4.5.4 Merits and Demerits of the Traffic Circulation Alternative Plans

The main merit of the Existing System Plan (1990) is that it is not necessary to change the existing facilities such as intersection geometrics, traffic signals, signs and other related devices. Therefore, there is no expenditure. However, several demerits remain under this plan, such as, mixed road usage by long trip and short trip vehicles, congestion on short weaving sections and concentration of traffic in the circulation loop around KOMTAR.

The main merit of Alternative S–1 (1990) is that by means of one-way operation on Carnarvon Street, Burma Road and Macalister Road, traffic congestion on Burma Road and Carnarvon Street will be reduced and also the provision of pedestrian paths along these roads will create safe and comfortable walking environment for pedestrians. In addition, the weaving problem on the section of Penang Road between Phee Choon Street and Prangin Road will be eliminated with the of reversed traffic along the existing unidirectional Burma Road and Penang Road.

The main merit of Alternatives L–1 and L–2 is the accommodation of impact introduced by the new Coastal Road by providing a smooth and continuous thoroughfare from/to the southern traffic corridors. In addition, under Alternative L–2, the introduction of one-way operation at Burma Road, Macalister Road and Carnarvon Street will alleviate traffic congestion along Penang Road and Carnarvon Street as well as make it possible to provide wide pedestrian paths along the three roads. Furthermore, the existing weaving problem on Penang Road will be solved under this alternative.

The main demerit of Alternatives L–1 and L–2 is the inadequancy of existing road capacity, thereby necessitate expenditure on road improvement. In both alternatives, it is necessary to widen Magazine Road to five (5) lanes, Dato Keramat Road and Penang Road (between Prangin Road and Magazine Road) to uninterrupted four (4) lanes. In addiition, it is desirable to provide additional lanes at intersection approaches along the latter two roads. Alternative L–1 has additional demerits in terms of road improvement. Under this alternative, Carvarvon Street need to be widen to six (6) lanes or uninterrupted four (4) lanes, Burma Road widen to four (4) lanes or uninterrupted two (2) lanes and Prangin Road (between Penang Road and Carnarvon Street) widen to five (5) lanes. Furthermore, Alternative L–1 will create weaving problem on the section of Prangin Road between Rope Walk and Carnarvon Street.

4.5.5 Proposed Traffic Circulation Plan

In order to ease the traffic pressure in the city centre it is important to construct the Coastal Road and/or Weld Quay Extension as well as to improve the ring roads, namely Perak Road and Western Road–Gottlieb Road–Bagan Jermal Road. The adopation of a new traffic circulation system per se alone cannot basically mitigate the traffic problems.

A. **Short Term Alternative Plan**

In the short term, it is not desirable to change the existing circulation system around KOMTAR, despite of several demerits such as mixed road usage by long trip and short trip vehicles, short weaving sections, concentration of most traffic there.

To change the existing system, it is advisable to carry out along with some occasions, for example, openings of the Coastal Road and/or Weld Quay Extension. Moreover, even if the existing system is changed before these occasions, the effectiveness to decrease congestion is doubtfol.

Thus, under the existing system, existing roads should instead be improved and controlled to ensure smooth traffic flow by such measures as advanced traffic system, enforcement of parking and booking of reckless drivers, better road markings, minor road improvements, etc. Furthermore, it is necessary to construct or widen roads in the periphery of KOMTAR according to a staging plan towards a long term improvement.

Figure 4.5.6 shows the proposed short term plan for traffic circulation system in Central Area.

B. **Long Term Alternative Plan**

After the opening of the Coastal Road and/or Weld Quay Extension, the existing circulation system will have to be changed or modified according to the traffic demand pattern which will be different from the existing one.

From the comparison of the two alternative traffic circulation plans, the following results are derived. Though each of the alternative system has merits and demerits as mentioned in the previous section, Alternative 2 is the more preferable plan from the view point of traffic engineering.

The main reason for this is that by means of one-way operation on Macalister Road, Burma Road and Carnarvon Street, pedestrian path with wide width can be provided on these roads for pedestrians to walk easily and comfortably. Better pedestrian facilities will become necessary in the near future because the public are becoming aware of its benefits and necessity.

However, even if either plan is adopted, the widening or improvement of roads around KOMTAR such as Penang Road, Magazine Road and Dato Keramat Road will be necessary to ensure smoother traffic flow.

This study is made according to the system under the existing KOMTAR Project Plan. Thus, if the traffic circulation system is changed, it is necessary to consider other alternatives.

Figure 4.5.7 depicts the proposed long term plan for traffic circulation system in the Central Area.

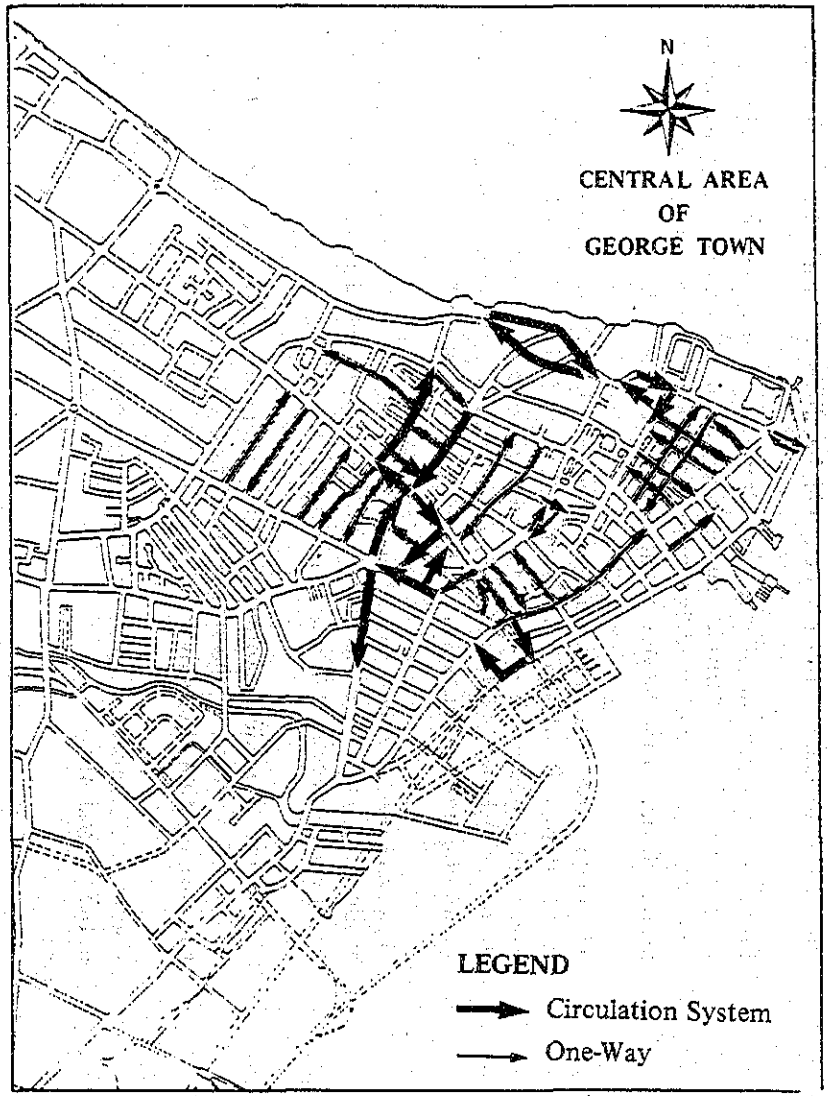
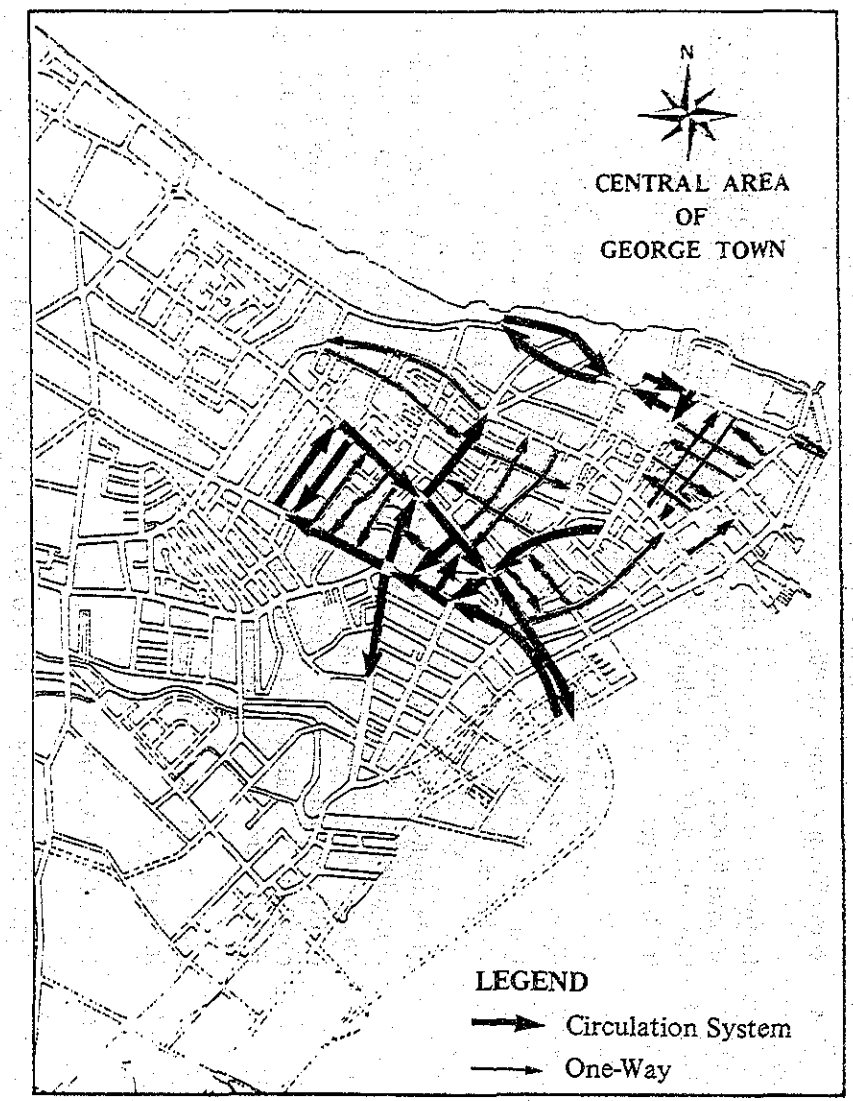


Figure 4.5.6 : Proposed Short Term Plan for Traffic Circulation System in Central Area



Figurr 4.5.7 : Proposed Long Term Plan for Traffic Circulation System in Central Area

4.6 Parking Plan

4.6.1 Basic Guideline

On-street parking has been allowed because of the need to cope with the demand for parking space and considerations for shop houses located on both sides of the road. For the time being the convenience of door-to-door mode afforded by the passenger car can still be ensured.

However, during 1990–2000 the number of inbound vehicular trips in the Central Area is expected to exceed 80,000 trips daily and without increasing the existing parking space capacity, it would become difficult to find an empty parking lot. Furthermore from the viewpoint of maintaining the desire service capacity on the arterial roads it will be inevitable to introduce on-street parking restriction on certain roads. Looking at the scenario described above, it would be envisaged that the motorists' dissatisfaction arising from parking woes would occur before that due to traffic congestion.

In other words, so long as the habitual door-to-door usage of passenger car remains, it will become increasingly difficult to find a suitable parking lot.

One solution to the parking problem is to build public and private parking facilities of suitable scale at several strategic locations in the city. Walking from parking facility to the destination point could be made more comfortable and conducive through the facilitation of a pedestrian path network.

With sufficient parking facility information provided to motorists, much inconvenience and time could be saved by a motorist seeking for an empty parking lot.

At the same time as when parking facilities for passenger cars have been provided, random parking by motorcyclists should be abolished. Orderly on-street parking by motorcyclists should be directed.

In tackling the parking problem, rather than imposing stricter parking regulations on the motorists it is even more necessary to instill a gradual change in parking attitude of the motorists as described above.

4.6.2 Parking Demand and Supply

A. Parking Demand in the Central Area

Car trips attracted to the Central Area give rise to parking demand. According to the Study Team's estimate, there are about 18,000 parking lots in the Central Area and at the peak one hour, a total of about 16,100 cars were parked there in 1986.

Although the existing circumstances show parking demand is sufficiently met by the number of parking lots, the increase in car trips following the increase in car ownership could be expected to cause a serious deficiency in parking space by year 2000. Figure 4.6.1 shows the forecasted parking demand in the Central Area will be 18,800 in 1990 and 29,000 in 2000.

However, in the future it would be necessary to extend the control of on-street parking in order to secure a smooth traffic flow and to enhance road safety for motorcyclists and pedestrians. Hence, the deficiency of parking lots will be further aggravated.

Parking space deficiency, if no measure is undertaken, would imposed a heavy load on urban traffic with all the needless driving around in search of parking space. These circumstances would cause a decrease in business trips and shopping trips and thus reduce the attractiveness of a city.

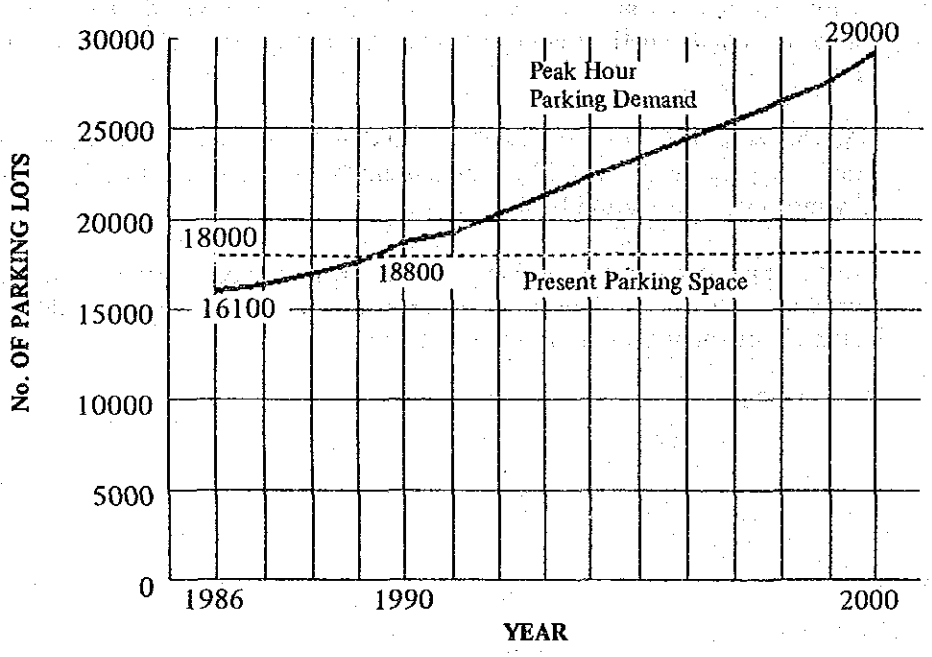


Figure 4.6.1 : Projections of Parking Demand at Peak Hour in the Central Area, 1986 – 2000

A two-prong approach to mitigate the foreseeable parking woes is to control on street parking on one hand and to provide off-street parking facilities at appropriate locations on the other hand.

In the following sections, On-street Parking Control Plans and Off-street Parking Plans will be discussed.

B. On-Street Parking Control Plans

The criteria for on-street parking control are traffic volume on road section and its functional classification. On-street parking would be prohibited on road section wherever warranted by the traffic volume. Basically, on-street parking on a primary road will be prohibited. However, single-side parking on any primary road or district road will be allowed only if the road width is permissible and necessary from landuse considerations.

Two (2) on-street parking control plans for the Central Area are formulated in view of increasing road capacity.

1. Parking Control Plan in year 1990

On-street parking will be prohibited on the primary roads and those roads forming the circulation system in the CBD. In principle, only single-side parking will be allowed on the district roads. Furthermore, from the standpoint of bus routes and pedestrian pathways, single-side parking on other roads will be allowed only when road space is sufficiently wide. Therefore, this parking control plan will reduce the number of existing on-street parking lots by about nine hundred (900).

2. Parking Control Plan for year 2000

On-street parking will be prohibited on the primary and secondary roads and those roads forming the circulation system in the CBD. The prohibition of on-street parking will also be extended to the district roads. Furthermore, from the standpoint of bus routes and pedestrian pathways, single-side parking on other roads will be allowed only when road space is sufficiently wide. Therefore, about one thousand and six hundred (1,600) parking lots will be removed from the existing on-street parking facilities.

C. Shortage of Parking Supply

Based on the On-street Parking Control Plan described in the previous section, the future parking requirement has been forecasted as shown in Figure 4.6.2. It is assumed that the natural increase of off-street parking provisions by the new developments or redevelopment would grow at the same rate as the employment growth rate in the Central Area. Therefore in 1990, about seven hundred (700) more parking lots will be required at peak hour. By the year 2000, the total shortage of parking supply will become nine thousand and six hundred (9,600) parking lots.

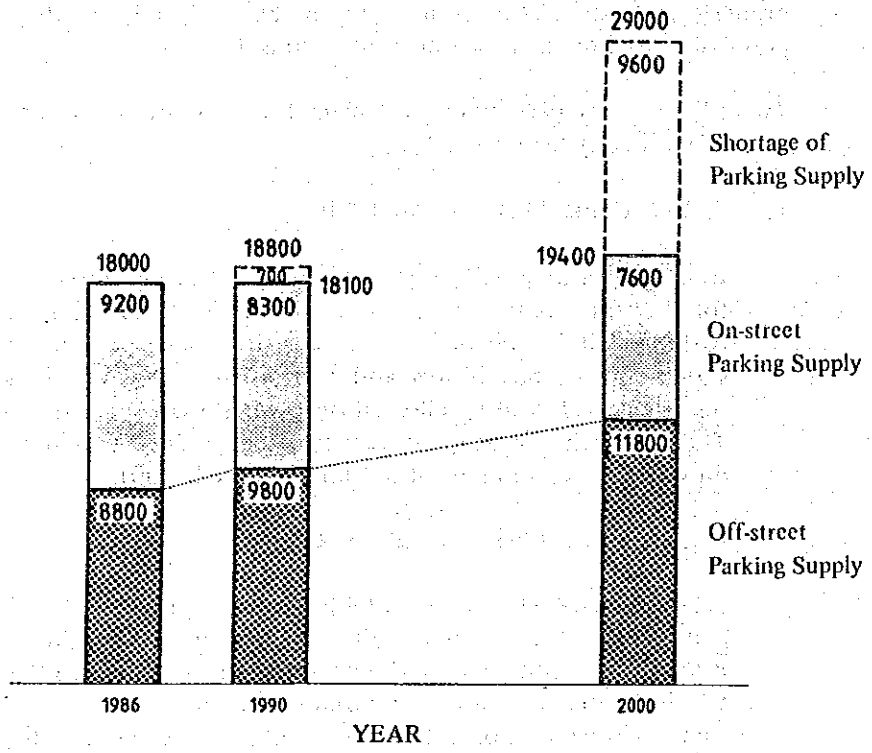


Figure 4.6.2 : Parking Supply and Shortage in the Central Area, 1986 – 2000

4.6.3 Public Parking Plan

A. Tactics to meet Parking Space Shortage

The future shortage of parking space may be mitigated by employing the following two (2) tactics.

(1) Encourage the use of public transport.

This tactic calls for an all out improvement of public transport services to attract more people to use public transport instead of car. Hence, parking demand could be reduced.

(2) To encourage privatisation of parking supply

The private sector would be encouraged to build and operate parking facilities. Besides the creation of more employment, this tactic could reduce public expenditure on new construction of parking buildings.

In order to make the implementation of these two (2) tactices successful, it is proposed to provide public parking facilities to counterbalance the parking space supply reduced by the enforcement of the on-street parking control plan.

In the Parking Control Plan for the year 2000, about one thousand and six hundred (1,600) parking lots are planned to be removed from the existing on-street parking facilities. Therefore, in line with the aim of upgrading the service level of public parking, it is necessary to plan for the provision of about two thousand (2,000) lots which is about 20% of the forecasted shortage (96,000 lots). The remainder of the shortage should be mitigated by the increase in public transport utilization and the construction of parking facilities by the private sector. This concept is illustrated in Figure 4.6.3.

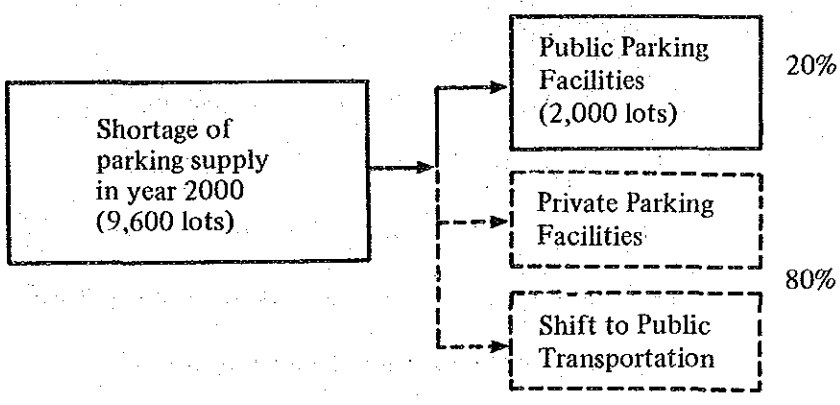


Figure 4.6.3 : Concept of Public Parking Plan

B. Implementation Consideration

1. Basic Guideline

A total of two thousand (2,000) parking lots in the form of public parking facilities will be provided by the year 2000. Based on the demand forecasted earlier, during the period 1991 to 1995, spaces for about six hundred (600) parking lots would be required first. Considering the availability of urban space and the scale of existing parking facilities, these will be provided by the construction of two (2) medium-scale public parking buildings in the CBD where parking demand will be highest. During the period 1996 to 2000, spaces for one thousand and four hundred (1,400) more parking lots will be facilitated at three (3) other locations in the Central Area.

2. Locations for Public Parking Facilities.

Since the construction of public parking facilities will have to be undertaken by the MPPP and considering the high land cost in the Central Area, it is assumed that the possible locations for the public parking facilities will have to be on land belonging to the MPPP or Penang State. Figure 4.6.4 shows the location of land belonging to the MPPP or Penang State.

In this examination, priority is given to the construction of public parking facilities serving the areas in the CBD where demand/supply ratio is high. Sufficient considerations have also been given to the selection of parking facility location such that walking to destination point could be made more comfortable and safer through the facilitation of a pedestrian path network.

Moreover, public parking facilities will also be provided in the new CBD Bus Terminal building proposed by the Study Team.

Therefore, in considerations of the abovementioned development and future landuses, the suggested locations for public parking facilities are identified and shown in Figure 4.6.5.

The proposed five (5) sites for public parking facilities are listed as below.

(1) On the site of existing market at Penang Road

(2) On the site of proposed CBD Bus Terminal

(3) On the site of existing car park at Downing Street

(4) On the site near Amoy Lane/Hutton Lane

(5) On redeveloped land near Brick Kiln Road

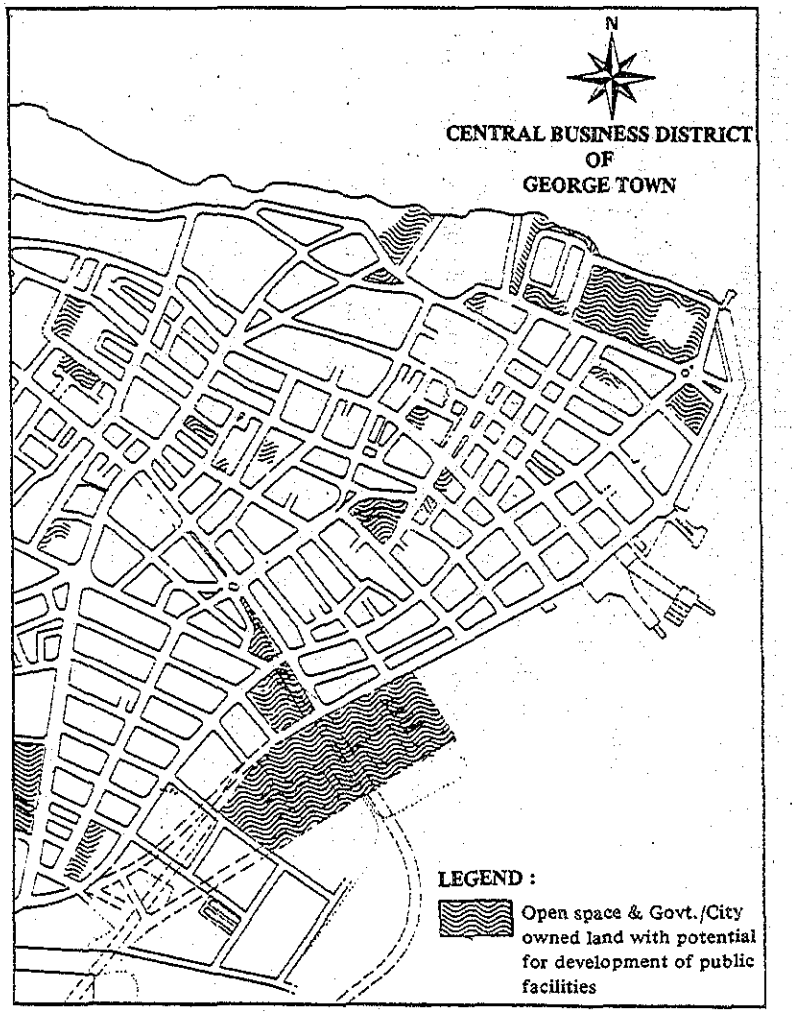


Figure 4.6.4 : Land Belonging to Penang State Or MPPP in the CBD of George Town with Potential for Development of Public Facilities

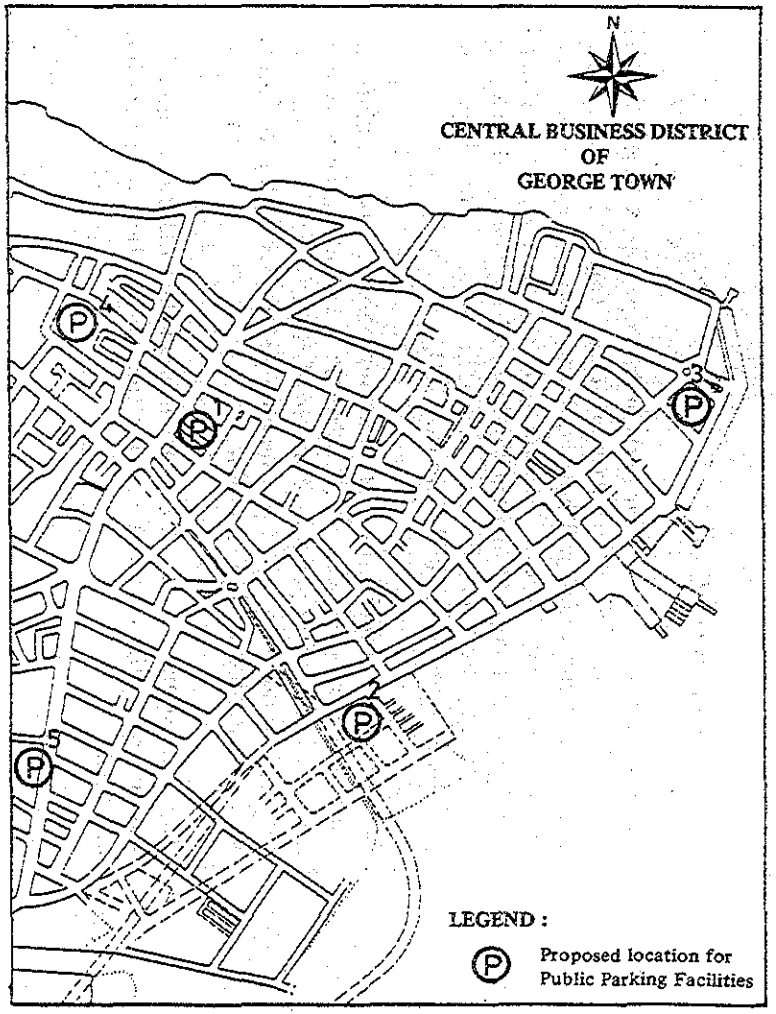


Figure 4.6.5 : Proposed Locations for Public Parking Facilities

3. Staging Plan

a. Estimation of Project Cost

The capacity of a typical car park building proposed in this plan is about three hundred (300) parking lots. This is a medium-scale parking building which will not require too large an area considering the high land cost in the CBD. Moreover, from the standpoints of building height control and traffic dispersal problem at the vicinity of a parking building, it is not desirable to construct large-scale parking buildings on small lots in the CBD.

Based on data available from the existing public car park building at Hutton Lane, the cost of construction excluding land cost is estimated as M$500 per square meter of floor space. Thus, the cost of a public building with three hundred (300) parking lots on public land is estimated as M$3.7 million.

The cost estimate of the parking facilities at the CBD Bus Terminal is considered in the cost estimate for the construction of a new bus terminal.

b. Staging Plan

The CBD Bus Terminal building is planned to be completed before the opening of Coastal Road, sometime in the period 1991 – 1995. Therefore, the public parking facility in this bus terminal building comprising about three hundred (300) parking lots is also to be constructed in the same period.

In addition a new public car park building with a capacity of about three hundred (300) parking lots is proposed on the site of the existing market at Penang Road.

Next, during the period 1996 – 2000, three (3) other medium-scale public car park buildings are to be constructed; one each at the Downing Street, Amoy Lane/Hutton Lane and Brick Kiln Road respectively.

Thus, the staging plan for the Parking Plan is presented in Table 4.6.1.

Table 4.6.1 : Staging Plan for Construction of Public Parking Facilities

Location	Capacity (Lot)	Project Cost (M$ million)	Phase 1 1988–1990	Phase 2 1991–1995	Phase 2 1996–2000
1. Penang Road Car Park	300	3.7			
2. CBD Bus Terminal Car Park	300	*			
3. Downing Street Car Park	500	6.2			
4. Amoy Lane Car Park	450	5.6			
5. Brick Klin Road Car Park	450	5.6			
Total	2,000	21.1	0	3.7	17.4

* Cost of parking facility has been included in the cost of the CBD Bus Terminal.

4.6.4 Financial Analysis of a Parking Building

In this section, the financial viability of a parking building is examined. This analysis is based on the following assumptions :

(1) Capacity of parking building is 300 lots and requires a land space of about 1,500 square meters.

(2) Construction Cost, Operation and Maintenance Cost and Revenue is based on the data obtained from the existing public parking building at Hutton Lane. Thus the cost of parking facilities only (excluding land cost) will be M$3.7 million. The expected revenue in 1992 estimated as M$0.7 million. Operation and Maintenance expenses is assumed to be 3% of the building cost.

(3) Interest on loan is assumed to be 6% per annum (long-term) for 50% of the loan and 12% per annum (short-term) for the rest.

(4) Project life is assumed as 25 years with construction beginning in 1990 and project to be opened to the public in 1992.

If a land cost of M$1,000 per square meter is assumed in the financial analysis, the financial rate of return is forecasted to be 10.8% indicating that the project is financially viable only if a low-interest rate loan is available. The cash flow of the project would be obtained as shown in Table 4.6.2. It can be observed that the annual profit/loss account shows a profit only nine (9) years after the opening of the parking building and to have a positive cumulative net balance twenty three (23) years after opening.

However, if the land cost is excluded the financial rate of return is forecasted to be 14.8% indicating that the project is financially viable. The cash flow of the project over a 25 year period, in this case, is shown in Table 4.6.3. It can be observed that the annual profit/loss account shows a credit balance right from the opening of the parking building and to have a positive cumulative net balance 13 years after opening.

The result of the financial analysis of the project suggested that if a low interest rate on loan is made available, privatisation of public parking building construction could be encouraged.

Table 4.6.2 : Cash Flow Analysis on Parking Building (includes land cost)

START YEAR 1990
INTEREST RATE (LONG–TERM) AT 6% PER ANNUM FOR 50% OF LOAN
INTEREST RATE (SHORT–TERM) AT 12% PER ANNUM FOR 50% OF LOAN
INFLATION RATE AT 3% PER ANNUM

YEAR	REVENUE	OPERATION/ MAINTENANCE & DEPRECIATION	NET INCOME	INTEREST PAYMENT LONG	INTEREST PAYMENT SHORT	PROFIT LOSS	LOAN TAKEN LONG	LOAN TAKEN SHORT	TOTAL INFLOW	LOAN REPAYMENT LONG	LOAN REPAYMENT SHORT	TOTAL OUTFLOW	BALANCE AT YEAR	CUMULATIVE BALANCE	
1990				0.1	0.2	−0.3	1.9	1.9	3.4	0.0	0.0	3.7	−0.3	−0.3	
1991				0.2	0.4	−0.6	1.2	1.2	1.8	0.0	0.0	2.4	−0.6	−0.9	
1992	0.8	0.3	0.5	0.2	0.4	−0.1	0.0	0.0	−0.1	0.0	0.3	0.3	−0.4	−1.4	
1993	0.8	0.3	0.5	0.2	0.4	−0.1	0.0	0.0	−0.1	0.0	0.3	0.3	−0.4	−2.0	
1994	0.8	0.3	0.5	0.2	0.3	0.0	0.0	0.0	0.0	0.0	0.3	0.3	−0.3	−2.5	
1995	0.9	0.3	0.6	0.2	0.3	0.1	0.0	0.0	0.1	0.0	0.3	0.3	−0.2	−2.9	
1996	0.9	0.3	0.6	0.2	0.3	0.1	0.0	0.0	0.1	0.0	0.3	0.3	−0.2	−3.5	
1997	1.0	0.4	0.6	0.2	0.2	0.2	0.0	0.0	0.2	0.1	0.3	0.4	−0.2	−4.1	
1998	1.0	0.4	0.6	0.2	0.2	0.2	0.0	0.0	0.2	0.2	0.3	0.5	−0.3	−4.9	
1999	1.1	0.4	0.7	0.2	0.2	0.3	0.0	0.0	0.3	0.2	0.3	0.5	−0.1	−5.6	
2000	1.2	0.4	0.8	0.2	0.1	0.5	0.0	0.0	0.5	0.2	0.3	0.5	0.1	−6.2	
2001	1.3	0.4	0.9	0.1	0.1	0.7	0.0	0.0	0.7	0.2	0.4	0.6	0.1	−6.9	
2002	1.4	0.4	1.0	0.1	0.0	0.9	0.0	0.0	0.9	0.2	0.0	0.2	0.7	−7.0	
2003	1.5	0.4	1.1	0.1	0.0	1.0			1.0	0.2	0.0	0.2	0.8	−7.0	
2004	1.6	0.4	1.2	0.1	0.0	1.1			1.1	0.2	0.0	0.2	0.9	−6.9	
2005	1.7	0.4	1.3	0.1	0.0	1.2			1.2	0.2	0.0	0.2	1.0	−6.7	
2006	1.8	0.4	1.4	0.1	0.0	1.3			1.3	0.2	0.0	0.2	1.1	−6.3	
2007	1.8	0.4	1.4	0.1	0.0	1.3			1.3	0.2	0.0	0.2	1.1	−6.0	
2008	1.9	0.4	1.5	0.1	0.0	1.4			1.4	0.2	0.0	0.2	1.3	−5.4	
2009	1.9	0.4	1.5	0.1	0.0	1.4			1.4	0.2	0.0	0.2	1.3	−4.9	
2010	2.0	0.4	1.6	0.1	0.0	1.5			1.5	0.2	0.0	0.2	1.4	−4.1	
2011	2.1	0.4	1.7	0.0	0.0	1.7			1.7	0.2	0.0	0.2	1.5	−3.1	↑
2012	2.1	0.4	1.7	0.0	0.0	1.7			1.7	0.2	0.0	0.2	1.5	−2.0	
2013	2.2	0.4	1.8	0.0	0.0	1.8			1.8	0.2	0.0	0.2	1.6	−0.6	Loss
2014	2.2	0.5	1.7	0.0	0.0	1.7			1.7	0.2	0.0	0.2	1.5	0.8	Profit
2015	2.3	0.5	1.8	0.0	0.0	1.8			1.8	0.1	0.0	0.1	1.7	2.5	
2016	2.4	0.5	1.9	0.0	0.0	1.9			1.9	0.0	0.0	0.0	1.9	4.4	↓
TOTAL	38.7	9.8	28.9	3.1	3.1	23.1	3.1	3.1	28.8	3.1	3.1	12.3	16.5		

Note : Total does not add up due to rounding up of figures.

Table 4.6.3 : Cash Flow Analysis on Parking Building (excludes land cost)

START YEAR 1990
INTEREST RATE (LONG–TERM) AT 6% PER ANNUM FOR 50% OF LOAN
INTEREST RATE (SHORT–TERM) AT 12% PER ANNUM FOR 50% OF LOAN
INFLATION RATE AT 3% PER ANNUM

YEAR	REVENUE	OPERATION/ MAINTENANCE & DEPRECIATION	NET INCOME	INTEREST PAYMENT LONG	INTEREST PAYMENT SHORT	PROFIT LOSS	LOAN TAKEN LONG	LOAN TAKEN SHORT	TOTAL INFLOW	LOAN REPAYMENT LONG	LOAN REPAYMENT SHORT	TOTAL OUTFLOW	BALANCE AT YEAR	CUMULATIVE BALANCE	
1990				0.1	0.1	−0.2	1.0	1.0	1.8			2.0	−0.2	−0.2	
1991				0.1	0.3	−0.4	1.2	1.2	2.0			2.4	−0.4	−0.6	
1992	0.8	0.3	0.5	0.1	0.3	0.1			0.1		0.2	0.2	−0.1	−0.8	
1993	0.8	0.3	0.5	0.1	0.3	0.1			0.1		0.2	0.2	−0.1	−1.1	
1994	0.8	0.3	0.5	0.1	0.2	0.2			0.2		0.2	0.2	−0.0	−1.2	
1995	0.9	0.3	0.6	0.1	0.2	0.3			0.3		0.2	0.2	0.1	−1.2	
1996	0.9	0.3	0.6	0.1	0.2	0.3			0.3		0.2	0.2	0.1	−1.3	
1997	1.0	0.4	0.6	0.1	0.2	0.3			0.3	0.1	0.2	0.3	0.0	−1.4	
1998	1.0	0.4	0.6	0.1	0.1	0.4			0.4	0.1	0.2	0.3	0.0	−1.6	
1999	1.1	0.4	0.7	0.1	0.1	0.5			0.5	0.1	0.2	0.3	0.2	−1.6	
2000	1.2	0.4	0.8	0.1	0.1	0.6			0.6	0.1	0.2	0.3	0.3	−1.6	
2001	1.3	0.4	0.9	0.1	0.1	0.7			0.7	0.1	0.4	0.5	0.2	−1.6	↑
2002	1.4	0.4	1.0	0.1	0.0	0.9			0.9	0.1	0.0	0.1	0.8	−1.0	
2003	1.5	0.4	1.1	0.1	0.0	1.0			1.0	0.1	0.0	0.1	0.9	−0.2	Loss
2004	1.6	0.4	1.2	0.1	0.0	1.1			1.1	0.1	0.0	0.1	1.0	0.8	Profit
2005	1.7	0.4	1.3	0.1	0.0	1.2			1.2	0.1	0.0	0.1	1.1	1.9	
2006	1.8	0.4	1.4	0.1	0.0	1.3			1.3	0.1	0.0	0.1	1.2	3.1	
2007	1.8	0.4	1.4	0.1	0.0	1.3			1.3	0.1	0.0	0.1	1.2	4.3	
2008	1.9	0.4	1.5	0.1	0.0	1.4			1.4	0.1	0.0	0.1	1.3	5.6	
2009	1.9	0.4	1.5	0.0	0.0	1.5			1.5	0.1	0.0	0.1	1.3	6.9	
2010	2.0	0.4	1.6	0.0	0.0	1.6			1.6	0.1	0.0	0.1	1.4	8.4	
2011	2.1	0.4	1.7	0.0	0.0	1.7			1.7	0.1	0.0	0.1	1.5	9.9	
2012	2.1	0.4	1.7	0.0	0.0	1.7			1.7	0.1	0.0	0.1	1.6	11.5	
2013	2.2	0.4	1.8	0.0	0.0	1.8			1.8	0.1	0.0	0.1	1.7	13.1	
2014	2.2	0.5	1.7	0.0	0.0	1.7			1.7	0.1	0.0	0.1	1.6	14.7	
2015	2.3	0.5	1.8	0.0	0.0	1.8			1.8	0.1	0.0	0.1	1.7	16.4	
2016	2.4	0.5	1.9	0.0	0.0	1.9			1.9	0.0	0.0	0.0	1.9	18.3	
TOTAL	38.7	9.8	28.9	2.2	2.2	24.5	2.2	2.2	28.9	2.2	2.2	8.8	20.1	22.2	

Note : Total may not add up due to rounding up of figures.

4.7 Bus Transort Improvement Plan

4.7.1 Basic Guideline

The recent introduction of the computerised ATC System Stage I and on-going road improvements such as grade-separation of intersections, etc., are all working towards reducing traffic congestion in George Town. However, in view of further growth in motorization and limited urban space for road constructions in the future, the improvement of public transportation would become an important measure to reduce traffic congestion. In this context, it would be necessary to consider bus related measures to encourage a shift from private vehicle usage to bus ridership.

On the other hand, bus transport problems are often complicated, most countermeasures do not normally produce immediate result as would have been shown by the opening of a new road to alleviate traffic congestion. It is therefore, a matter of fact that the solutions to bus transport problems need to be approached from the standpoint of a relatively long-term undertaking. Various bus related measures must together be implemented effectively, if not, then the fundamental problems can never be solved.

For example, in the case of bus network reorganization, if the bus routes were completely changed overnight the situation could create confusion among passengers. That could probably lead to more passengers giving up the bus rather than increase ridership.

Hence, in the preparation of a bus transport improvement plan for the Study Area, the following two tasks must be considered.

(1) To make clear the future role of bus transport

(2) To observe continuously the balance between the supply and demand of bus service vis-a-vis the overall traffic conditions and to implement various counter-measures efficiently.

Therefore, for this purpose, first of all, the establishment of a bus transport masterplan and a monitoring system for bus operations would be desirable. The establishment of a bus transport masterplan requires an in-depth study on the operating system which is the result of three components demand, supply and objectives. However, in this Study, the feasibility study of ATC System in Penang is the main task and an optimum solution to the bus transport woes is difficult to be achieved within the Study's limited scope.

In this Study, the data collected are insufficient for an in-depth analysis concerning demand and supply. Nevertheless, attempts will be made to identify the objectives and to suggest several possible options for the improvement of the existing bus transport system.

4.7.2 Objectives and Measures for Short-term and Long-term Planning

A. Objectives

Having examined the existing bus transport situation in the Study Area, the short-term and long-term planning objectives can be simplified into the following:

Short-term Objectives:

(1) To stop the declining trend of passenger volume

(2) To improve the economics of bus operations

Long-term Objectives:

(1) To address the role of bus transport within the context of the overall transportation system

(2) To secure a higher level of bus service

B. Measures

To achieve an increase in bus ridership, it is necessary to upgrade the existing bus transport service level. The conditions which are necessary in order to increase ridership are such as securing dependability, convenience, comfort, economics of operation, etc. However, these conditions must be supported at the base by an overall policy which gives priority to public transportation over private vehicle usage. Such conditions are necessary to encourage positively a shift from private vehicle usage to public transport.

As shown in Figure 4.7.1, there are five (5) possible measures to be taken to increase ridership, viz.

1) improvements to the bus route,
2) improvements to the operation of bus service,
3) improvements to the road used by bus,
4) improvements to the bus vehicle and
5) fare policy or subsidies to bus operators.

Table 4.7.1 presents a list of bus related measures which are in operation or are being considered world-wide. It is essential to realise that bus transport problems contain many other complex problems and hence the improvement measures must be implemented by involving many different measures at the same time in a comprehensive manner.

Conditions which are necessary in order to increase bus ridership	Measures to improve bus transport
1. Secure dependability	1. Improvements to the bus route
2. Secure convenience to users	2. Improvements to the operation of bus service
3. Upgrade amenities (comfort)	3. Improvements to the road used by bus
4. Secure economics of operation	4. Improvements to the bus vehicle
	5. Fare Policy and subsidies to bus operators.

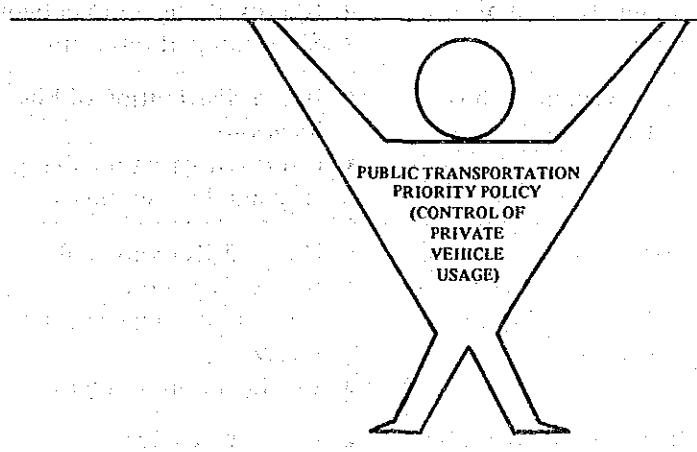


Figure 4.7.1 : General Approach to Increase Bus Ridership

Table 4.7.1 : Bus Related Measures

Category I	Category II	Category III
Improvements to the road used by bus	* Bus lane measures	• Bus exclusive lane • Bus priority lane • Bus contra-lane
	* Signal measures	• Bus priority signal • Synchronization of signals
Improvements to the bus vehicle	* Improvement of bus entrance/exit doors	• Bus with wider doors for boarding and unboarding • Bus with low-floor level • Improved methods for fare collection
	* Improvement of bus engine	• Improved acceleration/deceleration • power • Development of low polluting bus
	* Better amenities inside a bus coach	• Use of small bus • Air-conditioned bus • Improved designs of seats and aisle
Improvements to the bus route	* Reorganization of bus route	• Improved bus route network pattern • Shortening of bus route
	* Improvement of bus-stops	• Better distribution of bus-stop locations • Improved structural designs of bus-stop and bus terminals
Improvements to operation of bus service	* Control of route taken by bus, stopping places and accessibility to bus service	• Demand Responsive Bus • Route Deviation • Bus can pick up or drop passengers freely • Bus Location System
	* Increase bus frequency	• Increase bus fleet
	* Increase operation time	• Mid-night bus service
Fare Policy and subsidies to bus operators	* Fare policy	• Transfer to other modes without additional charge • Transfer to another bus without additional charge • Discount service
	* Subsidy policy	• Subsidy for buses serving low population area or non-profit making routes • Tax incentives for renewal of or/and addition to bus fleet

4.7.3 Short-term Measures to Bus Transport Problems

Among the more urgent issues at hand concerning bus transport in the Study Area are how to stop the current declining trend in bus ridership, how to increase ridership in the coming years and how to secure a healthy base necessary to manage bus operations. The solutions to these problems are important because they serve not solely for providing a mode of transport to the transportation poor, but also to alleviate some of the urban transportation woes which will become apparent with the continuous growth in motorization.

Therefore, from among these various bus related measures, several countermeasures which are considered suitable or necessary for implementation in the short-term to alleviate the bus transport problems in George Town today have been selected and presented in Table 4.7.2.

Table 4.7.2 : Short-term Measures to Bus Transport Problems

Items for Improvement		Countermeasures
Dependability	• Securing punctuality • Increase bus speed	• Consolidation of operation and management • Rerouting certain bus routes which are running too slowly in the CBD • Improvement on the roads plied by buses eg. parking restriction, etc.
Convenience	• Increase ease to use • Increase ease to transfer	• Provision of bus service information such as time-tables, route maps etc. • Provision of bus-stops and terminals
Comfort	• Increase amenities inside vehicle	• Introduction of air-conditioned, wide-door and low floor buses
Economics of operations		• Rerouting or elimination of non-paying routes (e.g. the operation schedule of Council buses on Jelutong Road need to be reviewed.) • Rationalization and modernization of bus operations' management and administration
Preparation for a long-term improvement plan		• To grasp the direction of urban development and the movements of persons • Preparation of a bus system masterplan

In this sub-section, the following three (3) countermeasures for the proposed Bus Transport Improvement Plan in the Central Area of George Town will be introduced.

A. Bus-stop Improvement Plan

The upgrading of bus-stop facilities for the convenience and comfort of bus users is one of the most basic and important measure for the overall improvement of the bus service level. Herein, a bus-stop improvement plan for the Central Area of George Town is presented.

More than ninety (90) bus-stop locations in the Central Area require improvement such as provision of shelter, bench and information board. However in this plan, the more necessary cases were identified from the criteria of passenger volume, existing road and traffic conditions and also from considerations of the future improvement plan for one-way circulation system. Thus, a total of forty (40) bus-stop locations depicted in Figure 4.7.2 has been identified for the implementation program. The project cost is estimated as about M$0.2 million.

However, the erection of bus shelters could be undertaken with the cooperation between the Municipality on one hand and sponsorship from bus companies, private enterprises and community service organizations on the other hand. Properly designed bus shelters can also be integrated into the design of the pedestrian path network and the roadway beautification program.

Examples of information boards and a typical bus-stop design are presented in Figure 4.7.3. The important elements of the design are shelter, information boards for time-table and route map, bench and dustbin.

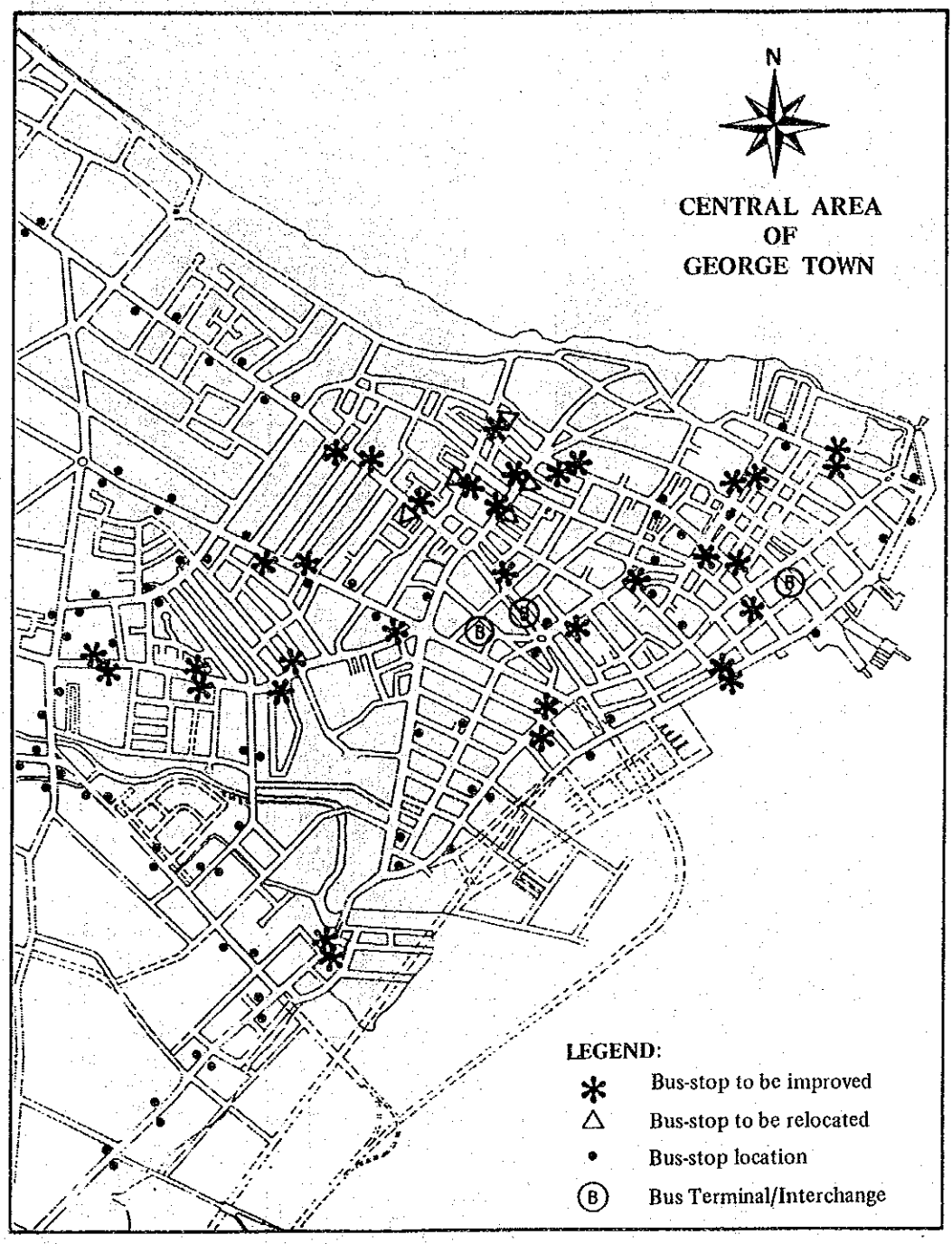
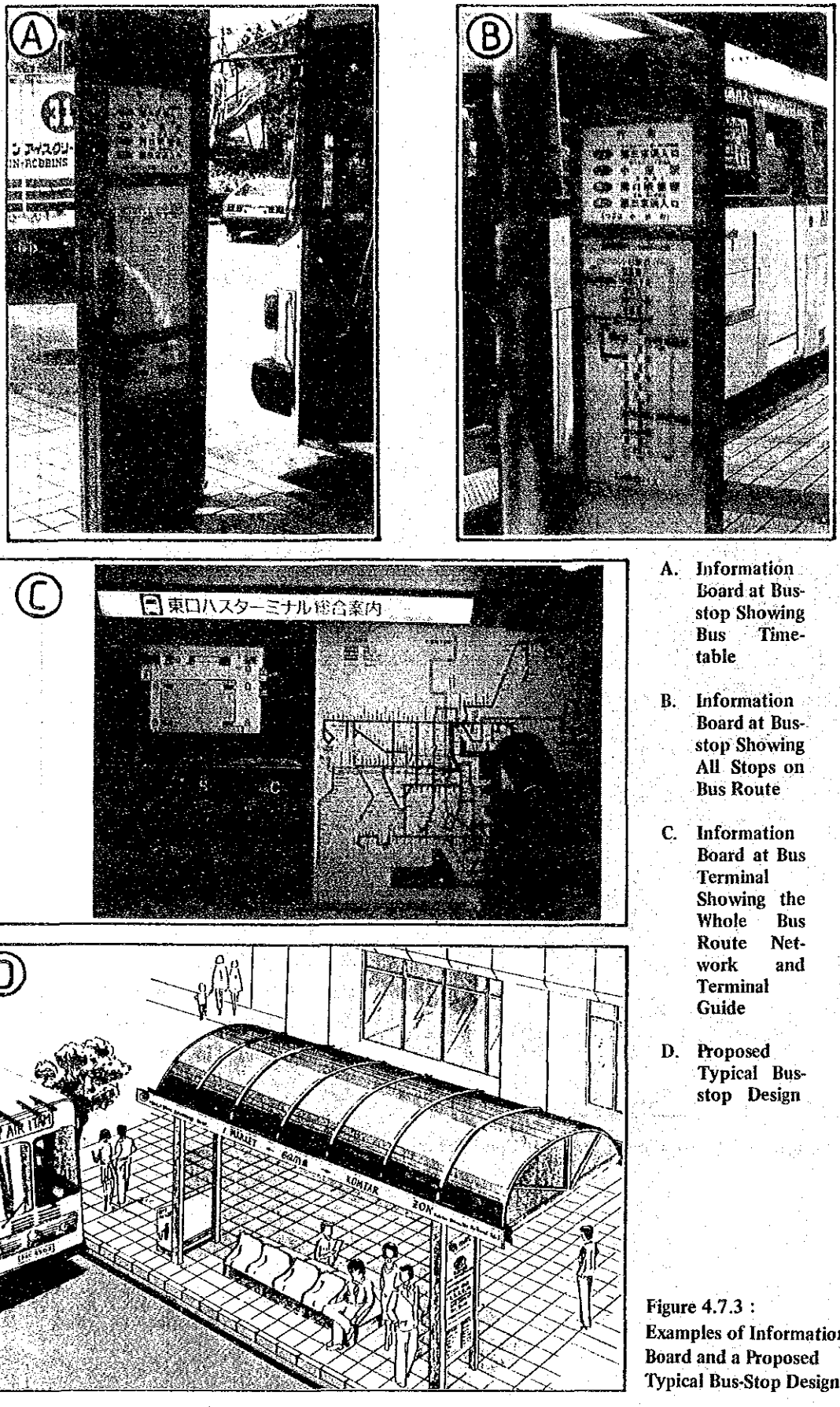


Figure 4.7.2 : Location of Bus-stops Under the Bus-stop Improvement Plan for Central Area



A. Information Board at Bus-stop Showing Bus Time-table

B. Information Board at Bus-stop Showing All Stops on Bus Route

C. Information Board at Bus Terminal Showing the Whole Bus Route Net-work and Terminal Guide

D. Proposed Typical Bus-stop Design

Figure 4.7.3 : Examples of Information Board and a Proposed Typical Bus-Stop Design

B. Prangin Bus Terminal Relocation Plan

In view of the impending construction of Coastal Road, the Prangin Bus Terminal must be relocated elsewhere to make way for road construction.

Many problems, like decrease of the bus patronage and poor bus facilities, etc. are apparent in the present bus transport system. In the establishment of the relocation plan, the improvement of bus service level in terms of dependability, convenience and comfort must be considered.

From the result of the Study Team's analyses (mentioned in detail in Supplementary Volume, Section B, Part III), a new terminal site will be recommended on land to be reclaimed near the entrance of Coastal Road. For the time being it is desirable for the new terminal to cater for regional bus only.

The new CBD Bus Terminal Building will have three (3) levels. The first level is the terminal level which will consist of the bus berths, platforms and bus parking space. The second level will consist of the passenger concourse and car park. Shop lots and stalls will also be provided for the convenience of bus users. The revenue expected solely from the rental of bus berths will not be sufficient to maintain the terminal. It is therefore necessary to increase the number of car parking space to generate more revenue. Thus, a third level is proposed for car parking. Based on this scheme, the project cost is estimated to be about M$7.35 million for the three levels.

In addition, the target year for the opening of the CBD Bus Terminal is just prior to the opening of Coastal Road. Thus a staging plan shown in Table 4.7.3 is proposed.

Figure 4.7.4 illustrates the concept of reorganized bus route network in the Central Area.

Table 4.7.3 : Staging Plan for CBD Bus Terminal

(Unit : M$ million)

Item	1991	1992	1993	1994	1995.....
Preparation					(Opening of Coastal Road)
Building (Concourse Level and Car Park)		1.8	2.5	2.5	
Terminal Level				0.48	
Pedestrian Bridge				0.07	
Total		1.8	2.5	3.05	
Operation & Maintenance (Building Construction Cost x 3%)					0.16 → 0.16

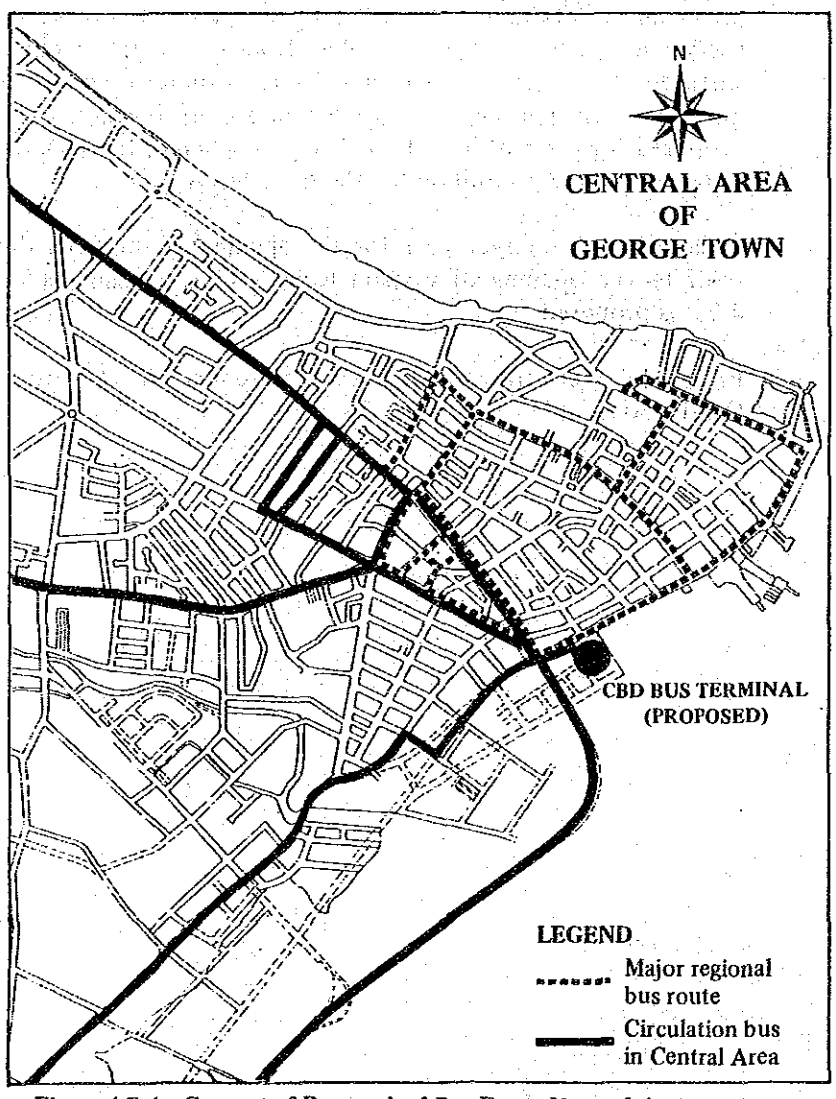


Figure 4.7.4 : Concept of Reorganized Bus Route Network in Central Area

C. Bus Fleet Improvement Plan

The existing bus fleet in George Town is mainly made up of old buses with poor amenity. More than 45% of the present bus fleets are older than eight (8) years. There is no air-conditioned bus. Therefore upgrading of bus amenity is one of the most important and attractive measure to draw in more passengers.

According to existing regulations, the life span of a stage bus is twelve (12) years. On this basis, one hundred and forty (140) replacement buses are estimated to be required between year 1988 to year 2000. The total cost over this period is estimated as M$11.2 million. (See Table 4.7.4) Thus, it is desirable for the current bus fleet to be renewed in a continuous process. In replacing the old buses, considerations should be given to secure better engine performance buses with wide-door, low-floor, comfortable seats and low-polluting characteristics. Air-conditioned buses should also be considered.

Financial incentives, either in the form of tax-benefit or low-interest loan made available to bus operators, could go a long way to expedite the bus fleet renewal process.

Table 4.7.4 : Bus Fleet Renewal Programme

Period	No. of Bus Required	Estimated Cost (M$ million)
1988 – 1990	25	2.0
1991 – 1995	70	5.6
1996 – 2000	45	3.6
Total	140	11.2

D. Bus Exclusive Lane

In general, one of the measures necessary to cause an increase in bus's speed and hence shorten travel time, is through the introduction of an exclusive lane for the bus. However, the present carriageway width is not sufficient to provide smooth traffic flow if one lane is reserved for bus. Furthermore, it will be difficult to keep the left lane as a bus exclusive lane due to the presence of many motorcycles and left-turning traffic. Therefore, widening the carriageway and controlling the left-turn traffic will be necessary.

Consequently, the timing for implementing this measure should be decided after considering the traffic flow conditions and the progress of future road widening plans.

4.7.4 Long-term Measures to Bus Transport Problems

The solutions to long-term bus transport problems are normally discussed in the context of a bus transport master plan. In this sub-section, the discussion will be limited to several of the measures which should be considered in the masterplan.

It is foreseeable that the progress of motorization which is expected to continue in the future would cause traffic congestion, (especially in the CBD), worsening with time such that the situation would affect the normal functioning of urban activities. Therefore, establishment of a transportation management plan which emphasizes on priority to public transportation over private vehicle usage is both timely and desirable.

The bus transport industry should become responsive to new developments in the future and a higher level of service would be expected of it. Therefore, the improvement of dependability, convenience, comfort and economics of operation would become even more indispensible. The main countermeasures considered for the long-term plan, such as the reorganization of bus network and the introduction of bus exclusive lane, should be implemented comprehensively together with other measures such as the improvement of roads plied by buses, reorganization of bus operators, reviews on policies concerning fare and subsidy, etc. (See Table 4.7.5).

Table 4.7.5 : Long-term Measures to Bus Transport Problems

Items for Improvement		Countermeasures
Dependability	• Securing punctuality • Increase bus speed	• Improvement of roads plied by buses
Convenience	• Shorten walking time • Increase frequency • Increase efficiency	• Reorganization of bus route network • Construction of bus terminals, bus-stops, transfer points, etc. • Introduction of medium or small buses for low demand routes
Securing comfort		• Improvement of bus vehicles (low-floor, wide door and air-conditioned)
Securing economics of operation		• Modification to fare policy • Subsidies to bus operators
Improvement of bus company's financial situation		• Reorganization of inefficient (non-paying) routes • Reorganization of bus operators • Promotion of rationalization and modernization of bus operations
Supportive Policies		• Public Transport Priority Policy (Policy for control of private vehicle usage)

Note : (This proposal is based on a future bus system masterplan which has to be formulated in accordance with the clearly identified role for the bus transport within the context of a comprehensive urban transportation system.)

Herein, only the concept of bus route network reorganisation will be introduced.

In the existing bus route network, almost all the urban and regional bus routes start from the CBD. The high degree of bus traffic in the CBD inevitably adds to road congestion and is also one of the causes for the deterioration in efficiency and punctuality of service. A possible solution to this problem is the separation of urban bus routes from regional bus routes with the introduction of a zone bus sytem.

In a zone bus system, the existing complicated long-haul routes and the shorter routes linking sub-urban areas and the CBD are separated into two (2) definite route system resulting in simplified routing and functions. On one hand in the residential or business-cum-commercial areas which can be consolidated as a zone, a bus system using smaller buses for easier manoeuvering and higher frequency would be operated. The bus routes inside this zone are called branch line buses. On the other hand, larger size buses will be operated along the main trunk lines between two major terminals. In such a plan, buses on the trunk lines could be easily monitored and be operated more efficiently.

In the reorganization of bus route network, it is necessary to grasp the passenger demand and characteristics of their movement including those of potential bus users. However, in the absence of such information at this stage, it is only possible for the Study Team to rely on information concerning total ridership volume on existing bus routes. On this basis, the desirable concept of a reorganized bus route network illustrated in Figure 4.7.5 is proposed.

In addition, local bus terminals (open space type) should be improved at the major housing development areas such as Bayan Baru, Thean Teik Estate, Tanjong Bungah etc. Moreover, in order to provide better services between the major growth centres in the southern corridor and the CBD, limited-express services could also be introduced to run on the impending Coastal Road.

Inter-regional (express) buses could also enter the Island via the Penang Bridge to link the mainland with the CBD Bus Terminal or Penang International Airport.

In addition, zone bus systems are suggested for the residential areas off the trunk lines. A zone bus system functions very much like a feeder service to the trunk line. With such a system, convenience within a zone would be greatly improved and the operation of main trunk lines would also become more efficient in terms of loading and fewer overlaping of routes in the CBD.

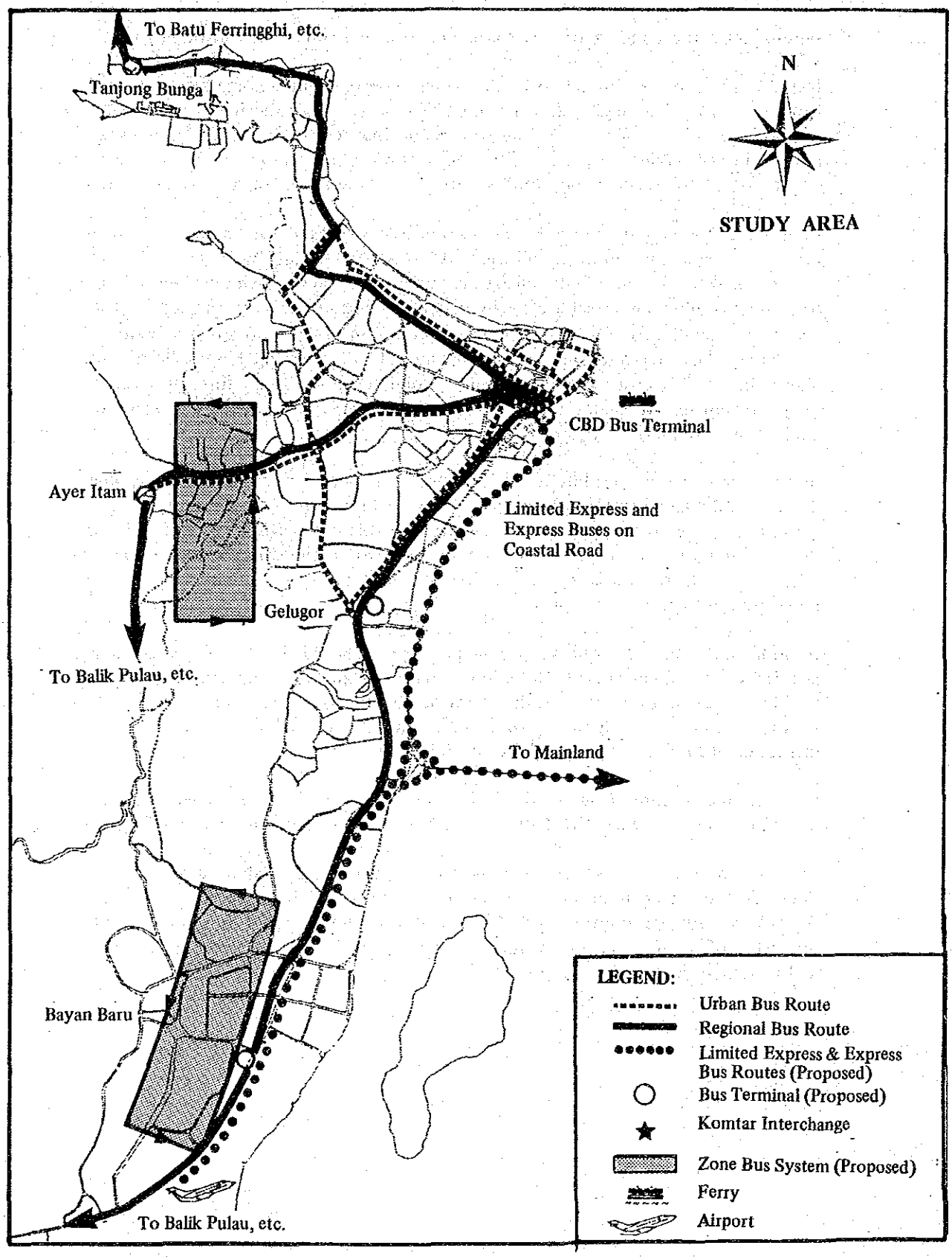


Figure 4.7.5 : Concept of Bus Transport Improvement Plan

4.7.5 Staging Plan

The project cost of bus transport facilities included in the short-term and long-term bus improvement plans which were discussed in the previous sub-sections, are roughly estimated. Based on these estimates, a staging plan for these projects is provided and shown in Table 4.7.6.

The most important problem to be solved is on the bus operation and management, thus the countermeasures regarding to these two aspects should be implemented as soon as possible.

The proposed CBD Bus Terminal will be constructed prior to the closure of Prangin Bus Terminal due to the opening of Coastal Road. The implementation of other terminals and interchanges should be based on a future bus transport system formulated from a Bus Transport Study, whichis proposed to be carried out.

For the convenience and comfort of bus users, improvement of bus-stop facilities, provision of bus service information and the introduction of new buses should be started soon.

Table 4.7.6 : Staging Plan for Improvement of Bus Transport Facilities

(Unit : M$ million)

Name of Project		Project Cost	Phase I 1988–1990	Phase II 1991–1995	Phase III 1996–2000
Bus Terminal/ Interchange	CBD Terminal	7.35		7.35	
	Gelugor	0.40			0.40
	Air Itam	0.32			0.32
	Others	0.60			0.60
Bus-stop including Information Board	CBD Area (20 stops/year)	0.20	0.10	0.10	
	Other Area (20 stops/year)	0.20		0.10	0.10
Sub-Total		9.07	0.10	7.55	1.42
Bus Fleet Improvement		11.20	2.00	5.60	3.60
Bus Transport Study		1.00	1.00		
Total		21.27	3.10	13.15	5.02

4.8 Pedestrian Path Network Plan

4.8.1 Basic Guidelines

The average trip length by pedestrians on urban streets is not very long. This is partly due to the local hot climatic condition and to the discomfort associated with walking because pedestrians often have to walk along corridor of unequal levels and to make dangerous road crossings.

Nevertheless, pedestrian demand will inevitably increase with the implementation of measures to attract a higher share of public transportation usage or the establishment of parking facilities at strategic locations in the city.

Efforts made to create a conducive walking environment and to provide other amenities such as street furnitures and plantings will go a long way to further attract more tourists to the island. Therefore, an all out effort should be undertaken to provide better facilities for the pedestrians and the implementation of a pedestrian path network in the city area.

4.8.2 Planning Considerations

Pedestrian path networks could be planned as movement systems for pedestrians encompassing the core areas of major activities in the city. Hence, areas where pedestrian movement are comparatively large are taken into the planning considerations to model the pedestrian movement characteristic. Provisions of public transport along the network and with car parks at the periphery are equally essential.

Figure 4.8.1 depicts a schematic flow chart used in establishing a pedestrian path network plan in the Central Area of George Town.

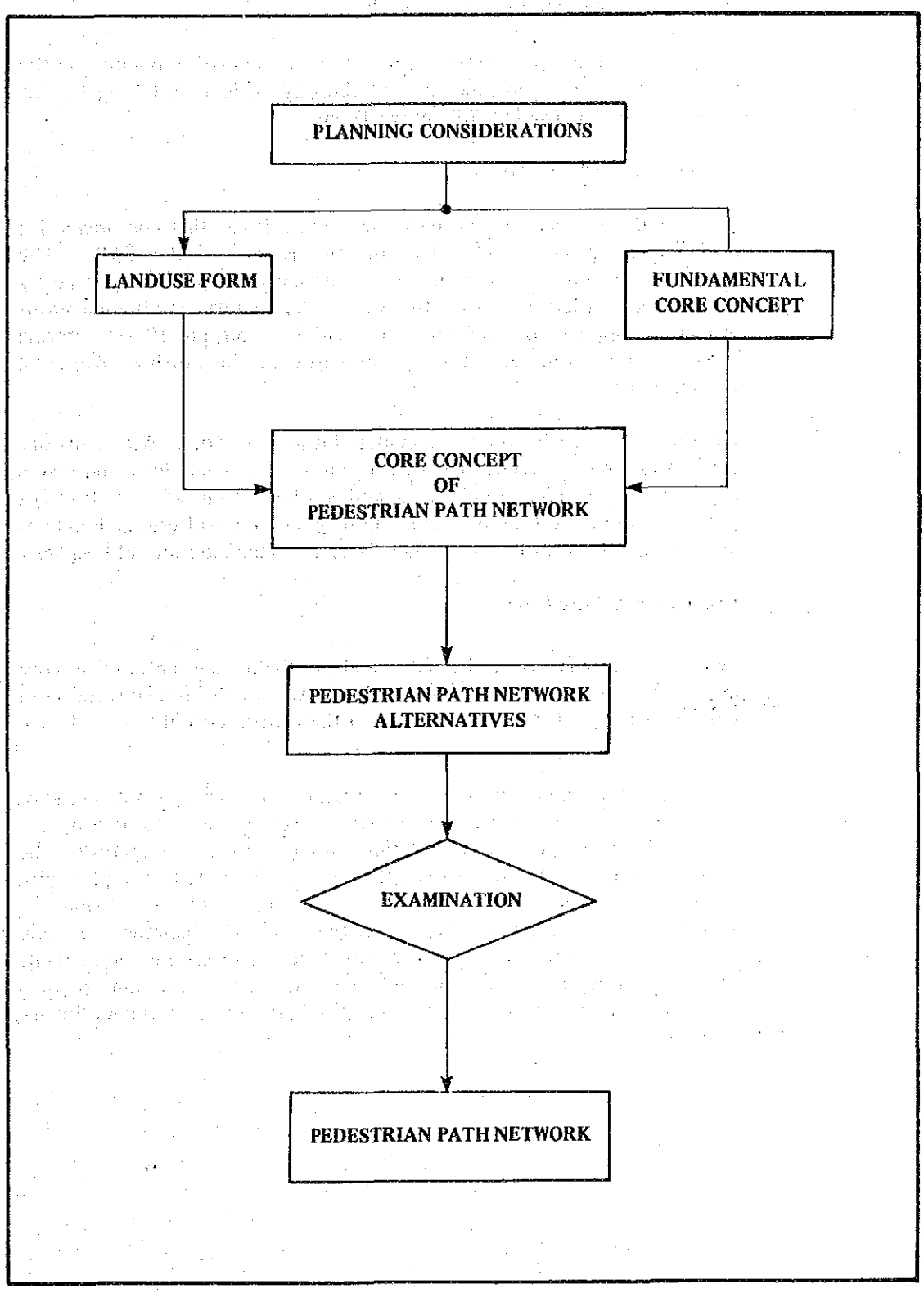


Figure 4.8.1 : Pedestrian Path Network Planning Flow Chart

A. Core Concept of a Pedestrian Path Network

To enable the planning for a network, it is equally essential to understand the urban form, townscape, and landscape of the city. Figure 4.8.2 depicts the landuse form in the central area of George Town.

1. Landuse and Urban Form

Situated in the heart of central George Town is the first comprehensive development project undertaken on the island – KOMTAR. The megastructure introduces an innovative design concept to the island by integrating a variety level of activities. In the vicinities are the numerous modern shopping complex or 'supermarkets' and hotel/food catering services. The latter are clustered primarily in the northern region of George Town.

On the eastern seaboard is the central business district. With a history that dates back two centuries, this region has many buildings and places of interests from a historical, social, and aesthetic point of view. Rows of pre-war commercial buildings, graceful religious and institutional buildings and ornamental clan houses reflect its unique character and atmosphere.

2. Fundamental Core Concept

Pedestrian trips are generally short and are highly concentrated in core areas of major activities. Figure 4.8.3 illustrates the fundamental core conept of a pedestrian path network in the central area of George Town.

The conceptual strategy is one of creating an environmental network embracing the core areas. KOMTAR has succeeded in revitalising the inner core of George Town and in time, should serve as an impetus for the other areas in the city to be redeveloped or rehabilitated. Coupled with its strategic location, KOMTAR would be an impeccable designation as a main core of central activities for the network planning. Several connecting sub-cores are equally essential in rendering the spread of its sphere of influence. As shown in Figure 4.8.3, the core concept of a network is composed of a main core, subsidiary cores, and major linkage patterns.

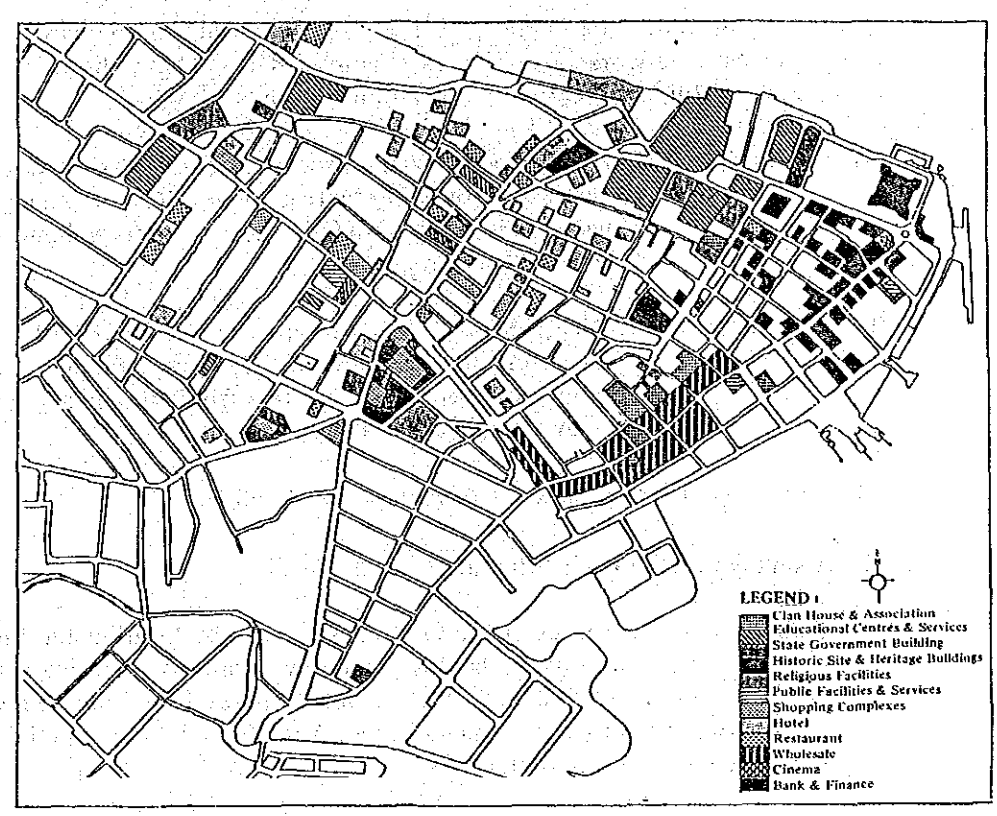


Figure 4.8.2 : Landuse Form In The Urban Area Of George Town

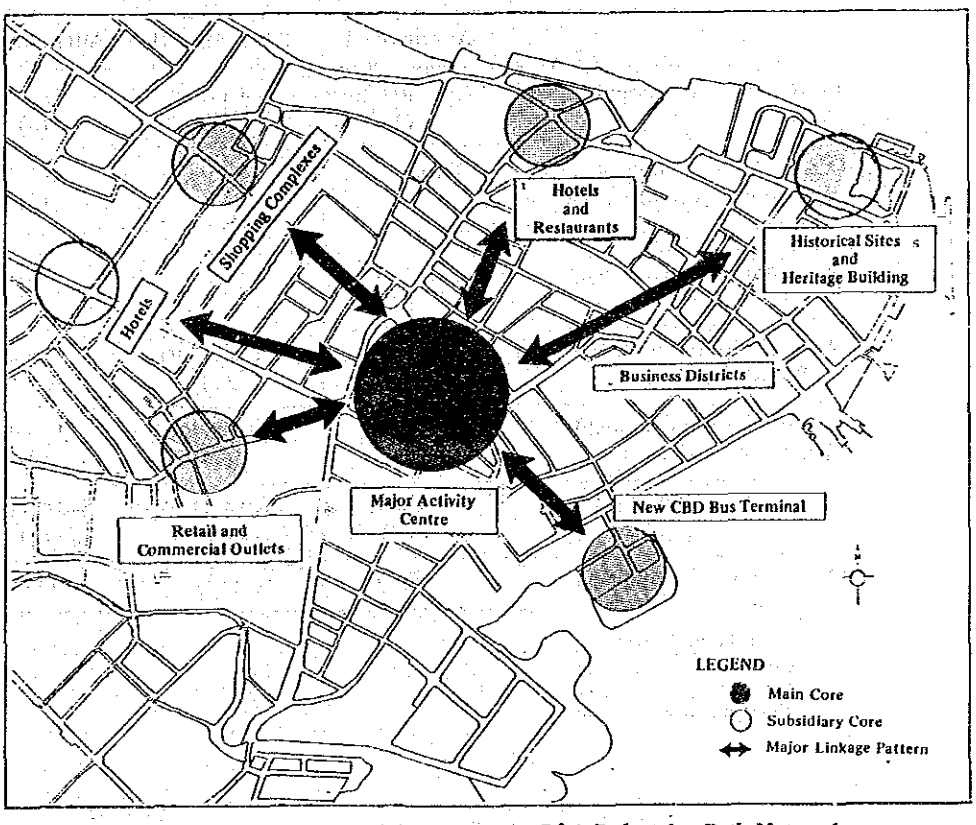


Figure 4.8.3 : Fundamental Core Concept Of A Pedestrian Path Network

B. Pedestrian Path Network Alternatives

Based on the preceding concept, three hypothetical alternatives for the pedestrian path network are obtained (Figure 4.8.4). These alternatives are based on the future road network circulation system.

(a) Alternative I : By incorporating the pedestrian path on the minor road networks, this alternative plan aims at segregating pedestrian routes from the heavy traffic volume roadways or major roads.

(b) Alternative II : This plan tries to incorporate the pedestrian path on the future major road networks. It does not call for segregation of pedestrian routes from the heavy traffic volume roadways or major roads.

(c) Alternative III : Admixture of Alternatives I and II.

1. Examination On Each Alternative

Pedestrian trip purposes in the Central Area vary by location and time of day, reflecting the mix of landuses and the locations of major activity centres. Table 4.8.1 depicts the examination results of the pedestrian path network alternatives. As indicated, Alternative III presents the most desirable pedestrian path network.

Table 4.8.1 : Examination Of The Pedestrian Path Network Alternatives

	Alternative I	Alternative II	Alternative III
Convenience for Shopping Purposes	Unsatisfactory (1)	Good (3)	Good (3)
Accessibility to entertainment, recreation, & food catering services	Satisfactory (2)	Good (3)	Good (3)
Accessibility to work places	Satisfactory (2)	Good (3)	Good (3)
Accessibility to public transport facilities & services	Satisfactory (2)	Satisfactory (2)	Good (3)
Accessibility to community facilities & services	Good (3)	Satisfactory (2)	Good (3)
Degree of pedestrian safety	Good (3)	Satisfactory (2)	Satisfactory (2)
Total Points Accumulated	(13)	(15)	(17)

Note : Grade Point System
Good : 3 pts.
Satisfactory : 2 pts.
Unsatisfactory : 1 pt.

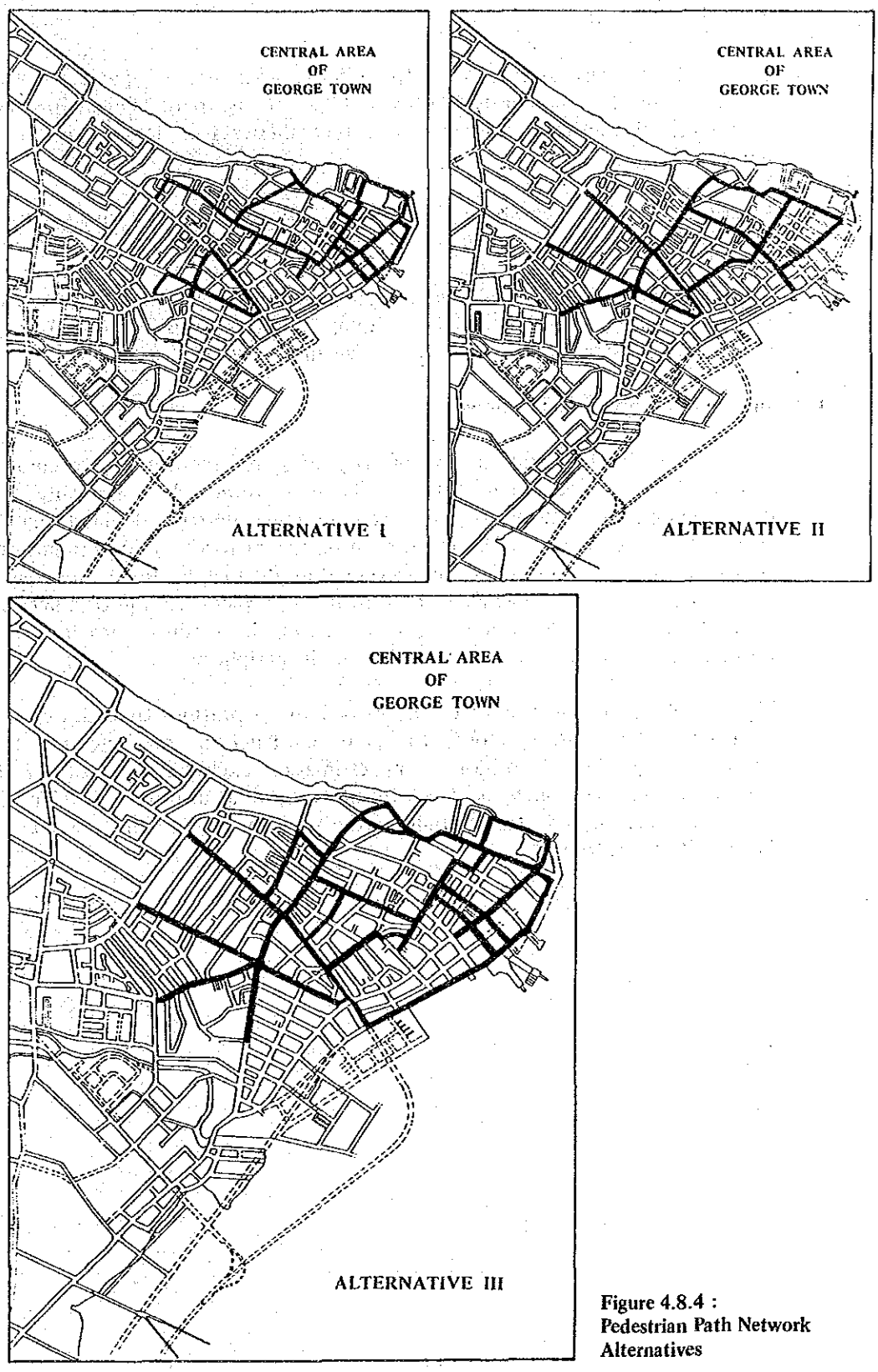


Figure 4.8.4 :
Pedestrian Path Network Alternatives

C. Pedestrian Sidewalk

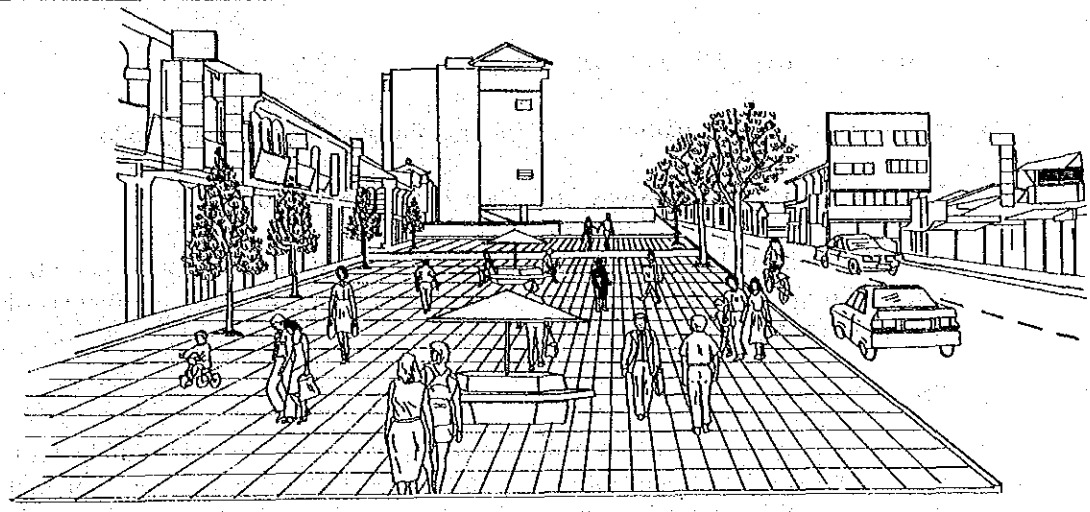
The existing type of sidewalk or footpath in the urban area of George Town are primarily corridor (popularly known as five-footway to the Penangites) and pavement. Structurally, corridor is not conducive for pleasant pedestrian movement.

Creation of a good pedestrian sidewalk network that links one major part of the city to another is one element that make movement on foot more agreeable and pleasanter. In this respect, the types of sidewalk in the proposed pedestrian network are pedestrian mall, community street, and pavement. Pedestrianisation amenities and landscaping works are also introduced to the sidewalk to further enhance the city's image and beauty (Figure 4.8.5).

D. Implementation Considerations

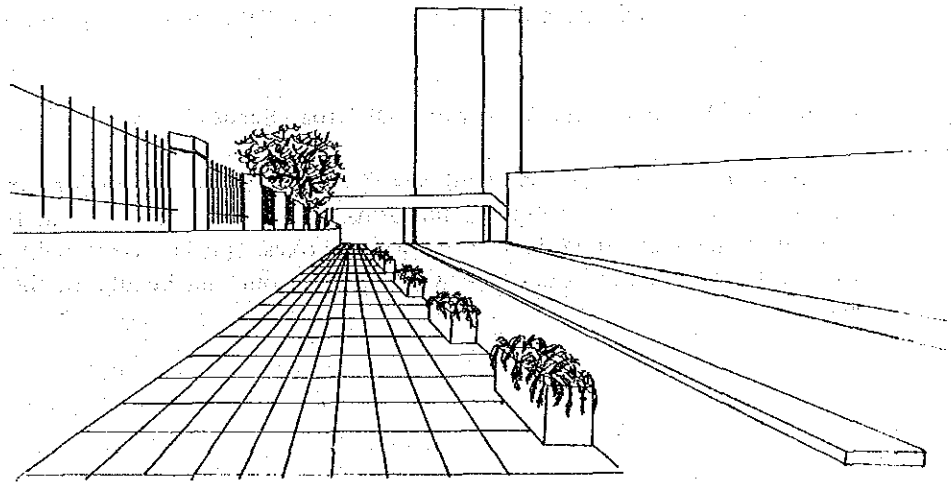
Prior to the implementation, the priority of implementation of each road section in the pedestrian network is pre-determined. Basically, the determination of such priority is based on the pedestrian demand and the adequacy of existing paved footpath on a particular roadway so as to ensure a continuous and pleasant pedestrian access within the highly valued core areas in the Central Areas. For instance, the priority of implementation of a network along Burma Road is notably high considering its landuse form and as a prominent network linkage to KOMTAR and its periphery.

The overall estimated cost of the network implementations (includes cost on improving the existing footpath and construction of new ones) is approximately M$3.81 million. The estimation excludes the cost for the pedestrian amenities such as street furnitures, public utilities (eg. telephone kiosk), greeneries, and etc. Details of the implementations are presented in Section B of this Report.



Pedestrian Mall

Community Street



Landscaped Pavement

Figure 4.8.5 : Types Of Pedestrian Sidewalk In The Path Network

4.8.3 Merits Of A Pedestrian Path Network

The merits of a pedestrian path network though obvious, are enlisted as follow:

A. Revitalization Of Urban Areas And Their Economic Viabilities

Revitalization of the urban areas in George Town and their economic viabilities can be brought about by providing major linkages between the core areas of major activities.

B. Pedestrian Safety

An efficient network enables pedestrians to window-shop or walk safely without being disturbed or endangered by traffic. Besides, it is only on foot that people can really appreciate the narrow shopping streets and the street vista in town.

C. Coping With Increasing Urban Pedestrian Demand

As the urban pedestrian demand increases, there will be an increased expectation for a higher quality of pedestrian footpath. The network would provide a continuous pedestrian access to the high value shopping centres or areas of diversified activities whilst maintaining accessibility in relation to transportation and parking.

D. Encouraging More Walking Trips

Trips made on foot, can all be encouraged by simply improving the walking conditions. Human discomfort due to walking up and down along corridors of unequal levels would then be eliminated. Long distances can be covered on foot in attractive settings, quiet and relaxing pedestrianised environment. Increasing such walking-trips rather than vehicle-trips play an important role in any city's transport strategy. Cars would then serve their original purpose which is to carry passengers over physically unwalkable distance. Moreover, cars cruising through the area in search of unavailable parking spaces will also be eliminated.

E. Upgrading The Image And Appearance Of Urban Scenes

Creation of a good pedestrian walkway system that links one major part of the city to another is one element that adds to the quality of life in the city. Amenities such as street furniture, flower boxes, special street lighting, and wherever possible individual tree would add colour and beauty to the city in general.

4.9. Area Traffic Control (ATC) System Plan

4.9.1 Basic Guideline

A. Necessity and Objectives of an ATC System

1. Necessity of an ATC System

Signalization is one of the most effective ways to control traffic at intersections. However, an increase in the number of signalized intersections in a conventional way will entail the following problems :

(1) The short distance between signalized intersections necessitates well-coordinated operation in order to get effective performance.

(2) Field survey is the only way to get information concerning traffic conditions and signal controls in operation. It is difficult to get this information simultaneously over a wide area.

(3) Adjustment of control timings for signal control on-the-spot is very troublesome. So it is nearly impossible to maintain the optimum control timing constantly.

(4) Drivers cannot get information related to road and traffic conditions such as congested locations, accident locations and parking conditions at parking facilities while driving and also before a trip. Therefore, it is difficult for drivers to decide the route and time of a trip.

(5) Malfunction of a traffic signal controller, if it happens, produces a serious traffic problem. Therefore it is important to introduce highly reliable controllers and to ensure efficient relaying of information regarding occurrence of malfunction as soon as possible.

The solution to the above problems lies in the introduction of centralized traffic control system, namely the Area Traffic Control (ATC) System.

2. Objectives of an ATC System

a. Alleviation of Traffic Congestion

There are still many serious problems and bottlenecks even in areas that have already been signalised. The main objective of an ATC system is to enhance the effect of signal-control providing well-coordinated operation and well-fitted control timing.

b. Reduction of Traffic Accidents

Recent rapid increase in the use of motor vehicles will result in an increase in the number of traffic accidents. Signalization of intersections is an effective way to reduce traffic accidents.

Conventional traffic signals bring advantages to only vehicular traffic. Efforts will be made in an ATC system to provide pedestrian crossings to ensure pedestrian safety.

c. Comprehensive Interpretation of Traffic Conditions

Traffic conditions change day by day. In order to trace traffic problems fast and implement counter-measures, a comprehensive interpretation of current traffic conditions using quantitative and statistical data compiled is one of the most significant objectives of an ATC system.

d. Conveying Traffic Related Information to Drivers

For drivers to avoid locations where there is traffic congestion, or to follow traffic regulations being enforced by the traffic management authority, it is necessary to convey traffic-related information from various sources to drivers on the road or at any site as quickly and as accurately as possible.

e. Training

With the introduction of an advanced ATC System, appropriate training is expected to produce specialists who will manage the traffic control system and devise adequate measures to anticipate future traffic problems.

B. Functions of Comprehensive ATC System

In order to achieve the objectives of a comprehensive ATC System, the following main functions are included in the system :

1. Traffic Information Gathering

Vehicle detectors are installed on the roads to detect the presence or absence of vehicles at the spot. These primary traffic data are transferred to the central computer which processes them into traffic-related data such as traffic volume, travel speed and congestion level. These traffic-related data are displayed on the wall map to help operators in the traffic control centre in grasping traffic conditions in the city.

In addition, CCTV cameras are installed at strategic locations in the city for traffic surveillance and to enable operators to further investigate traffic conditions.

The radio system of the police is also available to get additional traffic data, if necessary.

2. Traffic Signal Control

Traffic data from the vehicle detectors are automatically processed and analyzed by the central computer to select the optimum traffic signal control parameters, namely cycle time, split and offset, for an individual signal controller. According to these selected parameters, the computer issues commands to and receives confirmation from the signal controller every one second. Additional functions such as vehicle-actuated control, time-of-day control and operator's intervention are available to perform more effective system operations.

3. Conveying Information to Drivers

Variable signs and/or changeable message signs are installed on the roads to convey such information as congestion, occurrence of accident, and road conditions to drivers. The information displayed at the terminal is set by a computer automatically or by operators manually. This sub-system will be introduced simultaneously with the completion of the North Coastal Road.

Another way to inform drivers is through the broadcasting network. Thus, drivers can be informed through a radio on the road or at home.

In addition, a traffic information centre which has any information regarding traffic or road conditions can relay it to drivers by ordinary telephone.

4. Statistical Data Collection

During the operation of the system, traffic data and control data are recorded and appropriate reports are produced automatically.

These statistical data serve as adjustment of control parameters or timings now in operation and for the formulation of future traffic control policy.

A concept of a multi-functional ATC system is shown in Figure 4.9.1. (However, it does not include freeway surveillance and control system)

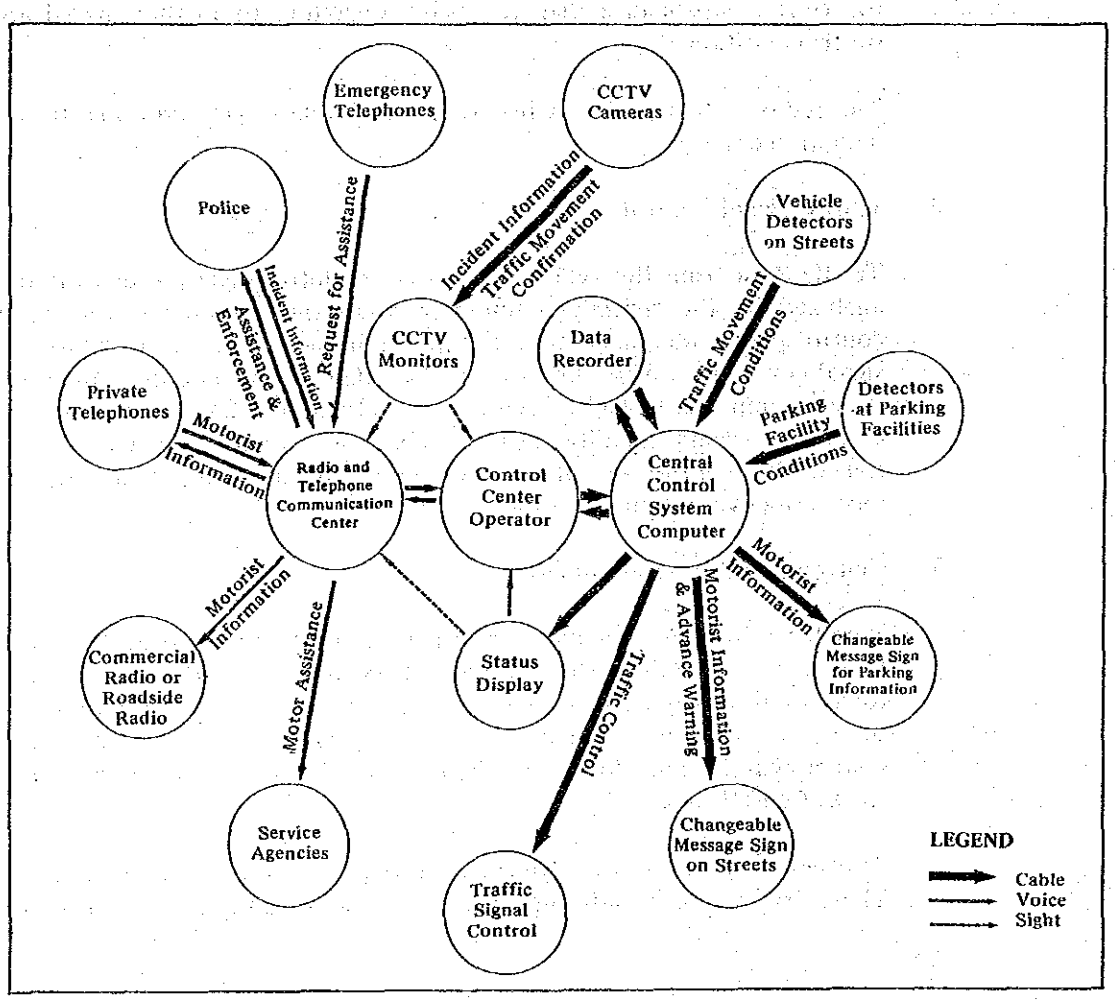


Figure 4.9.1 : A Concept of a Multi-functional ATC System

4.9.2 Proposed Area Traffic Control System Plan

A. Prospective ATC System Plan

The future comprehensive ATC System is to be geared towards traffic surveillance and/or control, covering the Greater Metropolitan Areas of George Town, Bayan Lepas, the Coastal Road, the Penang Bridge and furthermore Butterworth and Bukit Mertajam, even if traffic in these areas is managed and controlled by different traffic authorities. Of course, problems that involve overlapping of the concerns of the various authorities will occur when the ATC System is implemented and will have to be settled through cooperation and sometimes, compromise.

It is recommended that traffic flow between George Town and the Coastal Road, which are closely interrelated be managed and controlled by one traffic control authority with one particular policy and method. If this is not possible, then at least the various authorities should exchange traffic information with each other.

The Greater Metropolitan Area will be mainly divided into four areas as follows :

(1) George Town
(2) Bayan Lepas
(3) Coastal Road and Penang Bridge
(4) Butterworth and Bukit Mertajam

Figure 4.9.2 shows the ATC system perspective plan.

Covering of an area stage by stage by the ATC System has been planned as follows :

The period for implementation of each ATC system will depend on road and traffic conditions as well as the degree of necessity. The rough scheme for the introduction of the ATC System in each sub-area is :

Stage I : Central Area of George Town

Stage II & III : George Town

Stages II & IV : Bayan Lepas

Future Stages : Coastal Road and Penang Bridge as well as Butterworth and Bukit Mertajam

Stage I has been implemented by the MPPP. Stages II and III which cover the entire city of George Town are to be carried out by the MPPP in the future. Similarly, Stages II and IV which cover Bayan Lepas will be implemented by the MPPP in the future.

In future stages, the ATC system for Penang will be connected to an Expressway Surveillance and Control System for the Coastal Road and Penang Bridge. Alternatively the Penang Island System may include the Expressway Surveillance System. In addition, an ATC System for Butterworth and/or Bukit Mertajam will be connected to the ATC System of Penang Island to facilitate exchange of road and traffic-related information. It is expected that Majlis Perbandaran Seberang Perai (MPSP) will introduce an Area Traffic Control System to cope with traffic pressure in the areas of Butterworth and Bukit Mertajam.

Thus, the ATC System shall be capable of accommodating other systems such as the Expressway Surveillance and Control System for Penang Bridge and Coastal Road, as well as Butterworth and Bukit Mertajam without major modification to the ATC System for Penang Island.

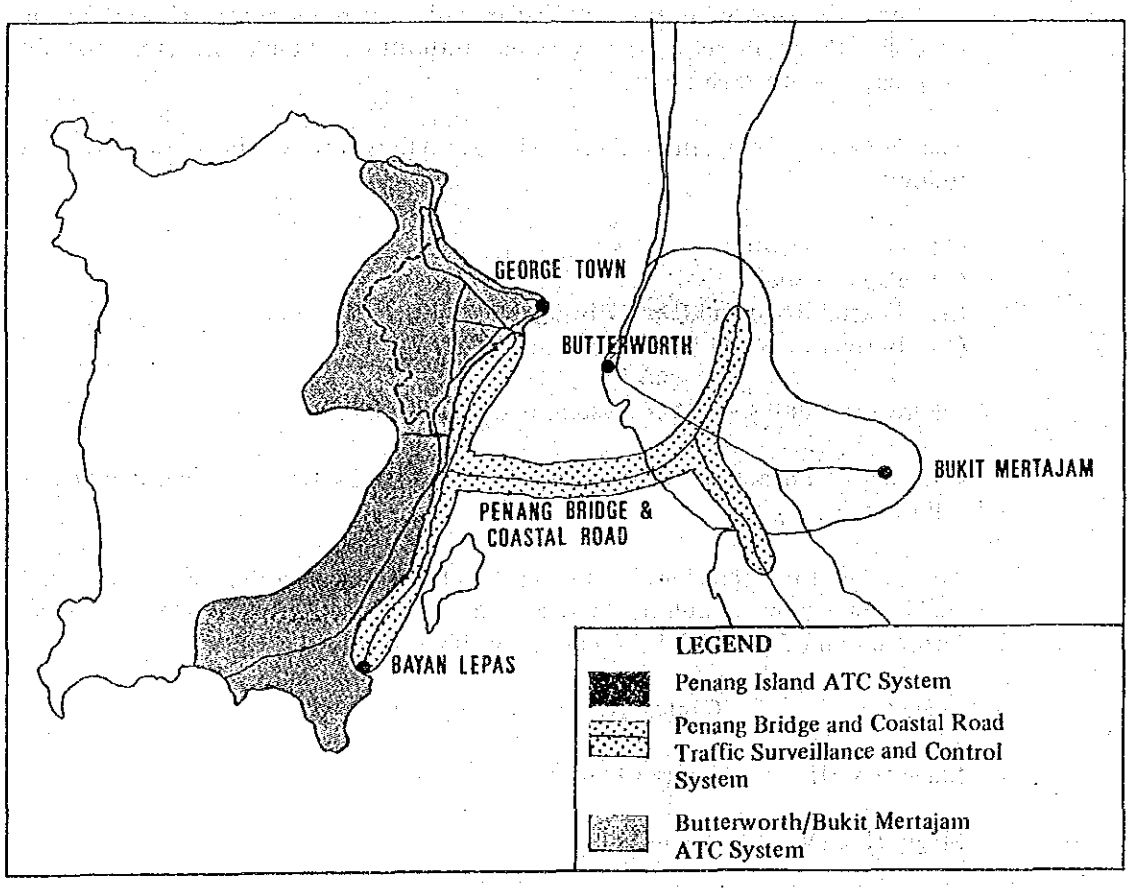


Figure 4.9.2 : ATC System Perspective Plan

B. Penang Island ATC System Plan

1. Hardware Structure Plan of the Penang Island ATC System

Main hardware structure plan is presented in Figure 4.9.3.

Four (4) major sub-systems are provided for traffic control in Penang Island, namely Signal Control System, Driver Information System, CCTV System and Statistical Data Collection System. Furthermore, the system will accommodate the Expressway Surveillance and Control System and the Traffic Control System in Butterworth and Bukit Mertajam area.

The signal control system comprises of a host computer and three (3) front-end processors (FEPs) (two FEPs for George Town and one FEP for Bayan Lepas). The FEP has a capacity of controlling sixty-four (64) traffic signals and one hundred (100) vehicles detectors. All FEPs are connected to the host computer via communication cables.

In addition, a micro-computer for the Driver Information System is necessary (identical to the FEP).

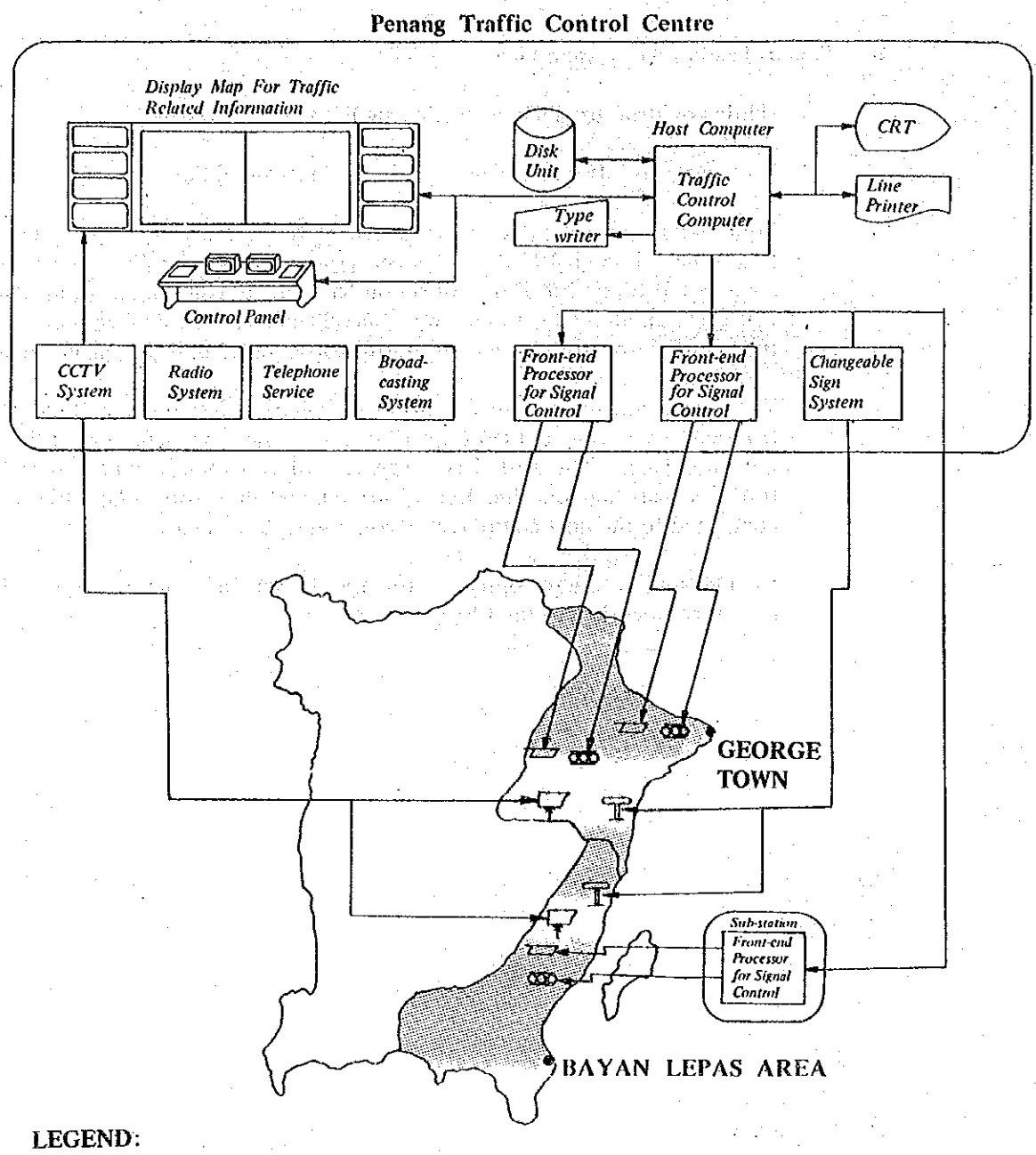


Figure 4.9.3 : Main Hardware Structure Plan

2. *Staging Plan and Cost Estimate of the Penang Island ATC System*

The ATC System Staging Plan is presented in Figure 4.9.4. In Stage I, there is a micro-computer (or front-end processor) installed in the control centre. There are sixteen (16) computerized intersections and two (2) CCTV cameras but no changeable message sign board in this stage. Under the ATC System Expansion Plan, there will be one host computer and three (3) micro-computers. Installation of one hundred and thirty-three (133) computerised traffic control signals, sixteen (16) CCTV cameras and seven (7) changeable message sign boards will be carried out in the expansion plan. Figure 4.9.5 depicts the signal locations in each stage in George Town and Bayan Lepas, whereas the CCTV camera and changeable message sign board locations are illustrated in Figures 4.9.6 and 4.9.7 respectively.

On the whole, the total installation cost for the ATC System Expansion plan is estimated at about M$37 million inclusive of intersection improvement. Table 4.9.1 shows the ATC System installation cost.

Table 4.9.1 : Installation Cost of ATC System Expansion Plan

(M$1000, 1986 Price)

		Stage I	Stage II	Stage III	Stave IV	Total
1.	System Cost					
	Traffic Signal Control System & Statistical Data Collection System	–	4,680 483*	12,328	0 3,869*	21,360
	Closed Circuit Television System	–	1,103	947	375*	2,425
	Driver Information System	–	.0	3,427	2,072 1,300*	6,799
	Contingency (10%)	–	627	1,670	762	3,059
2.	Insurance and others	–	346	1,670	762	3,059
	Sub-total	–	7,239	19,266	8,785	35,290
3.	Intersection Improvement Cost	–	611	721	373	1,705
	Grand Total	–	7,850	19,987	9,158	36,995

Notes : Tax is not included in the cost estimation.
* Cost for Bayan Lepas Area.

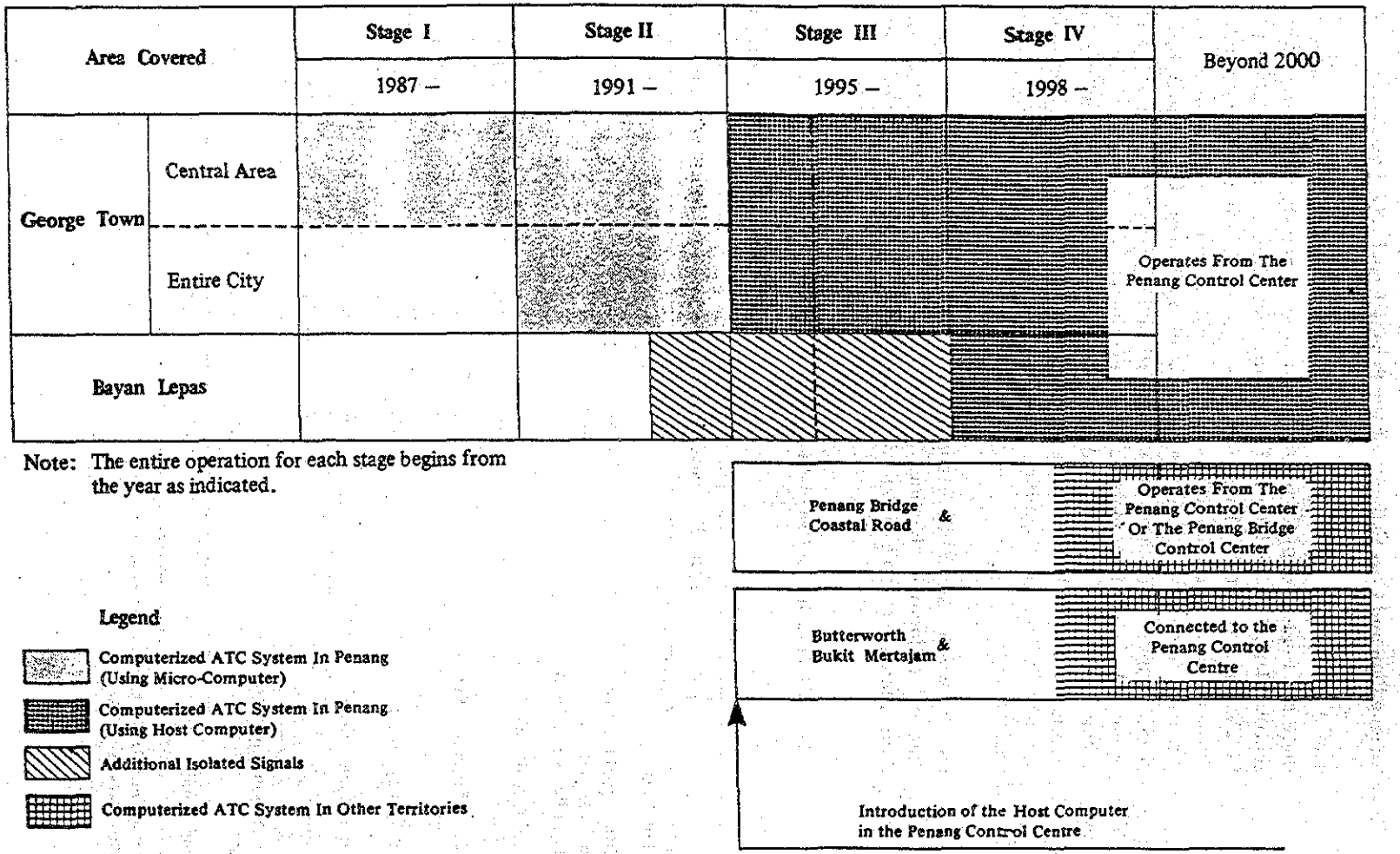
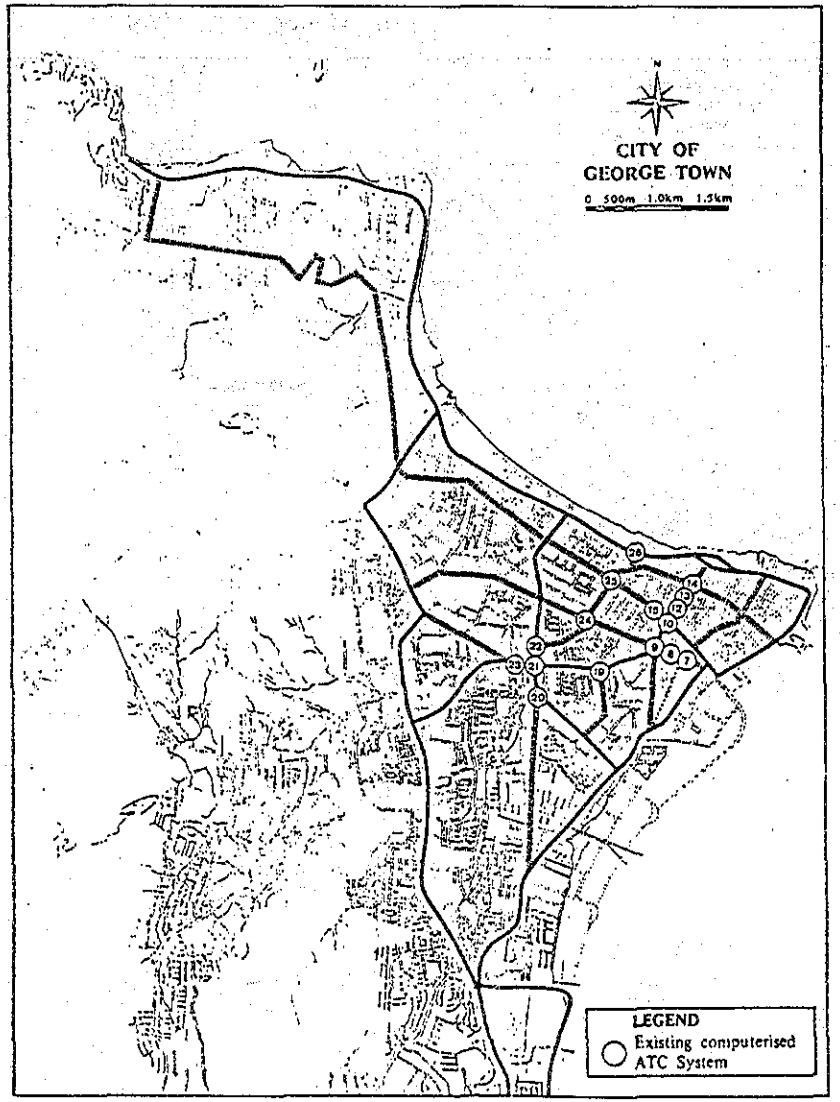
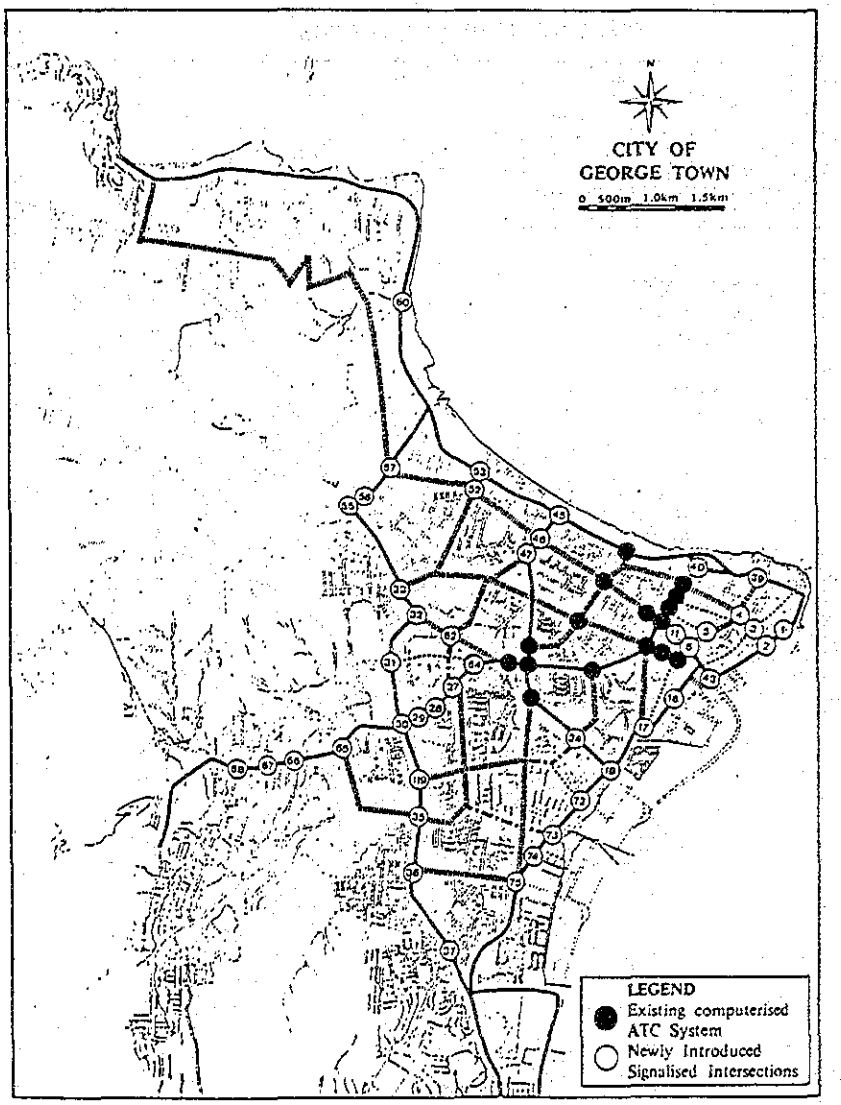


Figure 4.9.4 : ATC System Staging Plan

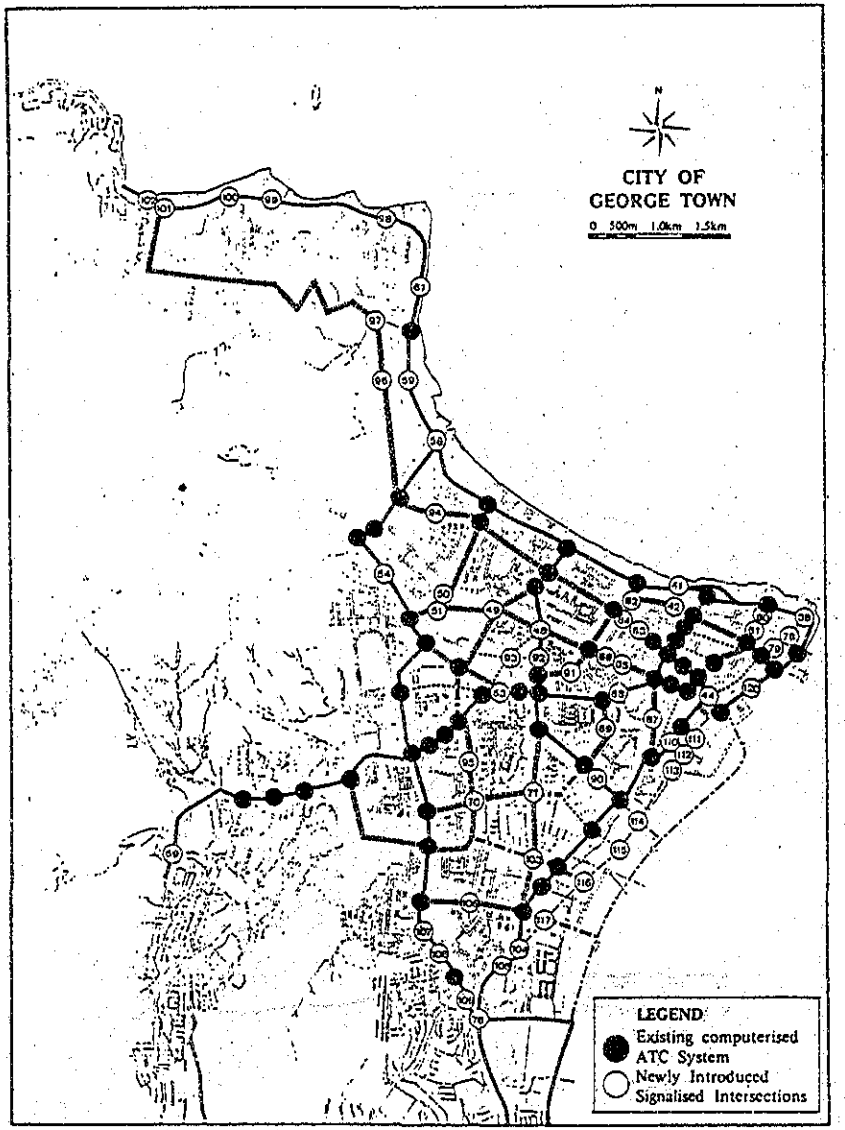


Stage I in George Town

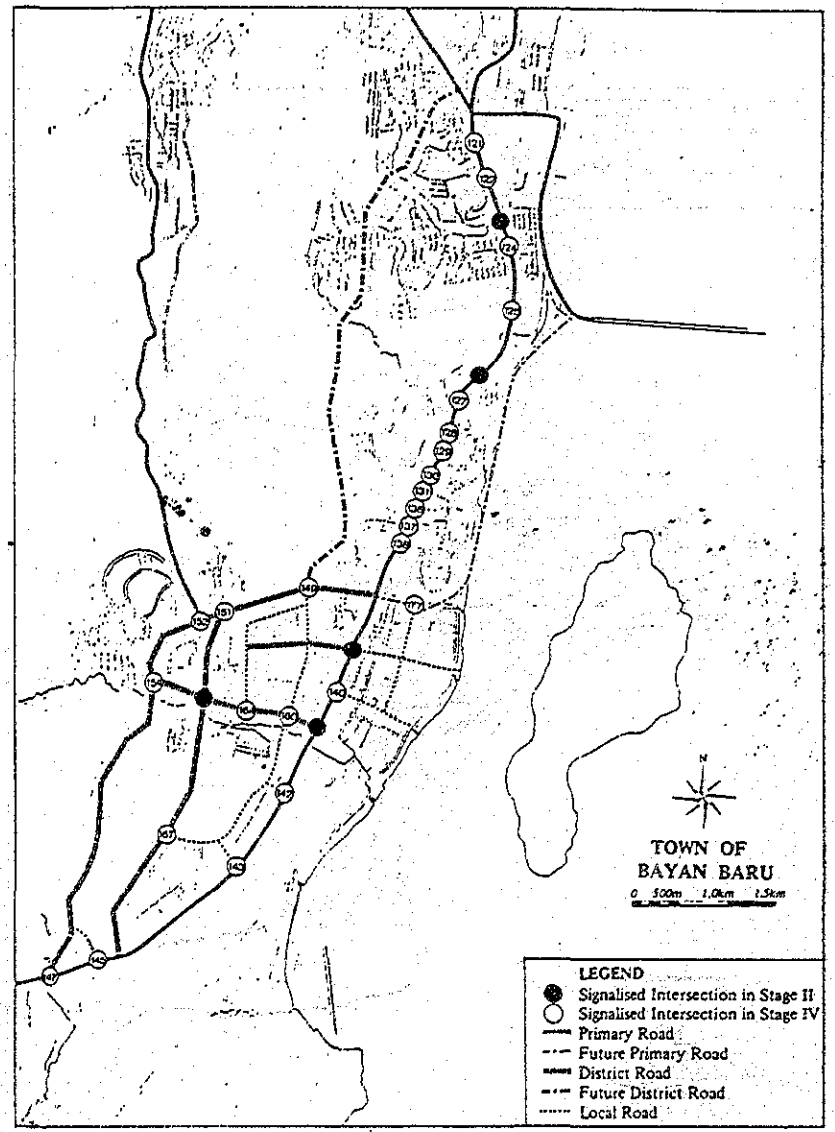


Stage II in George Town

Figure 4.9.5 (1) : Signal Locations in each Stage in George Town and Bayan Lepas



Stage III in George Town



Stage II & IV in Bayan Lepas

Figure 4.9.5 (2) : Signal Locations in each Stage in George Town and Bayan Lepas

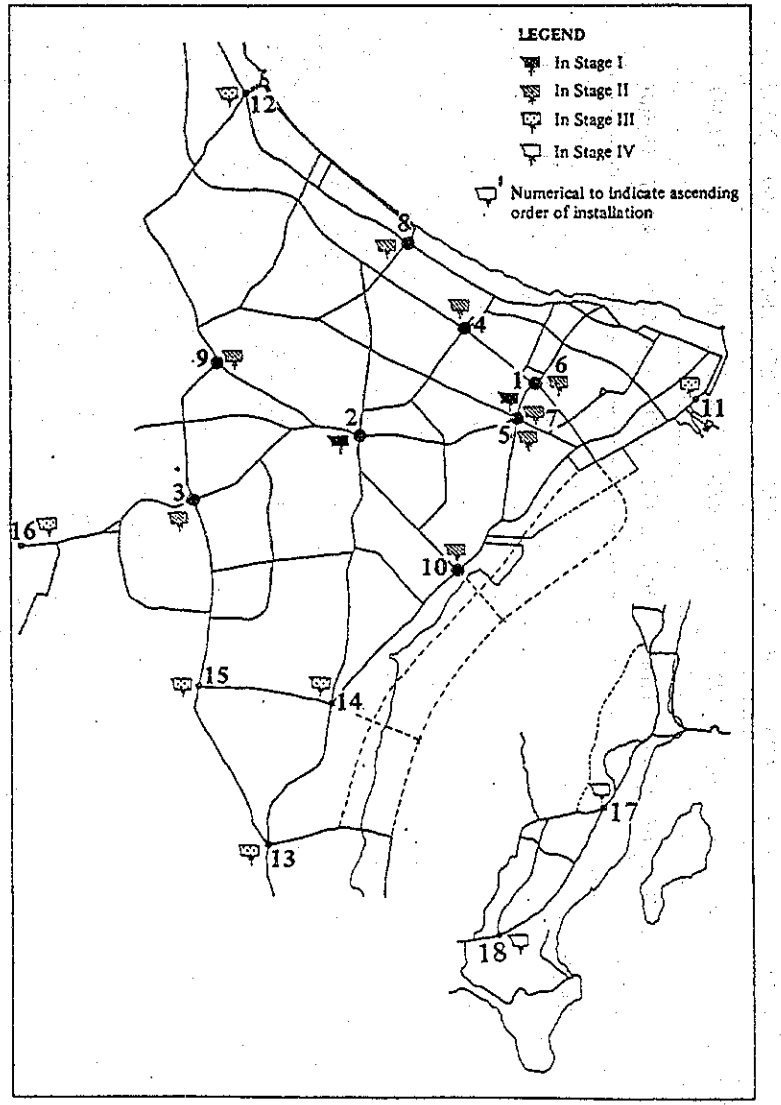


Figure 4.9.6 : CCTV Camera Location

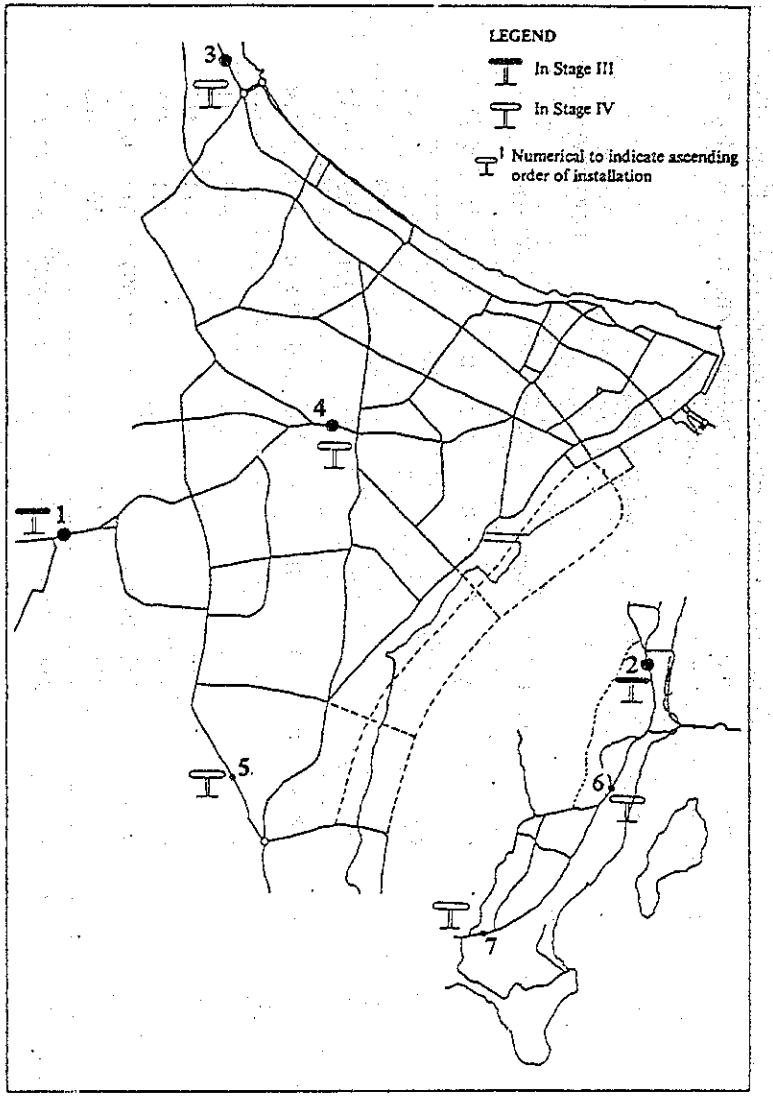


Figure 4.9.7 : Changeable Message Sign Board Location

Table 4.9.2 depicts the total costs, that is, construction and operation costs, according to phases for the ATC System. The total cost for the ATC System is estimated to be M$53.5 million.

Table 4.9.2 : Total Costs According to Phase

(M$1000, 1986 price)

	Year	Stage I		Stage II		Stage III		Stage IV		All Stages		
		A	B	A	B	A	B	A	B	A	B	Total
Phase 1	1988		93								93	93
	1989		93								93	93
	1990		93	7,850						7,850	93	7,943
Sub-Total		0	279	7,850	0	0	0	0	0	7,850	279	8,129
Phase 2	1991		93		218						311	311
	1992		93		218						311	311
	1993		93		218						311	311
	1994		93		218	19,987				19,987	311	20,298
	1995		93		218		392				703	703
Sub-Total		0	465	0	1,090	19,987	392	0	0	19,987	1,947	21,934
Phase 3	1996	3,100	93		210		392			3,100	703	3,803
	1997		93		218		392	9,158		9,150	703	9,861
	1998		93		218		392		257		960	960
	1999		93		218		392		257		960	960
	2000		93	6,893	218		392		257	6,893	960	7,853
Sub-Total		3,100	465	6,893	1,090	0	1,960	9,158	771	19,151	4,286	24,347
Total		3,100	1,209	14,743	2,180	19,987	2,352	9,150	771	46,988	6,512	53,500

Note : A — Construction Cost
B — Operation Cost

3. **Effects of the ATC System**

With the implementation of the ATC System Expansion Plan, the following positive effects can be expected:

a. **Minimize Traffic Congestion**

Traffic congestion is minimized because the coordinated and traffic responsive operation of signals allow more vehicles to travel along a route in shorter time.

b. **Minimize Traffic Accidents**

Traffic accidents caused by confusion among drivers are minimized because the traffic signals regulate the movement of vehicles in an orderly manner.

c. **Reduction of Noise and Air Pollution**

Noise and vibration generated by vehicles are reduced because the number of stops at intersections are lessened. Exhaust gas emitted on starting and stopping is also lessened.

d. **Rationalization of Manpower**

The manpower needed for traffic control and engineering functions is reduced by the use of computers, signals and other traffic control devices. The traffic police force can be then more effectively utilized for enforcement of other traffic offences.

e. **Economic Benefits**

As vehicles travel safely at higher speed, time becomes much shorter thereby reducing fuel consumption and averting loss of lives and/or damage to property or goods.

The economic feasibility of the ATC System is mentioned in Supplementary Volume, Section B, Part I and from the results of the economic evaluation, the proposed system plan is found to be economically feasible.

4.10 Other Traffic Engineering Measures

4.10.1 Basic Guideline

The solutions to transport problems are not merely restricted to the implementation of high-cost measures such as road network improvement or traffic control system.

There are other low-cost measures, for example, better lane-markings or through education on traffic safety and proper enforcement of traffic regulations, etc. which can also promote the mitigation of transport problems.

Therefore, in the following sections, these other low-cost traffic engineering measures will be introduced.

4.10.2 Traffic Control Devices

A. Signs and Regulations

It is recommended that stop signs and stop lines be installed on the approaches of minor roadways at their non-signalized intersection with major roadways.

These devices will require all vehicles approaching the intersection from the minor road to come to a complete stop and enter into the intersection only when it is safe to do so. As a result, they provide right-of-way to all vehicles on the major road.

It is important to channel drivers to the correct lanes by using traffic control devices such as pavement marking, channelization, signs, etc. Hence, on sections with multi-lanes, signs are needed to indicate route or road names for each lane on the road. These signs will enable drivers to decide on their route without confusion, especially new comers and tourists. Quick and decisive action by drivers will enhance traffic safety and expand road capacity.

Maps identifying road names and traffic control system such as the locations of no-entry, no-parking, no turning, one-way road and also public parking areas, etc. need to be prepared.

B. Installation of Centre Divider or Clear Lane Markings

Lane markings should be clearly demarcated so that cars and motorcycles can follow the space allocated for them easily, especially at night and during heavy rain.

1. Centre Divider

Centre dividers along main roads should divide traffic flow absolutely into two separate directions and prohibit right-turn movements if necessary. It is useful when the following conditions prevail :

(1) adequate road-width with more than two lanes
(2) major roads with heavy traffic volume
(3) major roads which have many minor intersections

2. Centre-line Marking

Centre-line markings should be clearly marked on high-volume roads such as primary and district roads and some local roads. For clear visibility, it is desirable to use reflective thermo-plastic paint, and to install the following devices onto the painted centre-line :

(1) metal traffic studs
(2) traffic delineators
(3) traffic clatter-bars

This is due to the fact that these devices enhance visibility of the centre line under any conditions and are durable.

3. Lane Line-marking

Lane line-markings should be used to separate lanes of traffic travelling in the same direction on multi-lane roadways or on wide roads, in order to ensure safety and orderly traffic flow. Such lane markings should be used to provide outer lanes for bicycles and trishaws so as to separate them from the other vehicles.

4.10.3 Traffic Safety

Traffic safety remains a matter of major concern all over the world. Every effort is being made to look into various aspects of the problem, especially improved environment, education, engineering, enforcement of safety rules, and other human factors. It is no different here in George Town. In George Town, one great problem faced by the authorities is how to deal with various types of traffic on the roads considering not only safety but also the comfort and convenience of the public.

(1) According to analyses of accidents in George Town, 'car-car' collisions and 'car-motorcycle' collisons are the predominant types of accidents, accounting for more than half of all accidents. These findings indicate that almost all the vehicles involved in accidents were moving at such high speeds that they could not avoid unforeseen events.

One countermeasure against these types of accidents would be to delineate centre lines, outer border lines of car lanes, motorcycle lanes or road shoulder with clear visible lines, delineators, guardrail and so forth. This can reduce accidents of this nature.

(2) Another serious type of accident is 'pedestrian-vehicle' collision which accounted for about ten percent (10%) of all accidents. Most accidents of this type have resulted in severe or even fatal injuries. It is urgent that every effort be made to improve pedestrian facilities.

(3) Accident records are kept in the traffic section of the Police Department. However, statistics of accidents and analytical reports are not always available to the City Engineering Department, educational institutions and other agencies concerned with safety, although they are an important requirement in any on-going programme to improve traffic operations.

Therefore, it is recommended that a uniform system of data processing methods be established first, to be followed by the identification of accident locations and the analysis of the causes of accidents based on accumulated analytical data.

The results of the analyses will in turn help bring about improvement measures.

(4) Education regarding road-usage and adequate information campaigns are equally important. Application of proper traffic engineering methods is not only enforceable but also self-education to a certain extent; for example, drivers tend to drive within a lane when markings are painted on streets. By way of driving on the streets with lane markings, drivers attain the habit of not weaving too frequently.

(5) Proper and effective enforcement is essential to attain safe and smooth operation of traffic facilities.

4.10.4 Other Consideration

A. Trishaw

1. Policy and Planning Concept

The current MPPP's policy of not issuing new trishaw licences should be pursued. However, it is undeniable that the trishaw is still one of the present transportation modes in George Town. Thus it is desirable that in the short-term the trishaw would remain in the Central Area for local services such as trips to school and the market until public transportation provided by bus and taxi is improved. In the long-term, the trishaw should only function as a tourist attraction.

Furthermore, it is suggested that the trishaw should not be allowed to cross a primary or main district road. Therefore, basically, the movement of trishaw would be restricted to within areas enclosed by primary and main district roads.

The immediate application of this planning concept to the Central Area of George Town is to prevent the slow-moving and obstructive trishaw from going through the congested KOMTAR area. This measure can increase the road capacity of the existing road network without new investment and increase road safety.

2. Implementation Concept

a. Restriction of Trishaw Movement

The control of trishaw movement is a Draconian measure, even more so in times of economic recession. Therefore such a measure should be implemented carefully and thoughtfully from two perspectives. First, old and aged trishaw drivers who cannot be easily retrained for other skills would continue with their occupation but redundant younger trishaw drivers would require retraining in more suitable new skills. Second, alternative transport modes in the form of walking or public transportation would be required by those who stop using trishaws. Therefore the control of trishaw movement should be implemented simultaneously with a program to improve public transportation capability and service level. At the same time the facilitation of a pedestrian pathway network to encourage walking should be pursued earnestly.

From the prevailing conditions of traffic congestion and trishaw volume on the roads in the CBD, the following road sections are to be closed to trishaw traffic in the near future.

(1) Penang Road between Macalister Road and Burma Road

(2) Prangin Road between Penang Road and Carnarvon Street

Later on, when the abovementioned measures have been found to be successful, a stricter control of trishaw movement can be advocated by further closing the following road sections :

(3) Magazine Road between Penang Road and McNair Street.

(4) McNair Street between Magazine Road and Carnarvon Street.

Figure 4.10.1 illustrates the suggested road sections to be closed to trishaw traffic in the future.

This section emphasizes control of trishaw movement at the main intersections around KOMTAR. However, in the future, trishaw movement at other main intersections with heavy congestion could also be restricted by similar means.

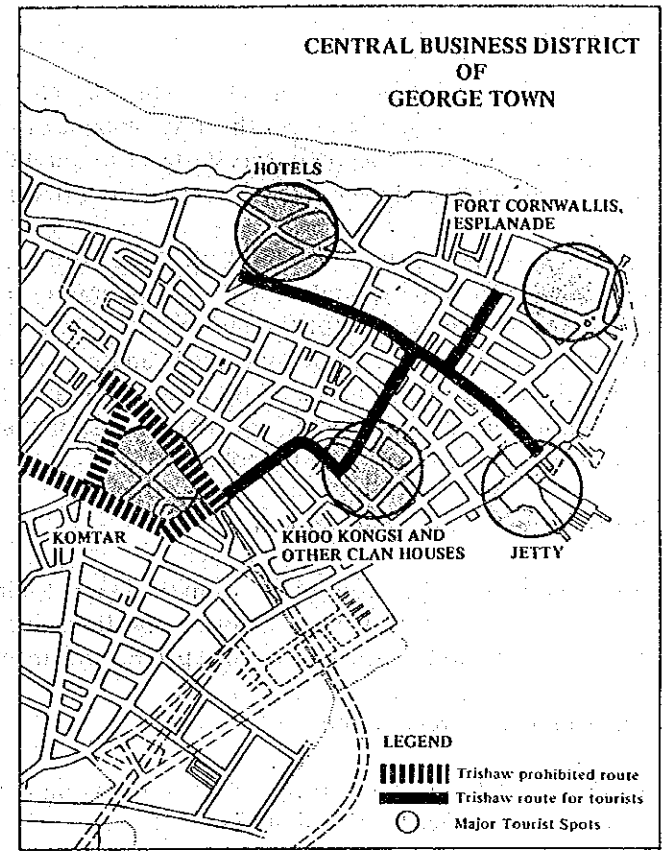


Figure 4.10.1 : Trishaw Control Plan

b. Conservation of Trishaw for Tourism

Trishaw can be said to be part of Penang's rich heritage. To many tourist tourist visiting the Island, a ride on the trishaw along streets lined by old shophouses, temples and magnificent old buildings is exotic. It is also an economical and convenient transportation mode for the tourist to move around the urban area.

Therefore, it is suggested that trishaw must be conserved for tourism and space for trishaw must be considered near tourist attractions and along the route which linked them together. Figure 4.10.1 also illustrates a suggested route on which trishaw are allowed to operate for tourism purpose. The route would link KOMTAR, the hotels and the Jetty to the main tourist spots which includes Port Coornwallis and Esplanade Area, Clock Tower, Kapitan Kling Mosque, Khoo Kongsi and other clan houses.

The following road sections have been identified to form the suggested trishaw route for tourists :

Carnarvon Street, Acheh Street, Pitt Street, King Street, Muntri Street, Stewart Street, China Street, and Market Street and Market Street Ghaut.

B. Illegal Taxi

The issue on illegal taxi is complex. On one hand it could be said that the presence of illegal taxis impeded the development of taxi and stage bus services, on the other hand, the poor service level of public transportation could be blamed for creating the illegal taxi service in the first place.

Although being a pain in the neck to the enforcement authorities, the illegal taxi appears to be popular with the common man who welcomed this alternative to a long wait for the bus or taxi. Therefore any countermeasure to the illegal taxis must consider the needs and convenience of these people who are without their own means of transport. Illegal taxi should be eradicated by the simulatenous improvement of public transport facilities as well as stringent and continuous enforcement by police.

C. Restriction of Hawker Movement

Hawkers should be prohibited from hawking their wares on primary and district roads entirely if possible, otherwise their hawking should be restricted to specified periods, special days and specified locations.

D. Environmental Preservation

In Penang, the following three points on environmental preservations as seen from the traffic perspective should be noted :

1. Preservation of the Residential Environment

In the newly developed area, the residential blocks had been pre-designed such that traffic would not need to flow into the residential blocks. However, in the old downtown area this is not so. The increase in traffic volume has led to a division of existing residential blocks. There is a need to reduce, if not prevent traffic from overflowing into the residential area in an effort to preserve the quality of residential environment.

2. Preservation of Old Trees along Roadways

The old trees lining along roadways in Penang play an important role in projecting a beautiful garden city image. The roads in the central and northern area of the city are lined with elegant huge trees on both sides. These trees should be protected and left as a heritage.

3. **Historical Ruins**

Historical ruins, temples and ancient architectural buildings need to be protected as these landmarks are necessary to attract tourists to the island. Many historical ruins are found in the area near the apex of the triangular land form – a geographical feature of George Town. This area could be transformed into a major tour course with proper planning of a pedestrian path network linking all the historical sites and other renowned landmarks.

4.11 Proposed Consolidated TSM Plan

4.11.1 Introduction

In the preceding sections, we have examined separately individual proposed plan for each transport facility or measure on the premises of the planning issues, goals and objectives identified for the Study Area.

It is however, necessary for the separately formulated plans to be inter-related and compatible with one another. For example, changes to the existing one-way system would affect the bus routes or on-street parking control should be considered on the major bus routes, and so on.

Therefore, in this section, taking into consideration their inter-relationships, these separately formulated plans are then compared and necessary adjustments made to ensure compatibility and rationality in the proposed TSM Plan for the Study Area.

This process can be illustrated schematically as shown in Figure 4.11.1. The figure shows the separate proposed plans being arranged into three (3) levels. At the uppermost level lies the Road Network Improvement Plan which is the planning of the basic infrastructure for the region. Based on the proposals of this plan, the Traffic Circulation System (one-way) Improvement Plan, the Parking Plan, the Bus Transport Improvement Plan and the Pedestrian Path Network Plan are proposed in the second level. Then on the premises of these plans, the Area Traffic Control System Expansion Plan and other Traffic Engineering Measures which are necessary are proposed in the third level. Finally, the total outcome of this process is the proposed TSM Plan for the Study Area.

In particular, the Traffic Circulation System Improvement Plan, the Parking Plan, the Bus Transport Improvement Plan and the Pedestrian Path Network Plan which constituted the second level in Figure 4.11.1 are concerned with the planning of transport facilities to ensure mobility in the Central Area of George Town. Study on these plans conducted in conjunction with the study on the feasibility of the Area Traffic Control System Expansion Plan is one of the important objectives of this study.

Therefore, the final proposal of the TSM Plan is presented separately as plans concerning the whole region within the Study Area and plans for the Central Area.

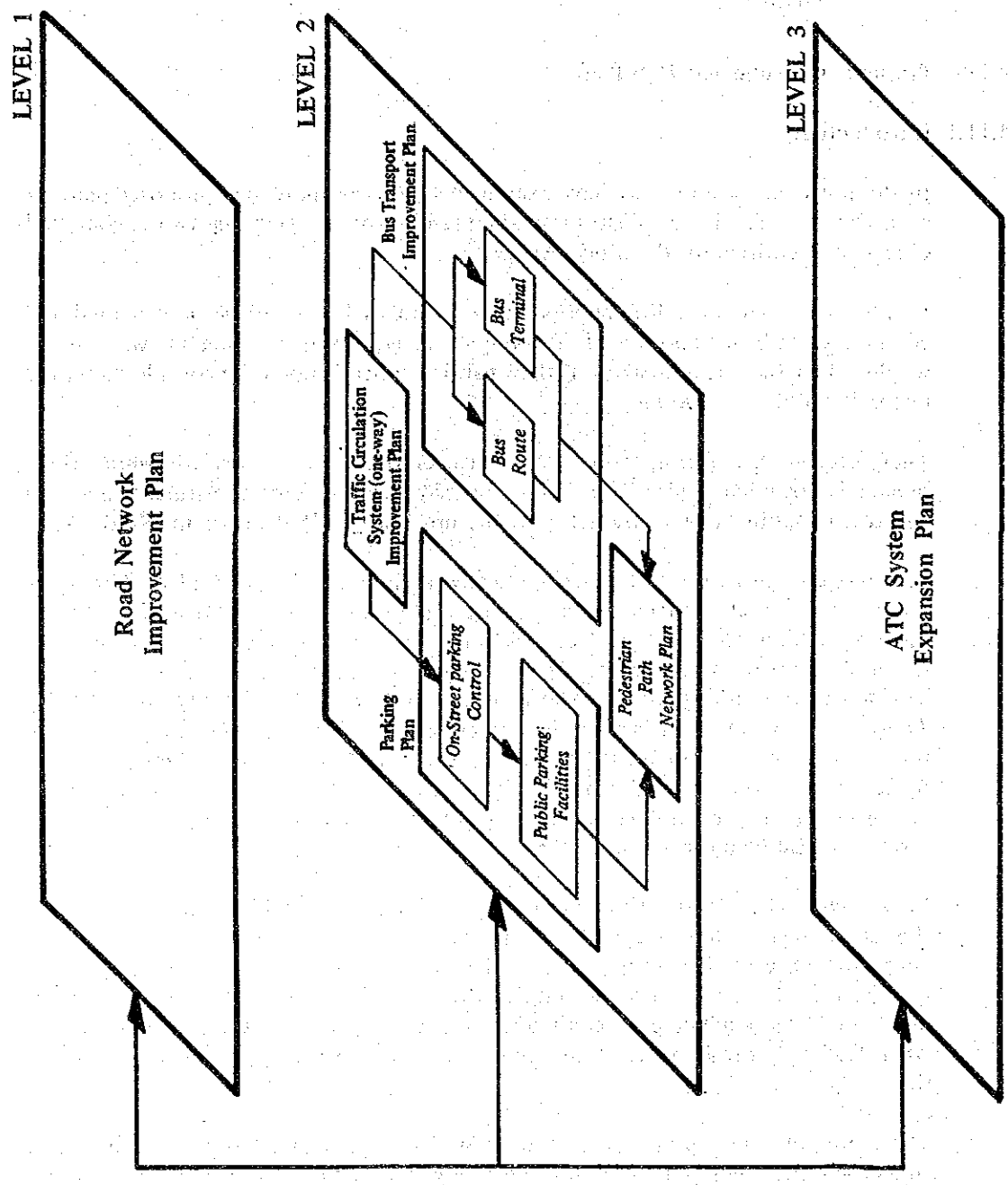


Figure 4.11.1 : Inter-relationships Between the Proposed Individual Plan

4.11.2 Proposed Regional Transportation Plan

In view of the future expansion of the urbanized area and the countermeasures taken to cope with the resulting increase in transport demand, the following transportation plans are necessary to secure mobility for the people and to ensure public safety. The proposed regional transportation plan is shown in Figure 4.11.2.

A. Road Network Improvement Plan

In response to the increasing traffic demand and in establishing a hierarchical road network in the Study Area, the implementation of the following roadway projects are necessary by the year 2000.

1. New Construction

(1) Primary Roads :

a.	Coastal Road	4.3 km
b.	Weld Quay Extension	4.1 km
c.	South Coastal Road	3.4 km

(2) Secondary Roads :

a.	Ayer Itam By-pass	4.0 km
b.	New Pair Road	4.9 km
c.	Van Praagh Road Extension (Hamilton Road – Weld Quay Extension)	1.7 km

(3) District Roads :

a.	Free School Road Extension (Free School Road – Patani Road)	0.8 km
b.	Trengganu Road Extension (Ayer Itam Road – York Road)	0.4 km
c.	Boundary Road Extension (Boundary Road – Batu Gantong Road)	1.2 km

2. Road Improvement

(1)	Dato Keramat Road Improvement	0.5 km
(2)	Perak Road Improvement	0.5 km

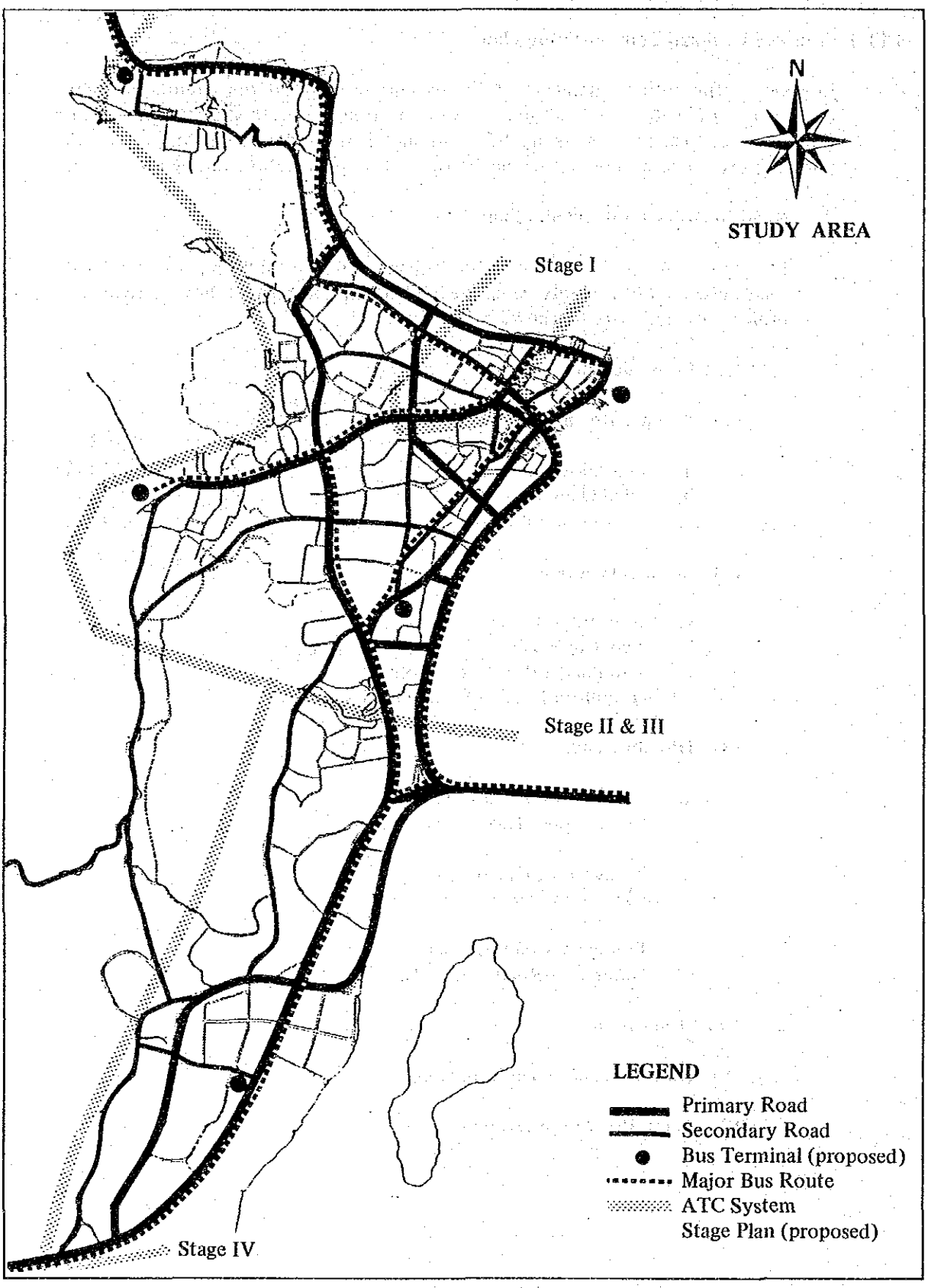


Figure 4.11.2 : Proposed Regional Transportation Plan

B. Bus Transport Improvement Plan

1. Bus Terminal Improvement

The construction of a bus terminal in the Central Area and local bus terminals at the major stopping points in the suburbs of George Town is necessary to improve bus service level. The proposed terminals to be constructed are :

- CBD Bus Terminal
- Gelugor Bus Terminal
- Ayer Itam Bus Terminal
- Bayan Baru Bus Terminal
- Tanjong Bungah Bus Terminal

2. Bus Fleet Renewal Program

It is necessary to replace old buses in the existing bus fleet in order to ensure dependability of bus services and comfortable bus rides.

3. Bus Transport Study

A bus transport study is necessary in order to formulate a bus transport masterplan to determine the future role of bus transport vis-a-vis the other modes. This study is proposed to be started as soon as possible.

C. Area Traffic Control System Expansion Plan

1. Expansion of the Coverage Area of the ATC System

It is necessary to expand the coverage area of the ATC System in four (4) stages as indicated in Table 4.11.1.

Table 4.11.1 : Staging Plan of ATC System

Stage	Coverage Area	Number of Equipment		
		Signal Set	CCTV	Sign Boards
I	Central Area	16	2	0
II	George Town	44	8	0
	Bayan Lepas	5	0	0
III	George Town and its suburbs	59	6	2
IV	George Town	0	0	3
	Bayan Lepas	25	2	2
Total	Study Area	149	18	7

Note : Stage I is already in operation since April 1987.

2. **Improvement of Intersections**

It is necessary to improve the geometric design and markings on one hundred and thirty-three (133) intersections together with the expansion of the ATC System's coverage area.

D. Traffic Safety Measures and Others

The solutions to transport problems are not merely restricted to the implementation of traffic control system or the road network improvement.

Other measures include a thorough education on traffic safety and proper enforcement of traffic regulations, improvement of road markings, etc. which can alleviate the transport problems.

In this respect, the following measures are proposed.

1. Improvement of Pedestrian Facilities
2. Data Processing for Accidents
3. Promotion of Traffic Safety Education
4. Stricter Enforcement of Traffic Rules and Regulations
5. Improvement of Road Markings and Signs
6. Control and Conservation of Trishaw
7. Control of Illegal Taxi
8. Control of Hawker Movement
9. Preservation of Environment

4.11.3 Proposed Central Area Transportation Plan

The main objectives of the Central Area Transportation Plan are to secure mobility for people and to improve public safety in order to encourage economic activities in the Central Area.

The basic guideline of the proposed plans for individual transport facilities still hold for the formulation of this TSM Plan. However, they are modified slightly in order to attain a consolidated plan. The items modified are :

(1) Imposing on-street parking control on major bus routes.

(2) Securing pedestrian path on the street with a major bus stopping point.

(3) Imposing on-street parking control on streets with pedestrian paths.

(4) Securing sufficient space for the effective utilization of road space and the coexistence of pedestrian and cars by turning the street into one-way street, wherever necessary.

(5) Linking up the location of public parking facilities with the pedestrian path network.

Figure 4.11.3 illustrates the proposed Central Area Transportation Plan. The proposed TSM Plan consists :

A. Traffic Circulation System Improvement Plan

The proposed long term plan in 2000 consists of the following circulation features:

1. Conversion of some major roads into one-way streets

   . Burma Road (between Steward Lane and Penang Road)
   . Carnarvon Street (between Leboh Acheh and Carnarvon Circus)
   . Macalister Road (between Penang Road and Yahudi Road)

2. Reversed traffic direction of the existing unidirectional street

   . Penang Road (between Burma Road and Chulia Street)
   . Transfer Road (between Argyll Road and Burma Road)

3. Non-provisional traffic access from Carnarvon Circus to KOMTAR through Prangin Road.

4. Outbound of the new Coastal Road connects Prangin Road and the inbound connects Magazine Road.

B. **Bus Transport Improvement Plan**

A bus-stop improvement plan and a bus terminal relocation plan for the Central Area are proposed in order to improve the existing bus services in terms of amenities, dependability and convenience (see Figure 4.11.3 (1).)

1. Bus-stop Improvement Plan

   Bus-stop facilities at about 40 locations in the Central Area are proposed to be improved urgently.

2. CBD Bus Terminal Plan

   Several candidate sites for the relocation of Prangin Bus Terminal are identified and evaluated. A CBD Bus Terminal is proposed to be sited on reclaimed land near the entrance of Coastal Road Based on the following standpoints:

   a. Convenience to existing bus commuters

   b. Future development prospects in the vicinity

   The total floor area necessary for the CBD Bus Terminal is about 16,000 square meters and the bus terminal should be ready in time with the opening of the Coastal Road.

C. **Pedestrian Path Network Plan**

The installation of a pedestrian path network in the city enhances pedestrians' safety and provides amenities for walking. As a result, it is possible to ensure traffic safety and mobility in the city.

A pedestrian network constituting 10.8 km of footpath in total is proposed to be installed by 1995.

D. **Parking Plan**

It is necessary to strengthen on-street parking control on primary and secondary roads in order to secure sufficient road space not only for the vehicular traffic demand within the Central Area but also for pedestrian traffic.

Nevertheless, it is not desirable to exclude vehicular traffic movement from the Central Area from the standpoint of economic development. Therefore the construction of parking facilities by both public and private sectors is also proposed.

By the year 2000, 1,600 on-street parking lots will be removed and replaced through the construction of five (5) public parking buildings having a combined capacity of about 2,000 parking lots.

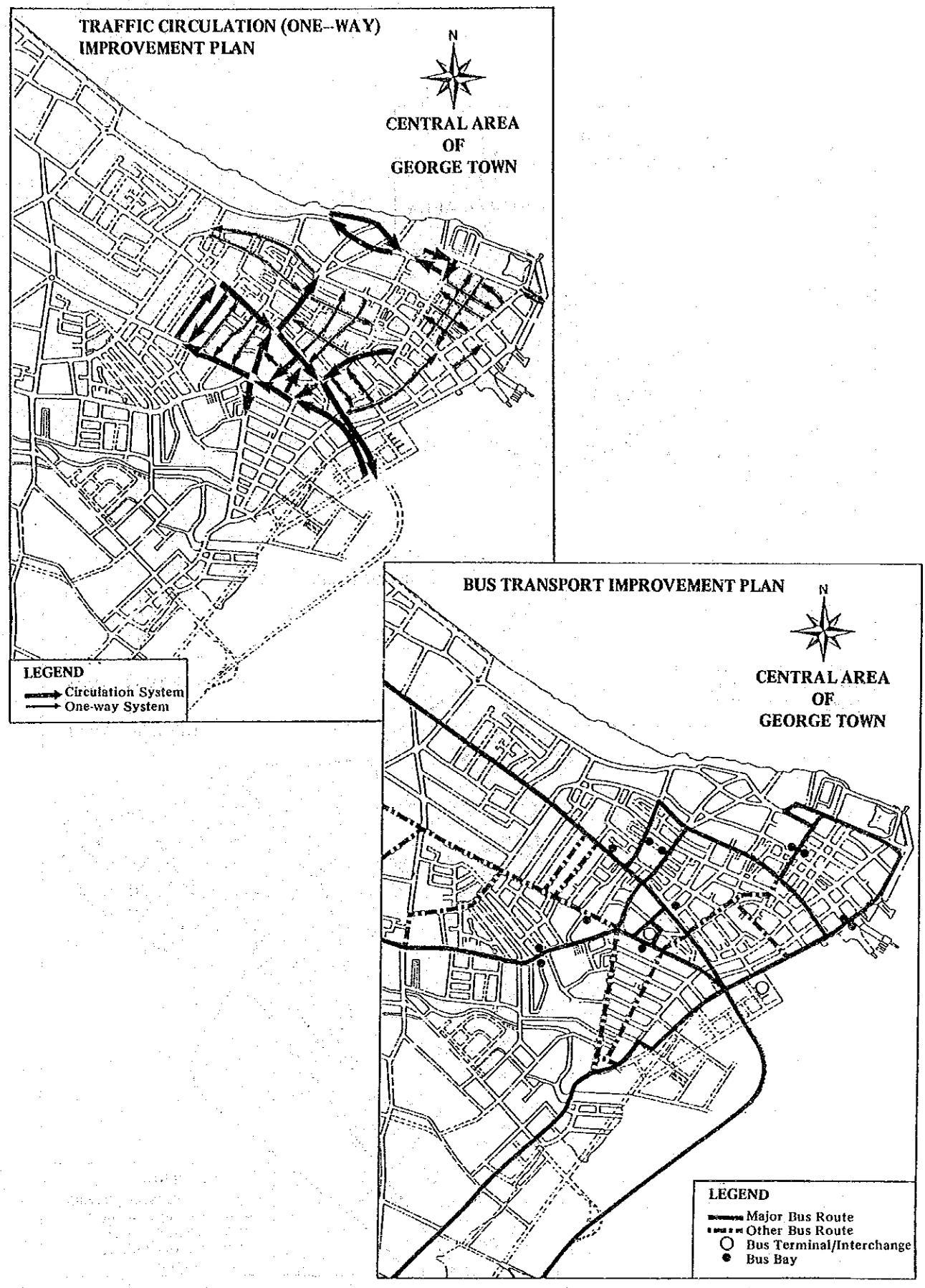


Figure 4.11.3 (1) : Proposed Central Area Transport Plan

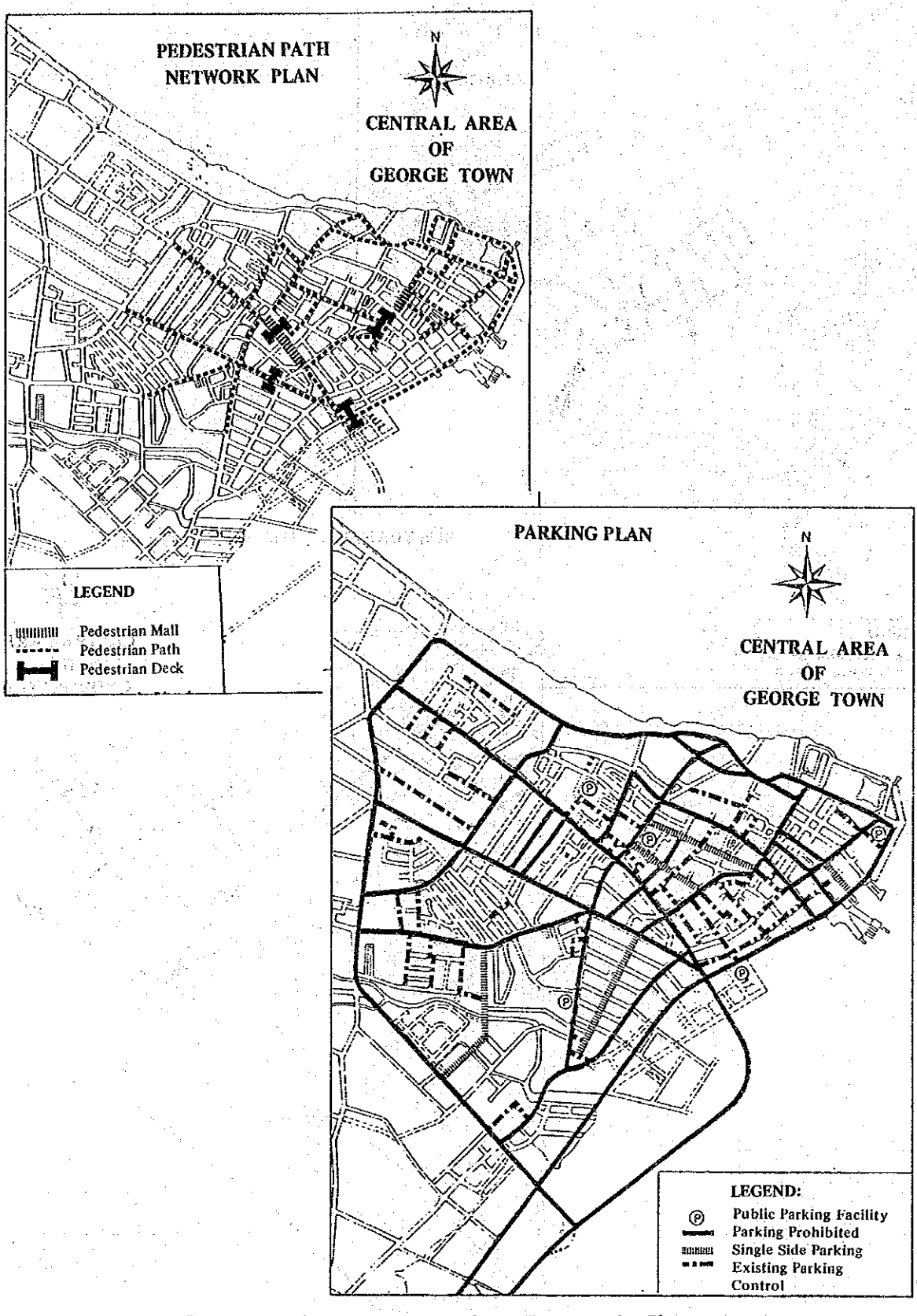


Figure 4.11.3 (2) : Proposed Central Area Transportation Plan

5.0 IMPLEMENTATION PLAN

5.1 Basic Guideline

The implementation programme for various measures proposed in the TSM Plan is separated into three (3) phases as shown in Table 5.1.1 and described as below:

(1) **Phase I (1988 – 1990)**

In this phase, existing on-going projects are expected to be completed. The major new works to be started in Phase 1 are projects under the Road Network Improvement Plan, Pedestrian Path Network Plan and ATC System Expansion Plan – Stage II.

(2) **Phase 2 (1991 – 1995)**

The construction of Coastal Road to link Penang Bridge to the CentralArea is to be started and completed in Phase 2. Upon its completion, changes to the traffic circulation system in the Central Area will take place.

It is also necessary to begin work on various other measures proposed, such as road improvement in conjunction with the improvement of intersections, enforcement of on-street parking control and the provision of public parking space elsewhere, the construction of the new CBD Bus Terminal to accommodate the relocations of Prangin Bus Terminal, the introduction of new buses to replace the old fleet, the completion of the proposed Pedestrian Path Network Plan and the implementation of the ATC System Expansion Plan – Stage III.

This period which will also see the implementation and completion of many of the TSM measures that mark the maturity period of the proposed TSM Plan.

(3) **Phase 3 (1996 – 2000)**

The TSM Plan will be completed in this phase. The projects undertaken in this period are the final stages of the Road Network Improvement Plan, further enforcement of on-street parking control and the provision of public parking space to replace them, the construction of local bus terminals and replacement of old bus fleet under the Bus Transport Improvement Plan and the implementation of ATC System Expansion Plan – Stage IV.

(4) Beyond the year 2000

In this Study, transportation plans comprising the various TSM measures until the target year 2000 are proposed. Although the traffic demand and traffic flow pattern in the Study Area forecasted by the Study Team do not vary much from the results of the "Urban Transport Study" conducted by JICA in 1979, it is proposed that the construction of Outer Ring Road (proposed in the previous study) be delayed to beyond year 2000 considering a slower economic growth rate is expected in Malaysia.

In addition, planning for improvement of urban streets or the introduction of a new transportation system, eg. Light Rail Transit, etc. would be necessary beyond year 2000.

Table 5.1.1 : Basic Implementation Programme

	Phase 1988–1990	Phase 2 1991–1995	Phase 3 1996–2000	Beyond 2000
Road Network Improvement	———	———	———	- - -
Traffic Circulation System Plan		—		
On-Street Parking Control	———	———	———	
Construction of Public Parking Facility		———	———	- - -
Construction of Bus Terminal		———	———	
Introduction of New Bus Fleet	———	———	———	- - -
Pedestrian Path Network Plan	———	———	- - -	
ATC System Expansion Plan	———	———	———	- - -

Note : The Traffic Circulation System Plan is to be implemented only after the completion of Coastal Road.

5.2 Expenditure Estimate of Implementation Programme

In accordance with the implementation programme set up for the proposed TSM Plan, the capital investment required for the various projects in each phase is then estimated and laid out in Table 5.2.1.

During the thirteen (!3) years between 1988 to 2000, a total of M$289 million (at 1986 prices) in capital investment is estimated. The MPPP, Penang State and the State's public corporations are identified as the three (3) possible implementing bodies for the projects.

A. Public Expenditure

The projects which will be implemented using public funds are those included in the following plans : Road Network Improvement Plan, Traffic Circulation System Improvement Plan, Pedestrian Path Network Plan and ATC System Expansion Plan. In particular, the Road Network Improvement Plan should be undertaken by the State.

Table 5.2.2 indicates the implementing body to undertake each project and the estimated investment required in each phase.

B. Public Corporation Investment

Projects which will generate revenues can be undertaken by the State's public corporations or undertaken by the private sector through the availability of low-interest rate loans. In this case, the investment required by phase will be as indicated in Table 5.2.3.

Table 5.2.1 : Implementation Programme for the TSM Plan

Name of Plan	Size	Unit	Phase 1 1988–1990	Phase 2 1991–1995	Phase 3 1996–2000	Project Cost M$ Million At 1986 Price	
ROAD IMPROVEMENT PLAN							
A. New Construction							
1. Coastal Road	4.3	km				70.00	
2. South Coastal Road	3.4	km				23.00	
3. New Pair Road	4.9	km				25.00	
4. Air Itam By-pass	4.0	km				3.70	
5. Weld Quay Extension	4.3	km	(5.00)	(20.00)	(35.00)	60.00	
6. Van Praagh Extension	1.7	km		(3.00)	(3.60)	6.60	
7. Free School Extension	0.8	km				2.36	
8. Trengganu Road Extension	0.4	km				1.41	
9. Boundary Road Extension	1.2	km				1.80	193.87
B. Improvement							
10. Dato Keramat Road	0.5	km				0.48	
11. Perak Road	0.5	km				0.55	1.03
Sub-total			6.03	98.50	90.37		194.90
CIRCULATION SYSTEM PLAN							
1. ATC System Modification	12	Intersection				0.36	
2. Intersection Improvement	4	Intersection				0.18	0.54
Sub-total			0	0.54	0		0.54
PARKING PLAN							
1. Public Parking Building	4	Building		(3.70)	(11.10)		14.80
Sub-total			0	3.70	11.10		14.80
BUS IMPROVEMENT PLAN							
A. Bus Terminal Buildings							
1. CBD Terminal	1	Building				7.35	
2. Gelugor Terminal	1	Building				0.40	
3. Ayer Itam Terminal	1	Building				0.32	8.07
B. Bus Terminals/Stops Improvement							
4. Local Bus Terminals	3	Lot				0.60	
5. Bus-stops in CBD	40	Stop	(0.10)	(0.10)		0.20	
6. Bus-stops in Other Area	80	Stop		(0.10)	(0.10)	0.20	1.00
C. Bus Fleet Improvement	140	Bus	(2.00)	(5.60)	(3.60)		11.20
D. Bus Transport Study							1.00
Sub-total			3.10	13.15	5.02		21.27
PEDESTRIAN PATH NETWORK PLAN							
1. Stage I	4.08	km				1.69	
2. Stage II	6.77	km				2.06	3.75
Sub-total			1.69	2.06			3.75
ATC SYSTEM							
A. System Cost							
1. Stage II	49	Intersection				7.24	
2. Stage III	59	Intersection				19.27	
3. Stage IV	25	Intersection				8.78	
4. Stage I Renewal	16	Intersection				3.10	
5. Stage II Renewal	49	Intersection				6.89	45.28
B. Intersection Improvement							
6. Stage II	49	Intersection				0.61	
7. Stage III	59	Intersection				0.72	
8. Stage IV	25	Intersection				0.37	1.70
C. Operation Cost		Lump Sum	(0.28)	(1.95)	(4.29)		6.52
Sub-total			8.13	21.93	23.44		53.50
GRAND TOTAL			18.95	139.88	129.93		288.76

Note : Numerals in brackets ( ) indicate the amount in each phase

Table 5.2.2 : Public Expenditure by Phase

(Unit : M$ million at 1986 prices)

Name of Plan	Implementation Body	Phase 1	Phase 2	Phase 3	Total Expenditure
		1988–1990	1991–1995	1996–2000	
Road Network Improvement Plan	State	–	73.70	48.00	121.70
	MPPP	6.03	24.80	42.37	73.20
Traffic Circulation System Plan	MPPP	0	0.54	0	0.54
Pedestrian Path Network Plan	MPPP	1.69	2.06	0	3.75
ATC System Expansion Plan	MPPP	8.13	21.93	23.44	53.50
Total	State	–	73.70	48.00	121.70
	MPPP	15.85	49.33	65.81	130.99

Table 5.2.3 : Public Corporation Investment by Phase

(Unit : M$ million at 1986 prices)

Name of Plan	Phase 1	Phase 2	Phase 3	Total Investment
	1988–1990	1991–1995	1996–2000	
Parking Plan	–	7.35	7.35	14.80
CBD Bus Terminal Plan	–	7.35	–	7.35
Bus Transport Improvement Plan	3.1	5.80	5.02	13.92
Total	3.1	22.58	12.37	38.05

5.3 Financial Capabilities

The financial capabilities of the three implementing bodies are examined herein with a view to having them undertake specific components of the proposed TSM Plan.

A. Penang State's Financial Capability

Table 5.3.1 indicates that the allocation of federal funds to Penang State for roads and bridges development constitutes 1.8% of the Fifth Malaysia Plan's (FMP) total allocation. This amount is by no means large. Nevertheless, a total amount of M$194 million in allocation is estimated for the ten (10) year period of 1991 – 2000.

Projects under the Road Network Improvement Plan is estimated to cost M$122 million. Henceforth, with earnest attempts made to obtain a larger allocation of federal funds to Penang State it will be possible to implement the projects in the proposed TSM Plan.

Table 5.3.1 : Allocation to Roads and Bridges

(Unit : M$ million)

	Malaysia	Penang State	% Share
Economic Development Funds			
1986–1990 *	23,548.40	762.36	3.2%
1991–2000 **	68,408.10	2,189.06	3.2%
Allocation to Roads and Bridges			
1986–1990 *	3,715.10	66.56	1.8%
1991–2000 **	10,792.36	194.26	1.8%

Note : * Fifth Malaysia Plan (1986–1990)

** Figures estimated by the Study Team by using the growth rate of GDP (5.0%)

B. MPPP's Financial Capability

1. Size of the Budget and Balance of Revenue and Expenditure

Table 5.3.2 shows the size of the MPPP's budget and the balance of revenue and expenditure during the period from 1983 to 1987.

In the 1987 Budget, the estimated revenue is M$69 million and the expenditure is M$76 million. Thus the balance of revenue and expenditure is an estimated deficit of approximately M$7 million.

The revenue was M$52 million in 1983. It increased to M$61 million in 1985. In 1986, it is supposed to have an increase of revenue on the actual basis. However, in the 1987 Budget, the estimated amount of revenue decreased by about 10% from the amount in the 1986 Budget. The decrease in the estimate of revenue is supposed to take into consideration the recent stagnant conditions of the Penang economy. As a matter of fact, the climate of the Malaysian economy has been rather dull because the prices of the Malaysian export products such as oil, tin, rubber, palm oil, etc. dropped sharply in the world trade market whereby producing a huge amount of deficit in the balance of foreign trade.

It is very likely that the economic conditions in Penang Island will recover and become active if the economic climate of Malaysia revert to an upward direction. Similarly, the financial conditions of the MPPP will improve if the Penang economy becomes bullish and starts to achieve higher growth. It is expected that the Malaysian economy is on the way to more development from a long term viewpoint. So, it is reasonable to predict that the Malaysian economy will start to grow again if the world economic conditions were activated after the long spell of economic recession.

Table 5.3.2 : Revenue and Expenditure of the MPPP (1983 - 1987)

(Unit : M$1000)

	Department's Revenue and Expenditure	1983	1984	1985	1986	1987	Average 1983–1987
		Actual Value	Actual Value	Actual Value	Approved Value	Estimated Value	
Revenue	All Revenue except Transport Department's Revenue	46,618	50,857	56,409	71,107	64,156	57,829
	Transport Department's Revenue	5,296	5,304	4,694	5,290	4,704	5,058
	All Revenue	51,914	56,162	61,103	76,398	68,860	62,887
Expenditure	All Expenditure except Transport Department's Expenditure	53,094	60,634	67,976	71,716	67,976	62,279
	Transport Department's Expenditure	6,940	6,748	6,687	8,377	8,009	7,352
	All Expenditure	60,034	67,383	74,663	80,093	75,985	71,631

Note : Figures are on the nominal price.

2. Forecasting the MPPP's Revenue and Budget for Transportation Improvement

In this sub-section, the MPPP's revenue and budget are forecasted.

The MPPP's revenue is forecasted to pick up based on the assumptions that the upturn of economic situation or changes to the structure of taxes and rates in the future.

The Fifth Malaysia Plan (FMP) forecasted an annual average growth rate of 5% for the GDP.

Therefore, the MPPP's future revenue can be forecasted to grow at 5% per annum.

Next, the 1986 budget for the MPPP's Engineering Department, which is responsible for the implementation of transport facility plans, was 20.1% of the total expenditure of the MPPP excluding the share of the Transport Department. For 1987, this amount was budgeted as 17.2%.

Note: MPPP's Transport Department is in charge of the MPPP Bus operation. Thus, its revenue and expenditure are separated from that of other departments.

In turn, the expenditure for road improvement and other works related to transport facilities constitutes about 50% of the Engineering Department's total expenditure.

Therefore, on the basis of the existing circumstances, the MPPP's revenue and budget allocated to transportation improvement is forecasted and presented in Table 5.3.3. From the forecast, based on an annual average increment of 5% in revenue it would be possible for the MPPP to finance transportation projects totalling about M$112 million (low estimate) to M$137 million (high estimate) over 13 years from 1988 to 2000.

Accordingly, the implementation of the ATC System Expansion Plan which requires about M$55 million until year 2000 and the construction of a major primary road, namely the Weld Quay Extension Project estimated at about M$60 million will constitute 103% (of low estimate) to 84% (of high estimate) of the allocated budget. Thus such a situation is considered slightly severe from the financial standpoint.

Table 5.3.3 : Forecasts of Revenue and Budget Allocated for Transportation Improvement

(Unit : M$1000 at 1986 prices)

	Average of 3 years (1985–1987)	1988–1990	1991–1995	1996–2000	Total Budget
Revenue of MPPP	63,890	222,058	450,569	575,053	1,247,680
% of Allocation for Improvement of Transport Facilities	11% (1)	24,426	49,563	63,256	137,245
	9% (2)	19,985	40,511	51,755	112,251

Note : (1) 50% of Engineering Department's Budget Estimate (20.1% of MPPP's) for 1986
(2) 50% of Engineering Department's Budget Estimate (17.2% of MPPP's) for 1987

3. MPPP's Financial Aspects

Figure 5.3.1 shows the share of the estimated expenditure for the proposed TSM Plan as a percentage of the MPPP's Engineering Department's budgetary allocation for transportation improvement for the three (3) phases.

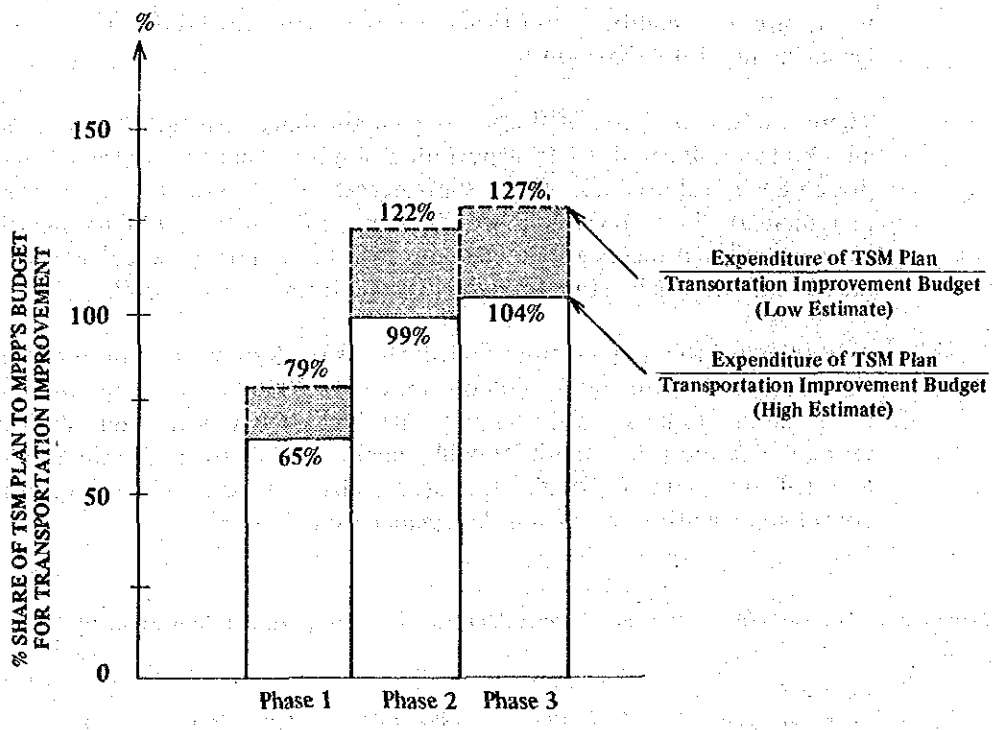


Figure 5.3.1 : % Share of TSM Plan to MPPP's Budget for Transportation Improvement in Each Phase

In particular, the investment required for the TSM Plan, Phase 2 (1991–1995) and Phase 3 (1996–2000) will be strictly over the budgetary allocation of the Engineering Department even using the high estimate.

Taking into consideration of the above, the capital investment required for the TSM Plan is not expected to come solely from the MPPP's financial resources.

The possibility of MPPP implementing the TSM Plan will naturally be higher if federal funds can be obtained.

In particular, out of the total investment of M$49.3 million required for Phase 2, two projects account for a major portion of the requirements. These are the Weld Quay Extension Project using M$20.0 million (41% of total for Phase 2) and the ATC System Expansion Plan – Stage III using M$21.9 million (44%).

Next, in Phase 3, the Weld Quay Extension will consume another M$35.0 million or 53% of the total for that period and the ATC System Expansion Plan – Stage IV using M$23.4 million (36%).

Thus, it is necessary for the MPPP to begin negotiations for federal fund or subsidies for the Weld Quay Extension as soon as possible.

With regards the ATC System Expansion Plan which includes the introduction of a host computer for the ATC System, it is recommended that the MPPP requests the Federal Government for assistance by treating its installation as a federal project. Besides this, foreign government aids could be requested to finance this project.

C. **Public Corporation Financial Capability**

The projects which can rely on funds from either the State's public corporations or the private sector are the construction of public parking buildings, the construction of a new CBD Bus Terminal and the Bus Fleet Renewal Program. The total investment required is estimated as M$38 million.

Based on the financial analyses of the public parking building and the CBD Bus Terminal, these projects are found to be financially viable with the availability of loans with interest rate of 6% or lower.

Therefore, it is better if these two projects can be undertaken and managed by either an existing or a new public corporation. In such a case, it will be necessary to request the Federal Government to make available low-interest rate loans to finance the construction of the buildings.

In addition, regarding the purchase of new buses to replace the old fleet, about M$11.0 million is estimated.

A detail plan for the comprehensive improvement of the stage bus transport industry is beyond the scope of this Study. However, it is necessary for the MPPP to conduct a comprehensive Bus Transport Study in order to formulate a Bus Transport Masterplan. The implementation of the Bus Fleet Renewal Program then can be incorporated into this masterplan and various sources such as foreign government aids, etc. could be requested for the financing of this project.