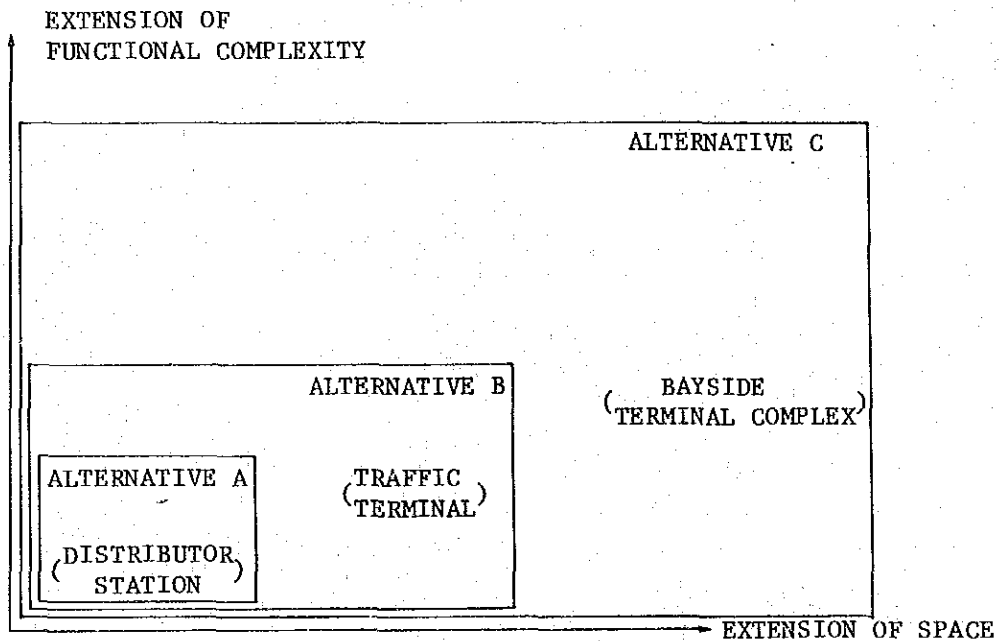


Fig. 8.5 THREE ALTERNATIVE CONCEPTS

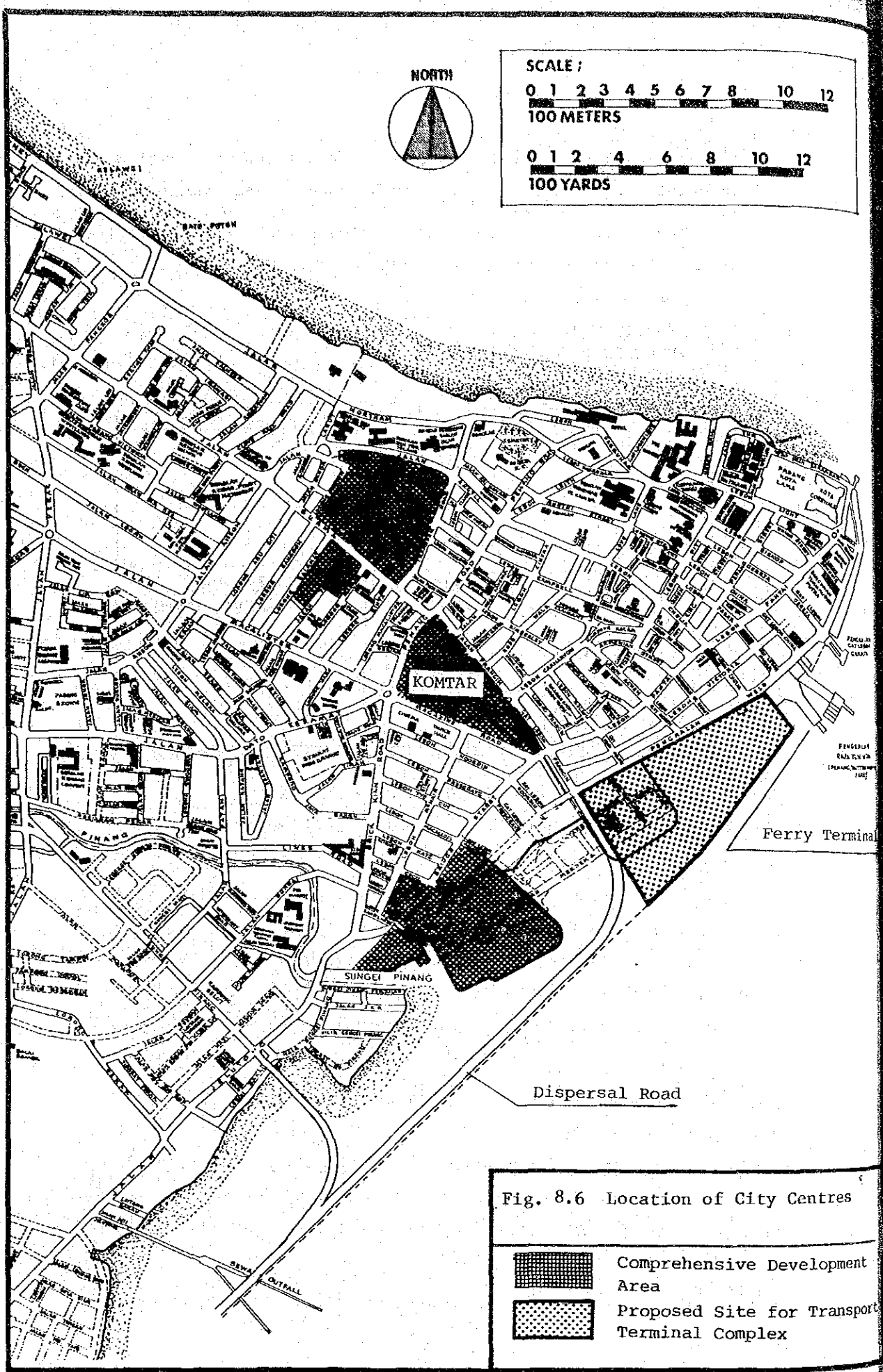




Fig. 8.6 Location of City Centres

	Comprehensive Development Area
	Proposed Site for Transport Terminal Complex

(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 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 re-development 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 at the reclaimed land.

The construction cost of each alternative is estimated as follows:

Table 8.8 CONSTRUCTION COST ESTIMATES  
OF TRANSPORT TERMINAL  
(In thousand dollars at 1979 prices)

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

#### 8.7.2 Transport Amusement Park

##### 1. Objectives

The objectives of this proposal are:

- (i) to educate the public on traffic manners and regulations through various exhibitions which will be held at the proposed hall.
- (ii) to make the public aware of existing and future traffic problems through lectures and seminars regarding traffic matters.
- (iii) to educate the public - children, youngsters and adults - to the changing traffic system by introducing the Traffic Play Area.



## 2. Location of the Transport Amusement 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 transport 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.)

### 8.8 **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

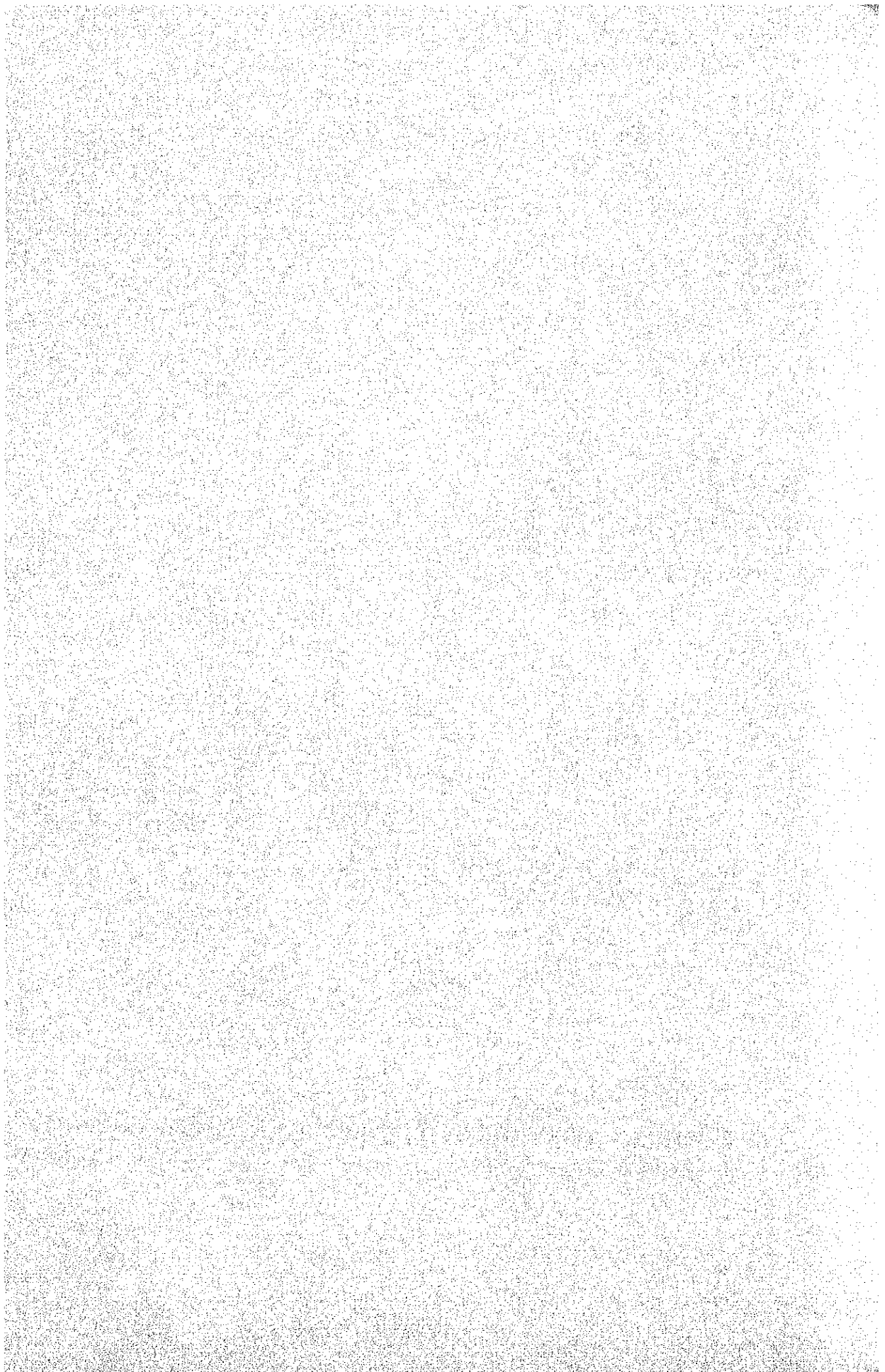
#### 2. Data

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 collected and compiled with the help of the staff to evaluate and update this plan.



## **9. Short Term Action - Traffic Engineering and Management**

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RECOMMENDED SHORT-TERM ACTION-TRAFFIC ENGINEERING  
AND MANAGEMENT

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## 9. RECOMMENDED SHORT-TERM ACTION-TRAFFIC ENGINEERING AND MANAGEMENT

### 9.1 Introduction

#### 9.1.1 Objectives

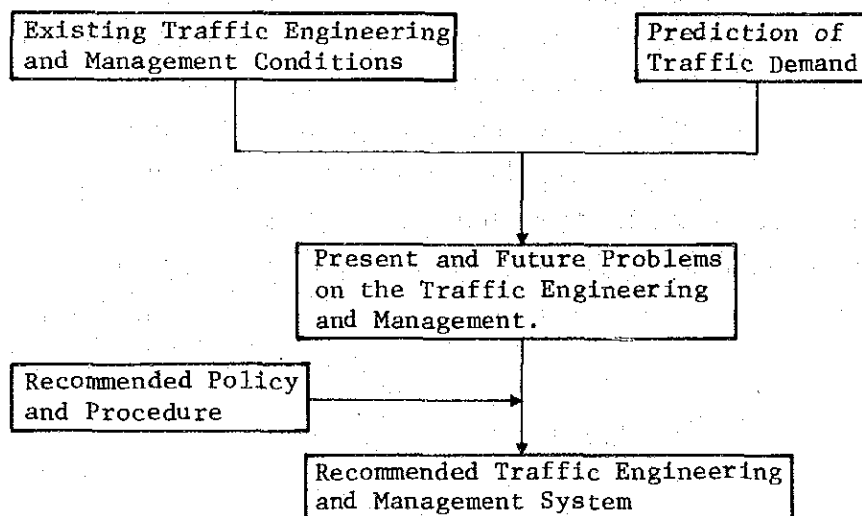
The main concern of the Traffic Engineering and Management study is the provision of a short-term programme in order to utilize the existing road infrastructure more smoothly, effectively and safely, with or without the implementation of the committed projects. This is because the problems of traffic flow will be almost solved if the existing road space can be made to provide for optimal traffic capacity.

In this connection, the following basic policies for traffic engineering and management can be identified.

1. To improve the existing road conditions and system so as to make possible the most effective road usage.
2. To provide a better transport environment thus making living more comfortable for people.
3. To provide for a better safety situation making movement within traffic safer for the public.

#### 9.1.2 Procedure of Traffic Engineering and Management Study

The procedure of traffic engineering and management study is described below.



1. Existing traffic engineering and management conditions are described in Technical Report 15 - "TRAFFIC ENGINEERING AND MANAGEMENT STUDY (EXISTING CONDITIONS)".
2. Prediction of traffic demand is made for three (3) cases, in 1979 and in 1985 without under planning projects and in 1985 with under planning projects.
3. Present and future problems on traffic engineering and management are picked on the basis of detailed study for existing traffic engineering and management conditions and prediction of traffic demand.
4. The recommended traffic engineering and management system is made to solve the present and future problems on traffic engineering and management. In this stage all recommendations are based on traffic engineering and management policies.

## 9.2 A Prediction of Traffic Demand

### 9.2.1 The Committed and Under-Planning Construction Projects

The committed and under-planning road construction projects which are expected to be completed within the period up to 1985 are as follows:

- Penang Bridge Project with four-lane carriage-way capacity.
- North Coastal Road of Penang Dispersal Plan with four-lane carriage-way.
- Alor Star - Changkat Jering Highway (New Federal Route 1)
- Alor Star - Butterworth section with a four-lane carriage-way.
- The East Coastal Road which extends south of Weld Quay.
- The widening of Green Lane into a four-lane carriage-way.
- The widening of Jalan Sungai Pinang into a four-lane carriage-way.
- The widening of Jalan Batu Lancang into a four-lane carriage-way.
- Prai Barrage Approaches Project for the new bridge construction with a two-lane carriage-way.

## 9.2.2 A prediction of Traffic Demand

### 1. A prediction of Traffic Demand in George Town

On the basis of the existing road network, and the committed and under-planning road construction projects up to 1985, described in 9.2.1, traffic demand in 1979, 1985 without committed and under-planning road construction projects and 1985 with the projects schematically illustrated in Fig. 9.1 to 9.3, show the main traffic flow out of the central area of George Town. In the figures, the outer cordon and the inner cordon which are divided into three (3) sections and two (2) sections respectively are set as such that traffic demand at each section can easily be compared. The traffic demand by section in 1979 and 1985 are tabulated in Table 9.1.

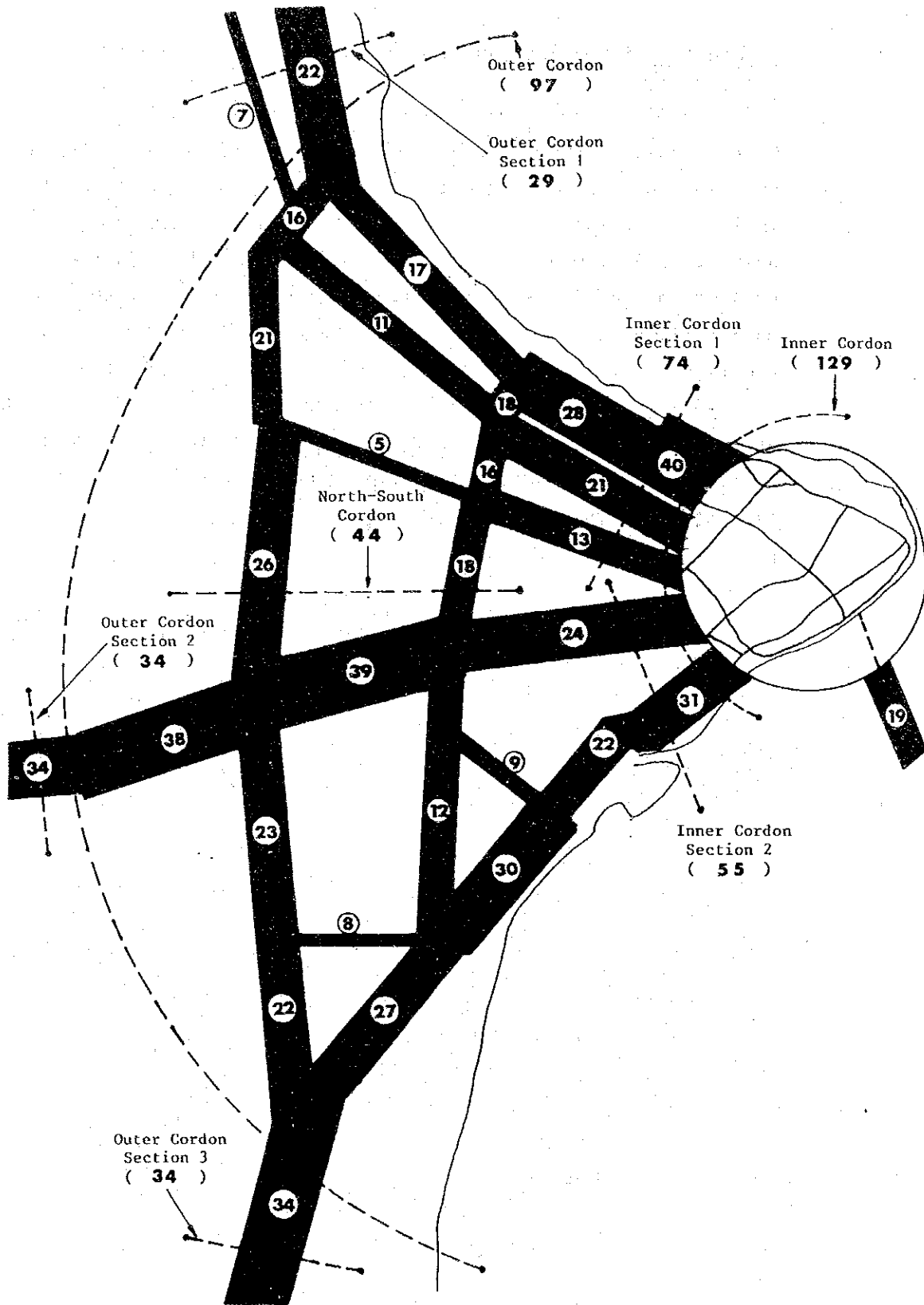


Fig. 9.1 Traffic Demand in 1985

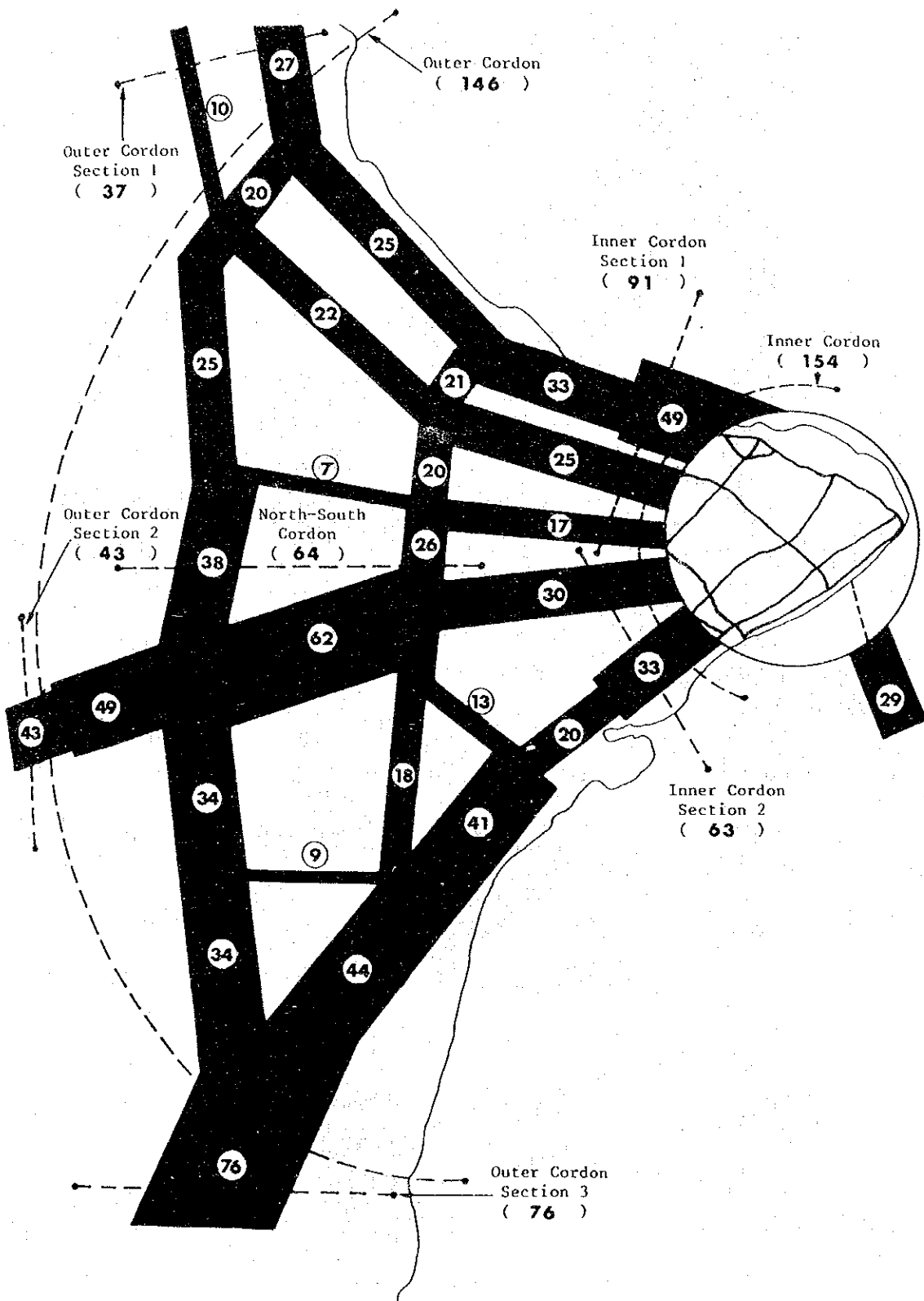


Fig. 9.2 Traffic Demand in 1985 without Road Construction Project

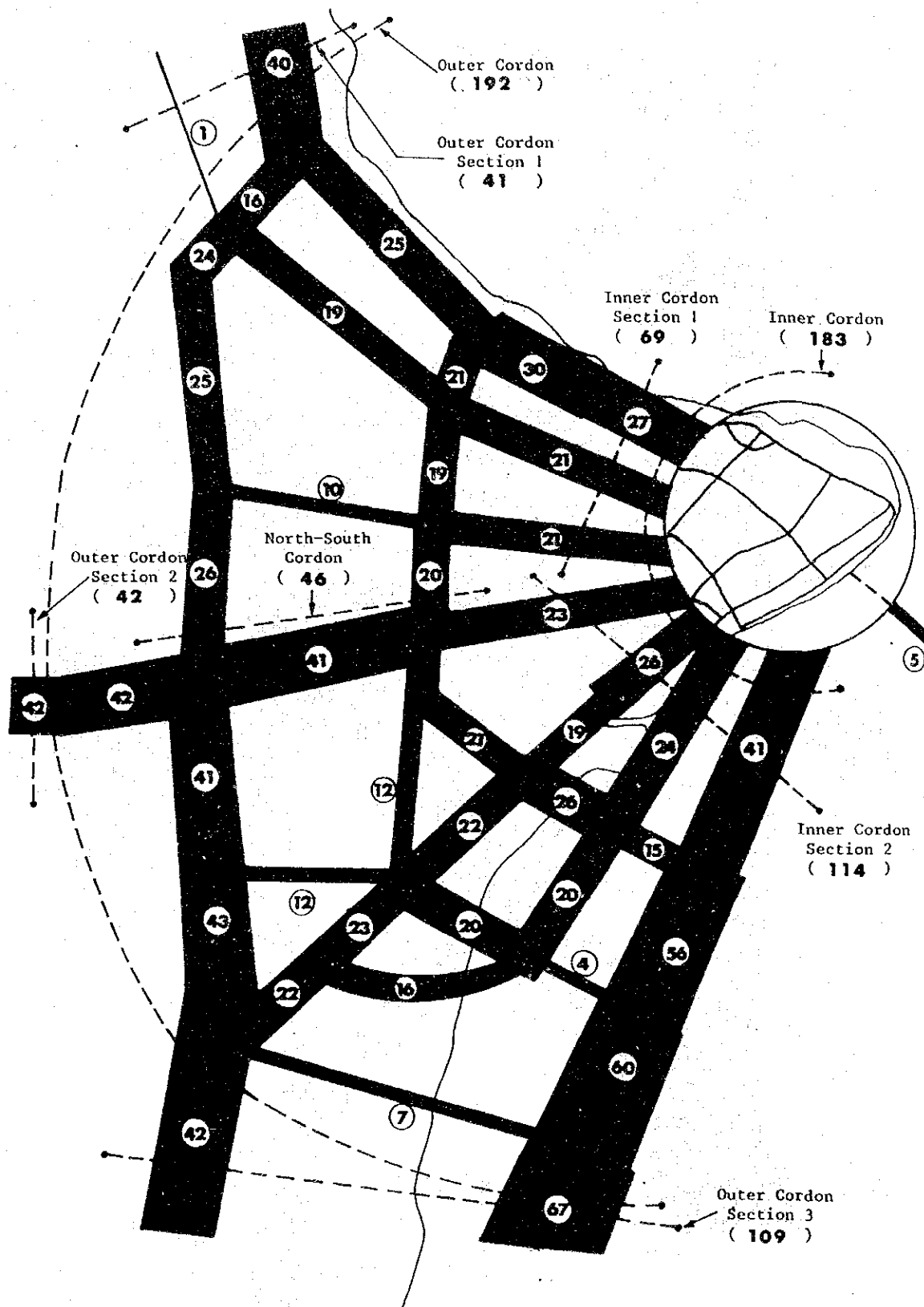


Fig. 9.3 TRAFFIC DEMAND IN 1985 WITH ROAD CONSTRUCTION PROJECTS

Table 9.1 TRAFFIC DEMAND BY SECTION IN GEORGE TOWN

1985\* : 1985 without road construction projects.

1985\*\* : 1985 with road construction projects.

Outer Cordon (Unit : 1000 P.C.U)

Year	Section 1 (Northwards)	Section 2 (Westwards)	Section 3 (Southwards)	Total
1979	29	34	34	97
1985*	37	43	76	146
1985**	41	42	109	192
Growth Rate (%)				
1979/1985*	128	126	224	151
1979/1985**	141	124	321	197

Inner Cordon (Unit : 1000 P.C.U)

Year	Section 1 (Northern)	Section 2 (Southern)	Total
1979	74	55	129
1985*	91	63	154
1985**	69	114	183
Growth Rate (%)			
1979/1985*	123	115	119
1979/1985**	93	207	142

North - South Cordon (Unit : 1000 P.C.U)

Year	
1979	44
1985*	64
1985**	46
Growth Rate (%)	
1979/1985*	145
1979/1985**	105

From an analysis of these figures, the change in the traffic demand in 1979 and 1985 in as well as out of the C.B.D. is described as follows:

- (i) The movement of traffic southwards will increase 124 percent without road construction projects and 221 percent with road construction projects. However, the movement of traffic westwards and northwards will not increase as much as the above due to people attracting development will concentrate in the southern part rather than in the western and northern parts of George Town.
- (ii) The traffic flow into the C.B.D. will increase 42 percent with road construction projects. At present, all traffic using the ferry has to go into the C.B.D., even if destinations are not there. However, when the Penang Bridge is completed, most traffic will use this bridge to cross the channel with destinations mainly being in the C.B.D. itself and as a result social activities in the C.B.D. will become more active in the future.

Furthermore, the comparison of the change in traffic volume on the major links can be described as follows :

- (i) Green Lane after road construction projects, will carry 1.9 times more traffic than in 1979.
- (ii) Jalan Ayer Itam between Green Lane Intersection and Jalan Perak Intersection without road construction projects will carry 1.6 times more traffic than in 1979. However, this road will have 1.1 times more traffic than in 1979.
- (iii) Jalan Jelutong along Jelutong town without road construction projects will carry 1.6 times more traffic than in 1979, on the other hand it will have less traffic with road construction projects than in 1979. But, new traffic flows will be generated from the North Coastal Road at Jalan Batu Lancang (20,000 P.C.U) and Jalan Sungai Penang Intersection (26,000 P.C.U).
- (iv) Other main roads, such as Jalan Northam, Jalan Burmah, Jalan Macalister and Jalan Perak will have more traffic in 1985



than in 1979 in both situations.

2. A Prediction of Traffic Demand in Butterworth and Bukit Mertajam

In the same manner as for George Town, the main traffic demand out of the central area of Butterworth and Bukit Mertajam in 1979, 1985 without committed and under planning road construction projects and 1985 with those projects are schematically illustrated in Fig. 9.4 to 9.6. In the figures, the outer cordons which are divided into two (2) sections can easily be compared with each other. The traffic demand by section in 1979 and 1985 are tabulated in Table 9.2 and 9.3.

Table 9.2 TRAFFIC DEMAND BY SECTION IN BUTTERWORTH

1985\* : 1985 without road construction projects.

1985\*\* : 1985 with road construction projects.

Outer Cordon (Unit : 1000 p.c.u)

Year	Section 1 (Northwards)	Section 2 (Eastwards)	Total
1979	38	34	72
1985*	56	59	115
1985**	36	30	66
Growth Rate (%)			
1979/1985*	147	174	160
1979/1985**	95	88	92

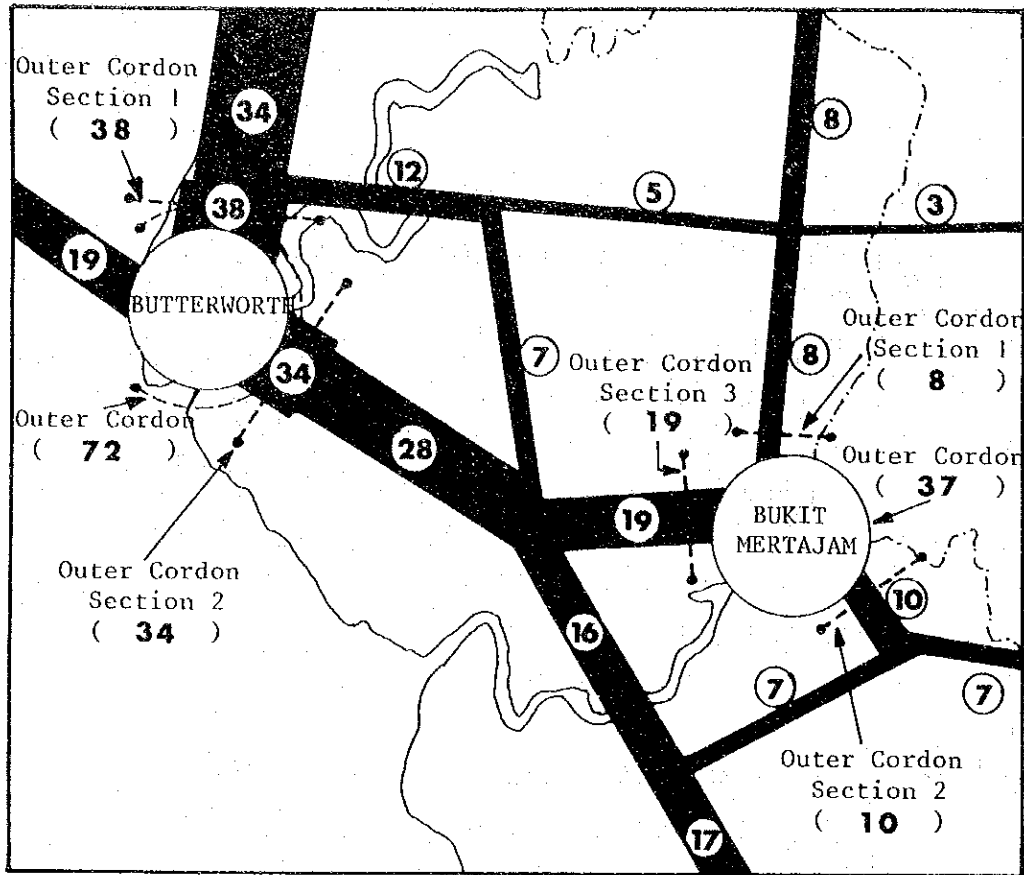


Fig. 9.4 Traffic Demand in 1979

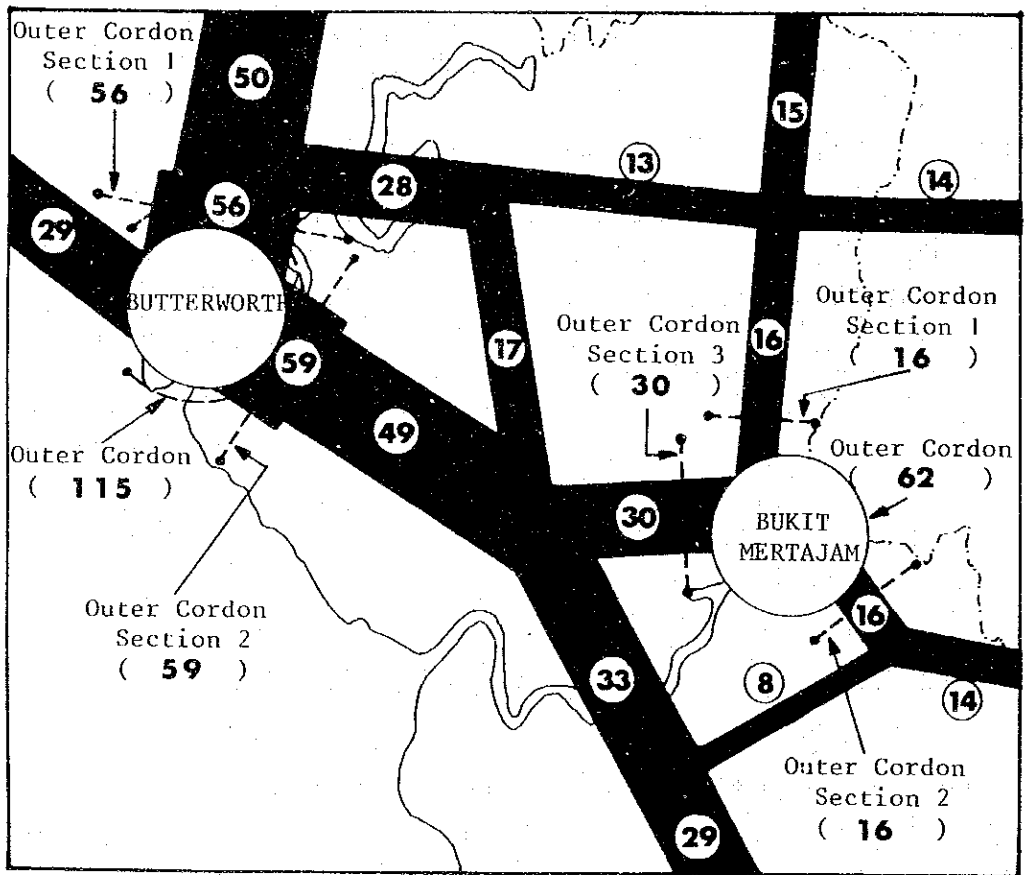


Fig. 9.5 Traffic Demand in 1985 without Road construction Projects

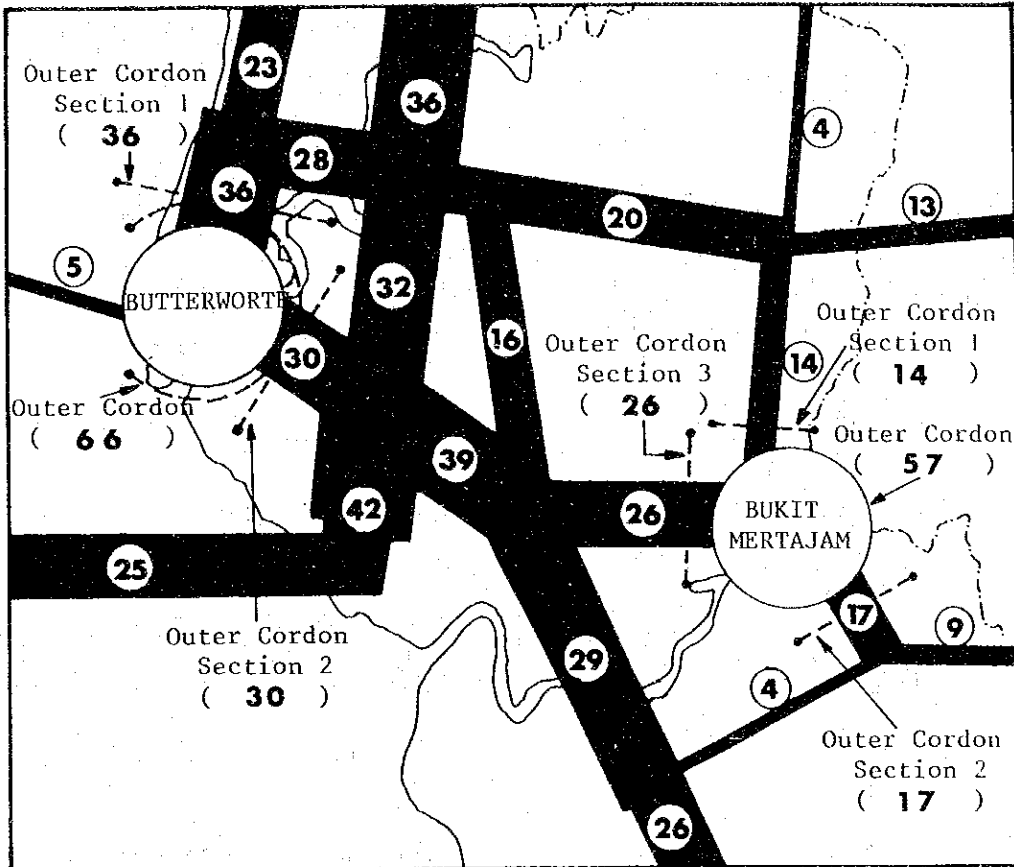


Fig. 9.6 Traffic Demand in 1985 with Road Construction Projects

Table 9.3 TRAFFIC DEMAND BY SECTION IN BUKIT MERTAJAM

1985\* : 1985 without road construction projects.

1985\*\* : 1985 with road construction projects.

Outer Cordon (Unit : 1000 P.C.U)

Year	Section 1 (Northwards)	Section 2 (Eastwards)	Section 3 (Westwards)	Total
1979	8	10	19	37
1985*	16	16	30	62
1985**	14	17	26	57
Growth Rate (%)				
1979/1985*	200	160	158	168
1979/1985**	175	170	137	154

From an analysis of the above figures, the change in the traffic demand in 1979 and 1985 in as well as out of the central area is described as follows:

(i) Butterworth

The movement of traffic northwards and eastwards will increase 47 percent and 74 percent respectively without road construction projects. However, there will be almost the same traffic volume as the existing situation with road construction projects. This is because the road construction projects, i.e. Penang Bridge Project and Federal Route 1, will have tremendous effects and will reduce the traffic demand in the central area of Butterworth.

(ii) Bukit Mertajam.

The movement of traffic in all directions will increase 50 to 100 percent in 1985 in both situations as a result of social activities in Bukit Mertajam becoming more active even without influence from the road construction projects as more traffic will pass through the town.

### 9.3 Existing and Future Problems on Traffic Engineering and Management

#### 9.3.1 Existing Problems on Traffic Engineering and Management

##### 1. Traffic Regulations

Regarding traffic regulations, the main problem is that one-way street systems are adopted only to solve the problems of certain streets or for certain points, not for the problems of the central area of the city.

Also, it is pointed out that certain types of traffic signs, i.e. stop-signs, speed limit signs, etc., are seldom seen.

##### 2. Intersections

It has been pointed out that the main problems of intersections are at roundabouts in the central area of the city, i.e. Magazine Circus, Carnavon Circus in George Town and Jalan Bagan Luar/New Chain Ferry Road Intersection in Butterworth. At these intersections, traffic jams occur frequently and during peak hours traffic police are needed to control the traffic flow. In addition, at these intersections, due to mixed traffic (Car/Bus/Motor-cycle/Trishaw/etc.) traffic accidents are numerous. In addition, Jalan Northam/Jalan Kelawai Intersection, Jalan Macalister/Jalan Anson Intersection and Jalan Kelawai/Jalan Bagan Jermal/Jalan Tanjong Tokong Intersection, where small roundabouts are installed, also face traffic jams during peak hours.

At some intersections between primary roads and district roads without traffic signals, the traffic from district roads face the difficulty of turning, especially to the right.

These intersections are listed below:

##### George Town

Jalan Gottlieb/Jalan Bagan Jermal/Jalan Burma/Mount Erskine  
Road

Jalan Ayer Itam/Jalan Trengganu

Green Lane/Jalan Free School

Green Lane/Jalan Hamilton/Lorong Batu Lancang

Green Lane/Jalan Batu Lancang

Jalan Perak/Jalan Free School/Lorong Perak  
Jalan Jelutong/Jalan Perak/Jalan Batu Lancang  
Jalan Jelutong/Lorong Perak

Butterworth

Jalan Bagan Luar/Jalan Pantai/Jalan Heng Choon Thiam

Bukit Mertajam

Jalan Arumugam Pillai/Jalan Besar

3. Traffic Signal

At many intersections with traffic signals, display faces have obsolete lens with 65 watt/250 volt screwed in bulbs and visibility is not good. At other busy intersections and large intersections, visibility is also not good because of pedestal-type installations and signal heads.

4. Traffic Safety

About two-third (2/3) of all accidents occur in the suburban area. Car/car collisions and car/motor-cycle collisions are the predominant types of accidents with a share of more than half of all accidents according to the accident analysis. These facts indicate that almost all vehicles involved in accidents were moving at such a speed that they could not avoid unforeseen events such as vehicles moving out from cross-roads or buildings, vehicles on coming from the wrong direction and the cutting in of overtaking vehicles.

In addition, one of the main problems working against traffic safety is that of mixed traffic containing vehicles, motor-cycles, trishaws and bicycles.

5. Parking

To consider the whole central area of the city, parking capacity seems to be sufficient. However, some busy streets in the business area and in the shopping area, such as Leboh Pantai, Combell Street in George Town and Jalan Pasar in Bukit Mertajam, lack parking space and double parking is often seen with parking activities on main roads obstructing smooth traffic flow.

## 6. Pedestrians

The facilities provided for pedestrians fall short of those for other road users. Even in the central area, sidewalks are non-existent along some streets while existing ones are too narrow to accommodate all the pedestrians who want to enjoy shopping along busy streets, with the situation being that the many people who walk along the carriage-ways must be wary of vehicular traffic while they shop. Also there are very few clearly marked pedestrian crossings even at busy intersections although dividing islands are installed in the middle of some intersection approaches.

### 9.3.2 Traffic Management Problems Resulting from Future Traffic Demand

The future traffic demand on the major network is described in 9.2.2 and future problems on Traffic Engineering and Management resulting from future traffic demand are pointed out in two (2) stages, namely 1985 without road construction projects and 1985 with road construction projects.

#### 1. Traffic Management Problems Resulting from Traffic Demand in 1985 without Road Construction Projects

##### (a) George Town

The traffic demand in Jalan Ayer Itam, Jalan Dato Keramat, Jalan Jelutong, Jalan Glugor, Green Lane, Jalan Scotland, Jalan Northam, Jalan Kelawai and Jalan Tanjong Tokong will increase greatly and therefore many problems will arise at major intersections, i.e., at Jalan Glugor/Green Lane, Jalan Ayer Itam/Jalan Dato Keramat/Jalan Perak and etc. The traffic demand in Jalan Western, Jalan Gottlieb, Jalan Bagan Jermal and Jalan Perak will also increase greatly and will exceed the highest possible capacity.

##### (b) Butterworth

The traffic demand in Jalan Bagan Luar, Jalan New Chain Ferry, Jalan Telaga Ayer and Jalan Permatang Pauh will exceed the highest possible capacity and this situation will cause severe traffic congestion at some intersections,

i.e Jalan Bagan Luar/Jalan Kampong Gajah/Jalan Telaga Ayer, Jalan Telage Ayer/Jalan Permatang Pauh/Jalan Siram/Jalan Raja Uda and etc. Furthermore, the traffic demand for ferries will be 1.5 times as much as the existing condition with longer queues anticipated which will obstruct the smooth flow of traffic.

(c) Bukit Mertajam

Traffic demand at Jalan Arumugam Pillai will exceed the possible capacity with the problem occurring at intersections with cross-roads.

2. Traffic Management Problems Resulting from Traffic Demand in 1985 with the Road Construction Project.

(a) The North Coastal Road/Weld Quay/Jalan Prangin intersection, will become more problematic as more than 41,000 P.C.U/day will concentrate at this intersection. Jalan Northem, Jalan Kelawai and Jalan Tanjong Tokong will face the same situation as described in 9.3.2 (1) (a).

(b) Butterworth

Road construction projects which will be undertaken in Butterworth and the many problems which are described in 9.3.2 (1) (b) will be solved. However, Butterworth New Port is expected to be completed and almost 4,000 cars will generate from and be attracted to the new port. Therefore, the Jalan Bagan Luar/Jalan Heng Choon Thian/Jalan Pantai intersection will face a problem.

(c) Bukit Mertajam

The situation will be similar to that without road construction projects as described in 9.3.2 (1) (c).



## 9.4 Recommended Traffic Engineering and Management System

### 9.4.1 Recommended Policies and Procedure

#### 1. Classification on Road Network

The streets, especially in the central areas of the city serve many urban activities such as for vehicular traffic movement, pedestrian traffic, loading and unloading of merchandise, short-term parking, delivery services, bus services, taxi stands and emergency services with their functions subject to change from hour to hour and by day to day. However, those functions that are not directly related to traffic movement should be assigned to off-street areas. This is especially the case during peak hour traffic when many usually permitted roadway functions may be banned in order to increase the capacity for traffic movement.

From the point of view of the functional uses of streets, it is suggested that streets in the central areas of the city be classified into the following five (5) categories.

##### (a) Primary Distributor (Inter-Urban)

This element of the road system links the major cities. It is designed specially for vehicles, and also as access points with other roads which are limited in this respect.

##### (b) Primary Distributor (Intra-Urban)

This being one of the elements of the road system which serve as the major traffic artery throughout the day. On-street loading, unloading, parking and other functions not related to traffic movement should be strongly discouraged with enforcement being rigid.

##### (c) District Distributor

This element of the street system performs a dual function, viz. being cleared for maximum traffic movement during peak periods and serving the general circulating and land service functions of the community during off peak periods.

##### (d) Local Distributor

Although these roadways are used for traffic movements

through the central areas of the city, they are generally not used for through traffic but rather for circulating from point to point within the area and for access to parking.

This street system would, when necessary, be used to fulfill the needs of the community for short-term parking, loading and unloading of merchandise and other similar services that cannot be conducted off the street.

(e) Access Road

This minor street system is seldom used for traffic movements through the central area of the city. Its major function is to provide access to adjacent properties, and includes back alleys and narrow streets not suitable for heavy traffic movements. Occasionally this system may be suitable for loading and parking purpose if it does not interfere with its main function.

2. Traffic Circulation Plan

The main purpose of the traffic circulation plan in the central area of the city is to form the main traffic flow line in the central area and to avoid the situation of through traffic going into minor roads. For this purpose, it is recommended that some Primary Distributors and some District Distributors be made into one-way streets which will result in higher capacity, thereby easing traffic at critical intersections although this will force drivers to make longer trips.

3. Traffic Regulations

The main concern of traffic regulations in George Town, Butterworth and Bukit Mertajam is one-way streets. The one-way street system in the central area for some Primary Distributors and some District Distributors is already explained in 9.3.1 (2), however, it is also recommended that Local Distributors in busy areas be made into one-way streets to provide parking spaces and/or pedestrian facilities.

Traffic regulations should be consistently applied according to circumstances on roads and traffic situations. Therefore, the

Municipal Council needs to prepare a traffic guideline or a traffic manual. At present, the Municipal Council has already prepared a traffic sign manual in which the installation standard and materials used for traffic signs are specified.

However, the traffic regulations such as one-way designations and parking prohibitions have socio-economic impacts on the people living along the roads and/or using buses. Thus, there should be discreet considerations given to this matter with the Municipal Council having to initiate a campaign in order to get a consensus from the people.

#### 4. Traffic Signals

The procedure for improving visibility of traffic signals is to introduce new signal bulbs and lens to replace the existing old models. It is also recommended that mast arms and horizontal overhead displays be installed at busy and large intersections.

If traffic signal control is deemed necessary for isolated intersections in George Town and in the peripheral and suburban areas of Butterworth and Bukit Mertajam, traffic actuated signal control is recommended as the most suitable for achieving higher capacity on these roads.

Traffic actuated signals can usually be modified to function as an area traffic signal control system. In the future, many of the traffic signals within the central area of George Town are expected to be controlled by an area traffic signal control system when traffic signals are closely installed as to warrant this system. In addition, the traffic actuated signal has an advantage in that it can collect data for monitoring traffic information at intersections.

However, in the central areas of Butterworth and Bukit Mertajam it is desirable to have traffic signal control of the fixed-time type contained within 3 to 4 patterns of phasing time, whereby the best combination of these time patterns can be selected. Also, fixed-time signal can usually be modified to function as a coordinated or interlinked unit in the future.

## 5. Traffic Safety

Traffic safety still remains a major concern all over the world and every effort is being made, especially from the engineering, human factor, educational, enforcement and environmental aspects. George Town, Butterworth and Bukit Mertajam are not exceptions, to the rule.

As traffic safety contributes to the well being of people the very problematical situation of mixed road traffic remains to be solved.

Accident records are kept in the traffic section of the Police Department. However, accident statistics and analytical reports are not always available to the Municipal Council, educational institutes and other agencies concerned with traffic safety, although they are an important requirement to any on-going programme for traffic operational improvement. Therefore a uniform system of standardization of data processing methods is recommended to be established at first, so that accumulated analytical data over a period of for example, one year can be collected.

## 6. Parking and Loading

Policies and regulations existing for the control of parking and loading within the central area is already described in Technical Report 15 "TRAFFIC ENGINEERING AND MANAGEMENT STUDY (EXISTING CONDITION)". However, a policy should be adopted which focuses enforcement activities on the parking of vehicles and loading of trucks which obstruct footpaths and severely hamper the passage of vehicles. This practice is prevalent in the highly developed commercial and congested areas, such as along Leboh Pantai and Leboh Campbell in George Town.

In any matter, the control of on-street parking and loading has to be strengthened as traffic volume will increase in the future. Therefore, a strategy of where and how to impose the control in the central area has to be prepared at this stage.

## 7. Pedestrian

Concerned effort through a wide variety of measures is required

to improve the facilities provided for pedestrians. As a basic measure, laws and ordinances which clearly define the duties and responsibilities of vehicle drivers and pedestrians have to be developed.

Also, every effort should be concentrated primarily on constructing side-walks or safe walking spaces for pedestrians so that they can move about safely and without obstruction.

#### 9.4.2 Recommended Traffic Engineering and Management System

##### 1. Classification of Road Network

###### (a) George Town

Fig. 9.7 illustrates the functional classification of the road network in George Town in 1985 when committed projects are completed.

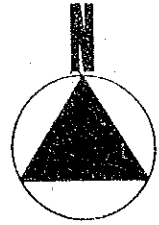
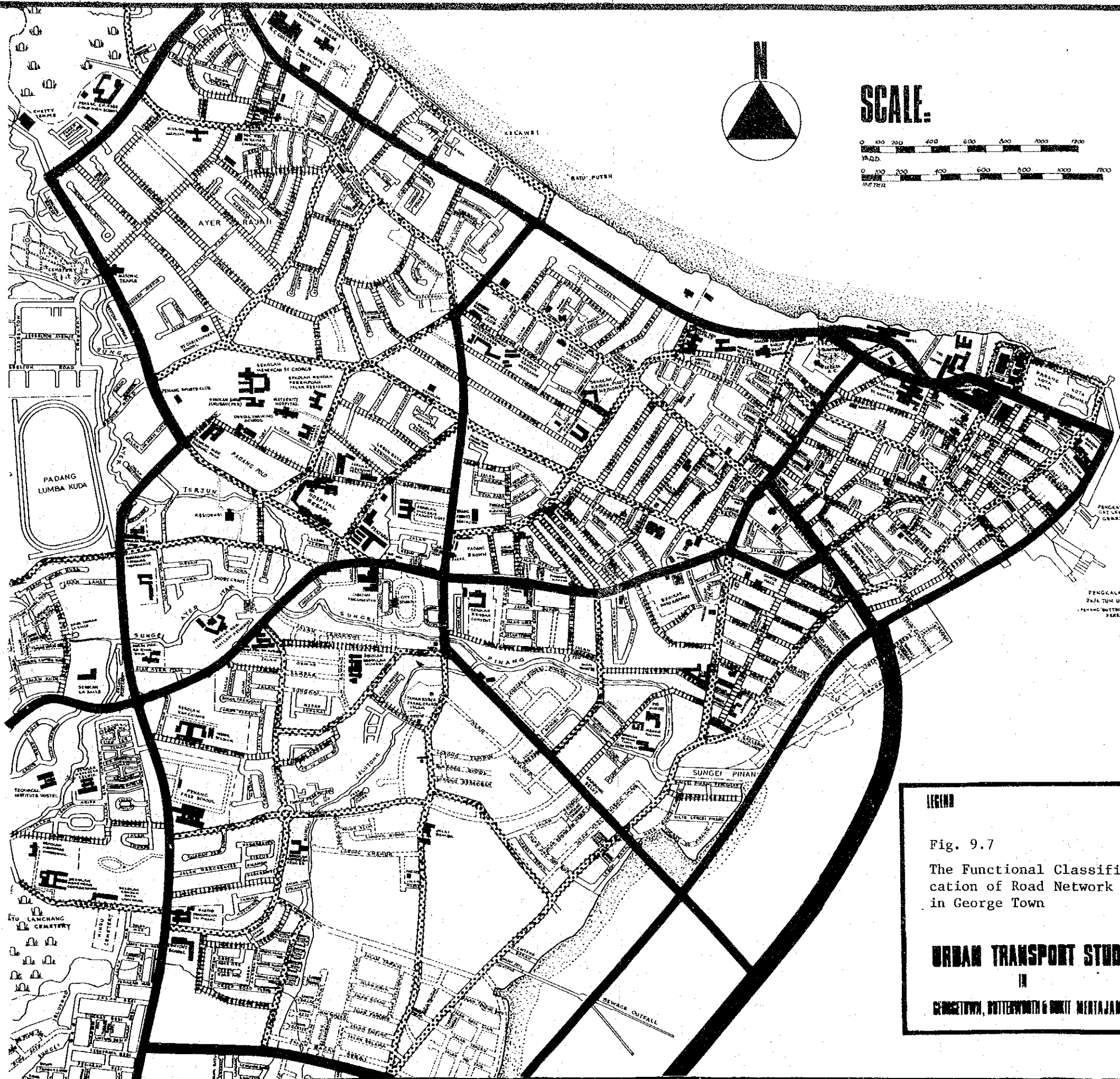
The only roads which fall into the category of Primary Distributors (Inter-Urban) is the North Coastal Road.

The roads which fall into the category of Primary Distributors (Intra-Urban) are Jalan Northam, Leboh Light, Jalan Kelawai, Weld Quay, East Coastal Road, Jalan Dato Keramat, Jalan Ayer Itam (these seven (7) roads form the main radial roads in George Town), Penang Road, Jalan Prangin, Magazine Road, Jalan Pangkor, Jalan Sungei Pinang, Jalan Bagan Jermal, Jalan Gottlieb, Western Road, Jalan Scotland, Green Lane and Jalan Batu Lancang (these eleven (11) roads form into three (3) ring roads in George Town).

###### (b) Butterworth

Fig. 9.8 illustrates the functional classification of the road network in the central area of Butterworth in 1985.

The roads in Butterworth which fall into the category of Primary Distributors (Intra-Urban) are New Chain Ferry Road, Chain Ferry Road, Jalan Bagan Luar, Jalan Kampong Gajah, Jalan Telaga Ayer and Jalan Permatang Pauh.



**SCALE:**



**Legend**

- Primary Distributor (Inter-urban)
- Primary Distributor (Intra-Urban)
- District Distributor
- Local Distributor
- Access Road

**LEGEND**

Fig. 9.7  
The Functional Classification of Road Network in George Town

**URBAN TRANSPORT STUDY**  
II  
GEORGETOWN, BUTTERWORTH & BUKIT MERTAJAM



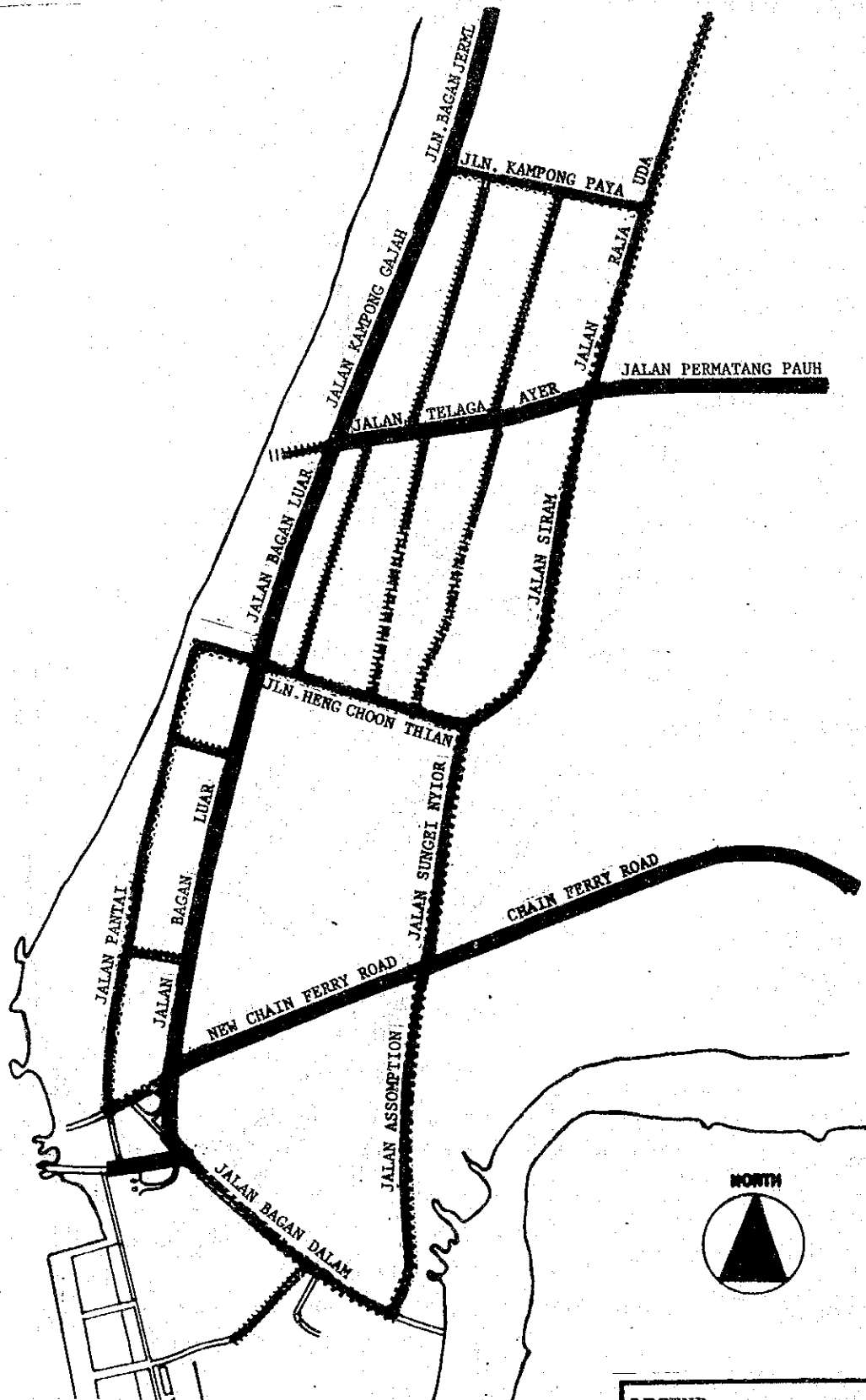
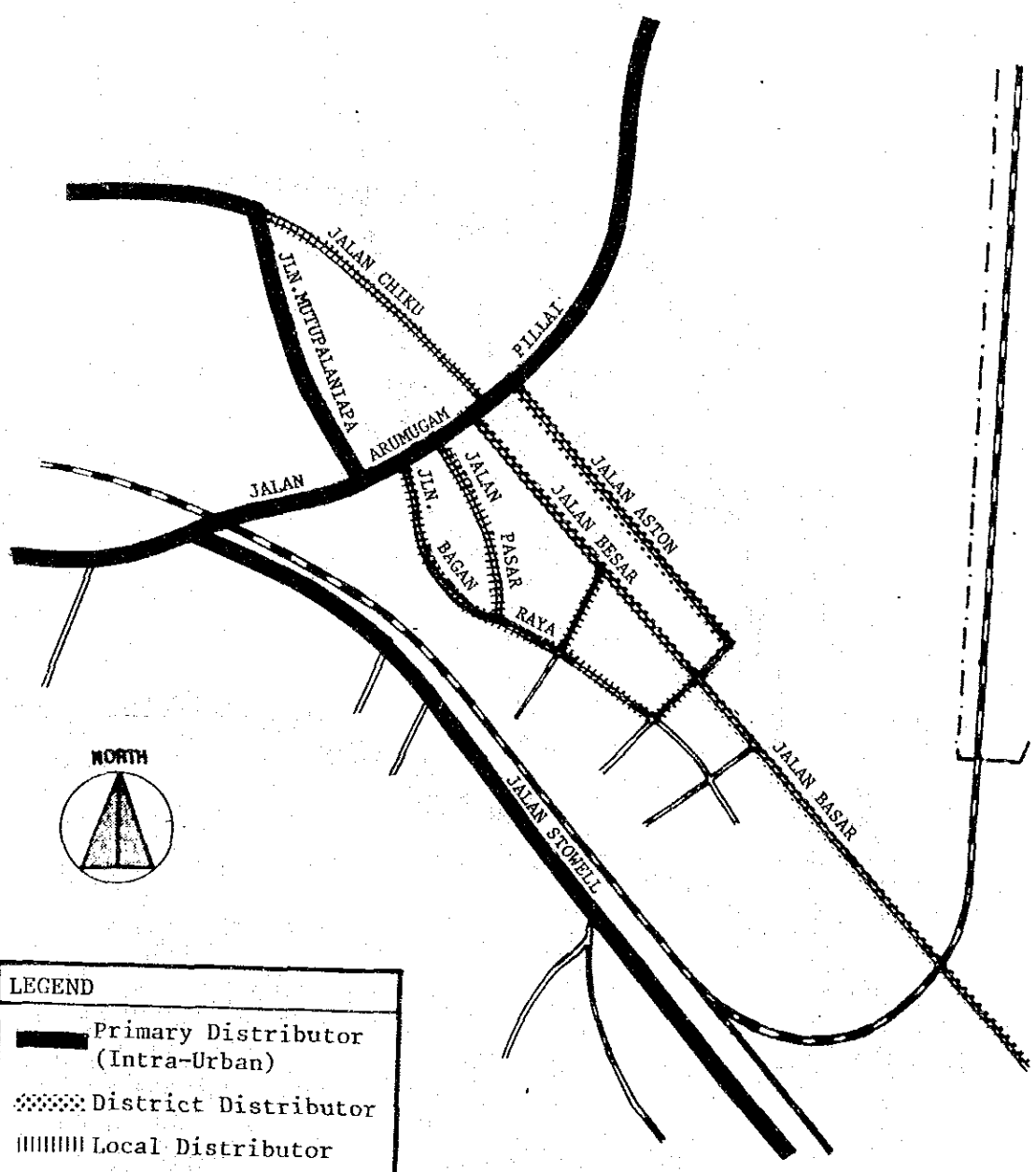


Fig. 9.8  
The Functional Classification of Road Network  
 in Butterwoth

LEGEND	
	Primary Distributor (Intra-Urban)
	District Distributor
	Local Distributor
	Access Road









LEGEND	
	Primary Distributor (Intra-Urban)
	District Distributor
	Local Distributor
	Access Road

Fig. 9.9  
The Functional Classification of Road Network  
in Bukit Metajam

(c) Bukit Mertajam

Fig. 9.9 illustrates the functional classification of the road network in the central area of Bukit Mertajam in 1985.

The roads in Bukit Mertajam which fall into the category of Primary Distributors (Intra-Urban) are Jalan Arumugam Pillai, Jalan Mutupalaniapa and Jalan Stowell.

2. Traffic Circulation Plan

The main reason for introducing the traffic circulation plan into the central area of the city was described in 9.4.1 (2). From this reasoning, it was also recommended that a traffic circulation system be introduced into the C.B.D of George Town related to the Komtar traffic circulation plan.

At this stage, the study team puts forward three (3) alternatives for the traffic circulation plan for the C.B.D of George Town. They are shown in Figs. 9.10 to 9.12. Alternatives A and B are the original plans by the study team while Alternative C is the proposed plan by the Municipal Council of Penang Island. Each of these three alternatives have advantages and disadvantages which are described under each plan.

Considering these alternatives, the study team recommend that Alternative A will be most suitable for a traffic circulation plan in the C.B.D. of George Town.

3. Traffic Regulations Proposal

The introduction of a one-way street system into the Primary Distributors (Intra-Urban) and District Distributors was discussed in 9.4.2 (2). However, it is also recommended that Local Distributors in busy areas be made into one-way streets. Fig. 9.13 illustrates the recommended one-way street system in George Town, which does not include the one-way street system in the traffic circulation plan.

Fig. 9.14 illustrates the recommended one-way street system in Butterworth. The main purpose of this recommendation is to introduce one-way streets into some District Distributors and some Local Distributors.

Fig. 9.15 illustrates the recommended one-way street system in Bukit Mertajam. There will be no drastic change of the existing one-way street system.

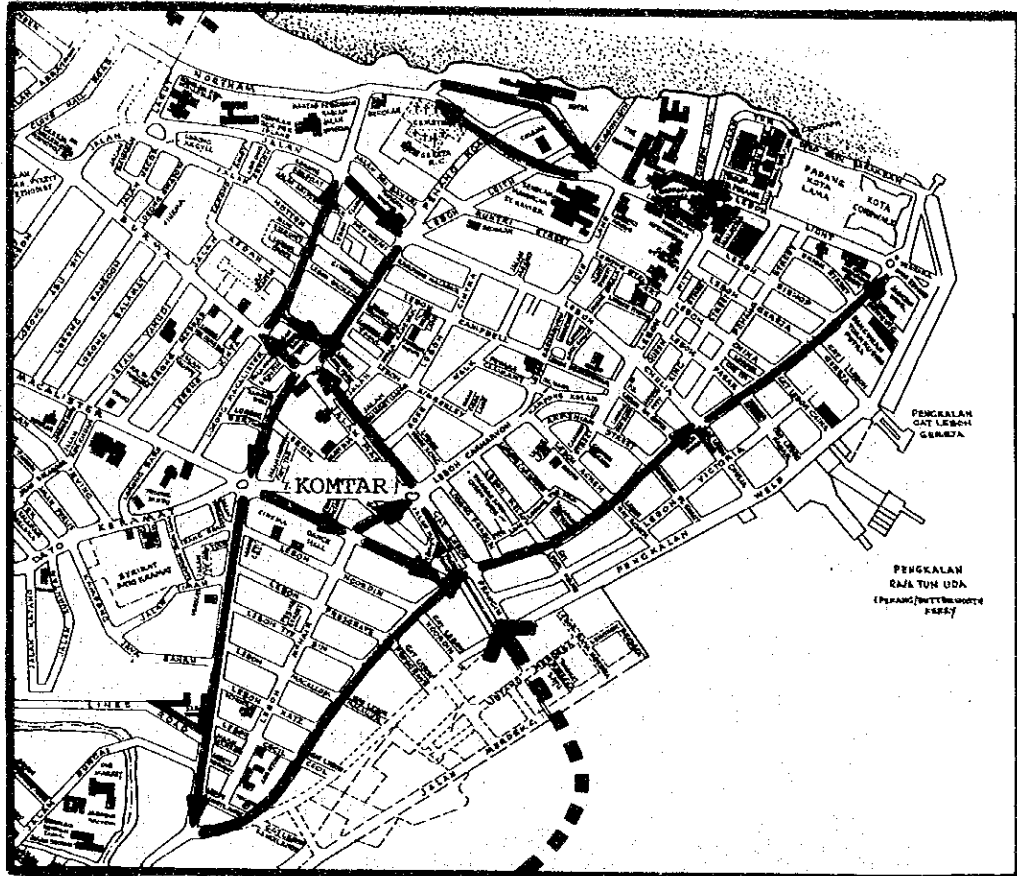


Fig. 9.10 TRAFFIC CIRCULATION PLAN for GEORGE TOWN

ALTERNATIVE A

(A) Advantages

- This plan allows a smooth circulation system in the C.B.D. of
- George Town without the need of any big changes of the existing one-way street system.
- The traffic flowing towards Magazine Circus will be reduced from four (4) to three (3) directions so that traffic control at this intersection will be easier.
- The traffic flowing into the Jalan Burma/Jalan Prangin/Penang Road intersection will be reduced from three (3) to two (2) directions so that traffic control at this intersection will also become easier.
- Traffic flow around Komtar will be counter-clockwise which facilitates easy access to Komtar.
- Traffic congestion along Jalan Pantai will be solved.

(B) Disadvantages

- It will be necessary to change existing bus routes around Komtar.
- The traffic from Jalan Burma towards Jalan Prangin will have to be detoured.
- Traffic signal control will be necessary at the Jalan Jelutong/Brick Kiln Road/Bridge Street intersection.

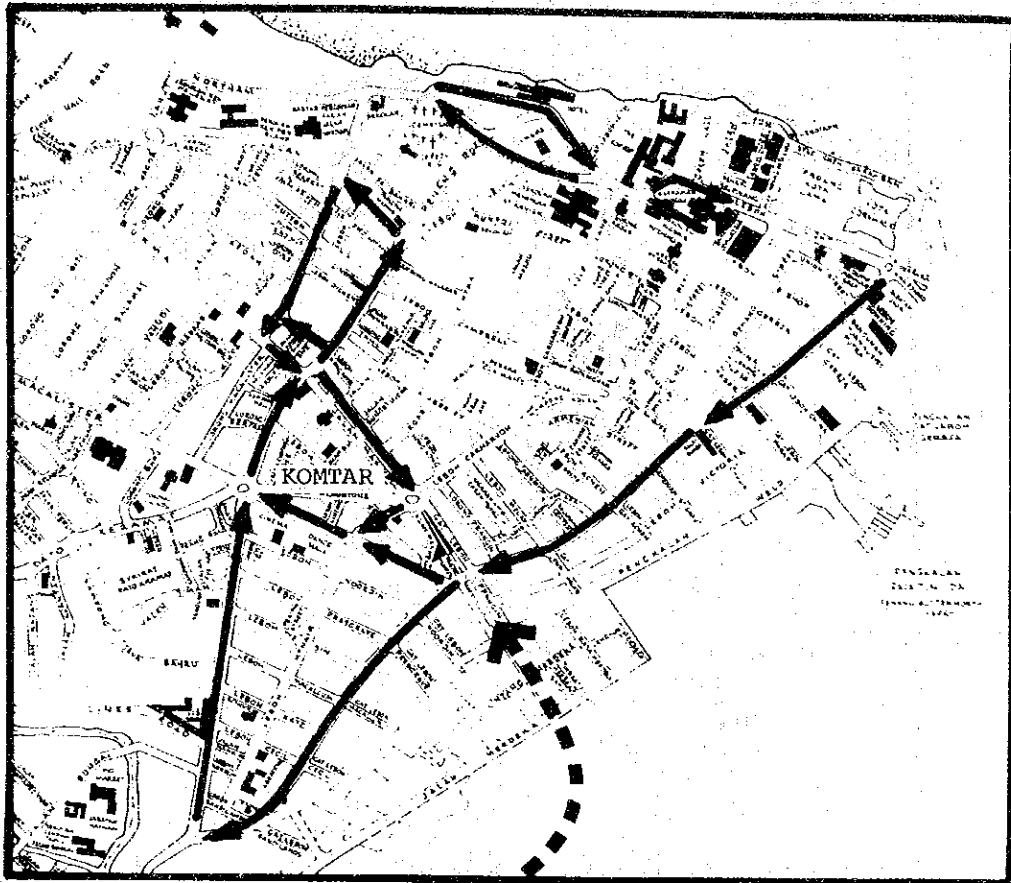


Fig. 9.11 TRAFFIC CIRCULATION PLAN for GEORGE TOWN

ALTERNATIVE B

(A) Advantages

- The traffic flowing into the Jalan Burma/Jalan Prangin/Penang Road intersection will be reduced from three (3) to two (2) directions so that traffic control at this intersection will be easier.
- Traffic signal control will not necessary at the Jalan Jelutong/Brick Kiln Road/Bridge Street intersection.
- Traffic congestion along Jalan Pantai will be solved.

(B) Disadvantages

- It will be necessary to change the existing one-way street system to achieve a smooth circulation system in the C.B.D. of George Town.
- Traffic flow around Komtar will be clockwise which will produce many right turn movements and hence hinder easy access to Komtar.
- It will be necessary to change existing bus routes around Komtar.
- The traffic from Jalan Prangin to Jalan Burma will have to be detoured.

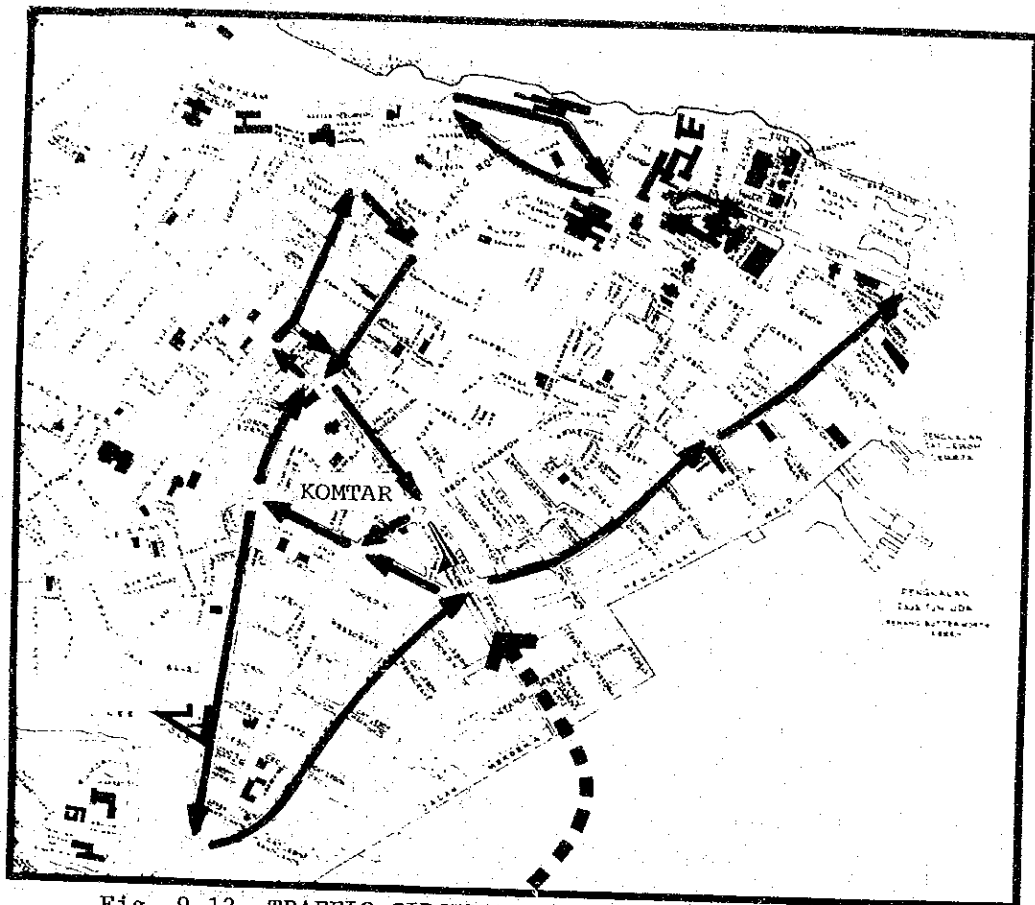


Fig. 9.12 TRAFFIC CIRCULATION PLAN for GEORGE TOWN  
ALTERNATIVE C (MPPP PROPOSAL)

(A) Advantages

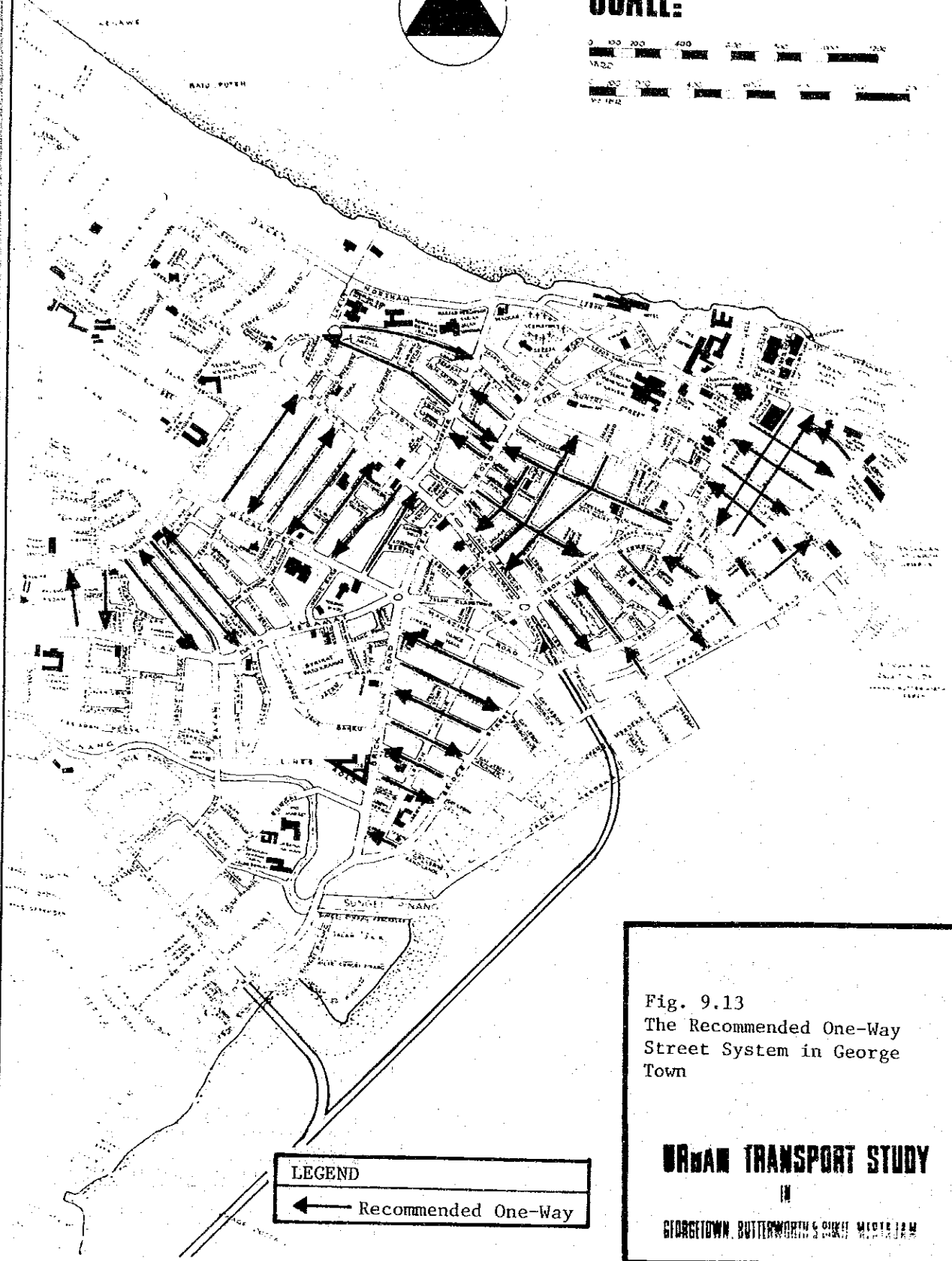
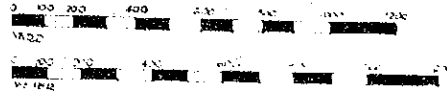
- The traffic flowing into Magazine Circus will be reduced from four (4) to three (3) directions so that traffic control at this intersection will become easier.
- The traffic flowing into the Jalan Burma/Jalan Prangin/Penang Road intersection will be reduced from three (3) to two (2) directions so that traffic control at this intersection will become easier.
- It will be unnecessary to amend existing one-way street system.
- It will be unnecessary to amend existing bus route.
- Traffic congestion along Jalan Pantai will be solved.

(B) Disadvantages

- This plan will not produce a smooth circulation system in the C.B.D. of George Town.
- Traffic flow around Komtar will be clockwise which will produce many right turn movements and hence hinder easy access to Komtar.
- The traffic from Penang Road (north part) towards the Magazine Circus will have to be detoured.
- Traffic signal control will be necessary at the Jalan Jelutong Brick Kiln Road/Bridge Street intersection.



**SCALE:**



**LEGEND**  
← Recommended One-Way

Fig. 9.13  
The Recommended One-Way  
Street System in George  
Town

**URBAN TRANSPORT STUDY**  
IN  
GEORGETOWN, BUTTERWORTH & SIKUT, MALAYSIA

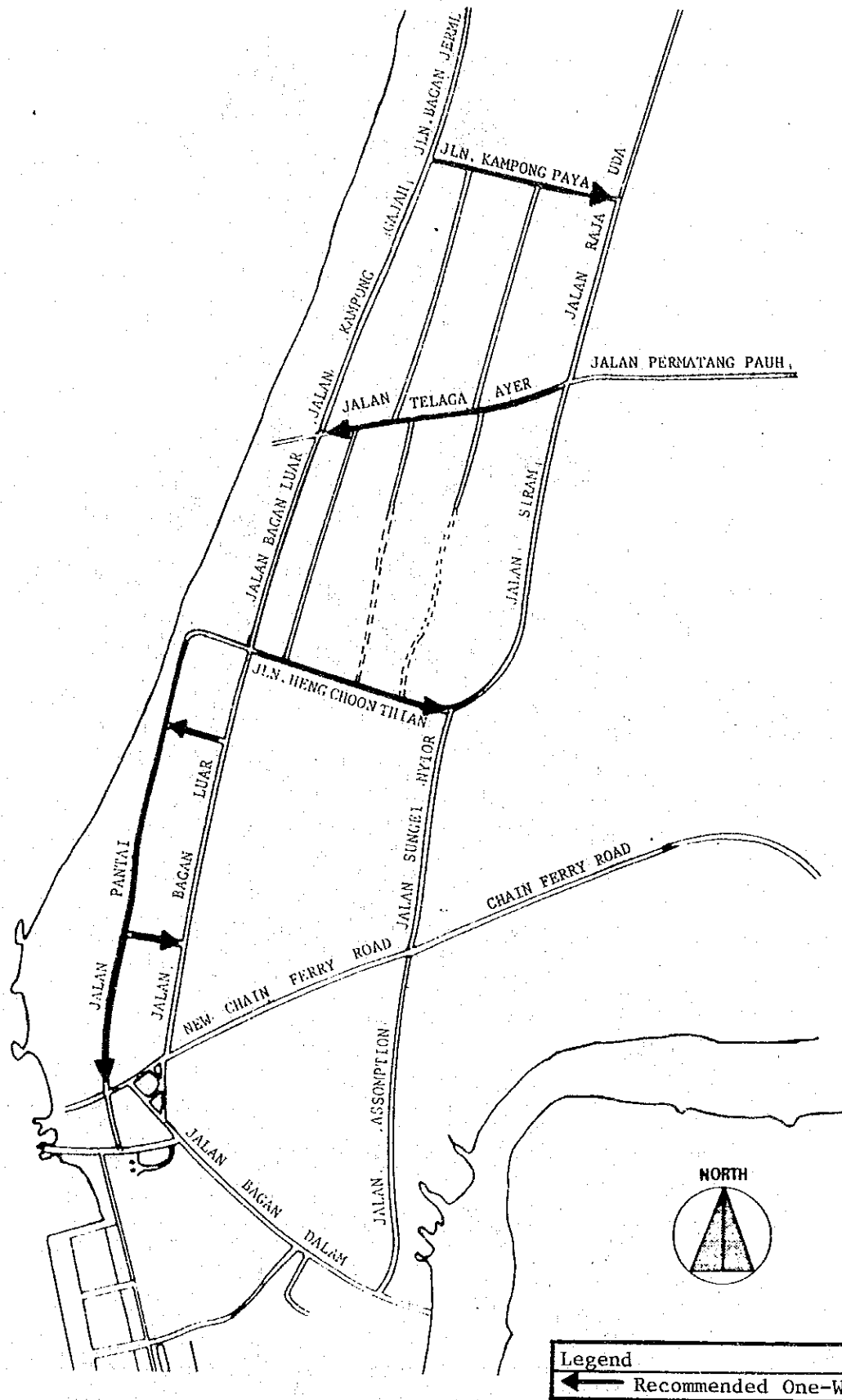


Fig. 9.14 The Recommended One-Way Street System in Butterworth

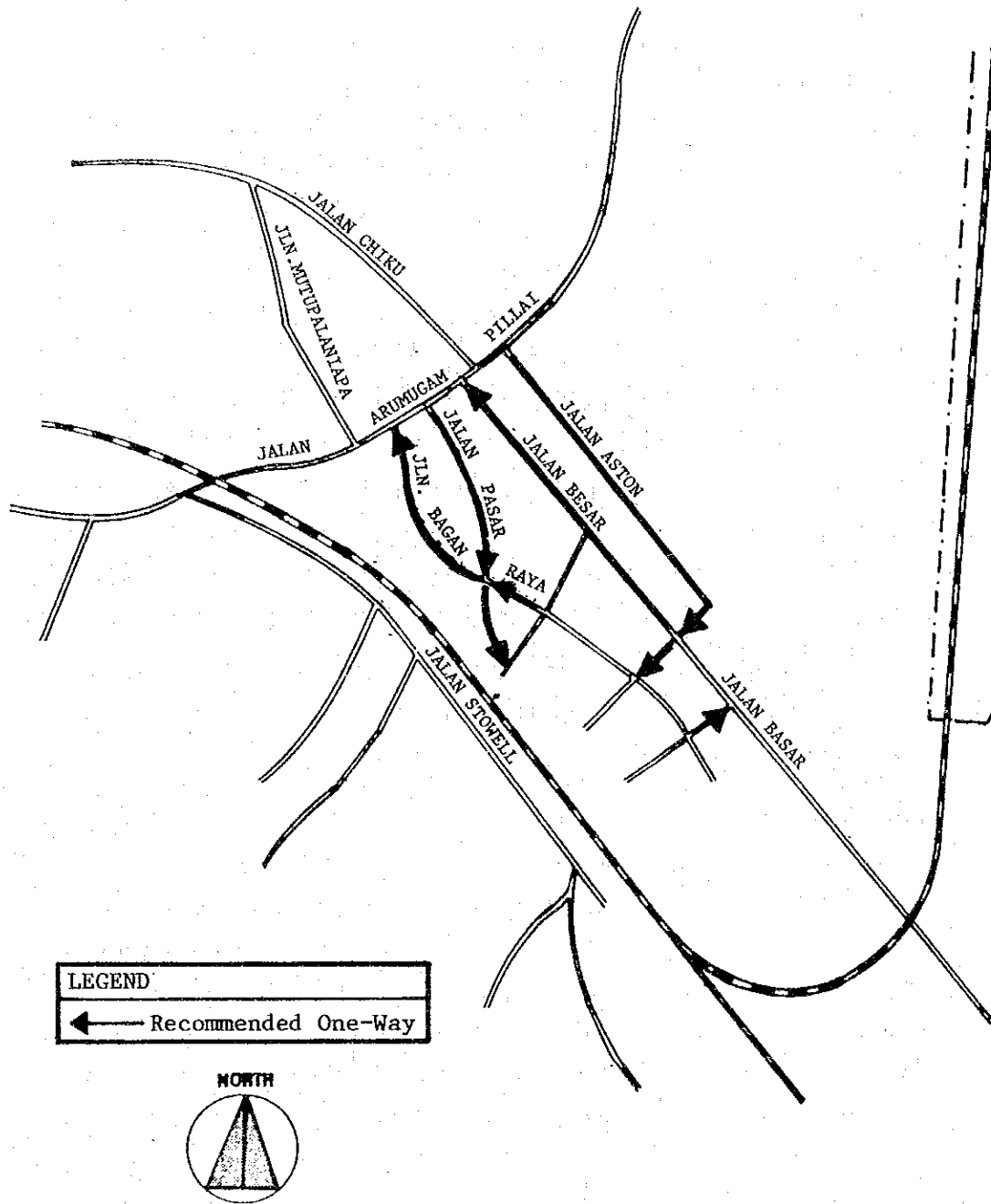


Fig. 9.15 The Recommended One-Way Street System in Bukit Mertajam



Fig. 9.15 illustrates the recommended one-way street system in Bukit Mertajam. There will be no drastic change of the existing one-way street system.

It is also recommended that stop signs be installed on the approaches of Local Distributors (minor roads) at their intersection with Primary Distributors (Intra-Urban) or/and District Distributors to facilities circulating traffic flow.

Lane marking should be clearly installed so that cars and motor-cycles can easily follow the road space allocated for them whereby avoiding the occurrence of too much confusion with trishaws and bicycles. As well as this, it is desirable to have markings on the outer lane for space allocated for bicycles and trishaws to separate them from the other vehicles on the road.

Hawkers should be prohibited from dispensing their wares on the carriage-ways of Primary Distributors (Intra-Urban) except during specific hours of special days and should also be prohibited from hawking at Local Distributors as much as possible.

One of the major concerns of the Municipal Council is parking regulations. This will be discussed in 9.4.2 (5) under Parking Regulation Proposal.

#### 4. Traffic Signals

There can still be seen many traffic signals where the display faces have obsolete lens with 65 watt/250 volt screwed in bulbs. To improve visibility, it is recommended that these be replaced with new 50 watt/12 volt tungsten halogen projector lens, bulbs and plastic acrylic lens as soon as possible. At busy and large intersections with four or more lane carriage-ways mast arms, horizontal overhead displays of 10 inch diameter lens are recommended.

#### 5. Traffic Safety

One of the counter measures against traffic accidents is to establish what is called a delineation system which involves the demarcation of the centreline and the outer border of car lanes, bicycle-lanes or road shoulders with clear visible lines, delineators, guard-rails and so forth. The delineation system can, if

properly accorded to the existing road and traffic circumstances can remove the problem of mixed traffic which is one of the major problems in Penang. Our experience has shown that this will lead to the reduction of accidents.

It is also recommended that enforcement of traffic regulations, especially those regarding speed limits, which is one of the main causes of traffic accidents, be strengthened.

#### 6. Parking Regulation Proposal

It is recommended that in the future there should be no parking at Primary Distributors (Intra-Urban) and busy streets under the category of District Distributor and/or Local Distributor, when parking and loading obstruct pedestrian movement and severely hamper vehicular traffic. However, steps should be taken to strengthen control to ensure that, first, parking is prohibited within 100 feet of intersections, then, on one side of the streets and finally along a whole section of streets. Another step will be the prohibition of parking only during peak hours and then later to be extended for the whole day. The public should be informed in advance of any new programme of parking control so that those affected can arrange for alternative parking. Parking prohibition proposals for the central area of George Town, Butterworth and Bukit Mertajam are illustrated in Fig. 9.16 to 9.18.

#### 7. Pedestrian Facilities Proposal

To ensure not only traffic safety but also smooth traffic flow, it is recommended that side-walks be installed on the Primary Distributors (Intra-Urban) and District Distributors. In this case, it is also recommended that guard-rails be installed, not only to prevent traffic accidents involving pedestrians but also to stop discretionary crossing of roads by pedestrians. Side-walks are also recommended to be installed along the Local Distributors in busy areas. However, steps should be taken to install side-walks which follow the parking regulation schedule as they have relationship to each other.

The proposals for side-walk installation for the central area of George Town, Butterworth and Bukit Mertajam are illustrated

in Fig. 9.19 to 9.21. The typical cross-sections for the installation of side-walks are illustrated in Fig. 9.22.

It is recommended that clearly marked zebra crossings be installed at intersections of streets. Furthermore, pelican crossings and/or overhead bridges and under passes should be installed at intersections where vehicle traffic is very heavy.

In the case of pedestrian crossings installed away from intersections, signs showing "Give way" or "Yield" should be reinforced with traffic signals of the push-button type with yellow flashing globes. An increased use of pedestrian signals in conjunction with traffic signals is also recommended.

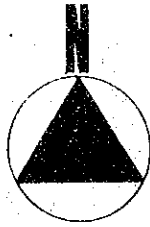
Campbell Street in George Town and Jalan Pasar in Bukit Mertajam were once closed to all traffic except pedestrians. In areas where pedestrian needs exceed those of vehicle traffic, as in the case of Campbell Street and Jalan Pasar, street closures, even on a part-time basis, are worth experimenting with.

Generally speaking, the following merits and demerits will exist when pedestrian malls are introduced:

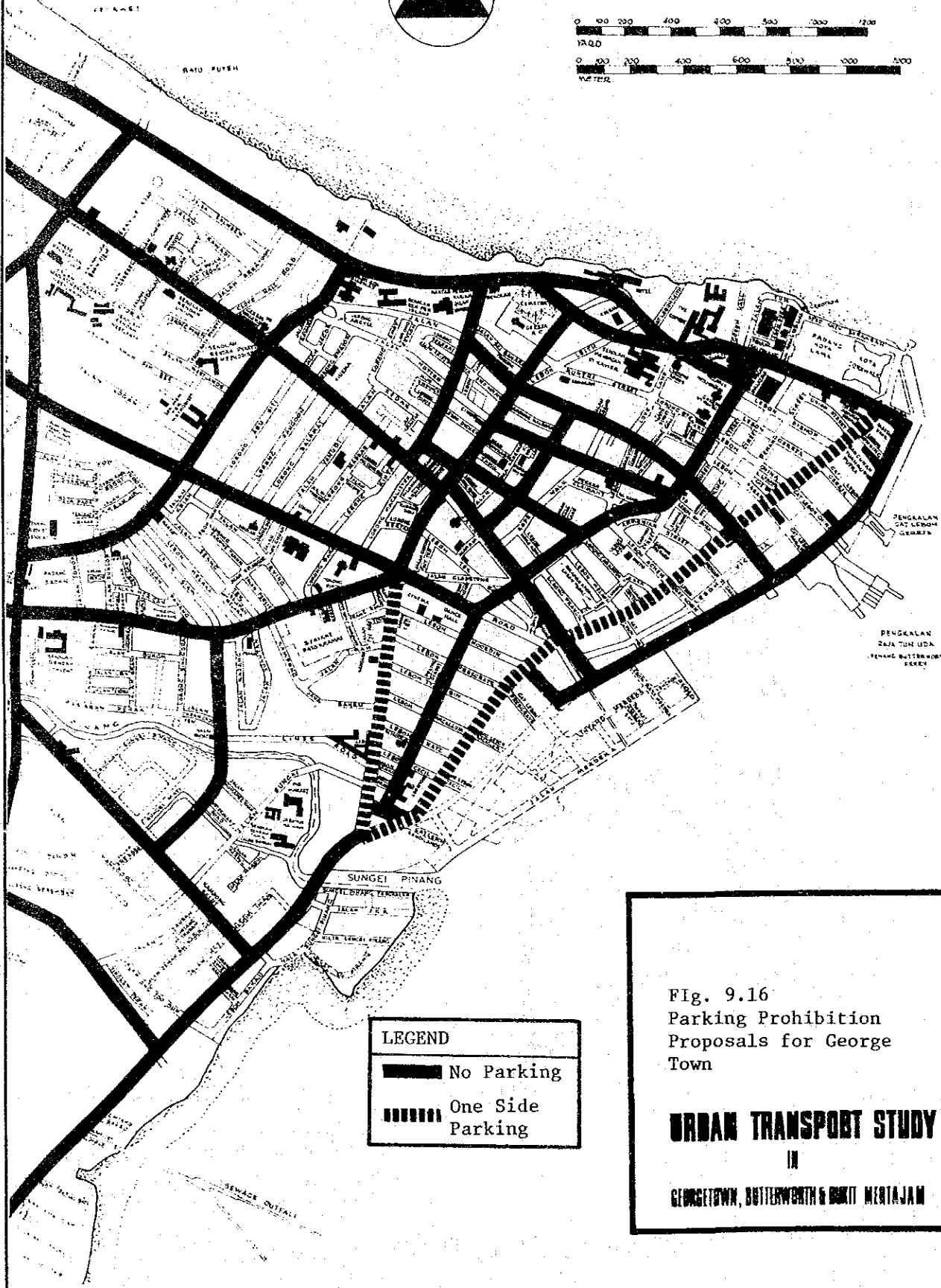
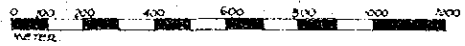
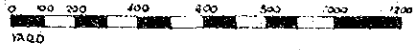
- Merits
- a. To ensure traffic safety of pedestrians
  - b. To ensure better amenities for shopping and walking.
  - c. To increase the sales of shops along the malls (the various cases recorded usually experience 20 ~ 30 percent increase in sales.)

- Demerits
- a. To force the system of delivery services to be changed
  - b. To avoid the convenience of parking along the mall.
  - c. To force the present traffic systems to be rearranged

In the case of the proposed malls, the above mentioned demerits are judged to be almost negligible. However, prior to the mall being introduced, it will be necessary to get the agreement and cooperation of shops owners. Considering these, detailed investigation is deemed necessary prior to introduction of the mall.



**SCALE:**



**LEGEND**

- No Parking
- One Side Parking

Fig. 9.16  
Parking Prohibition  
Proposals for George  
Town

**URBAN TRANSPORT STUDY**  
IN  
GEORGETOWN, BUTTERWORTH & BUKIT MERTAJAM

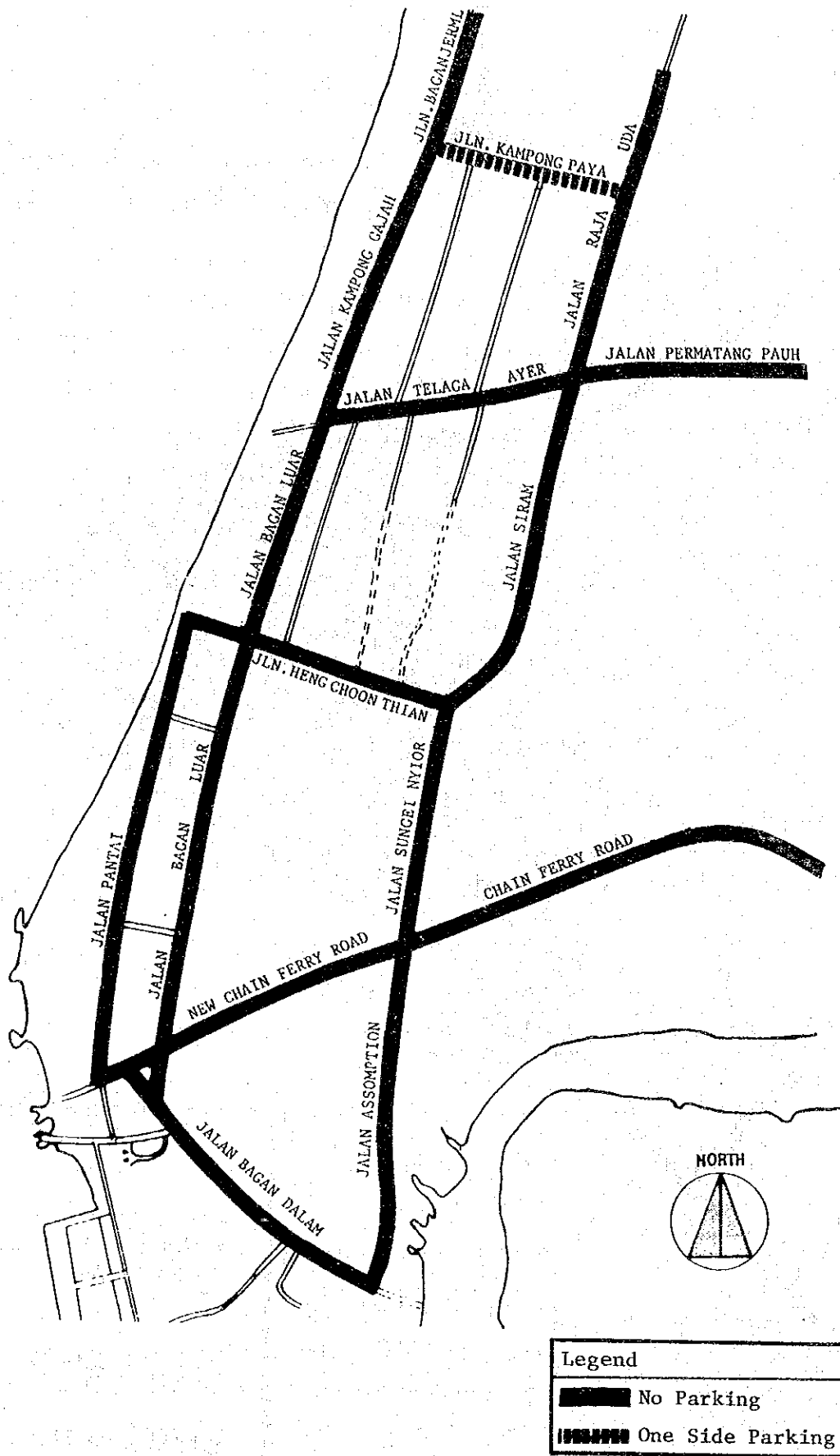


Fig. 9.17 Parking Prohibition Proposal for Butterworth

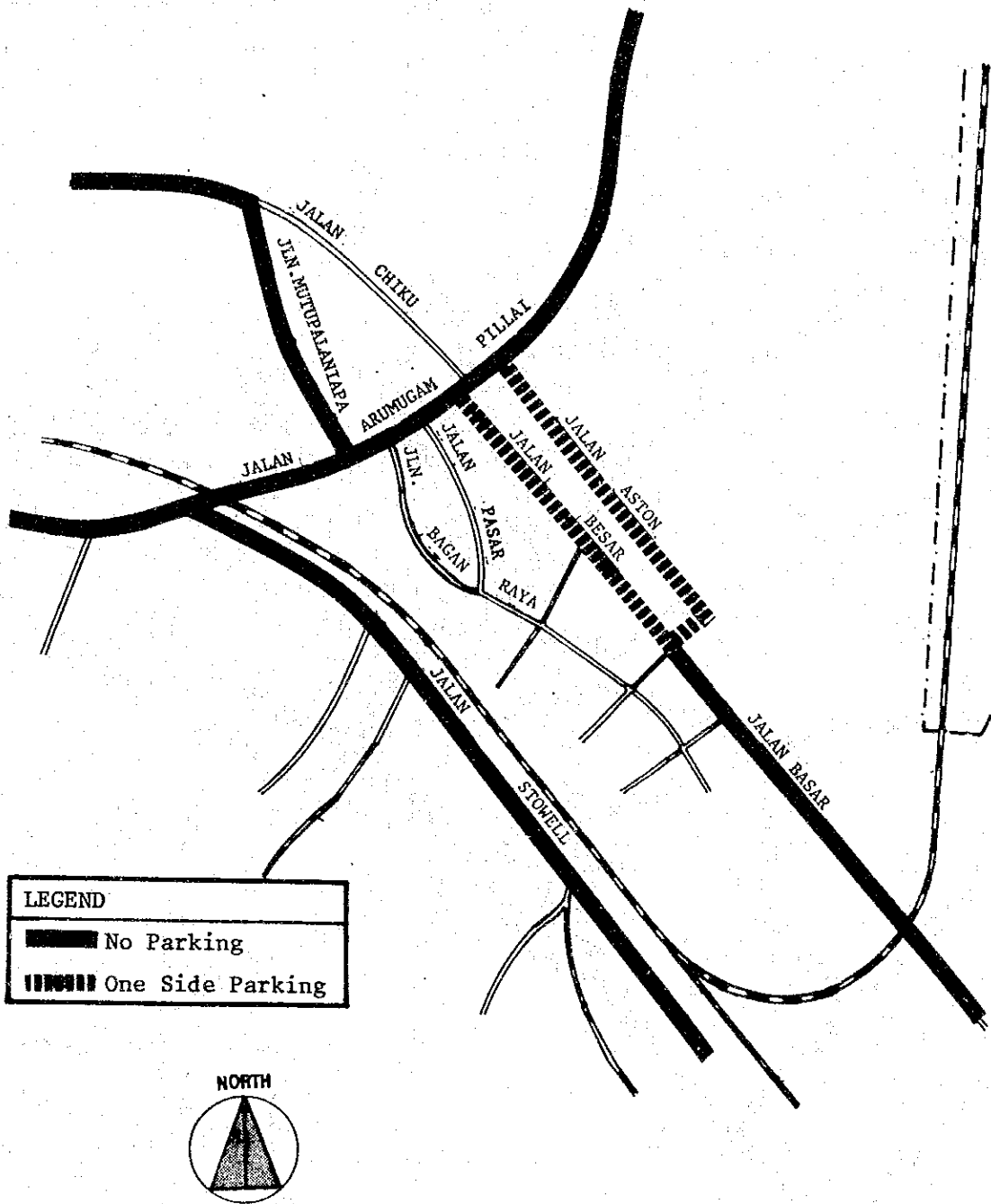
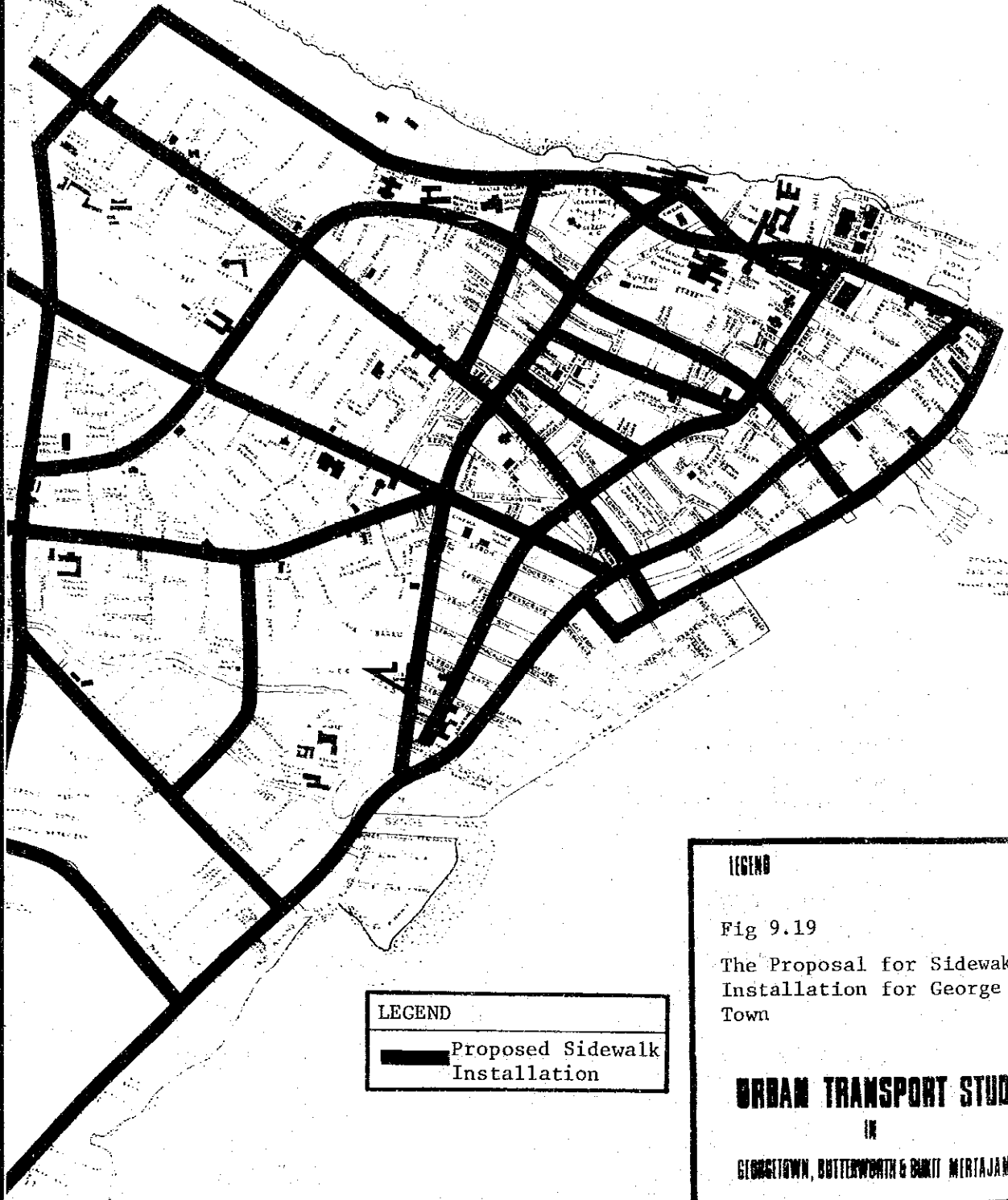
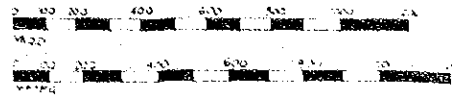


Fig. 9.18 Parking Prohibition Proposal for Bukit Martajam



**SCALE:**



**LEGEND**  
— Proposed Sidewalk Installation

**LEGEND**  
Fig 9.19  
The Proposal for Sidewalk Installation for George Town  
**URBAN TRANSPORT STUDY**  
IN  
GEORGETOWN, BUTTERWORTH & BANGI MERTAJAN

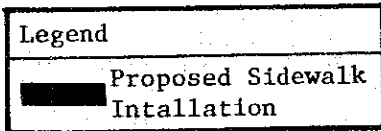
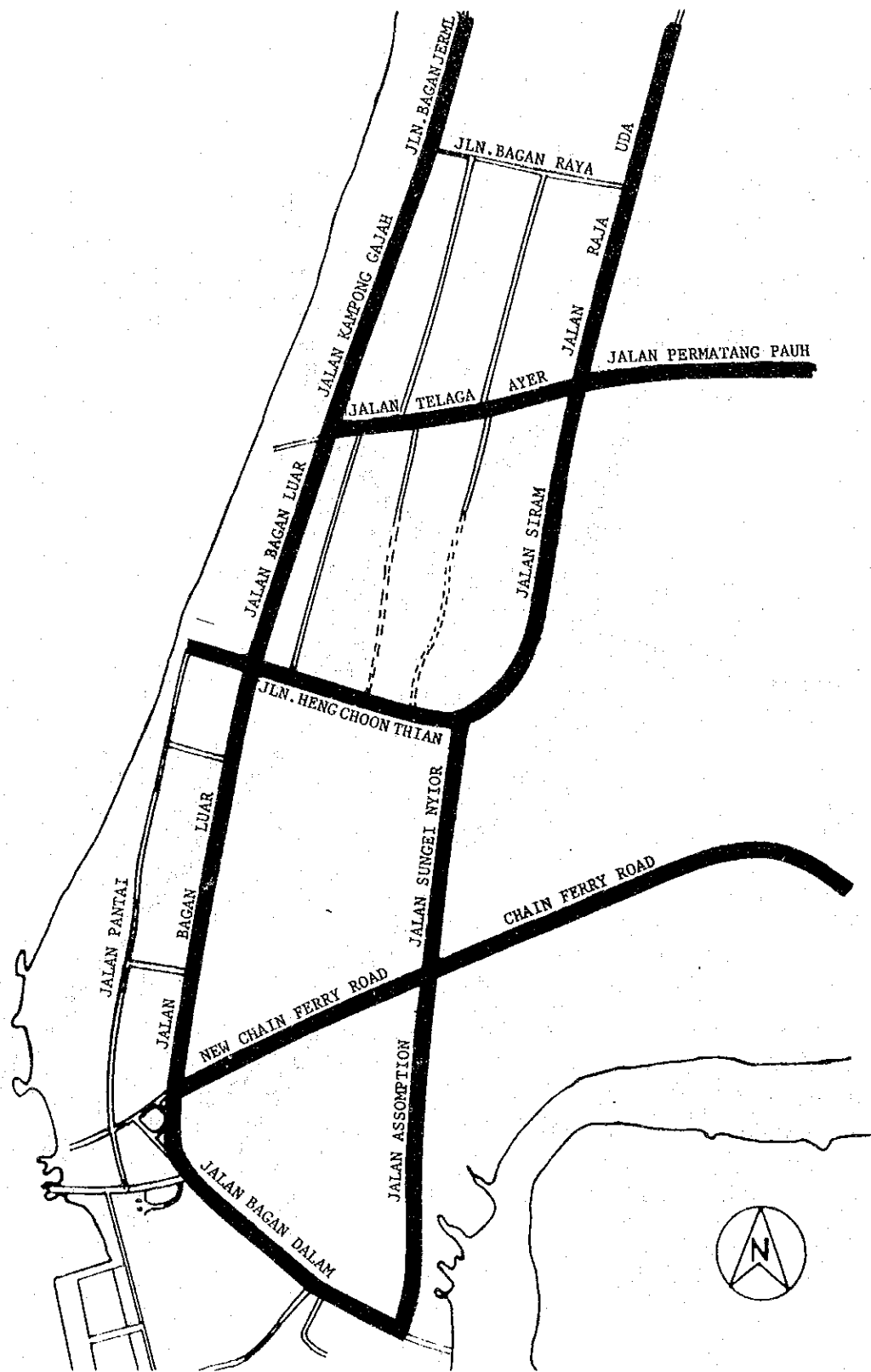


Fig. 9.20 The Proposal for Sidewalk Installation for Butterworth



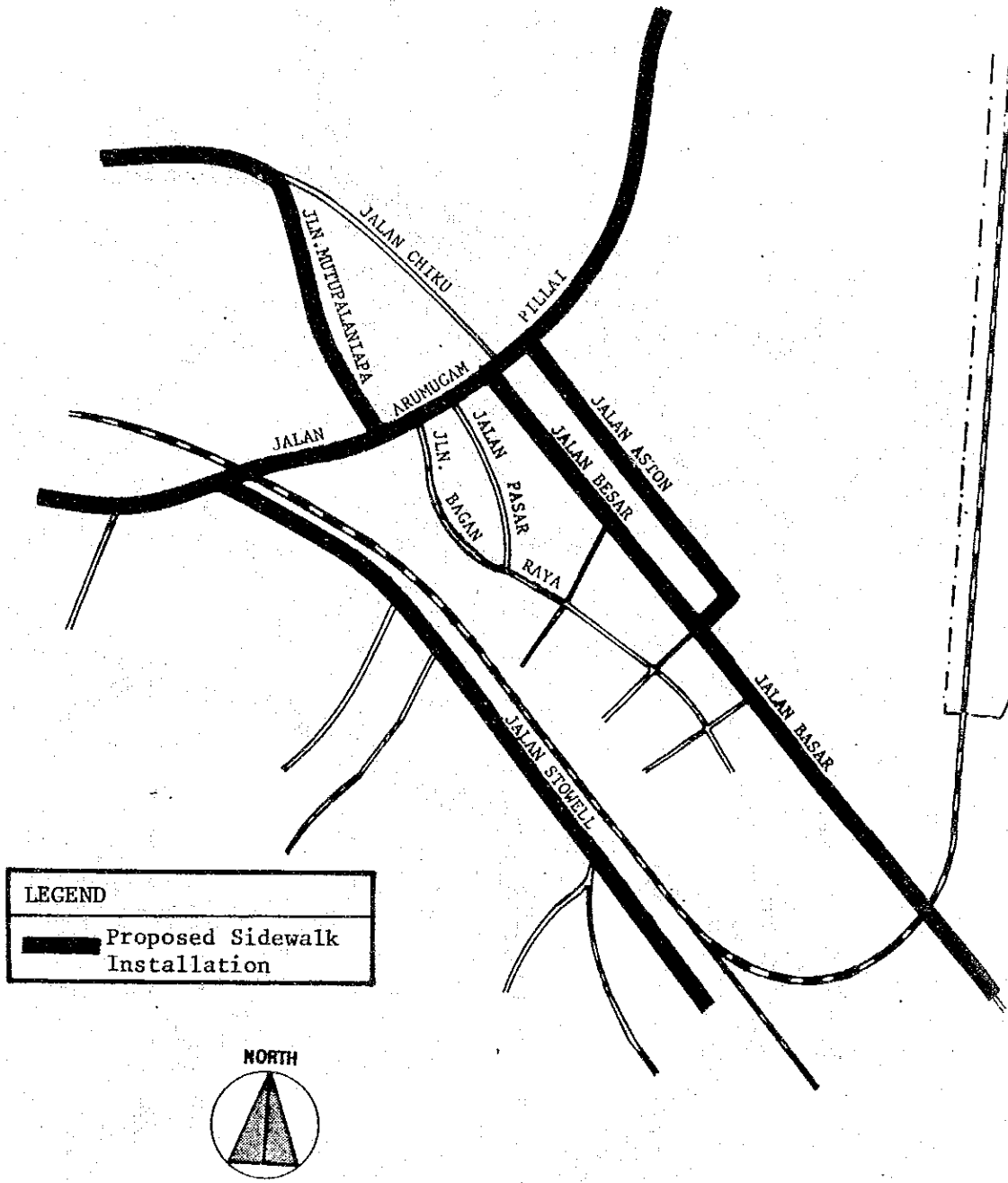


Fig. 9.21 The Proposal for Sidewalk Installation for Bukit Mertajam

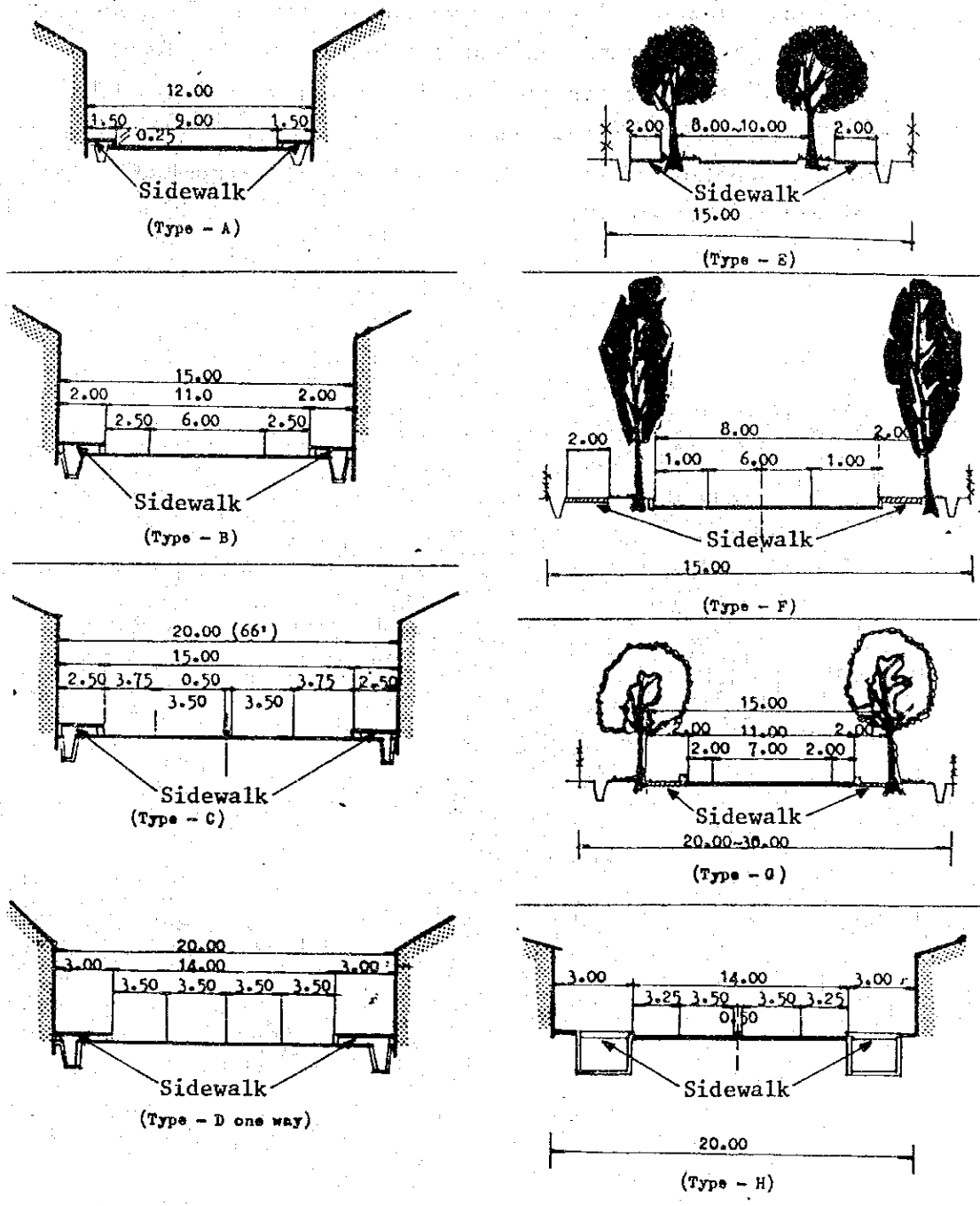


Fig. 9.22 Typical Cross Sections of Sidewalk

## 8. Intersection Improvement Plan

Regarding existing and future problems of intersections, intersection improvement and the installation of traffic signals are recommended for some intersections so that a smooth flow of traffic in both directions can be achieved. Figs. 9.23 and 9.24 show the location of intersections which are recommended to be improved by 1983 and 1985.



Fig. 9.23 The Location of Intersections to be Improved in George Town

- Intersection Improvement by 1983
- Intersection Improvement by 1985

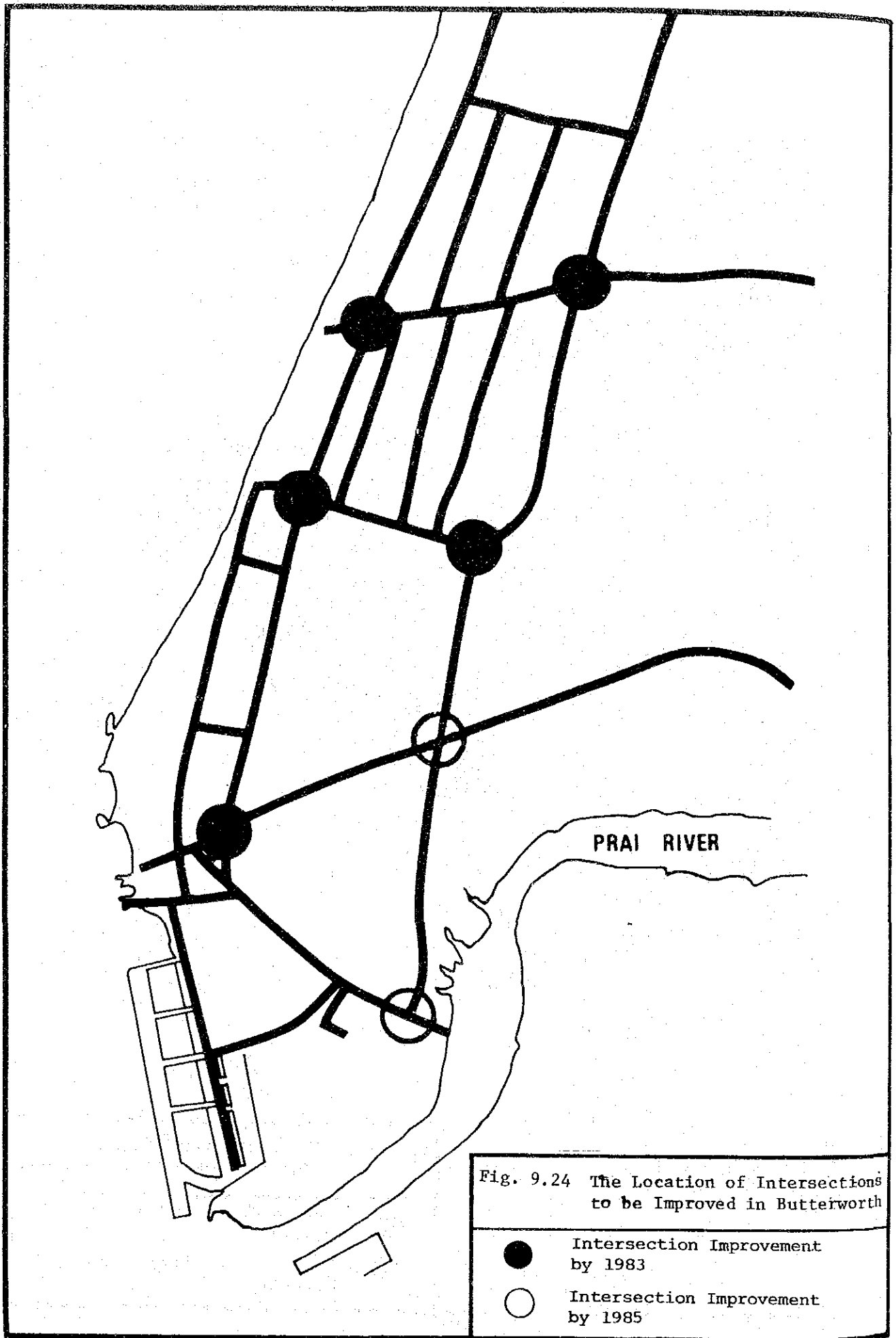


Fig. 9.24 The Location of Intersections to be Improved in Butterworth

- Intersection Improvement by 1983
- Intersection Improvement by 1985

## 9.5 Immediate and Short-Term Action

For the implementation of the recommended Traffic Engineering and Management system, which is described in 9.4.2, the team recommends a proposal for immediate action by the middle of 1983 and short-term action by the end of 1985.

### 9.5.1 Immediate Action Proposal

#### (a) Implementation of Traffic Circulation Plan

The circulation plan, which has been described before, should be implemented as soon as possible in order to achieve smooth dispersal at critical intersections.

#### (b) Traffic Regulation Proposal

1. Introduction of one-way street system.
2. Installation of stop signs.
3. Clear installation of lane marking.
4. Limitation of hawking on the road.

#### (c) Traffic Signal Improvement

1. Replacement of old display lenses.
2. Introduction of mast arms, horizontal overhead displays at busy and large intersections.

#### (d) Traffic Safety

1. Introduction of delineation system.
2. Stricter enforcement of traffic regulations.

#### (e) Parking Regulation Proposal

Parking prohibition at Primary Distributors (Intra-Urban), Access Roads and busy streets under the category of District Distributors and/or Local Distributors.

#### (f) Pedestrian Facilities Proposal

1. Installation of side-walks
2. Installation of zebra crossings at intersections.
3. Road closure on a part-time basis at Campbell Street and Jalan Pasar.

(g) Intersection Improvement Plan

It is recommended that the following seven (7) intersections be improved by 1983.

- (i) Magazine Circus (Penang Road/Jalan Macalister/Jalan Dato Keramat/Jalan Brick Kiln/Magazine Road). - George Town.

Regarding the traffic circulation plans, two (2) alternatives which are shown in Figs. 9.26 and 9.27 are recommended for the improvement of this intersection.

- (ii) Jalan Northam/Jalan Kelawai/Gurney Drive/Jalan Pangkor Intersection. - George Town.

Recommended intersection improvement plan and signal phase are illustrated in Fig. 9.28.

- (iii) Green Lane/Jalan Hamilton and Green Lane/Batu Lancang Lane Intersection - George Town.

Recommended intersection improvement plan and signal phase are illustrated in Fig. 9.29.

- (iv) Jalan Burma/Jalan Gottlieb/Jalan Bagan Jermal/Mount Erskine Road Intersection. - George Town.

Recommended intersection improvement plan and signal phase is illustrated in Fig. 9.30.

- (v) Jalan Bagan Luar/New Chain Ferry Road Intersection. - Butterworth.

Recommended intersection improvement plan and signal phase is illustrated in Fig. 9.31.

- (vi) Jalan Telaga Ayer/Jalan Raja Uda/Jalan Permatang Pauh/Jalan Siram Intersection. - Butterworth.

Recommended intersection improvement plan and signal phase is illustrated in Fig. 9.32.

- (vii) Jalan Arumugam Pillai/Jalan Besar Intersection. - Bukit Mertajam.

Recommended intersection improvement plan and signal phase is illustrated in Fig. 9.33.

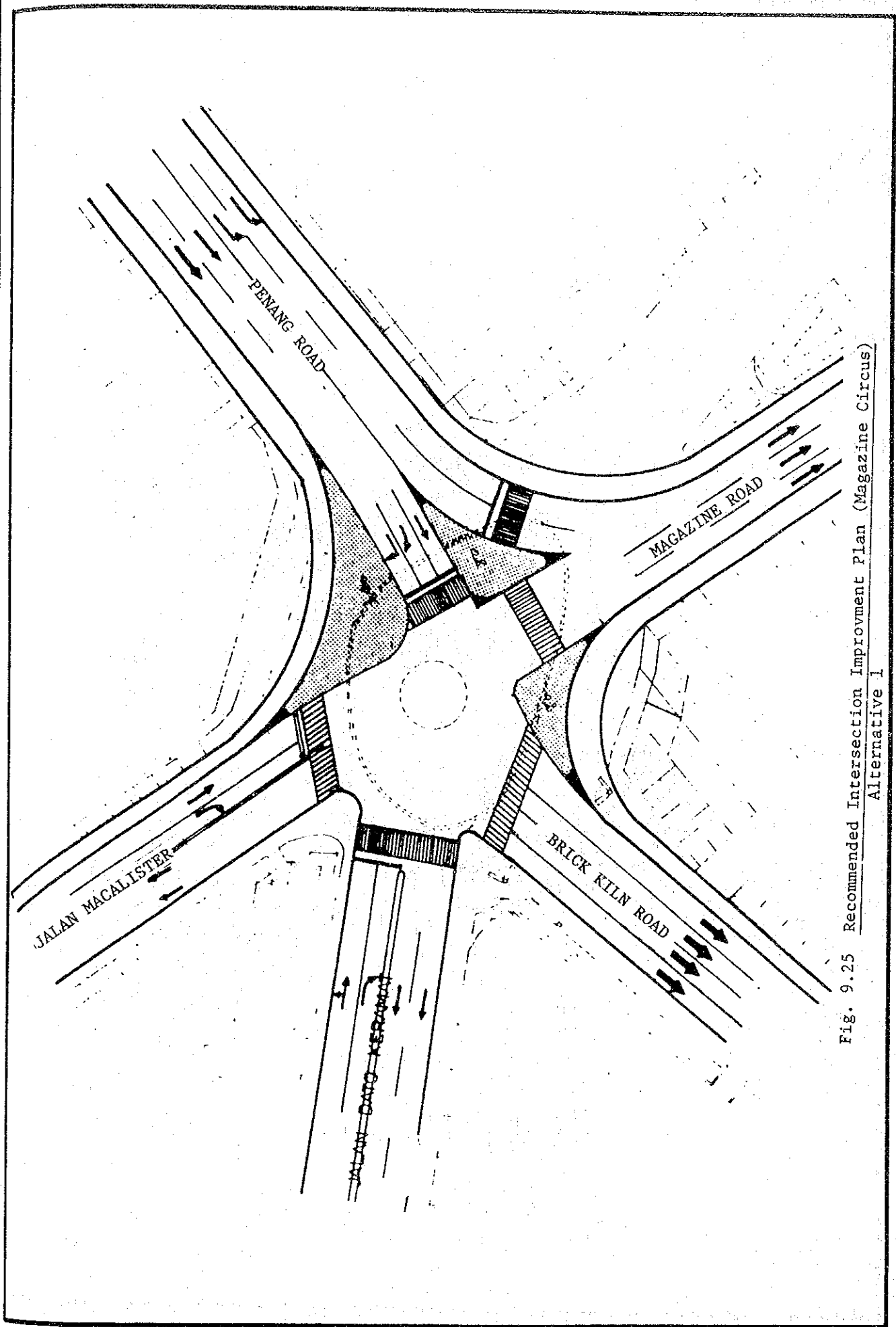


Fig. 9.25 Recommended Intersection Improvement Plan (Magazine Circus)  
Alternative 1



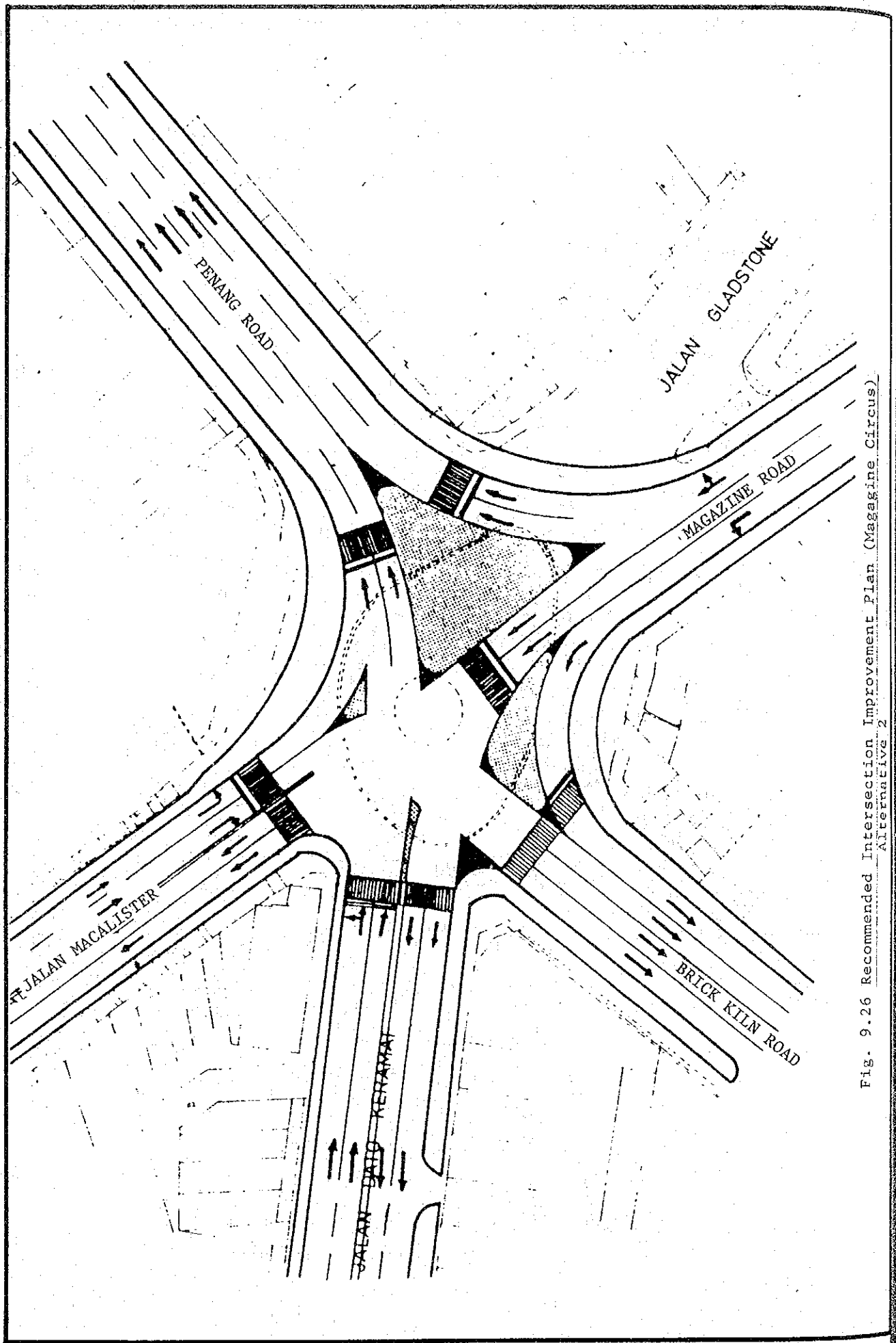
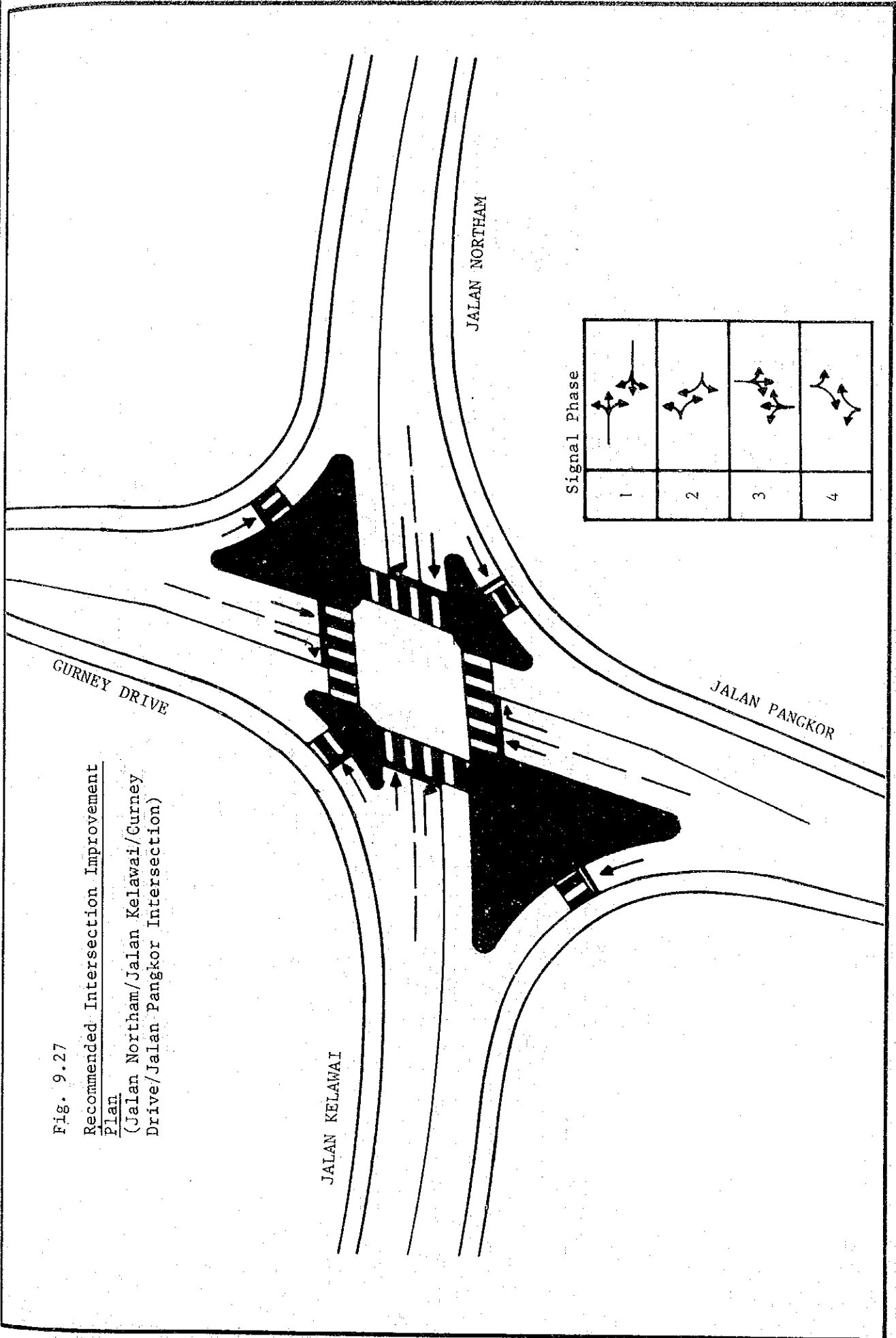


Fig. 9.26 Recommended Intersection Improvement Plan (Magazine Circus)  
Alternative 2

Fig. 9.27  
Recommended Intersection Improvement  
Plan  
 (Jalan Northam/Jalan Kelawai/Curney  
 Drive/Jalan Pangkor Intersection)



Signal Phase	
1	
2	
3	
4	

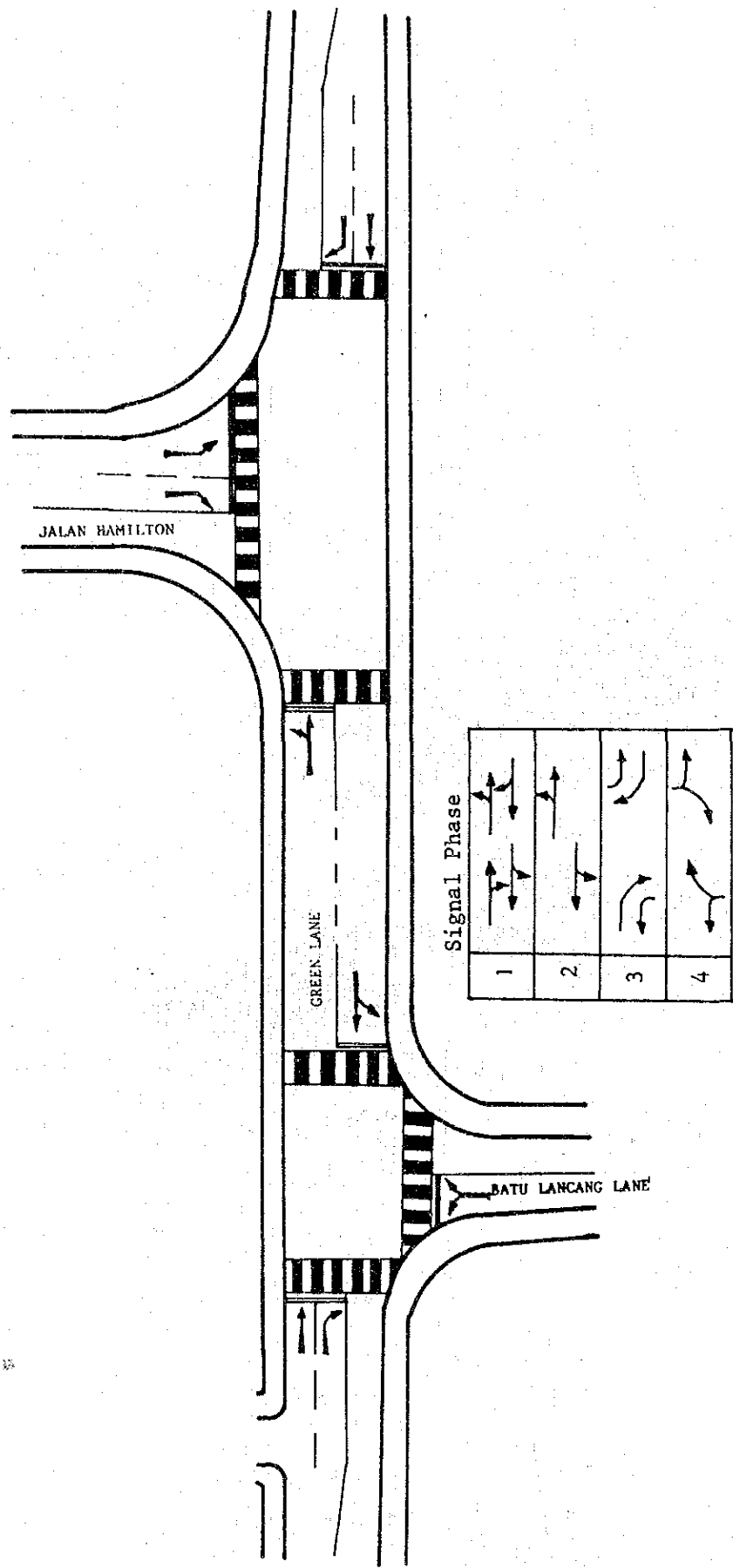
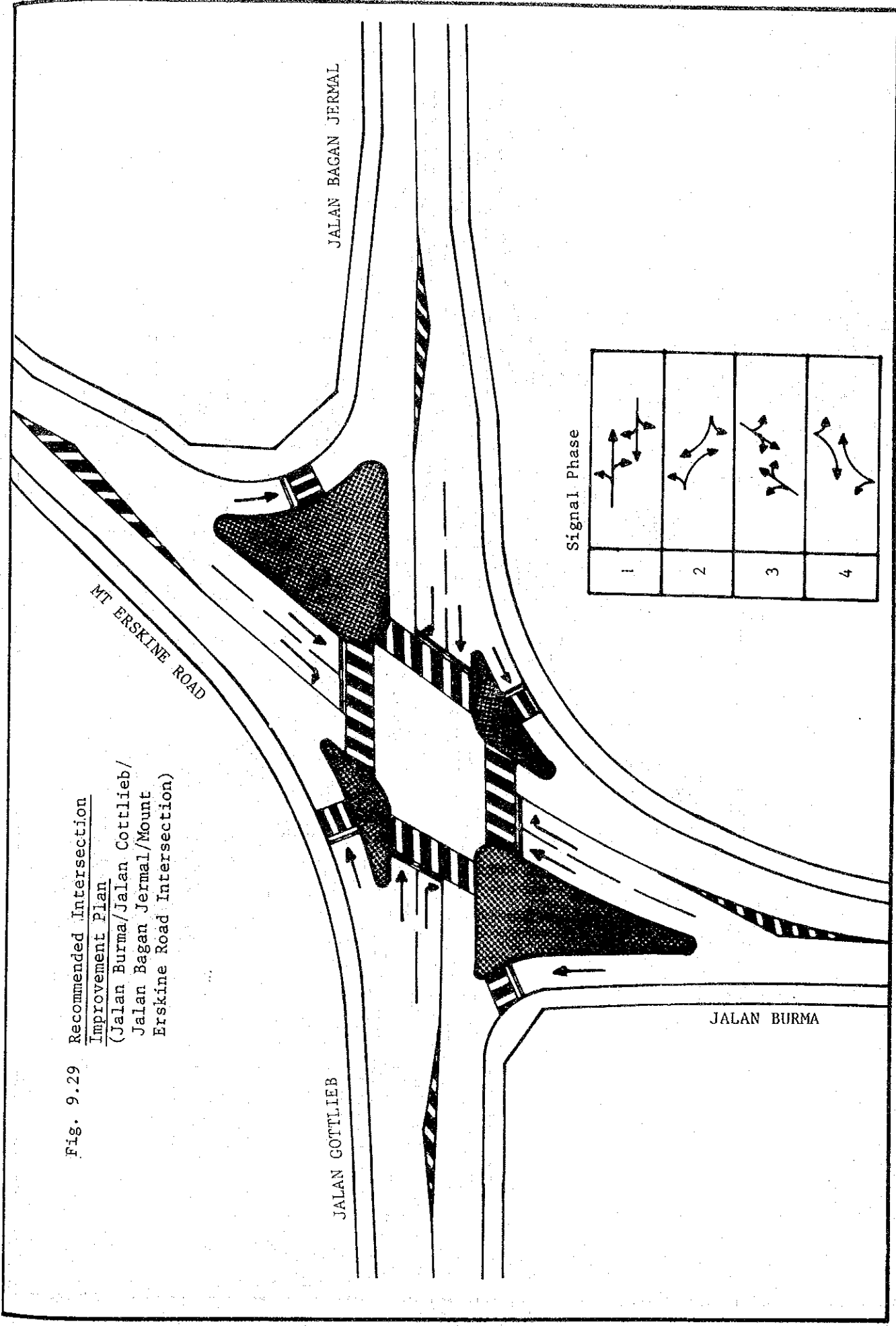


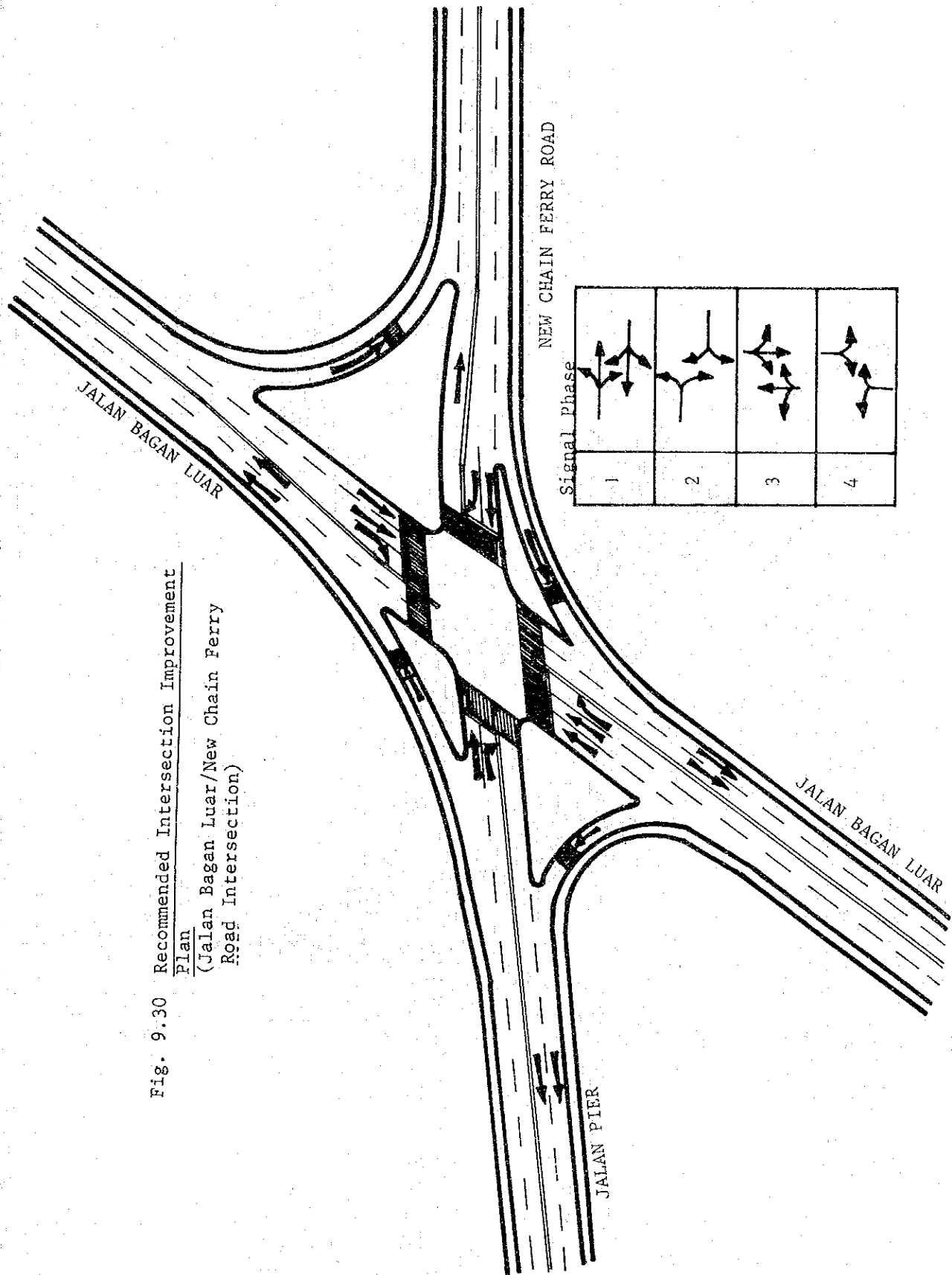
Fig. 9.28 Recommended Intersection Improvement Plan  
 (Green Lane/Jalan Hamilton and Green Lane/  
 Batu Lancang Lane Intersection)

Fig. 9.29 Recommended Intersection Improvement Plan  
 (Jalan Burma/Jalan Cottlieb/  
 Jalan Bagan Jermal/Mount  
 Erskine Road Intersection)



	Signal Phase			
1				
2				
3				
4				

Fig. 9.30 Recommended Intersection Improvement  
 Plan  
 (Jalan Bagan Luar/New Chain Ferry  
 Road Intersection)



Signal Phase

1	
2	
3	
4	

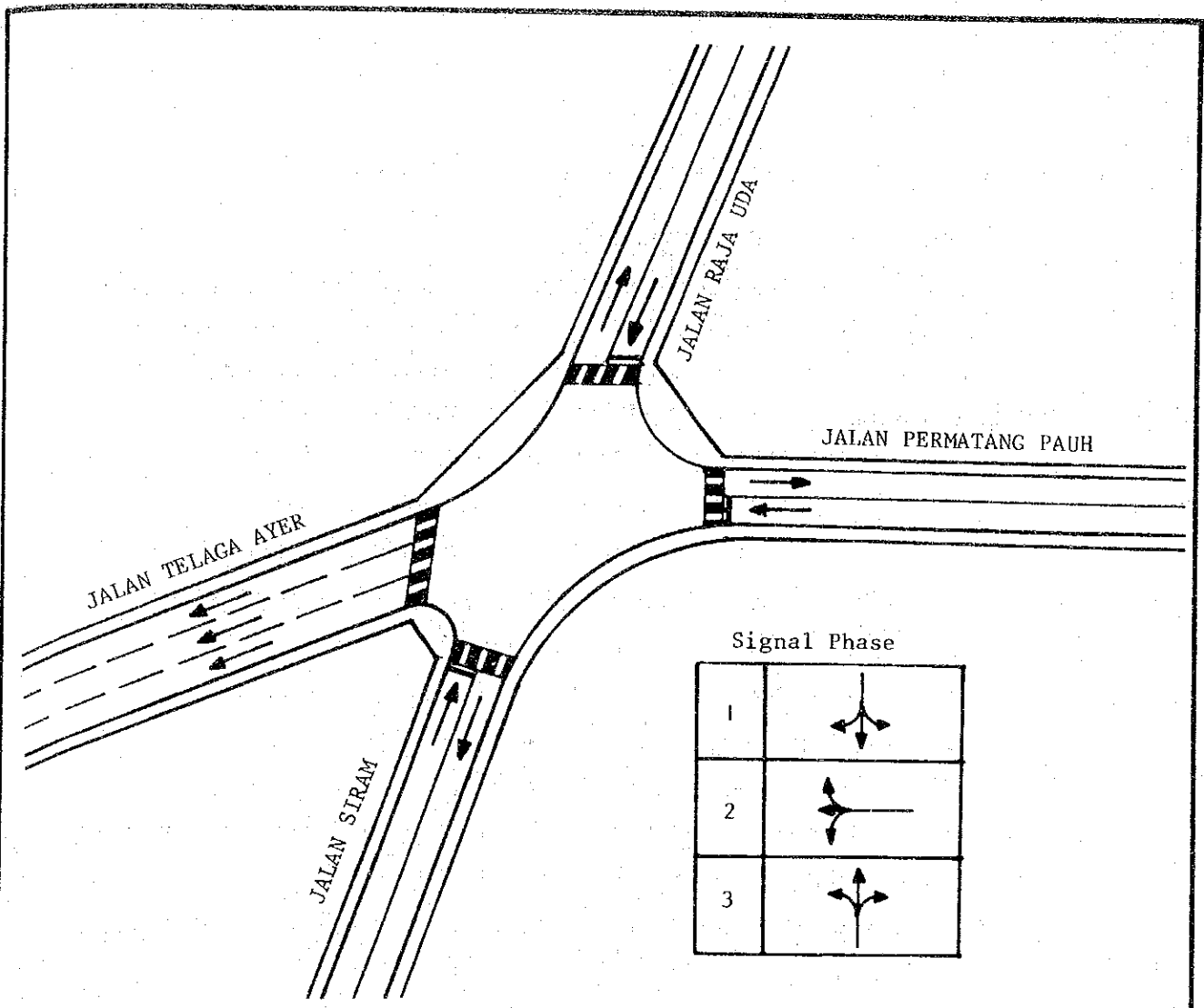


Fig. 9.31 Recommended Intersection Improvement Plan  
 (Jalan Telaga Ayer/Jalan Raja Uda/Jalan Permatang Pauh/Jalan Siram Intersection)

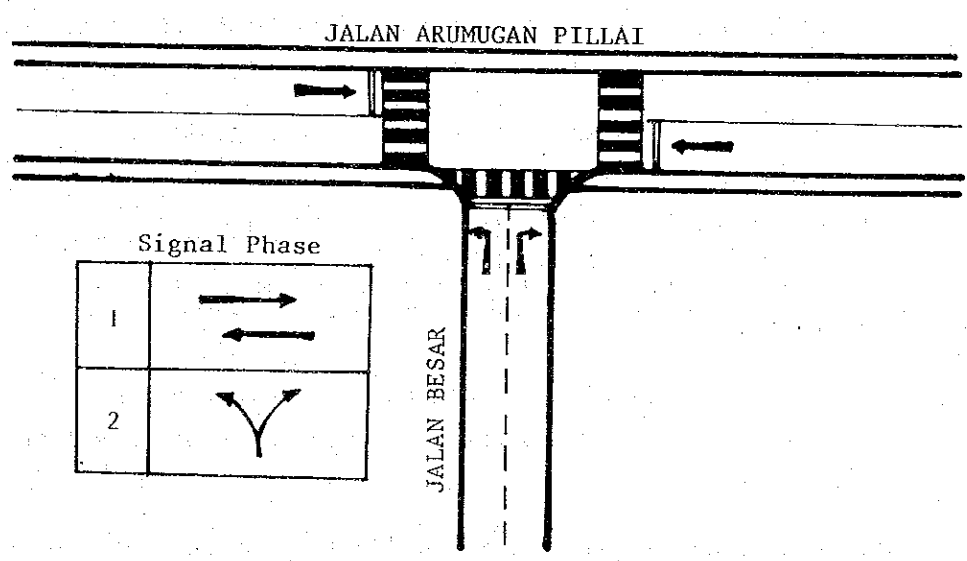


Fig.9.32 Recommended Intersection Improvement Plan  
 (Jalan Arumugam Pillai/Jalan Besar Intersection)