社会開発協力部報告書

マレイシア国

ジョージタウン・バタワース道路計画調査

都市交通基本計画調査報告書

〔増補編〕

昭和55年5月

国際協力事業団

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1.1 道路・交通現況

1.1.1 道 路 現 況

ペナン州の道路はまだ不充分で、ジョージ・タウンでは市域面積の２２％、バタワースでは４％が道路面積となっている。

1.1.2 交 通 現 況

１９７９年６月にO.D調査を行い、その結果によれば、調査対象区域の総トリップ数は６８万３４００トリップで、うち４２％が車、残りがモーターバイクと後者の割合が多い点が特徴的である。

またO.Dパターンはジョージ・タウン中心部にトリップエンドをもつ交通がほとんどである。またウェルスリー県ではバタワースとプライ、ブキット・メルタジャム間の需要量が大きい。

1.2 バ ス

現在４１０台のバスがあり、約25,800人／日の旅客が運ばれている。この他に学校バス、工場バスがあり、それぞれ約16,000人の生徒、30,000人の労働者が利用している。

1.3 タクシー、トライショー

現在４７０台のタクシーがあるが、タクシーのサービスは不充分である。一方トライショーは約2,490台あり、約14,500人が1日に利用していると想定される。

1.4 フェリー

３０年の歴史をもつフェリーは、１１台が稼動し、2,６００万人の旅客、１００万台の自転車、４００万台のモーターバイク、３２０万台の車、６０万台のトラックを1978年に運んだ。

1.5 航 空

ペナン空港は3,354m×45mの滑走路をもち、１９７８年には６８万５千人の旅客が利用した。

1.6 鉄 道

マレー鉄道によって、バタワース ― ブキメット・メルタジャム、アロースター方向へ鉄道が運営されている。バタワース、ブキット・メルタジャムの乗降客数は１９７８年

にそれぞれ１１９.４万人、8.1万人である。

1.7 観　光

ペナンは東洋の真珠と呼ばれるリゾートで、１９７８年には約１６万人の観光入込客があった。

1. PRESENT TRAFFIC AND TRANSPORT CONDITIONS

This part presents the traffic characteristics of persons, goods and transport conditions of which brief descriptions are given below:

1.1 Road Conditions and Traffic Characteristics

1.1.1 Road Conditions

1.1.1.1 General Road Conditions

The roads in the Study Area, including main and local, measure a total length of approximately 480 kilometers; being about 280 kilometers in George Town, about 16 kilometers in Butterworth and 21 kilometers in Bukit Mertajam.

The road spaces in the Study Area are shown in Table 1.1. In this table, the ratio of road space is defined;

$$\text{Ratio of road space} = \frac{\text{Area of Road Space}}{\text{Land Area}}$$

Table 1.1 LENGTH AND AREAS OF ROADS
Study Area 1979

	Land Area (has.)	Length of Roads (kms.)	Area of Roads (has.)	Road Area / Land Area (%)
Penang Island (Study Area Only)	14,692	301.3	647	4.4
George Town	2,796	279.3	610	21.8
Other Areas	11,896	22.0	37	0.3
Province Wellesley (Study Area Only)	22,029	182.3	548	2.5
Butterworth	1,088	15.7	47	4.3
Bukit Mertajam	389	20.9	63	16.1
Other Areas	20,552	145.7	438	2.1

Note: On the basis of a scale of 1/25,000, the length of roads are calculated. Then, with the width of road assumed, the area of roads are computed.

The table shows that the ratio of road space in George Town is approximately 22 percent, in Butterworth about 4 percent and in Bukit Mertajam, roughly 16 percent. In comparison the ratios of industrial cities are as follows:

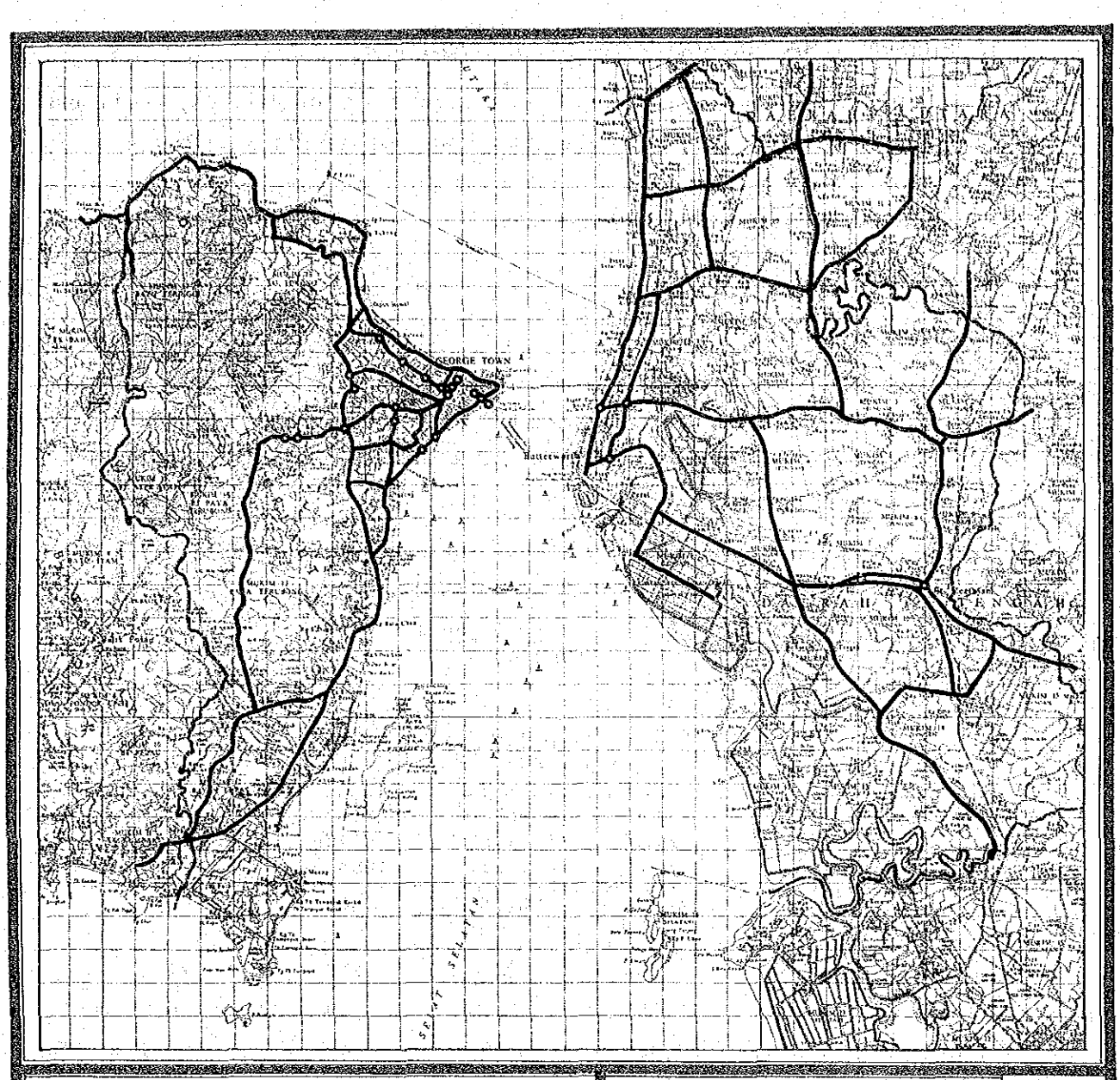

Fig. 1.1 Existing Road Network with Signalized Intersections

PENANG URBAN TRANSPORT STUDY

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

Page.

City	Rate of Road Space
Washington	43%
New York	35
Paris	26
London	25
Tokyo	11

Source: Ministry of Construction Japan (1979)

Considering these figures, the rate of road space in George Town is comparatively low, especially in Butterworth, showing that it is necessary to formulate a road plan.

1.1.1.2 Road Network

The major road network in the Study Area is illustrated in Fig. 1. In George Town it mainly consists of a developed radial and ring system comprising of six (6) radial and three (3) ring roads.

Most of these roads consist of wide single carriage-ways. The road network in other areas consists of only trunk roads with wide single carriage-ways and local roads with mostly narrow single carriage-ways.

Fig. 1 shows the major road network illustrating signalized intersections. There are twenty two (22) signalized intersections in the Study Area; eighteen (18) in Penang and four (4) only in Province Wellesley.

1.1.2 Traffic Characteristics

In order to assess the existing traffic situation in the Study Area, the team has been conducting several traffic surveys such as a vehicle-owner survey, an interview survey of vehicles using the ferry, a screen line traffic count survey and interviews and traffic count surveys on the cordon line. After processing this data, the traffic characteristics regarding vehicles are presented below.

1.1.2.1 Number of Trips

In 1979, the average number of trips per vehicle per day in the Study Area is as follows:

Private Car	= 3.98
Lorry	= 3.01
Taxi	= 8.07
Bus	= 20.57
Motor-cycle	= 3.78

The number of vehicular trips by vehicle type is shown in Table 1.2.

Judging in terms of traffic volume, this indicates that motor-cycles are the most used type of vehicle in Penang, followed by private cars.

Table 1.2 NUMBER OF TRIPS PER DAY BY VEHICLE TYPE

	Number of Trips (thousands)	Per Cent
Private Car	236.0	34.5
Lorry	28.4	4.2
Taxi	2.7	0.4
Bus	19.0	2.8
Sub-Total	286.1	41.9
Motor-cycle	397.3	58.1
Total	683.4	100.0

Source: Origin and Destination Survey, 1979.

Table 1.3 shows the trip purpose of private cars and motor-cycles.

Table 1.3 NUMBER OF TRIPS PER DAY BY TRIP PURPOSES

	Private Car		M-Cycle		Total	
	Trip	Percent	Trip	Percent	Trip	Percent
To work	66.4	28.1 %	113.4	28.5 %	179.8	28.4 %
Business	33.4	14.2	40.9	10.3	74.3	11.7
Private	53.1	22.5	87.8	22.1	140.9	22.2
To home	83.2	35.2	155.2	39.1	238.4	37.6
Total	236.0	100.0%	397.3	100.0%	633.3	100.0%

Source: O-D Survey, 1979.

If the traffic returning from work and private trips to home are grouped with the outward trip, it can be seen that approximately 43 percent of private car trips are work trips, 22 percent make business trips and the remaining 35 percent make private trips. The composition of trip purpose of motor-cycles is almost the same as that of private cars with some difference in business trips.

1.1.2.2 Trip Generation and Attraction by Zone

Trip generation and attraction by zone is illustrated in Fig. 1.2.

The largest amount number of traffic generated and attracted is in zone 100 and its volume of 187,300 or 62 percent of internal traffic is going from and coming to zone 100. The volume of trip generation and attraction in the other areas is considerably smaller than that in zone 100. However, among the other zones, 13 percent or 40,000 vehicles are generated and attracted in zone 500.

1.1.2.3 Desired Line

The desired lines of vehicles and motor-cycle trips are illustrated in Figs. 1.3 and 1.4. The traffic flow of vehicles is largest between zones 100 and 300 with a volume of 22,700 per day. Second largest is the traffic flow of vehicles between zones 100 and 200 and after that between zones 100 and 400.

In Province Wellesley, it can be seen that the largest flow is between zones 500 and 600 with a volume of 10,000 per day. The traffic flow of vehicles between Butterworth and Bukit Mertajam is only 5,000 per day. The desired line of motor-cycle traffic flow is almost the same as the vehicle flow excluding that of Butterworth and Bukit Mertajam. The volume of motor-cycles between Butterworth and Bukit Mertajam is comparatively large.

1.1.2.4 Traffic Flow on Major Roads

The traffic flow on major roads is estimated and illustrated in Figs. 1.5 and 1.6. According to the traffic flow in George Town, the traffic volume on the cordon line of the C.B.D. is approximately 86,000 per day excluding motor-cycles. That on the city-limited cordon line is about 75,000 per day. Out of these, most of the inflow and outflow of traffic is concentrated in the C.B.D.

The other towns such as Butterworth and Bukit Mertajam are comparatively small with traffic volume on the cordon line of Butterworth being about 57,000 per day while that in Bukit Mertajam is only 25,000 per day.

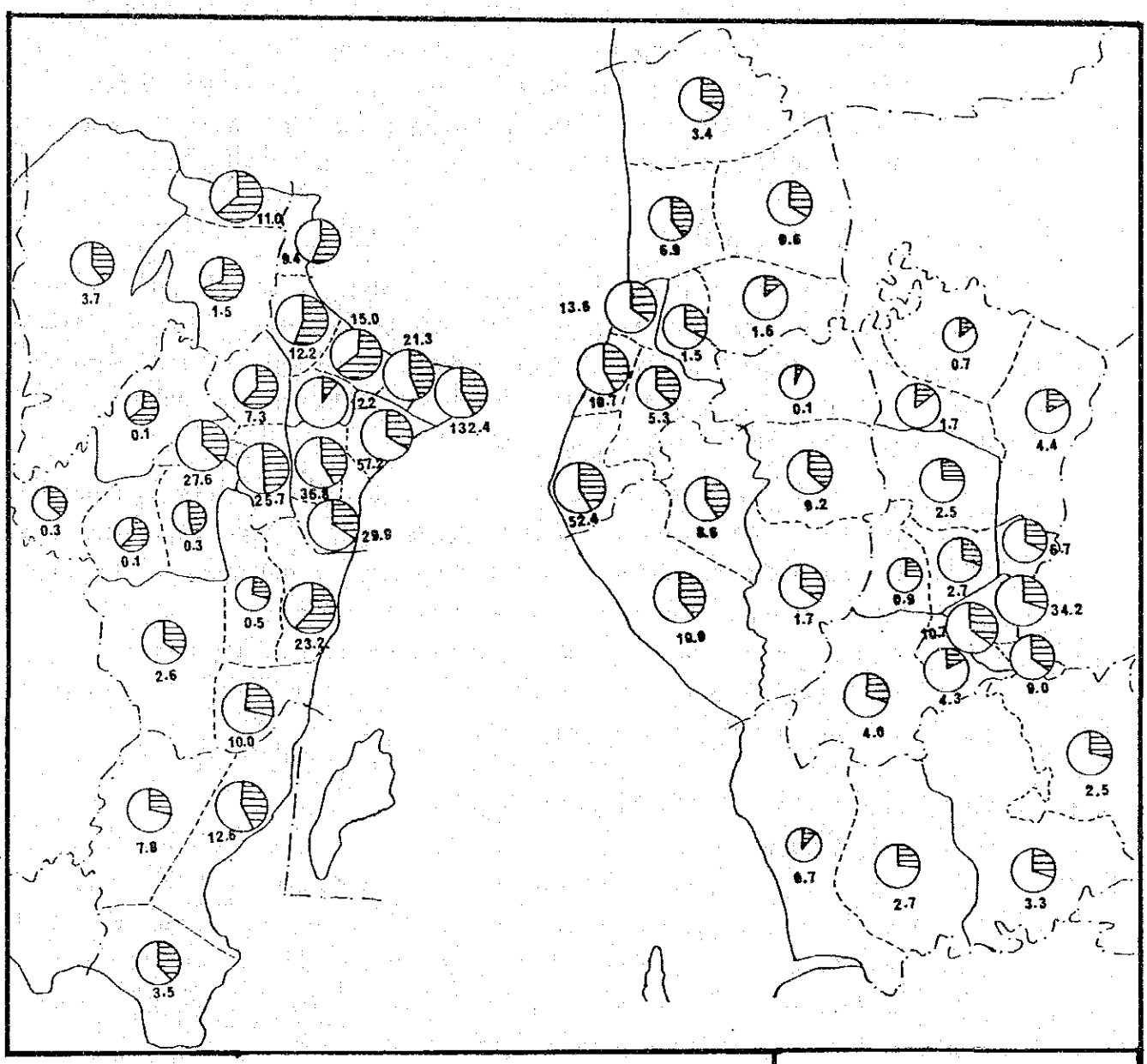

Fig.1.2 Trip Generation and Attraction

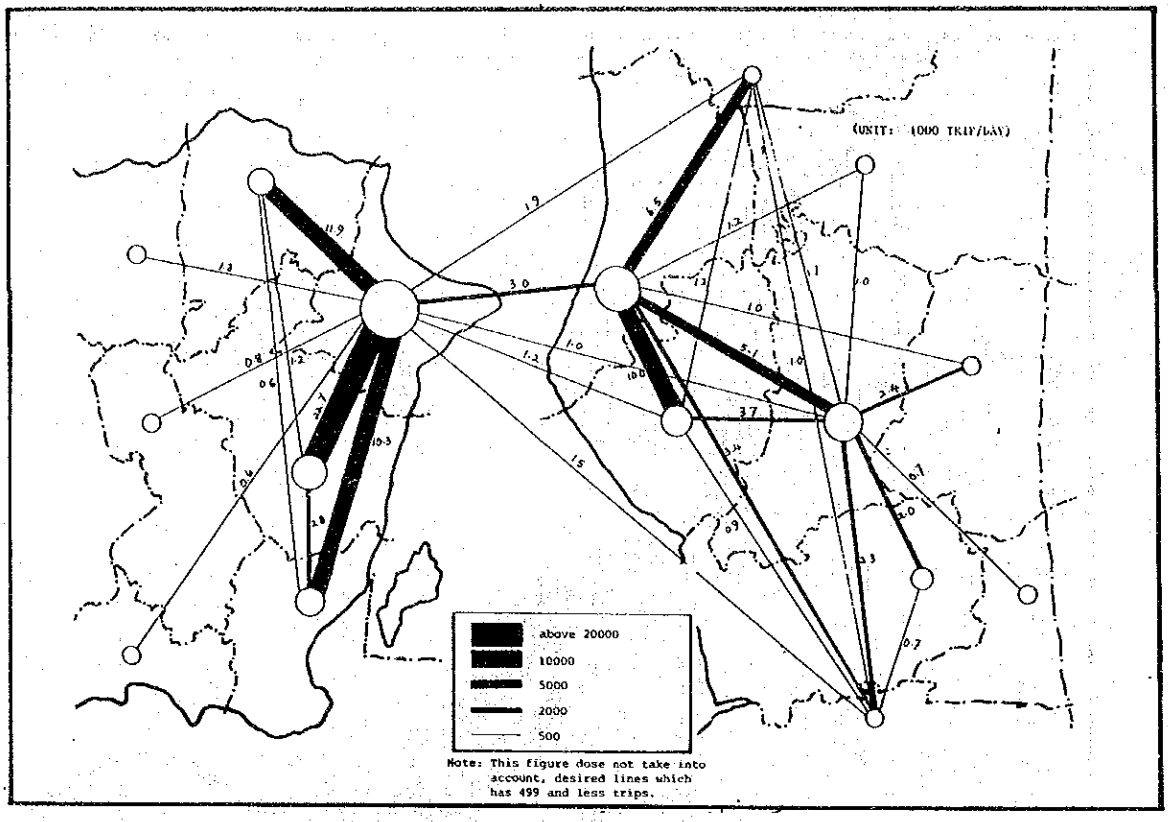

Fig. 1.3 DESIRED LINE (Vehicles)

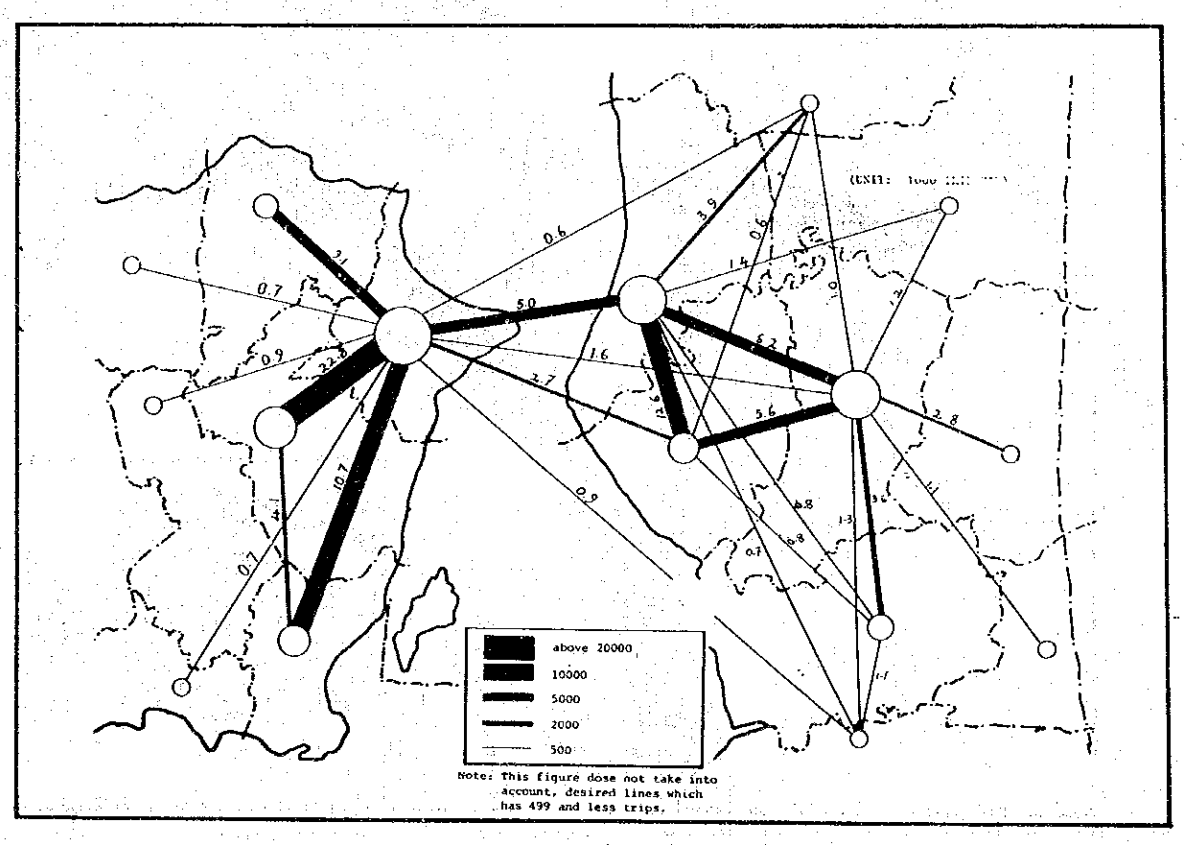

Fig. 1.4 DESIRED LINE (Motor Cycles)

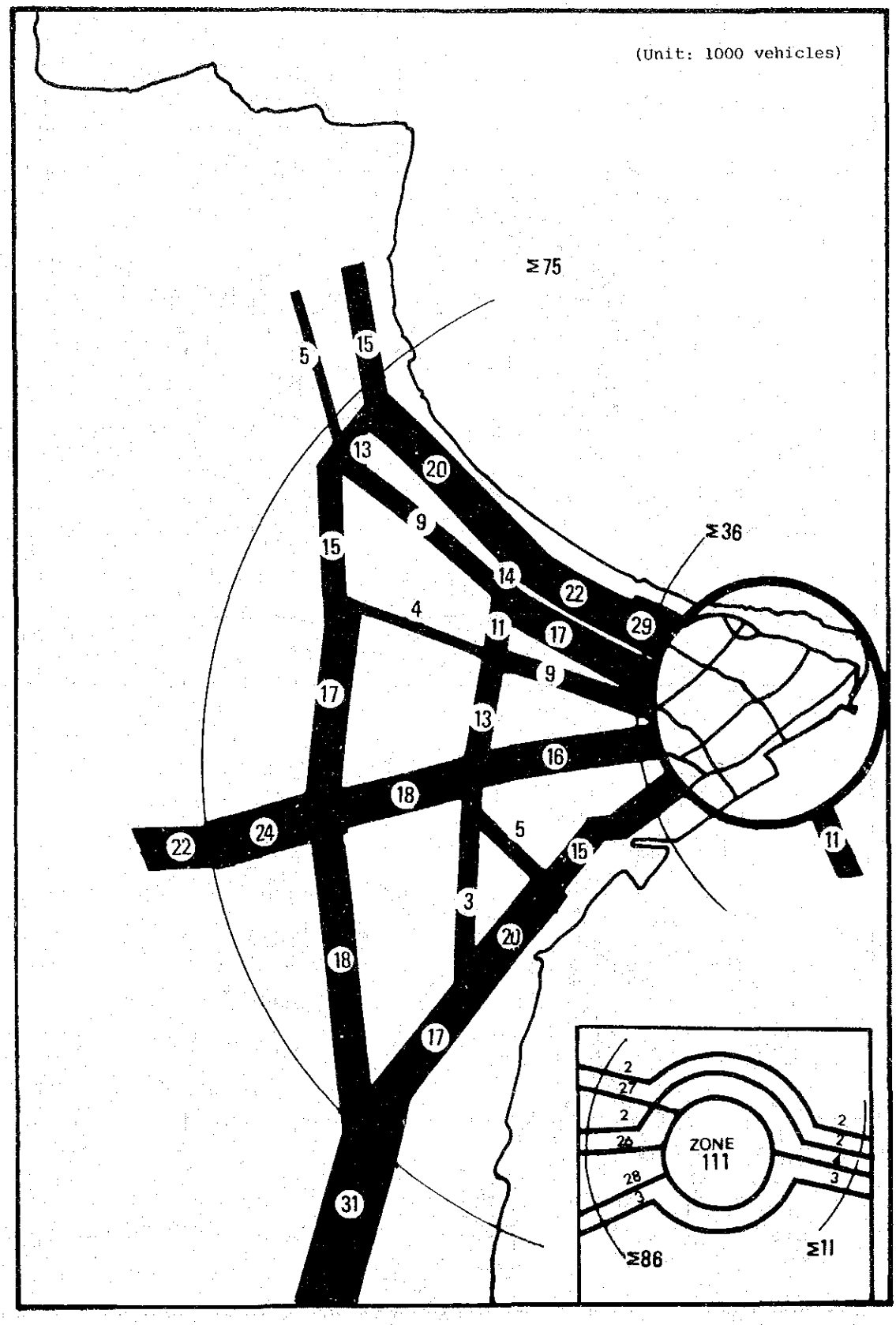

Fig. 1.5 PRESENT TRAFFIC ASSIGNMENT

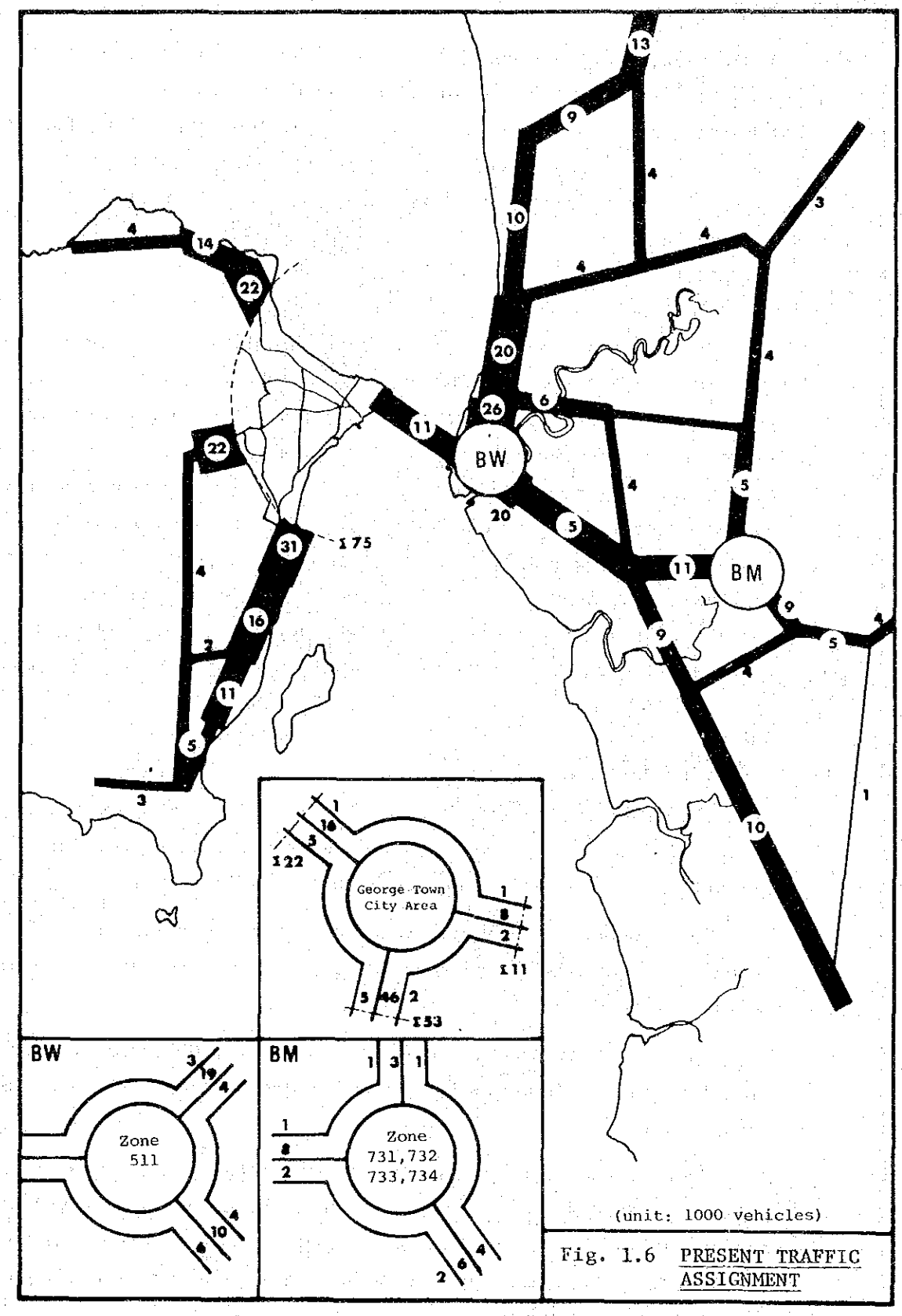

Fig. 1.6 PRESENT TRAFFIC ASSIGNMENT

1.2 Bus Transport

At present, there are two (2) kinds of bus transport; one is the scheduled bus system, while the other is the specific bus system. The specific bus system is further sub-divided into two; one is the factory bus and the other is the school bus. By these modes of transport, a large part of public transport demand is satisfied. A brief description is presented below.

1.2.1 Scheduled Bus System

There are at present about 410 buses authorized to operate in the State of Penang. Most of these buses are of the large type ranging from those with a seating capacity of 30 passengers, to large single-deck buses with a seating capacity of 55 passengers or so. Utilizing these buses, approximately 258,000 passengers travel daily to their destination. In 1971, approximately 20 percent of passenger trips were by bus. These buses are operated by private companies and the Penang City Council.

The route coverages of all bus operations in the urban area is shown in Figs. 1.7 and 1.8. Fare levels are the same for all bus operators and are set by the Ministry of Transport.

1.2.2 Factory and School Buses

The other bus system which is popular in the State of Penang is sub-divided into two (2) types; one is the factory bus (Bas Kilang) and the other is the school bus (Bas Sekolah).

The factory bus provides services for factory workers commuting to and from work while the school bus provides services to school children going to and returning from school.

Approximately 30,000 workers and about 16,000 school children travel daily to factory and to school respectively by these modes of transport.

Most of the factory buses and school buses are managed by private enterprises with some 320 factory buses and 490 school buses registered in the State of Penang. Most factory bus fares are covered by factories although, school bus fares are paid individually on a monthly or yearly basis.

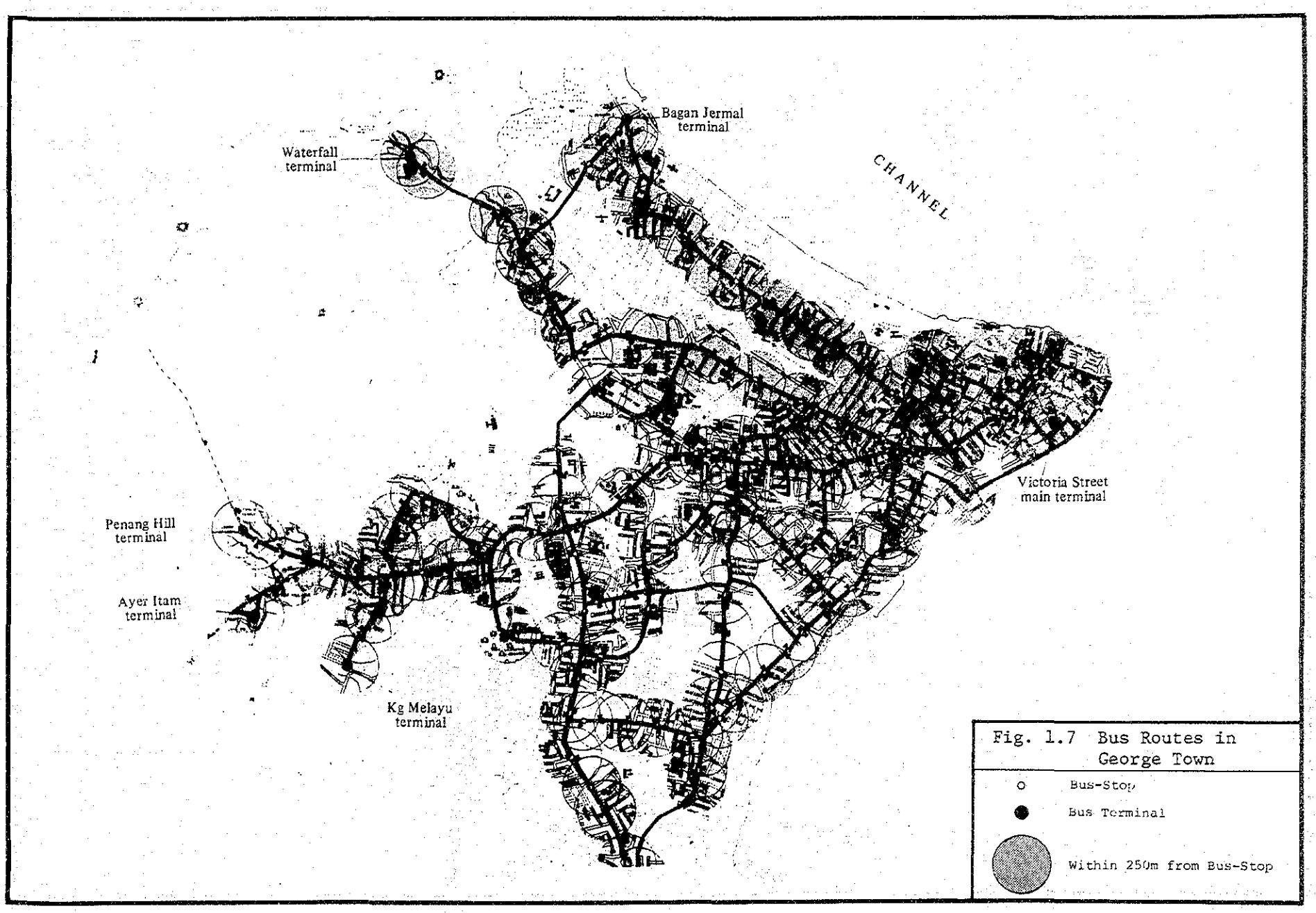

Fig. 1.7 Bus Routes in George Town

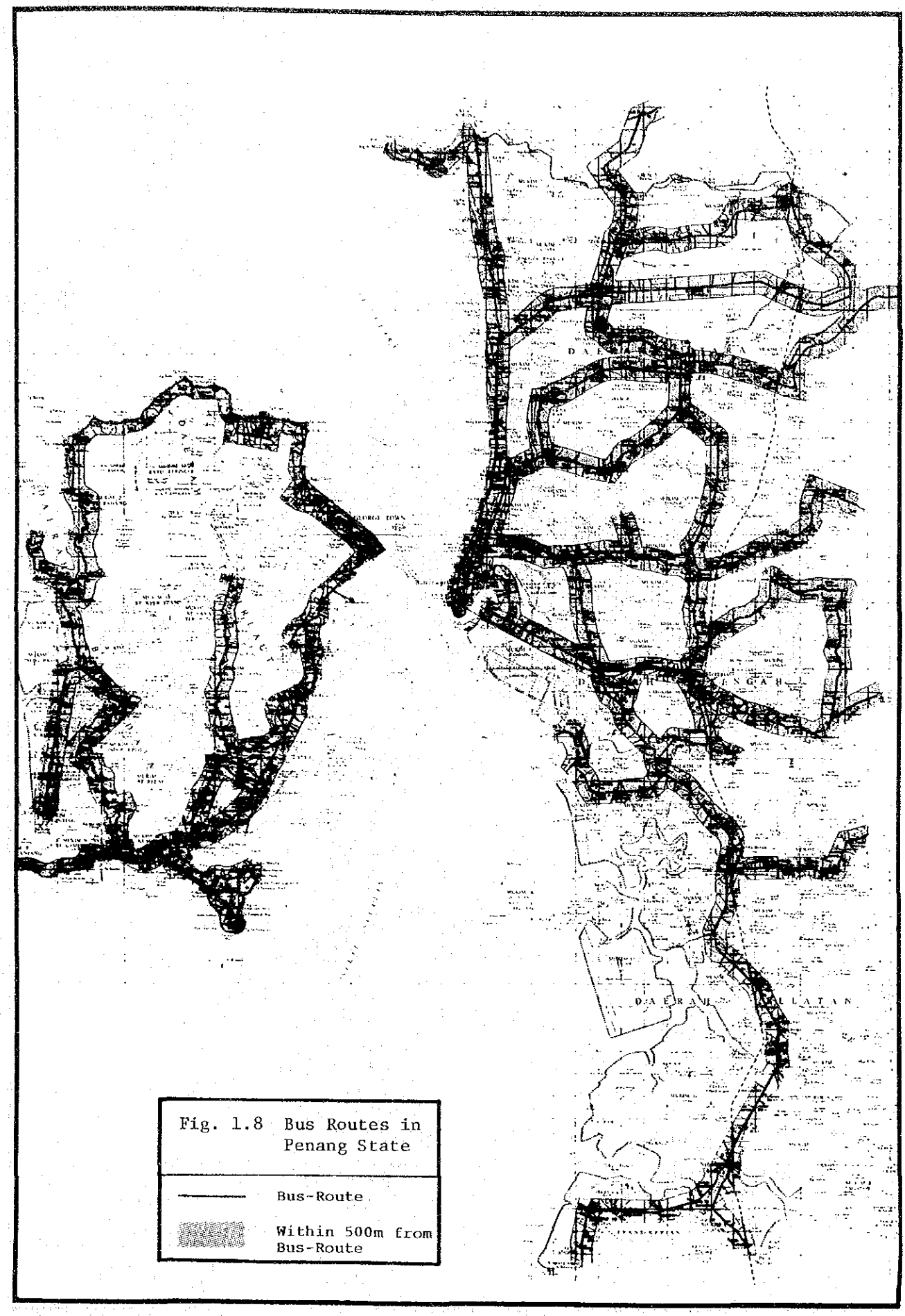

Fig. 1.8 Bus Routes in Penang State

1.3 TAXI AND TRISHAW

1.3.1 Taxi

There are at present some 470 taxis registered in the State of Penang, of which half are in Penang and the other half in Province Wellesley.

In 1979, the number of taxi trips in the internal area has been only 2,700 trips per day while in the external area has been 1,990 trips per day. The composition of taxi trips to total trips excluding motor-cycle trips is approximately 1 percent in the internal area and about 6 percent in the external area.

At the moment, most taxis provide services mainly for long-distance trips, unlike in Kuala Lumpur or other major metropolitan areas in South-East Asia. The fare rates of taxis are set at 60 cents for the first mile and 20 cents for each subsequent half mile as regulated by the Ministry of Communications. However, most taxi drivers negotiate the fare prior to trips so by making for irregular fare rates.

1.3.2 Trishaw

In 1978, some 2,500 trishaws were registered in the State of Penang, of which approximately 1,470 were in Penang Island and about 1,030 in Province Wellesley.

From this data, the total number of trishaw trip movements is estimated to be approximately 5.82 trips per day with the number of passengers carried being about 14,500 persons. Most trishaws provide services for short distances, viz within 3 kilometers.

The fare-rates of trishaws are reached through negotiation with passengers.

1.4 Ferry System

The ferry service between Penang Island and Province Wellesley has a history of over 30 years and is established as the only means of public transport for passengers and vehicles across the straits. The ferry service is under the administration of the Penang Port Commission (PPC), which also has supervisory functions over the Port of Penang.

At present, there are three (3) ferry berths, two (2) of them for single-deckers which carry both passengers and vehicular traffic and the remaining one for double-deckers which carry vehicles only on both decks. The vessels operated are eleven (11) in number of which eight (8) are old-type ferries called single-deckers and the remainder are new type ferries.

The ferry service operates 24 hours daily. During busy periods, ferries commute to and fro while having about a 5 to 7 minute interval in between trips. The amount number of traffic that uses the ferry is illustrated in Fig. 1.10.

There were 26 million passengers, 1 million bicycles, 4 million motor-cycles, 3.2 million cars and 6 hundred thousand trucks that made use of the ferry in 1978.

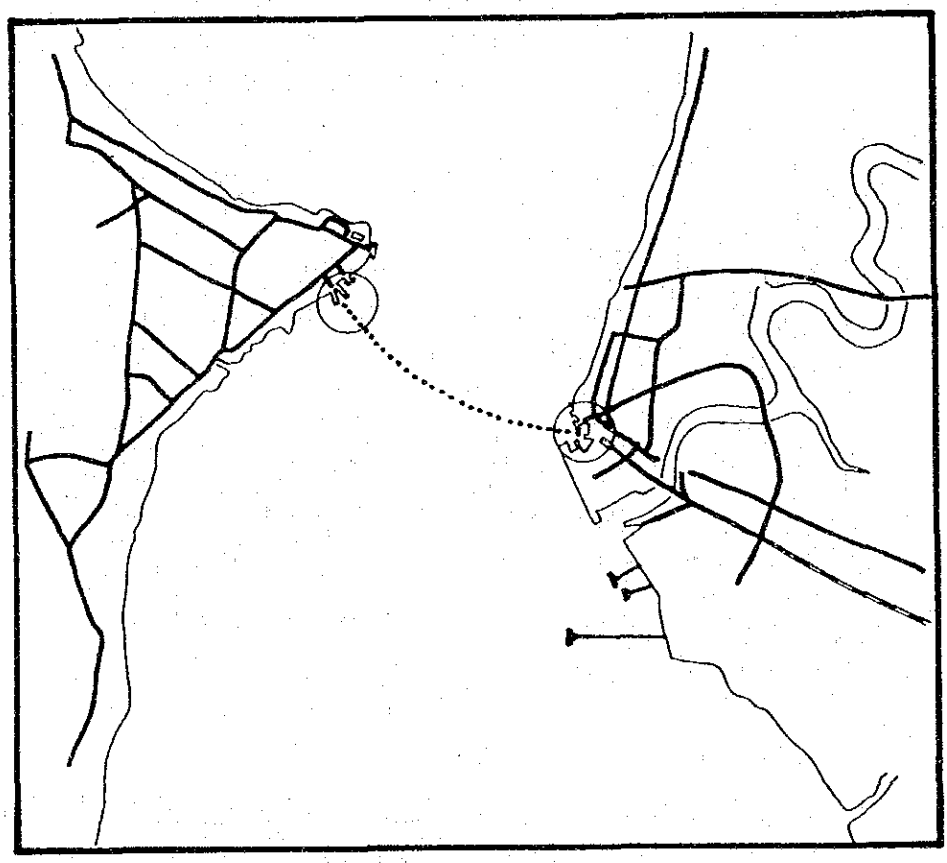

Fig. 1.9 LOCATION MAP OF FERRY

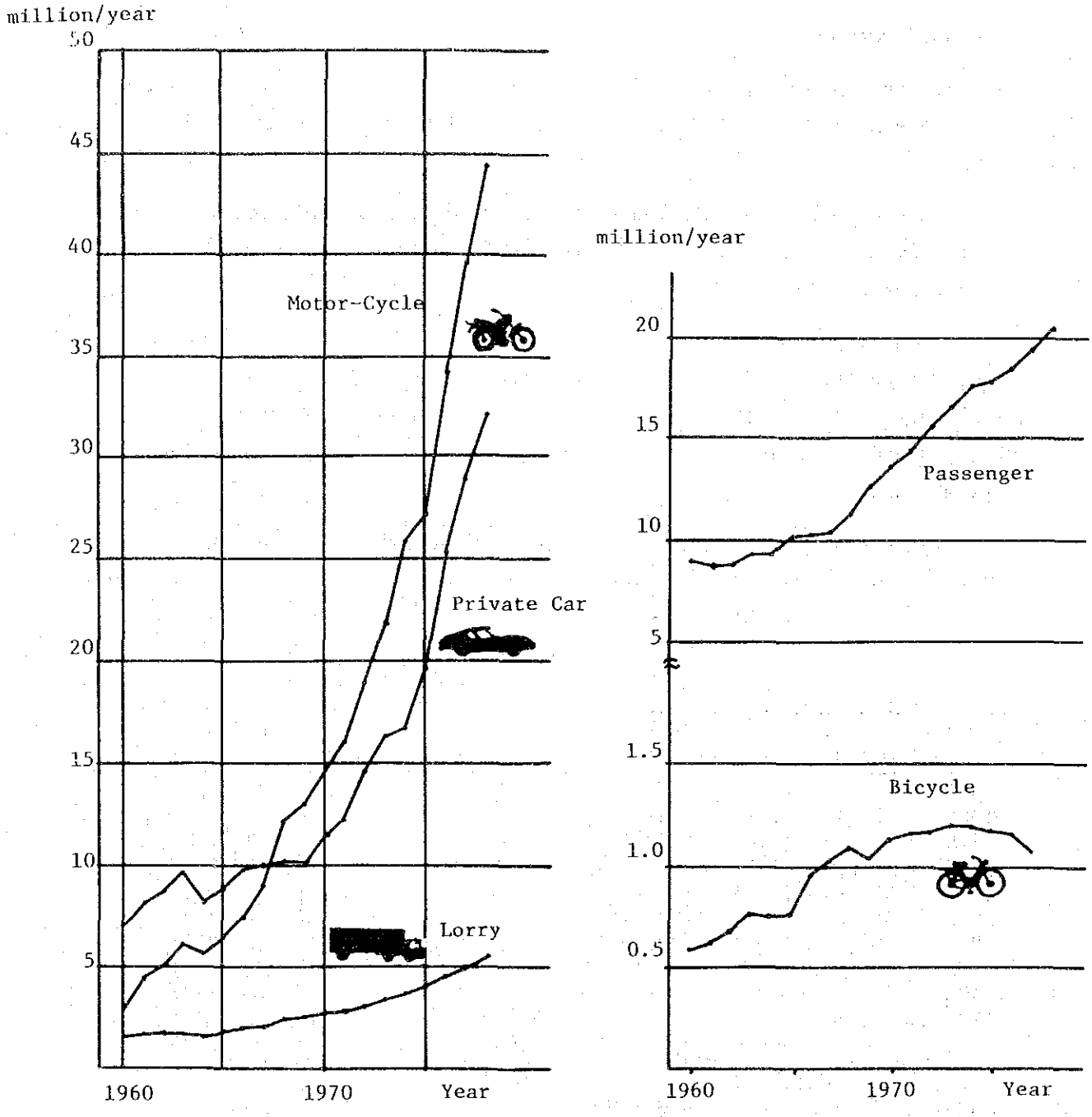

Fig. 1.10 TREND OF FERRY TRAFFIC

1.5 Civil Aviation

Penang International Airport, located at Bayan Lepas in the southern part of Penang Island is the second largest international airport in Malaysia.

This airport has a 3,354m x 45m runway equipped with ILS, VOR/DME instrumentation and a modern terminal building the first in Malaysia to have passenger-loading bridges.

This airport plays a key role as a stop-over point on the intercontinental routes originating in Europe and servicing South East Asia as well as in the provision of domestic services of which 100 domestic flights and 80 international flights a week are served for embarking and disembarking.

The trend of passengers and cargo at Penang Airport has increased consistently throughout the past ten years as is shown in the table below:

Table 1.4 AIR TRAFFIC FLOW
1969-1979, Penang Airport

	Embarking/ Disembarking	Mails (tonnage)	Cargos (tonnage)	No. of Flights Landing and Take Off
1968	137,766 (100)*	163 (100)	523 (100)	5,830 (100)
1969	162,910 (118)	165 (101)	500 (96)	6,784 (116)
1970	198,661 (144)	158 (97)	440 (84)	8,018 (138)
1971	233,393 (169)	158 (97)	539 (103)	8,818 (151)
1972	286,646 (208)	175 (107)	801 (153)	8,821 (151)
1973	441,231 (320)	239 (147)	1,831 (350)	12,232 (210)
1974	497,038 (361)	328 (201)	2,960 (566)	13,216 (227)
1975	560,631 (407)	315 (193)	4,337 (829)	12,372 (212)
1976	588,577 (427)	341 (209)	5,936 (1,135)	13,274 (228)
1977	635,629 (461)	325 (199)	5,840 (1,117)	13,692 (235)
1978	685,463 (498)	434 (266)	6,463 (1,236)	15,020 (258)
1979**	411,420	301	3,985	10,922

Note: * The number in parentheses shows indices against 1968.
** from Jan. to Jul. (7 months)

1.6 Railway

Malayan Railways provides services for the entire Peninsular Malaysia and is one of the means of land trunk transport system. The railway network as illustrated in Fig. 1.11 consists of three (3) main routes;

* Padang Besar - Alor Star - Bukit Mertajam - Ipoh - Kuala Lumpur
* Kuala Lumpur - Seremban - Johor Bahru
* Pasir Mas - Gemas

The total length of the route is about 1,640km.

In the State of Penang, there are nine (9) stations; Butterworth, Prai, Bukit Tengah, Bukit Mertajam, Simpang Ampat, Nibong Tebal, Penanti, Tasik Glugor and Pinang Tunggal. At present, ten (10) trains are in operation.

	Passenger Train	Mixed Train	Goods Train	Total
Padang Besar - Butterworth				
Southbound	2	1	2	5
Northbound	2	1	2	5
Total	4	2	4	10
Butterworth (Prai) - Kuala Lumpur				
Southbound	3	0	3	6
Northbound	3	0	3	6
Total	6	0	6	12

Source: Year Book of Transport Statistics.

Regarding the annual number of passengers boarding and alighting at each station in Penang, information is available only for Butterworth and Bukit Mertajam of which is shown below.

		1976	1977	1978
Butterworth	Boarding	299,268	338,219	343,194
	Alighting	209,124	190,451	251,175
	Total	508,392	528,670	594,369
Bukit Mertajam	Boarding	59,875	55,800	54,490
	Alighting	37,621	36,609	26,903
	Total	97,496	92,409	81,393

However, extremely few passengers (23 passengers in 1978) use the railway for intra-urban travelling.

Regarding cargo services, annual tonnage of each station is shown below:

		1976	1977	1978
Butterworth	Inbound	55,164	71,367	82,715
	Outbound	85,557	121,139	152,609
	Total	140,741	192,506	235,324
Prai	Inbound	151,854	180,970	213,870
	Outbound	127,505	176,568	173,248
	Total	279,359	357,538	387,118
Bukit Mertajam	Inbound	1,685	2,560	2,029
	Outbound	2,087	12,578	33,029
	Total	3,772	15,136	35,058

In Penang Island, there is one (1) railway service located on Penang Hill which is mainly being used for sightseeing.

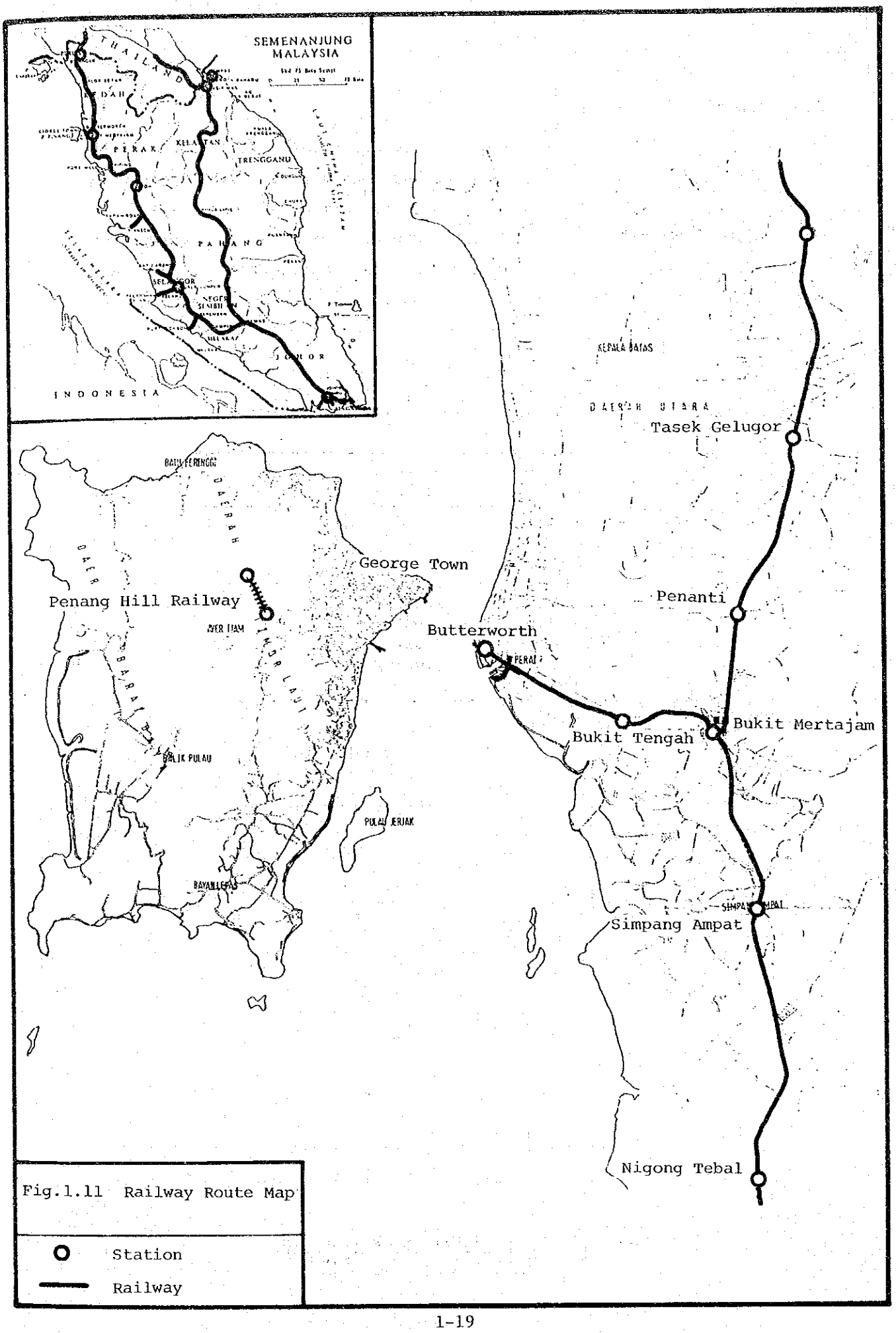

Fig.1.11 Railway Route Map

Station

Railway

1.7 Tourism

Penang, one of the renowned holiday resort areas in the East Pacific Area, is endowed with beautiful beaches and scenery. In 1978, there were approximately 160,000 tourists in Penang. The number of tourists in Peninsular Malaysia in 1977 was about 2,000,000, with Penang contributing a share of 7.4 percent for Peninsular Malaysia. During 1970 to 1978, a high growth rate of over 19 percent per annum of tourists was recorded in Penang.

Table 1.5 NUMBER OF TOURIST ARRIVALS 1970-1978, Peninsular Malaysia & Penang.

	Penang[1)]	Peninsular[2)] Malaysia	Share of Penang (%)
1970	39,454		
1971	49,278		
1972	62,801		
1973	92,367	2,168,651	4.3
1974	100,773	2,007,883	5.0
1975	105,578	2,081,559	5.1
1976	109,491	2,014,770	5.4
1977	150,025	2,023,741	7.4
1978	160,027	-	-

Source: 1) P.D.C.

2) "Monthly Statistical Bulletin" Department of Statistics

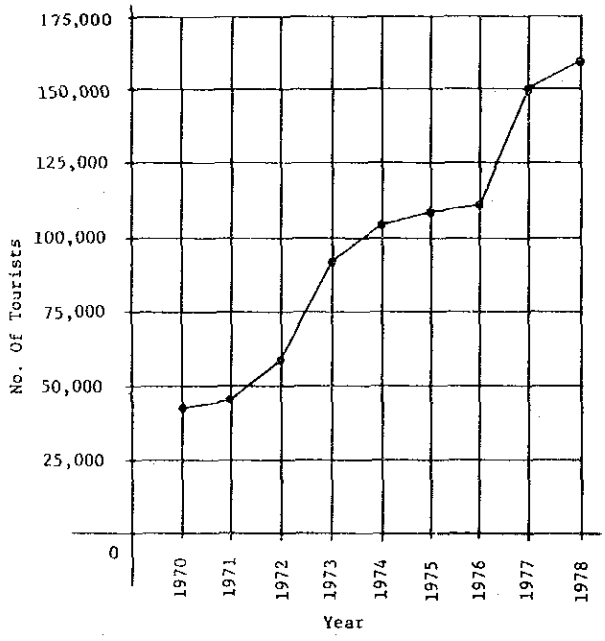

Fig. 1.12 NUMBER OF TOURISTS ARRIVALS IN PENANG ISLAND 1970 - 1978

2. 都市開発の現況と将来

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2.1 社会・経済の背景

2.1.1 現　　況

最近9年間の平均経済成長率は年7％である。ペナン州のG・D・P.は10.9％平均の成長である。

2.1.2 人　　口

ペナン州人口は776,770人（1970年）で、1957～1970年で2.4％の年成長率である。1979年人口は946,570人と推計される。

2.1.3 雇　　用

1970年の就業者数は212,219人で、失業率は10.1％である。

2.1.4 世帯収入

1977年の平均世帯収入は427マレイシアドル／月で、68％の人は平均以下の収入である。

2.1.5 現況土地利用

都市的利用のされている土地は、ペナン島で14,700ha、ウエルスリー県で22,000haである。

2.2 フレーム・ワーク

2.2.1 将来人口予測

ペナン州の2000年人口は1,617,800人と予測され、年平均成長率は2.4％である。

2.2.2 経済指標

ペナン州のG.D.P.は3つのケースで推定し、高いケースで1,265億ドル（2000年）、中間ケースで1,151億ドル、低いケースで971億ドルである。

2.2.3 雇用予測

1990年、2000年には完全雇用となるとして、2000年には54.2万人の就業者となる。特に製造業での伸びが大きい。

2.2.4 車輌保有台数

現在12％の成長率を示しており、2000年には1,000人当り125台（モーターバイク除く）となるものと推計される。

2.3 土地利用計画

2.3.1 計画手順

インテリム・ゾーニング、構想図に従って経済フレームに見合った土地需要を推計して計画した。

2.3.2 計画方針

インテリム・ゾーニングに基本的に従い、必要な検討を加えるとともに、最近の開発動向を考慮して計画する。

2.3.3 開発構想

3つの比較案を作成したが、ペナン島、ウェルスリー県ともに開発するプランCを最適案として採用する。

2.3.4 土地利用

新たに6,000 *ha* の都市用地を計画し、将来土地利用計画図を作成した。

2.4 人口計画

2.4.1 現況人口分布

1979年のゾーン別人口をトレンド方式によって推計した。

2.4.2 人口配分計画

2000年のゾーン別人口を、土地利用計画に基づいて、人口密度を設定する事により計画した。

2.4.3 従業地就業人口予測

1次及び2，3次に分けて、ゾーン別の就業人口を土地利用、人口計画に基づいて推計した。

2. CURRENT AND FUTURE URBAN DEVELOPMENT

2.1 Socio-Economic Background

2.1.1 Existing Economic Situation

The economic growth of Malaysia has increased significantly within the last 10 years. The expansion of world economic activity has been sufficient to generate a growth in demand for Malaysian exports. In addition to the effects which this growth has on Malaysia's traditional agricultural and manufactured exports, a further boost to external earnings is provided by the export of petroleum products. This growth in export trade has had a stimulating impact upon the economy as a whole, enabling it to grow at a rate higher than the full production potential of economic growth. Table 2.1 shows the Gross Domestic Product (GDP) in the last 9 years. The average annual growth rate of GDP within the last 9 years was about 7 percent.

Table 2.1 GROSS DOMESTIC PRODUCT, Malaysia, 1970 - 1978
($ Million in 1970 Prices)

	GDP	Annual Growth Rate (%)
1970	12,308	-
71	13,016	5.7
72	14,238	9.4
73	15,904	11.7
74	17,227	8.3
75	17,365	0.8
76	19,288	11.1
77	20,753	7.6
78	22,284	7.4

Source: EPU

Recently, the economy of the State of Penang has also recorded high and rapid rates of growth. Table 2.2 shows the Gross Regional Product (GRP) in the State of Penang and its percentage composition to the GDP. The average annual growth rate of GRP between 1970 and 1978 recorded about 10.9 percent.

Table 2.2 GROSS DOMESTIC PRODUCT AND GROSS REGIONAL PRODUCT Malaysia and Penag State, 1970, 1975 and 1978 ($ Million in 1970 prices)

	Penang		Malaysia		
	GRP	Average Annual Growth (%)	GDP	Average Annual Growth (%)	Share to Total GDP (%)
1970 (1)	794.7	-	10,708.0	-	7.4
1975 (2)	1,486.9	13.3	17,365.0	10.2	8.5
1978 (2)	1,817.0	6.9	22,284.0	8.7	8.2

Sources: (1) Third Malaysia Plan.

(2) Mid-Term Review of Third Malaysia Plan.

The share of the GRP to the GDP, therefore, has shown an increase from 7.4 percent in 1970 to 8.2 percent in 1978.

Table 2.3 shows the rgional variation in per capita GDP by state in Malaysia in 1978. The average per capita GDP in Malaysia as a whole is $1,680, while that in the State of Penang is $1,900. Comparisons of GDP between states show that Selangor and Sabah have higher rates than Penang whereas those of the other states are lower.

Table 2.3 REGIONAL VARIATION IN PER CAPITA Gross Domestic Product, Malaysia, 1978 ($ in 1970 prices)

Region	Per Capita GDP	Index
Total Malaysia	1,679	1.00
Penang	1,901	1.13
Johore	1,573	0.94
Kedah/Perlis	900	0.54
Kelantan	630	0.38
Malacca	1,218	0.73
Negeri Sembilan	1,482	0.88
Pahang	1,740	1.04
Perak	1,414	0.84
Sabah	2,198	1.31
Sarawak	1,274	0.76
Selangor	3,083	1.84
Trengganu	1,006	0.60

Sources: Third Malaysia Plan and Mid-Term Review of Third Malaysia Plan.

As measured by the Gross Regional Product, economic activities in the State of Penang are mainly defined by the commercial and manufacturing sectors. In 1978, commerce, including services, accounted for two-thirds (2/3) of the total GRP, manufacturing accounted for one-fourth (1/4), while the remaining was shared between the agricultural and construction sectors. Past trends between 1970 and 1978 show that the production of the agricultural sector has stagnated and its growth rate is only 1 percent, but the production of the manufacturing sector is extremely fastgrowing, i.e., at a rate of 21 percent per annum. (See Table 2.4).

Table 2.4 GROSS REGIONAL PRODUCT BY SECTOR OF ORIGIN
Penang State 1970, 1975 and 1978
($ Million in 1970 Prices)

	1970	1975	1978	Average Annual Growth '70-'85	Average Annual Growth '75-'78
Agriculture, Forestry	155.0 (19.5)	178.9 (12.0)	168.2 (9.3)	2.9%	-1.2%
Mining and Quarring	1.1 (0.1)	4.0 (0.3)	4.5 (0.2)	29.5	4.0
Manufacturing	101.2 (12.7)	348.2 (23.4)	480.5 (26.4)	28.0	11.3
Construction	45.9 (5.8)	58.5 (3.9)	72.2 (4.0)	5.0	4.3
Services (1)	491.5 (61.8)	897.3 (60.3)	1091.6 (60.1)	12.8	6.8
Gross Regional Product	794.7 (100.0)	1486.9 (100.0)	1817.0 (100.0)	13.3	4.1

The Number in Parentheses: %

Notes: (1) Includes utilities, transport, storage and communications, and insurance, wholesale and retail trade, banking public administration and defence, real estate and other services.

Source: Third Malaysia Plan and Mid-term Review of the Third Malaysia Plan.

2.1.2 Population

2.1.2.1 Population Trend

According to the 1970 census, the toal population in the State of Penang was 777,000 with 434,000 in Penang Island and 343,000 in Province Wellesley. The population growth rate in the State of Penang during the 1947 to 1970 period was 2.4 percent per annum, while in Penang Island it was 2.2 percent per annum and in Province Wellesley 2.8 percent per annum. (See Table 2.5).

Table 2.5 POPULATION TREND, Penang State, 1947, '57 and '70

	Population			ANNUAL GROWTH	
	1947	1957	1970	'47-'57	'57-'70
WEST MALAYSIA	4,908,086	6,278,758	8,801,399	2.5 %	2.6 %
PENANG STATE	446,321	572,100	776,770	2.5 %	2.4 %
PENANG ISLAND	262,705	338,866	433,760	2.6 %	1.9 %
PROVINCE WELLESLEY	183,616	233,234	343,010	2.4 %	3.0 %

Source: Population census

2.1.2.2 Ethnic Composition

Table 2.6 shows the ethnic composition of Penang State. 264,000 or 31 percent of the population are Malays, 435,000 or 56 percent are Chinese with only 89,000 or 12 percent Indians.

In Penang Island, the Chinese community predominates and its share to the island's total population is about 65 percent. In contrast to the island, the proportion of Malays to Chinese on the mainland is more or less the same, that is, 43 percent Malays and 45 percent Chinese.

Table 2.6 ETHNIC COMPOSITION, Penang State, 1970

		Malay	Chinese	Indian	Others	Total
Penang State	Ethnic Composition	263,907	435,323	89,395	11,702	773,327
	(%)	30.6	56.3	11.6	1.5	100.0
Penang Island	Ethnic Composition	90,273	281,597	49,482	9,350	430,702
	(%)	21.0	65.4	11.5	2.2	100.0
Province Wellesley	Ethnic Composition	146,634	153,726	39,913	2,352	342,625
	(%)	42.8	44.9	11.6	0.7	100.0

Source: Population Census in 1970.

2.1.2.3 Age Composition

The age composition of the population of Penang shows that there is a younger age group that is smaller and an older age group that is larger than in any of the other states in the country except for the State of Perlis. This situation is a result of the fact **that** the rate of natural increase of Penang has been lower than the average rate of Peninsular Malaysia. (See 2.7).

Table 2.7 AGE COMPOSITION BY STATE, Peninsular Malaysia 1957 and 1970

State	1957					1970				
	Total	0-14	0-24	15-64	65+	Total	0-14	0-24	15-64	65+
Peninsular Malaysia	100.0	43.8	61.9	53.4	2.8	100.0	44.6	64.2	52.2	3.2
Johore	100.0	46.2	64.5	51.5	2.3	100.0	47.1	66.7	49.9	3.0
Kedah	100.0	43.3	61.4	53.8	2.9	100.0	44.1	63.2	52.8	3.1
Kelantan	100.0	40.9	58.6	55.4	3.7	100.0	43.9	61.5	52.3	3.8
Malacca	100.0	47.0	63.5	49.9	3.1	100.0	46.5	65.6	50.0	3.5
Negri Sembilan	100.0	44.7	62.3	52.6	2.7	100.0	46.9	66.0	69.7	3.4
Pahang	100.0	44.2	62.4	53.1	2.7	100.0	45.6	64.2	51.5	2.9
Penang	100.0	42.4	60.3	54.6	3.0	100.0	41.1	61.6	55.4	3.5
Perak	100.0	42.1	60.8	55.4	2.5	100.0	45.0	64.1	51.7	3.3
Perlis	100.0	41.6	58.7	54.6	3.8	100.0	40.5	59.3	55.4	4.1
Selangor	100.0	44.1	62.7	53.6	2.3	100.0	43.0	64.7	54.3	2.7
Trengganu	100.0	41.7	58.9	44.1	3.2	100.0	45.5	62.6	51.3	3.2

Source: 1970 Population Census.

2.1.2.4 Migration

According to the Population Census of 1970 the State of Penang showed a net loss in migration between 1965 and 1970, due to the productive age group leaving for other states. (See 2.8).

Therefore the State of Penang has failed to absorb the labour force that has increased as a result of the high growth rate.

Table 2.8 NET MIGRATION RATE DURING 1965 - 1970
Penang State, 1965 - 1970 (in 1000 Persons)

	Malay		Chinese		Indian	
	Male	Female	Male	Female	Male	Female
0 - 4	- 0.5	- 0.5	+ 1.7	+ 2.0	+ 4.6	+ 8.1
5 - 9	- 0.6	- 0.7	+ 4.9	+ 6.0	+14.9	+27.6
10-14	2.6	3.0	+ 7.4	+ 8.9	+19.3	+36.2
15-19	9.6	10.7	+19.5	+22.1	+20.6	+37.3
20-24	-20.0	-20.1	-11.9	-12.3	+ 4.4	+ 7.6
25-29	-17.6	-18.7	- 8.3	- 8.7	- 4.8	- 9.7
30-34	- 9.0	- 9.6	- 6.9	- 7.6	+ 3.0	+ 6.1
35-39	-12.9	-12.6	- 6.4	- 6.5	+ 3.2	+ 7.2
40-44	-18.4	-20.1	- 9.2	- 9.2	- 1.5	- 3.5
45-49	-17.1	-19.0	-12.6	-12.2	- 2.5	- 8.8
50-54	-14.4	-16.0	- 7.1	- 6.9	+ 0.4	+ 0.8
55-59	-18.4	-20.5	- 7.2	- 7.8	- 4.0	-15.3
60-64	-18.6	-17.4	-10.4	-11.2	- 4.4	-18.8
65-	-20.7	-20.0	- 6.1	- 5.3	- 3.3	-16.4

2.1.2.5 Household Size

Table 2.9 shows the average household size in 1957 and 1970 respectively. There were 135,000 households in the State of Penang in 1970 with an average household size of 5.77.

Table 2.9 DISTRIBUTION OF HOUSEHOLD SIZE, Penang State
1957 and 1970

	1957	1970
Total Household	101,881	134,514
1	9,842	11,191
2	10,560	11,657
3	12,594	14,466
4	13,288	16,669
5	12,590	16,766
6 - 10	35,772	53,030
11 - 15	5,779	8,869
16 - 20	1,117	1,314
21 and more	339	552
Total Population	572,100	776,770
Average Household Size	5.61	5.77

Source: Population Census in 1957 and 1970.

2.1.2.6 Estimated Population in 1979

Since 1970, the State of Penang has undergone accelerated development in housing and industry in an effort to expand its

urbanized area. However, as there is no available data on population except for the 1970 census, it is assumed that past trends during the 1957 to 1970 period would continue through 1979 and as a result, the estimated population in the State of Penang is 946,570 in 1979 of whihc 513,250 are in Penang Island with 433,320 in Province Wellesley.

Of these, the estimated population in the Study Area is 724,970 in 1979 and that in the external area 433,320.

Table 2.10 ESTIMATED POPULATION, Penang State, 1979

		Internal	External	Total
Penang Island	1970	394,481	38,722	433,203
	1979	470,150	43,100	513,250
Province Wellesley	1970	199,346	143,575	342,921
	1979	254,820	178,500	433,320
Penang State	1970	593,827	182,277	776,124
	1979	724,970	221,600	946,570

2.1.3 Employment

The potentially employable population over 15 years of age in the State of Penang was 460,000 according to the 1970 Census, of which 51 percent represents the Labour Force while 49 percent the Outside Labour Force. (See Table 2.11).

Table 2.11 LABOUR FORCE AND EMPLOYMENT CHARACTERISTICS
Penang State, 1957 and 1970 (in persons)

	1957	1970
Population Working Age	572,100	776,124
Population (15 years and over)	329,490	457,370
Labour Force	165,710	234,902
Participation Rate (%)	50.3	51.4
Employment	160,545	212,219
Unemployment Rate (%)	3.0	10.1
Outside Labour Force	163,467	222,468

Source: Population Census

From Table 2.11, it can be seen that the rate of unemployment in 1970 was 10 percent, while in 1957 it was 3 percent.

There are noticeable sectoral variations in employment levels relative to the pattern of production. (See Table 2.12).

The labour intensiveness of the agricultural and manufacturing industries contrasts with the relatively lower labour utilization in the construction, commerce and services industries. It is surprising that labour productivity of the manufacturing industry is low and therefore it is supposed that probably a large share of the manufacturing industry is made up of small-scale industries. Table 2.13 shows the figures for employment by industry between 1957 and 1970 while Table 2.14 shows the recent figure for employment in factories with over 20 employees. According to Table 2.14, the growth rate of the manufacturing industry is over 10 percent due to the high growth rate of the G.D.P.

Table 2.12 COMAPRISON OF EMPLOYMENT AND GROSS REGIONAL PRODUCT
Penang State, 1970

Sector	Percentage of Total G.R.P.	Percentage of Total Employment
Agriculture	19.5	26.0
Construction and Mining	5.9	3.5
Manufacturing	12.7	16.1
Commerce and Services	61.8	54.4
Total	100.0	100.0

Table 2.13 EMPLOYMENT BY INDUSTRY, Penang State, 1957 and 1970

	1957		1970		Average Annual Growth Rate 157 - 70
	Number	Percentage	Number	Percentage	
Agriculture hunting and fishing.	30,304	18.6	39,048	18.2	
Agriculture products.	19,390	11.9	16,890	7.9	
1. Agriculture and fishing	49,684	30.5	55,938	26.0	0.9
2. Manufacturing	19,363	11.9	34,503	16.1	4.5
Mining and Quarrying	878	0.5	621	0.3	
Construction	6,901	4.2	6,970	3.2	
3. Mining and Construction	7,779	4.7	7,591	3.5	-0.2
Electricity, Gas and Water	1,370	0.8	2,384	1.1	
Transport and Communication	15,533	9.5	16,982	7.8	
4. Electricity and Transport	16,903	10.4	19,366	9.0	1.1
Commerce	31,148	19.1	39,683	18.5	
Services	38,130	23.4	57,182	26.9	
5. Commerce and Services	69,278	42.5	97,495	45.4	2.7
Total	163,023	100.0	214,893	100.0	2.1

Table 2.14 NUMBER OF PERSONS EMPLOYED by INDUSTRY (1) and (2), Penang State, 1975 - 1979

	1975		1976		1977		1978		1979		Average Annual Growth Rate %
	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage	
1. Agriculture	7,557	6.1	7,619	5.7	7,401	5.3	7,933	5.2	8,101	5.1	1.8
2. Manufacturing	54,275	43.5	61,839	45.9	67,339	47.8	76,218	49.9	79,984	50.4	10.2
3. Mining and Construction	2,338	1.9	2,473	1.8	2,757	2.0	3,137	2.1	3,301	2.1	9.0
4. Transportation	6,940	5.6	7,572	5.6	7,483	5.3	7,797	5.1	7,790	4.9	2.9
5. Commerce and Services	53,629	43.0	55,109	40.9	55,988	39.7	57,772	37.8	59,482	37.5	2.6
Total	124,739	100.0	134,612	100.0	140,968	100.0	152,857	100.0	158,658	100.0	6.2

Notes: (1) 20 employees and over only.
(2) Labour Force and Industrial Department.

2.1.4 Household Income Distribution

Data on monthly household income in the State of Penang and in the Study Area obtained from NIDAS 1977 is represented in Table 2.15.

The average household income is M$ 427 per month in the State with the figures showing that 67.62 percent of households earn an amount which is below the average household income.

These inferences are graphically represented in Fig. 2.1.

Fig. 2.1 shows the cumulative distribution of household income. From this figure, we observe that 51.6 percent of households in the State of Penang earn an income of less than M$ 300 although the calculated average household income is M$ 427.

The household income distribution in the internal Study Area and the external area can be seen from Table 2.15.

The average household income in the internal area is M$ 499 but 40.9 percent of households earn less than this while in the external area the average is M$ 239 of which 54.1 percent are earning less than M$ 200.

Fig. 2.1 shows the cumulative distribution of household income for the internal and external Study Area respectively. Here we observe that 60.1 percent of households in the internal area earn less than M$ 400 although the calculated average household income is M$ 499. In the external area we see that 54.1 percent of households earn less than M$ 200 while the calculated average household income is M$ 239. In the latter the differance in the figures is slight.

Another observation that can be made is that 60.1 percent of households in the internal area earn less than M$ 400 whereas 88.9 percent of households in the external area earn less than M$ 400.

Table. 2.16 shows the average household income by zone. Here we see that households in zones 100, 200 and 500 earn higher incomes than households in zones 400 and 800. Also, the highest income of M$ 687 is earned by households in zone 200 whereas the lowest household income is earned in zone 800. This is because zones 100, 200 and 500 are in the urban area and zones 400 and 800 are in the rural area which are largely agricultural.

Table 2.15 MONTHLY HOUSEHOLD INCOME DISTRIBUTION
PENANG STATE : 1977

Area / Income Categories	M$ 1 - 99	M$ 100 - 199	M$ 200 - 299	M$ 300 - 399	M$ 400 - 499	M$ 500 - 799	M$ 800 - 1499	M$ 1500 and above	AVERAGE HOUSEHOLD INCOME
	%	%	%	%	%	%	%	%	
STATE OF PENANG	9.05	19.25	23.29	16.03	9.47	11.17	7.69	4.07	M$427
INTERNAL STUDY AREA	4.36	14.03	24.04	18.02	11.46	13.83	9.89	5.38	M$499
EXTERNAL AREA	21.29	32.83	23.94	10.83	4.29	4.20	1.97	0.66	M$239

Source: NIDAS 1977

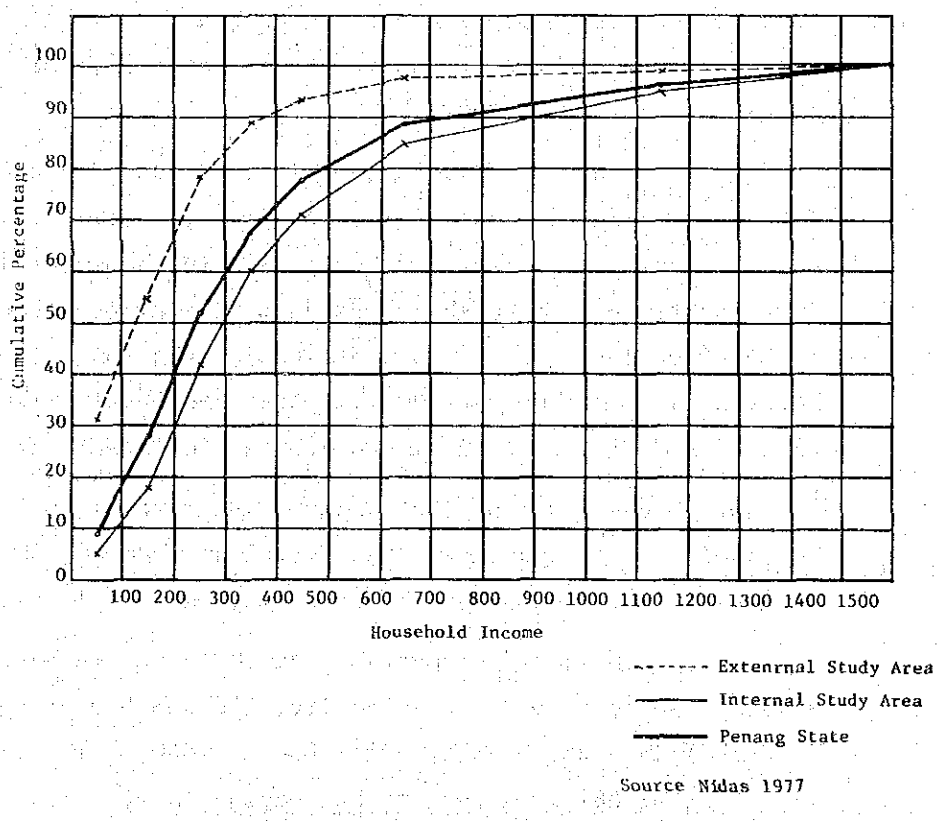

Fig. 2.1 Cumulative Distribution 1977
(Monthly Household Income in $M)

Table 2.16 AVERAGE HOUSEHOLD INCOME BY ZONES OF STUDY AREA
Study Area, 1977

TRAFFIC ZONES	AVERAGE HOUSEHOLD INCOME ($M)
100	533.6
200	687.0
300	591.2
400	396.9
500	425.0
600	511.8
700	391.8
800	298.6
Total	479.5

Source: NIDAS 1977

2.1.5 Existing Land Use

The overall pattern of land use within the Study Area is as follows:

In George Town, most of the land is already built-up apart from mountainous areas. However, there are still many areas suitable for development or redevelopment within the built-up area.

In other areas in Penang Island, there are still many areas of undeveloped or under developed land while in Province Wellesley, there exist many good agricultural areas especially padi lands. Some of the areas in Butterworth and its surroundings are still under developed. At present, the area (in hectares) devoted to differant land uses are roughly as follows:

	Penang 1) Island	Province 1) Wellesley
Residential	2,700 has	3,180 has
Commercial	400	
Institutional	390	
Industrial	360	1,510
Open Space and others	10,850	17,340
Total	14,700	22,030

1) Study Area only

It seems that approximately 1,500 hectares are occupied by industrial use in Province Wellesely. However, approximately 20 percent only of this area is occupied while the rest is presently being developed.

Fig. 2.2 and 2.3 illustrate existing land use in the study area.

The development trend during 1974 to 1977 is illustrated in Fig. 2.4 to 2.7. From these figures it is concluded that development has been moving from George Town to the suburbs, especially to the Bayan Lepas area with this trend continuing in the future.

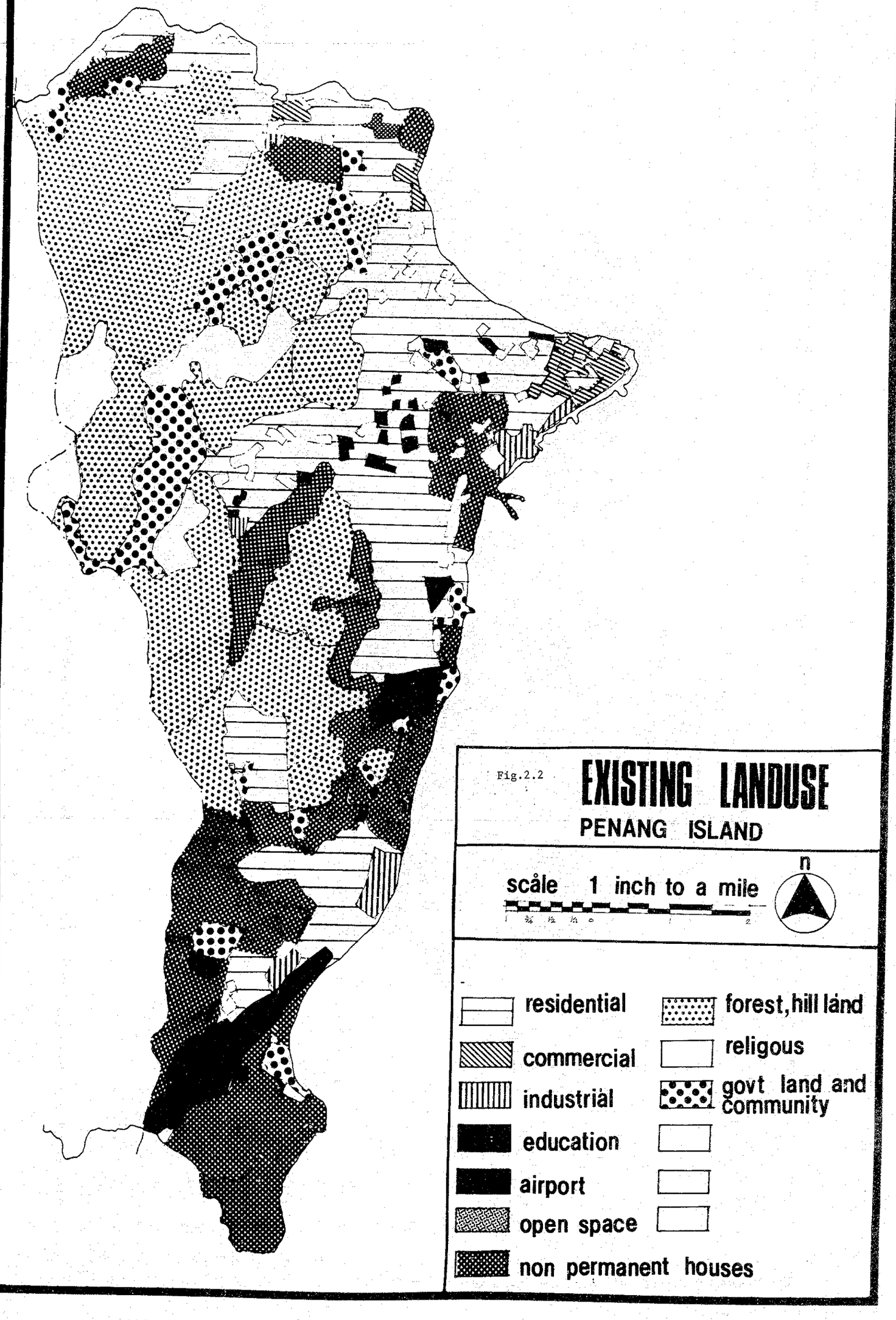
Fig.2.2
EXISTING LANDUSE
PENANG ISLAND
scale 1 inch to a mile
n
residential
commercial
industrial
education
airport
open space
non permanent houses
forest, hill land
religous
govt land and community

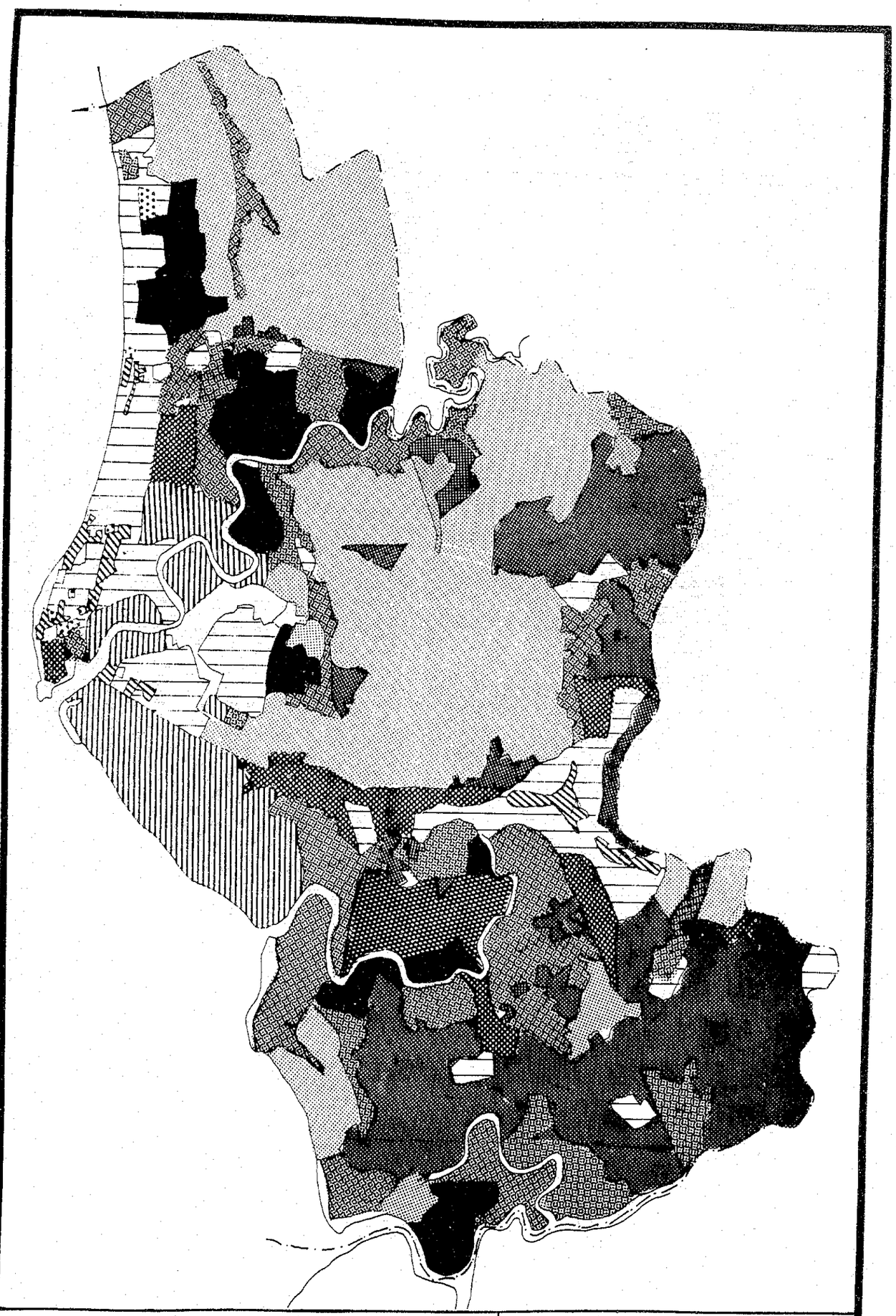

Fig.2.3 **EXISTING LANDUSE**
PROVINCE WELLESLY

scale 1 inch to 1 mile

n

Legend

- residential
- industrial
- commercial
- non-permanent houses
- padi fields
- rubber
- other agriculture
- swampy land
- education
- airport

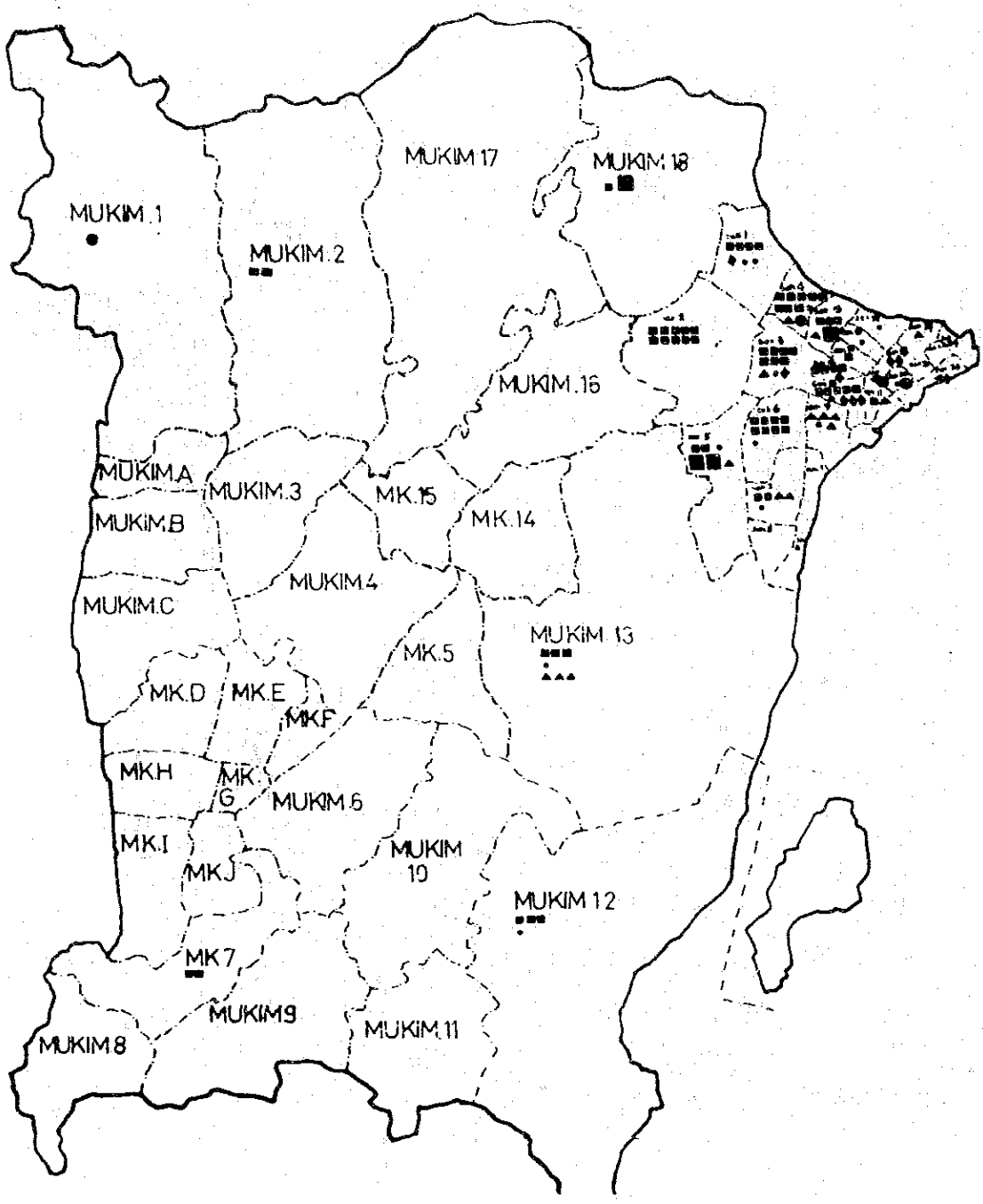

Fig. 2.4 Development Pressure
Penang Island 1974

Housing		Commercial		Mixed	Other	Total
■ 1-50 Units	■ above 50 Units	● 1-4 Stories	● above 4 Stories	◆	▲	
68	4	15	3	10	16	116

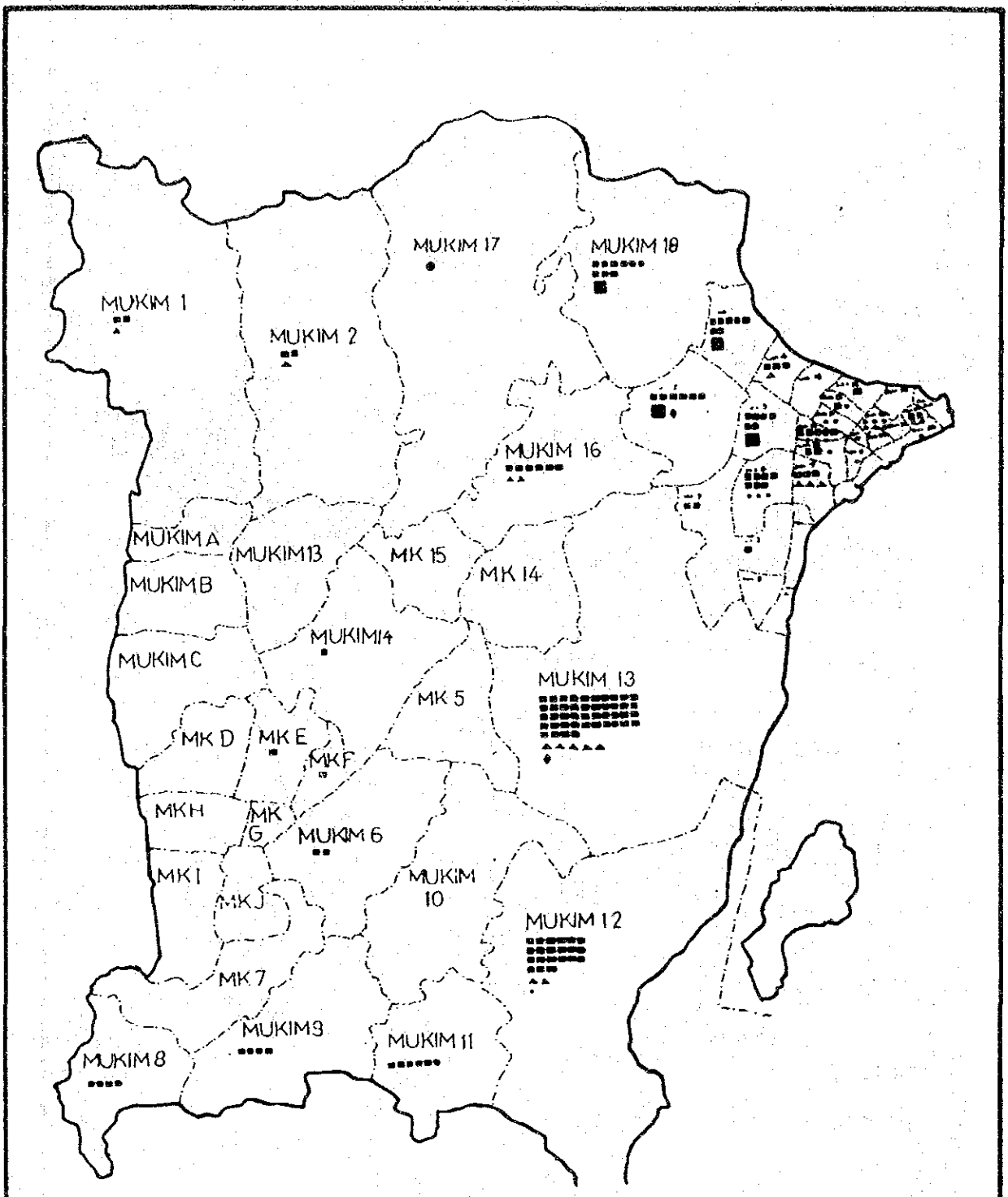

Fig. 2.5 Development Pressure
Penang Island 1975

Housing		Commercial		Mixed	Other	Total
■ 1-50 Units	■ above 50 Units	● 1-4 Stories	● above 4 Stories	◆	▲	
150	4	24	1	2	15	196

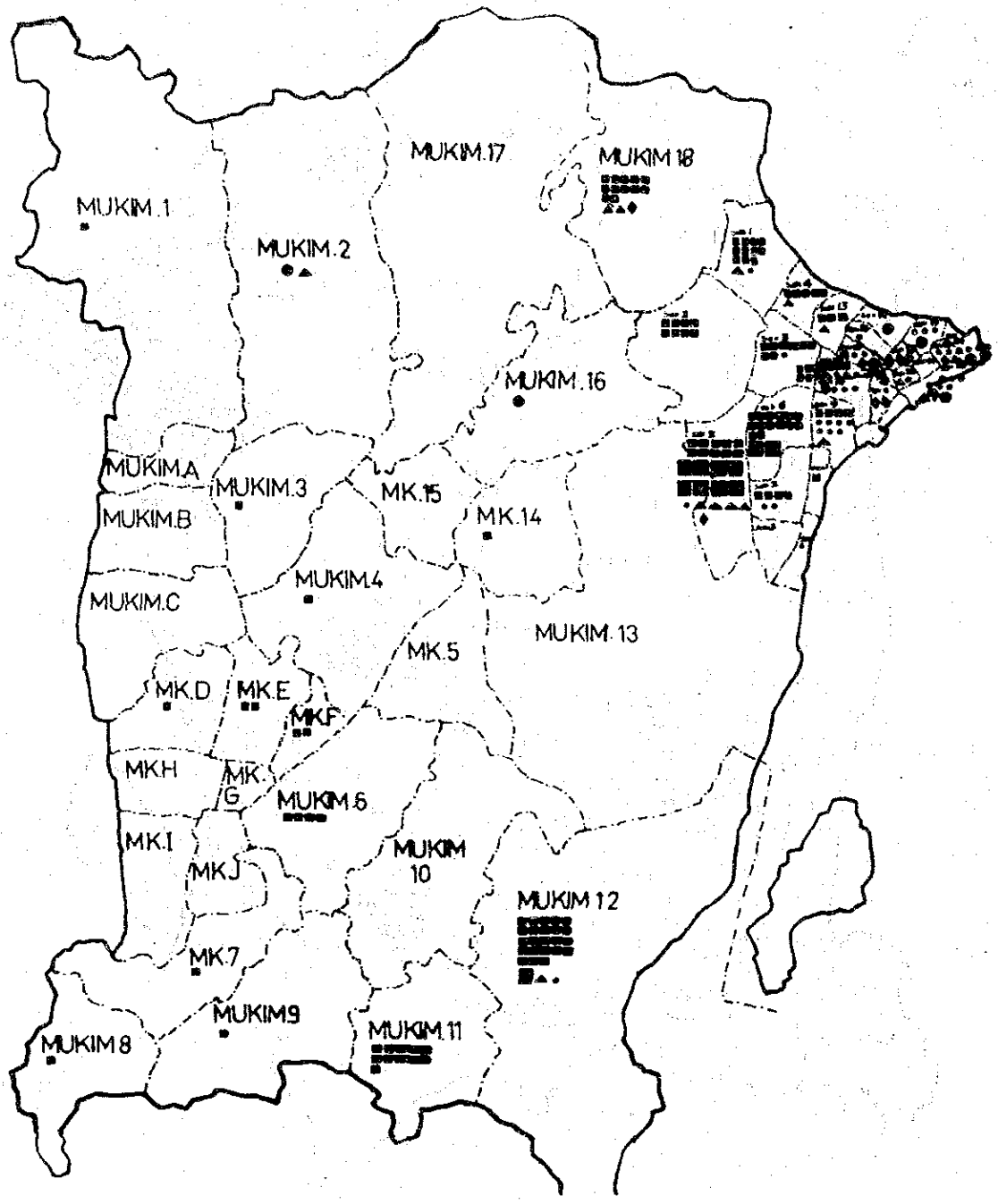

Fig. 2.6 Development Pressure
Penang Island 1976

Housing		Commercial		Mixed	Other	Total
■ 1-50 Units	■ above 50 Units	● 1-4 Stories	● above 4 Stories	◆	▲	
195	11	49	8	12	22	299

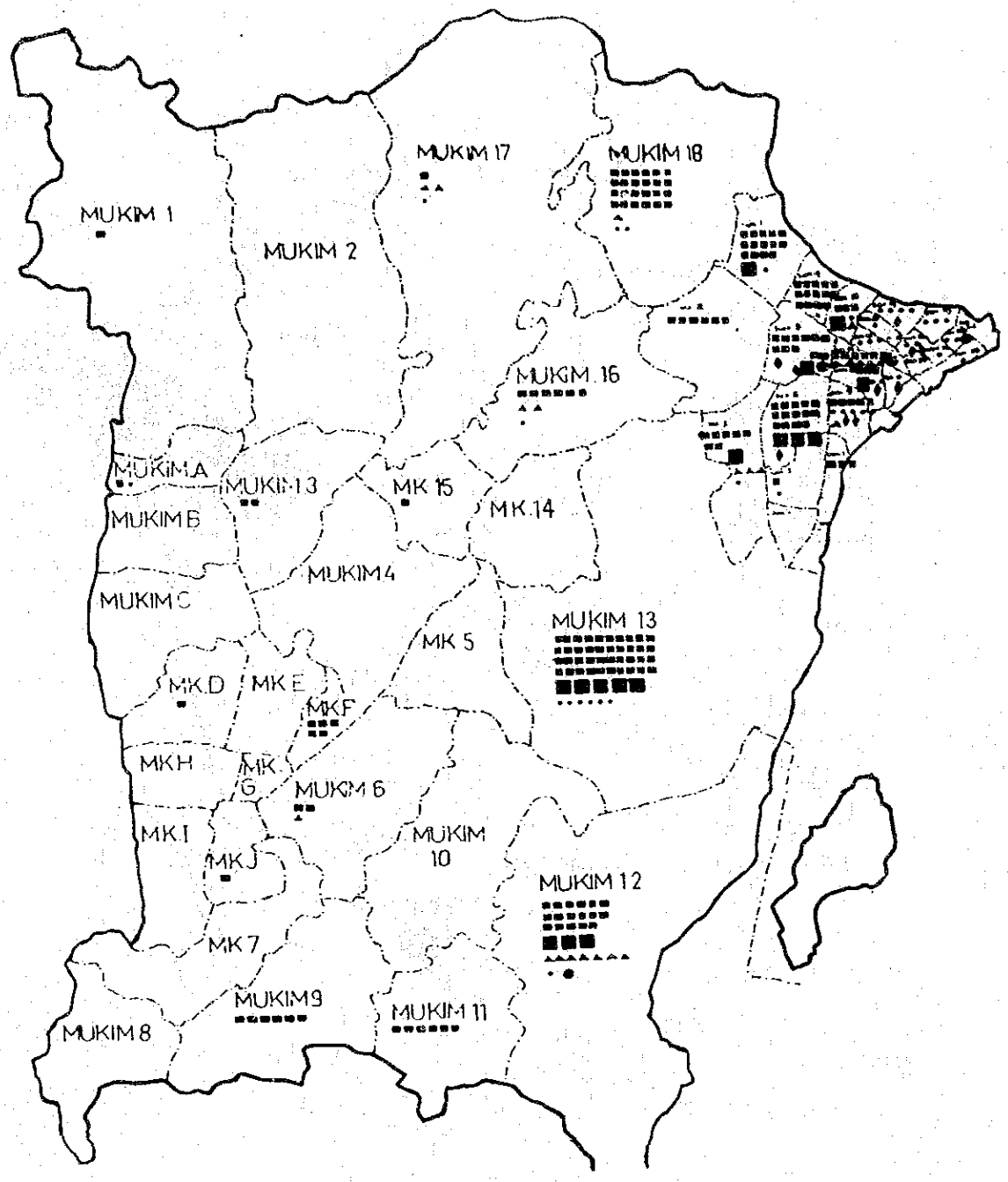

Fig. 2.7 Development Pressure
Penang Island 1977

Housing		Commercial		Mixed	Other	Total
■ 1-50 Units	■ above 50 Units	● 1-4 Stories	● above 4 Stories	◆	▲	
68	4	15	3	10	16	116

2.2 Framework Plan

2.2.1 Population Projection for the State of Penang

Based on the population of 1980 projected by the Department of Statistics, three (3) cases of population growth rate were prepared:

CASE - A: The present population growth rate will be maintained (2.2%)

CASE - B: The same rate as given in the "Federal Route 1 Study" (2.4%)

CASE - C: The same rate as given in "Third Malaysia Plan" and "Penang Linkage Study" (2.6%)

Table 2.17 POPULATION PROJECTIONS, Penang State, 1970 - 2000

	1970*	1979*	1980*	1985	1990	2000
CASE A	776,124	946,580	968,220	1,079,500	1,203,600	1,496,300
CASE B	776,124	946,580	968,220	1,090,100	1,227,300	1,555,800
CASE C	776,124	946,580	968,220	1,200,800	1,251,500	1,617,800

* Source: Department of Statistics

The population estimated for the year 2000 ranges from 1,500,000 to 1,600,000. The median estimation will be adopted for use in this study.

Resulting from the projection, the net natural increase is 1.2 percent per annum and the migration rate is 1.1 per cent per annum.

Table 2.18 PROJECTION OF AGE COMPOSITION
Penang State, 1970 - 2000

	1970(1)	1979(2)	1985	1990	2000
0 - 14	318,754 (41.1)	347,390 (36.7)	390,200 (35.2)	427,000 (34.8)	510,000 (32.8)
15 - 24	159,314 (20.5)	210,140 (22.2)	249,600 (22.9)	283,400 (23.1)	363,900 (23.4)
25 - 64	270,746 (34.9)	353,070 (73.3)	407,700 (37.4)	466,330 (38.0)	615,800 (39.6)
65 and over	27,310 (3.5)	35,970 (3.8)	42,500 (3.9)	50,300 (4.1)	65,300 (4.2)
Total	776,124 (100.0)	946,580 (100.0)	1,090,000 (100.0)	1,227,000 (100.0)	1,555,000 (100.0)

Note: (1) 1970 census
(2) Population Projection 1970 - 1980

2.2.2 Future Economic Activities

2.2.2.1 Gross Domestic Product

The economic growth of Malaysia has increased significantly within the last 10 years. Despite the serious oil crisis, the Malaysian economy has expanded and has been able to grow at a high rate.

The average annual growth rate of the Gross Domestic Product within the last 9 years was recorded as about 7 percent and that within the last 3 years as about 8.7 percent.

Considering these past trends and circumstances of the world economy, the team projects the future Gross Domestic Product as follows:

High-rate Projection : It is expected to grow at an average annual growth rate of 8.5 percent between 1980 and 1990, and 8.0 percent between 1990 and the year 2000.
(According to the EPU Porjection)

Medium-rate Projection: An average annual growth rate of 8.1 percent between 1980 and 1990 and 7.0 percent between 1990 and the year 2000 is expected.

(According to the growth rate of TMP)

Low-rate Projection : The GDP is expected to grow at an average annual growth rate of 7.7 percent between 1980 and 1990 and 6.0 percent between 1990 and the year 2000.
(According to the annual growth rate of "Mid-term Review of TMP between 1978 and 1980)

Table 2.19 shows the results of the Gross Domestic Product Projections.

Table 2.19 PROJECTION OF GROSS DOMESTIC PRODUCT
($ Million in 1970 Prices)

		Gross Domestic Product	Average Annual Growth (%)
1978 (Base Year)		22,284	-
1980 1)		25,825	7.7
1985	High 2)	38,800	8.5
	Medium 3)	38,100	8.1
	Low 4)	37,400	7.7
1990	High 2)	58,600	8.5
	Medium 3)	56,300	8.1
	Low 4)	54,200	7.7
2000	High 3)	126,500	8.0
	Medium 2)	115,100	7.0
	Low 4)	97,060	6.0

Note: 1) Mid-Term Review of TMP.
2) Projected by EPU.
3) Projected by the Team using the growth rate of TMP.
4) Projected by the Team.

2.2.2.2 Gross Regional Product in the State of Penang

The economy of the State of Penang has also recorded high and rapid rates of growth in the last 9 years. The average annual growth rate of Gross Regional Product (GRP) was 9.6 percent in the last 9 years and 6.9 percent within the last 3 years. Therefore,

the proportion of the GRP to the GDP has increased from 7.4 percent in 1970 to 8.2 percent in 1978.

It is expected that there will be an increase of the proportion of the GRP to the GDP in the future from 8.2 percent in 1978 to 8.6 percent in 1985 and 9.3 percent in the year 2000. Using the GDP and the proportion share of the GRP of the State of Penang to the GDP, the Gross Regional Product is projected in Table 2.20.

The GRP is divided into the industry of origin using an average annual growth rate of TMP by industry (Table 2.21), subsequently, Table 2.22 shows the future Gross Regional Product by Industry of Origin.

Table 2.20 PROJECTION OF GROSS REGIONAL PRODUCT
Penang State, 1978 - 2000
($ Million in 1970 Prices)

		Gross Regional Product Penang State	Gross Domestic Product	Percentage to Gross Domestic Product (%)
1978	(Base)	1,817	22,284	8.2
	High	3,340	33,800	
1985	Medium	3,280	38,100	8.6
	Low	3,220	37,400	
	High	5,160	58,600	
1990	Medium	4,950	56,300	8.8
	Low	4,770	54,200	
	High	11,800	126,500	
2000	Medium	10,700	115,100	9.3
	Low	9,000	97,060	

Table 2.21 GROSS REGIONAL PRODUCT BY INDUSTRY OF ORIGIN
Penang State, 1970 - 1990

	Gross Regional Product				Average Annual Growth (%)		
	1970	1975	1980	1990	1975-1980	1980-1990	1975-1990
Agriculture, fishing etc.	155.0	171.2	212.1	299.9	4.4	3.5	3.8
Mining and Construction	47.0	70.2	104.6	226.2	8.3	8.0	8.1
Manufacturing	101.2	229.0	433.3	1593.3	13.6	13.9	13.8
Services	491.5	711.0	1035.8	2057.4	7.8	7.1	7.3
Total	794.7	1181.4	1785.8	4176.8	8.6	8.9	8.8

Source: Third Malaysia Plan. Outline of Perspective Plan, 1971 - 90

Table 2.22 PROJECTION OF GROSS REGIONAL PRODUCT BY INDUSTRY OF ORIGIN
Penang State, 1978 - 2000

	Gross Regional Product (Million $)				Average Annual Growth Rate (%)		
	1978	1985	1990	2000	1978-1985	1985-1990	1990-2000
Agriculture, fishing etc.	168	213	250	330	3.5	3.3	2.8
Mining and Construction	77	130	183	330	7.8	7.1	6.1
Manufacturing	480	1180	2128	6010	13.7	12.5	10.9
Services	1092	1757	2389	4030	7.0	6.3	5.4
Total	1817	3280	4950	10700	8.8	8.6	8.0

Notes: 1) Medium projection

2) An average annual growth is used for that of Penang State in TMP.

2.2.3 Employment Projection

2.2.3.1 Labour Force

Table 2.23 presents the labour force projection for the year 2000. In this projection, major factors considered are as follows:

1. The age composition of the labour force population is slightly higher in the future than at present due to a decrease in the birth and death ratios. Therefore, there will be an increase in the percentage of the working age population (15 years and above) in the future.

2. Past trends show that the participation ratio (1) has slightly increased between 1957 and 1970. Considering this trend and prospects between labour supply and demand, the participation ratio will be increased in the future.

3. Following the increase of economic activities, the unemployment rate has been decreasing between 1970 and 1979. Considering this trend, the unemployment ratio will be decreased by 4.0 percent in 1990 and the year 2000. From this unemployment ratio, it can be said that there will be a full employment situation in 1990 and the year 2000.

In this projection, the labour force in the year 2000 will be about 542,000 with the increase in labour force between 1970 and the year 2000 reaching 327,000.

Note: (1) The participation ratio is the rate of labour force to working age population, i.e $\frac{\text{Labour Force Population}}{\text{Working Age Population}}$

Table 2.23 LABOUR FORCE PROJECTION
Penang State, 1970 - 2000

	1970 (1)	1979	1985	1990	2000 (2)
Population	776,124	946,580	1,090,000	1,227,000	1,555,000
Percentage 15 years and over (%)	59.1	63.3	64.2	65.2	67.2
Population 15 years and over	457,370	599,180	699,800	800,000	1,045,000
Participation Rate (%)	51.4	52.2	52.7	53.2	54.0
Labour Foce Unemployment	234,902	312,770	368,800	425,600	564,300
Rate (%)	8.5	6.0	4.9	4.0	4.0
Employed Population	214,893	294,000	350,700	408,600	541,700

Notes : (1) Population Census
(2) Others projected by the Team

2.2.3.2 Employment by Industry

On the basis of the labour force projections mentioned previously, employment by industry is projected using the growth rate of Gross Regional Product by industry of origin. However, two factors of growth are included in the growth rate of GRP; one is the increase of labour productivity and the other is the increase in production in proportion to the employment. The team therefore assumes the following growth rate of employment in the projection:

	1979-1985	1985-2000
Agriculture	-2.5%	-4.9%
Mining and Construction	2.4%	2.5%
Manufacturing	5.9%	4.6%
Commerce and Services	3.0%	3.0%

As a result, Table 2.24 shows employment projection by industry.

Table 2.24 EMPLOYMENT BY INDUSTRY (1)
Penang State, 1979-2000

		1979	1985	2000
Agriculture	Number	53,690	46,330	21,670
	Increase	-	-7,360	-32,020
Mining & Construction	Number	9,360	10,810	15,710
	Increase	-	1,450	6,350
Manufac-turing	Number	82,700	116,350	229,700
	Increase	-	33,650	147,000
Commerce & Services	Number	148,290	177,210	174,640
	Increase	-	28,920	126,350
Total	Number	294,000	350,700	541,700
	Increase	-	56,700	247,700

Note: (1) Estimated and projected by the Team.

2.2.4 Vehicle Ownership

During 1965 to 1979, the number of vehicles registered in the State of Penang has been increasing rapidly at an average rate of almost 10 percent per annum. Especially in the 1970 to 1975 period, extremely high growth rates of almost 12 percent per annum were recorded. However, in comparison with Peninsular Malaysia, the growth rate of vehicle registration during 1965 to 1977 is still lower in the State of Penang.

In 1979, the vehicle ownership level in the State of Penang is 82.6 vehicles (exculding motor-cycle) and 214.6 vehicles (including motro-cycle) per thousand persons.

As to the composition of vehicle types, 65,000 vehicles or 32 percent of total vehicles are shared by private cars and 125,000 vehicles or 62.0 percent by motor-cycles.

The number of vehicles is projected by using the past trend and by considering the income level in the future, shown in Table 2.25.

By the year 2000, the vehicle ownership level, excluding motor-cycles, will be expected to increase from 82.6 vehicles in 1979 to 125 vehicles in the year 2000. On the other hand, the motor-cycle ownership level will be expected to decrease slightly from 132 vehicles to 128 vehicles. In this projection, it is judged that motor-cycle owners will convert to car owners in proportion to the expected increase in family income.

Table 2.25 PROJECTION OF VEHICLE OWNERSHIP
Penang State and Study Area, 1979, 1985 and 2000
(1000 vehicles)

	1979		1985		2000	
	Penang State	Study Area	Penang State	Study Area	Penang State	Study Area
Car	65.4	59.3	91.6	79.8	161.5	136.1
Taxi	0.5	0.4	0.7	0.6	1.2	1.0
Lorry	11.4	9.4	16.0	13.0	28.3	22.9
Bus	1.1	0.9	1.5	1.2	2.7	2.2
Total (A)	78.3	69.9	109.9	94.6	193.8	162.2
Motor-cycle (B)	125.0	105.1	140.3	116.6	199.0	163.8
Grand Total (c)	203.3	175.0	250.2	211.2	392.8	326.0
Population (D) (1000 people)	947.5	723.9	1,090.0	837.0	1,555.0	1,207.0
A/D x 1,000	82.6	95.6	100.8	113.0	124.6	134.4
B/D x 1,000	131.9	145.2	128.7	139.3	128.0	135.7
C/D x 1,000	214.5	240.8	229.5	252.3	252.6	270.1

2.3 Land Use Plan

2.3.1 Procedure of Land Use Planning

Fig. 2.8 illustrates the procedure of land use planning undertaken in this study. Prior to the land use study, a frame work plan of a socio-economic study was made.

Based on the framework plan, a general guideline for land use planning was prepared taking into consideratаion existing conditions, planned and proposed land development projects and land use zoning.

The conceptual development plans and details were prepared following this guideline. After careful examination of alternative concepts, a basic concept adopted in the land use plan is selected. At the same time, transport plans and projects proposed by the previous studies and related agencies were identified. The Study Area was divided into urban areas and rural areas with the urban areas further divided into planned areas and others.

In the planned areas, the conditions of plans and projects were

provided by the relevant agencies and therefore the team carefully reviewed these and prepared the conditions.

For other urban areas, the land use plan was prepared on the basis of the framework plan.

By using all these plans, an entire land use plan for the Study Area was prepared which was considered compatible with the transport plan.

On the basis of the land use plan, the population distribution of each zone was projected by assuming future population density and land use area.

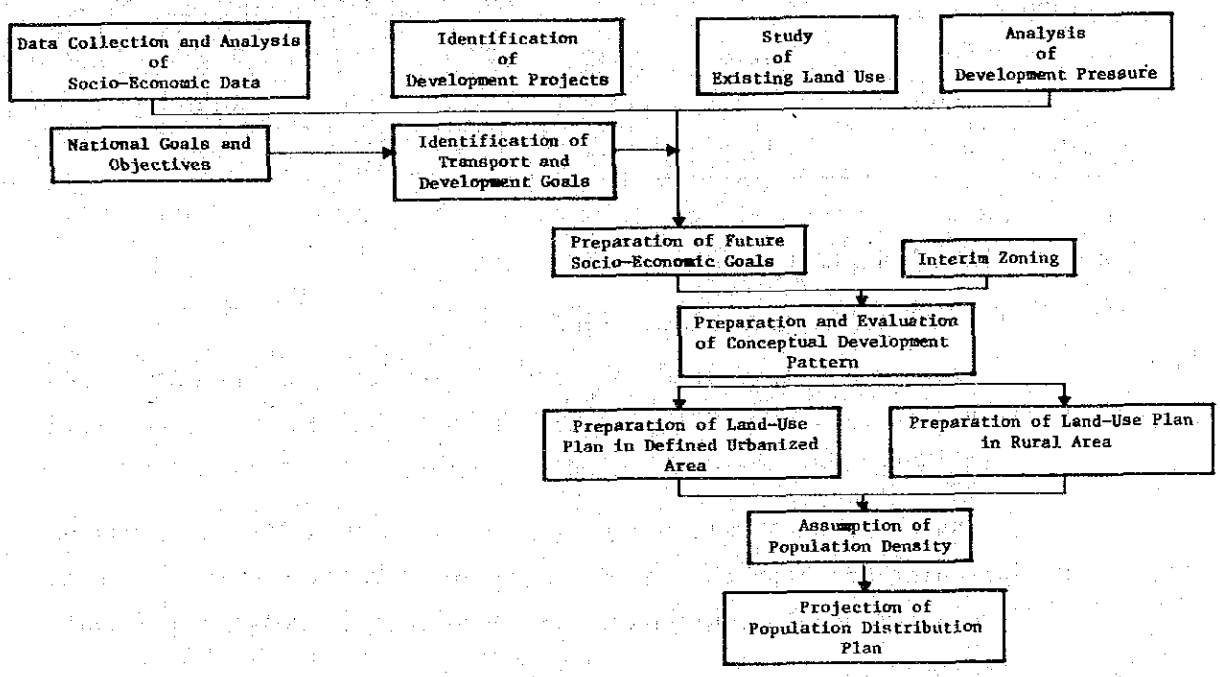

Fig. 2.8 LAND USE PLANNING PROCEDURE

2.3.2 Guideline of Land Use Planning

The following guideline is adopted in land use planning:

1. Basically the Interim Zoning Plan is adopted for our land use study.
2. However, there seems to be a lack of clarity concerning the holding capacity of each land use in the Interim Zoning. The team therefore, examined and analysed future land use demand and supply and prepared compatible land utilization areas with land use demand.
3. The Interim Zoning was partially modified by plans and pronects proposed by the relevant agencies. The projects are as follows:
   1) Penang Container Port Project.
   2) Eastern Airport Development Project and others.
4. The transport network plan was prepared with the point of view of promoting land utilization in the Interim Zoning.
5. In the Interim Zoning, attention was given to the maintenance of good environmental conditions with the team also working to this goal.
6. Rural development as well as urban development are very important issues in the policy of the State of Penang. Bearing this in mind, rural development as well as urban development was given importance.
7. Consideration was given to the latest development pressures of each land utilization in land use planning.

2.3.3 Conceptual Development Plans

The conceptual development plans are illustrated in Figs. 2.9, 2.10 and 2.11.

The major features of these alternatives are described below:

Alternative A (as shown in Fig. 2.9)

1. Structurally, for Penang Island, there are two (2) major urban cores. One is George Town and the other is Bayan Lepas.

The development site at Balik Pulan in the external area will not be very greatly expanded.

As far as major land use is concerned, the industrial area in Penang Island will not be extended in the future.

2. In Butterworth, there is an abundance of suitable land viz. areas to the north, east and south of existing urban areas. Considering the compatibility of port highway and residential development, industrial areas are located within the inland areas.

   The improved Federal Route - 1 will be as far removed as possible from existing urban area, so that reserve land will be available for future expansion of the built-up area.

Alternative B (as shown in Fig. 2.10)

1. Penang Island is composed of two (2) major urban cores and one (1) sub-core. The development of Balik Pulau in the external area is expected to be one of these cores.

2. In Butterworth, urbanization is progressing at a slower rate while Bukit Mertajam is developed on a small scale as a more or less self contained district center.

   As an alternative, Penang Island will develop more as a residential area, while Butterworth will serve as an employment area.

Alternative C (as shown in Fig. 2.11)

Alternative C is a combination of Alternative A and B. For Penang Island, development pattern B is adopted while for Butter- Major features are as in the above description.

The team is of the opinion that Alternative C is the most likely choice for the Study Area.

The reasons are as follows:

1. The plan is basically aimed at self-contained development either for Penang Island or Province Wellesley.

2. The plan follows the current development trends and current government policies.

3. For Province Wellesley, it is desirable to expand the existing

urban area to Bukit Mertajam.

For Penang Island, from the future development viewpoint, in that Balik Pulau will be the new development core.

4. There is an abandance of suitable areas for industrial development in Province Wellesley. In addition, the transport system including the new contianer port will be further improved in the near future. Considering these advantages, it is desirable to develop Province Wellesley.

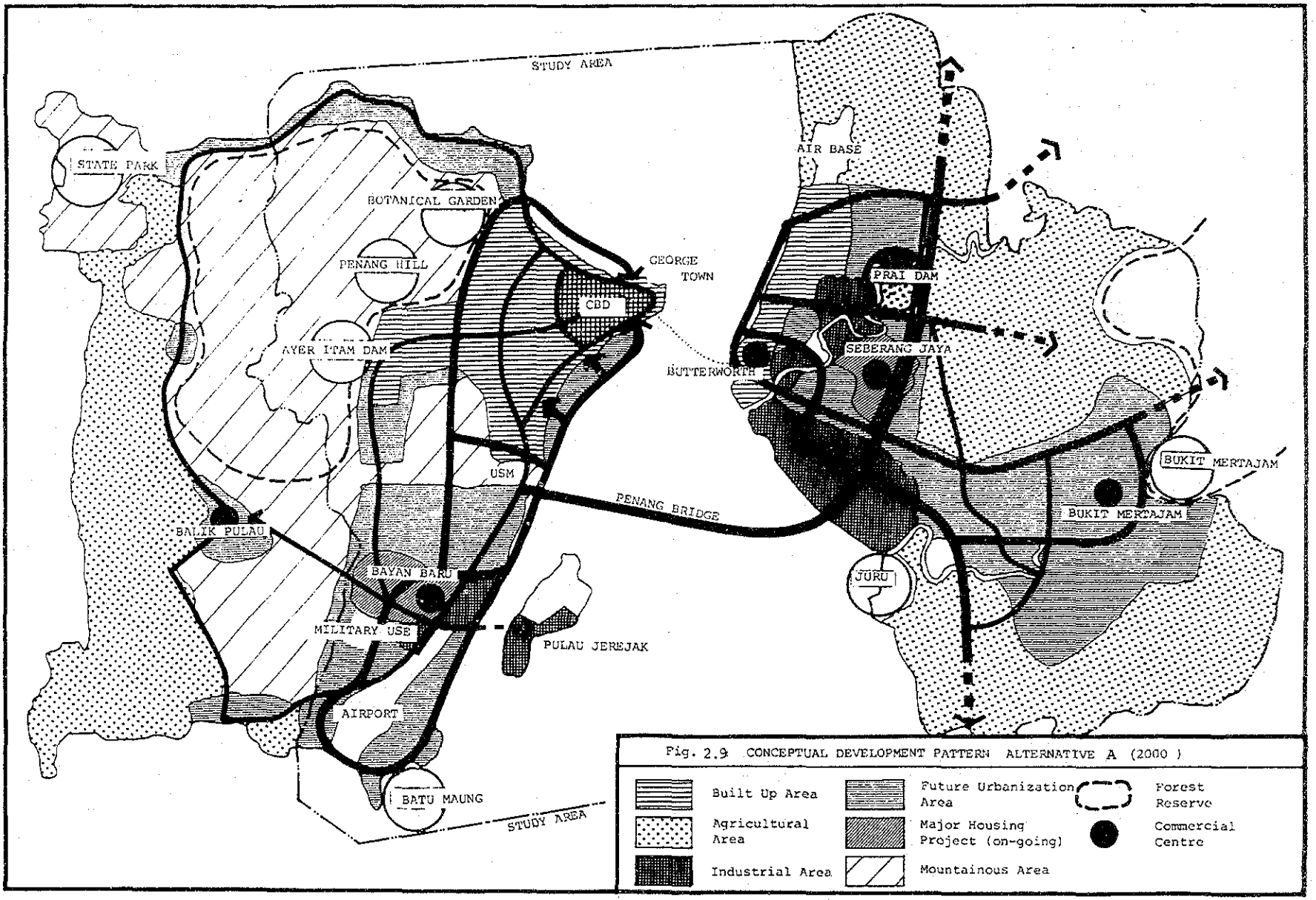

Fig. 2.9 CONCEPTUAL DEVELOPMENT PATTERN ALTERNATIVE A (2000)

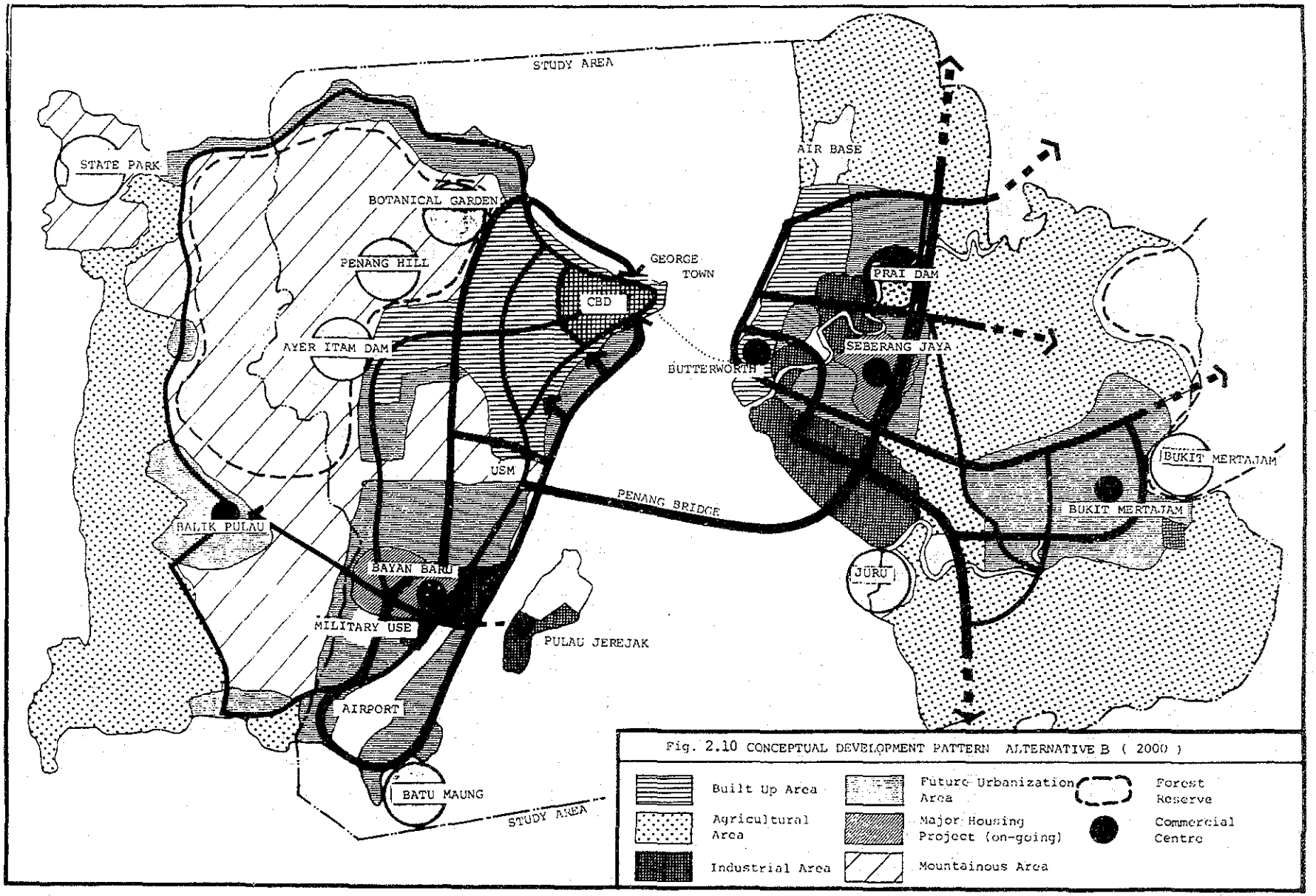

Fig. 2.10 CONCEPTUAL DEVELOPMENT PATTERN ALTERNATIVE B (2000)

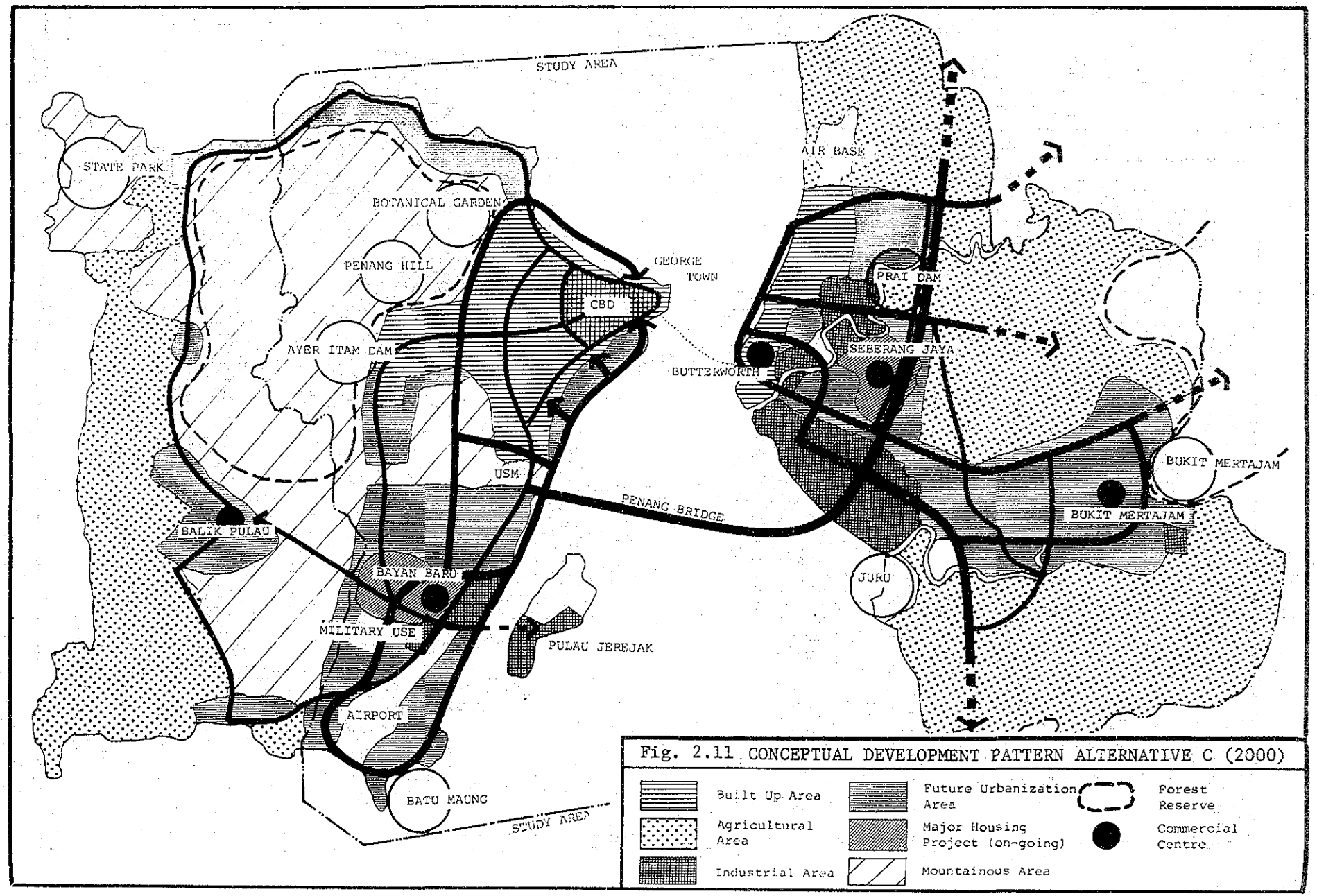

Fig. 2.11 CONCEPTUAL DEVELOPMENT PATTERN ALTERNATIVE C (2000)

2.3.4 Land Use Plan

2.3.4.1 Demand for Space

Corresponding to the economic development of the State, more space will be utilized for this activity.

This section describes the estimate of the demand for space in line with the future economic frame of the Study Area as given in the previous chapter.

A. Residential Area

Regarding populations, the residential population in the State of Penang is expected to increase from 950,000 in 1979 to 1,550,000 in the year 2000. Thus, the need for residential area relevant to future increase in population will be as follows:

Increase in Population during 1979 to 2000	600,000 persons
Average Gross Residential Population* Density	100 persons/ha.
Required Residential Area	6,000 ha.

* Existing average gross population density is 110 persons/ha.

Additional residential area required in the State of Penang by the year 2000 is about 6,000 hectares. Taking into account this expected increase in demand, the supply of residential area is examined by using the residential area proposed in the Interim Zoning Plan.

In the Study Area, about 4,800 hectares or 80 percent of this area will be supplied by the year 2000. Both Penang Island, and Province Wellesley, will get an equal share of this area i.e. 50 percent of the total area each.

B. Commercial Area

According to the employment projection mentioned in Fig. 2.2 of this section, employment in tertiary industry is expected to increase from 148,000 in 1979 to 175,000 in the year 2000. The actual increase in employment in the tertiary industry will be 127,000 for the next 20 years. At present, the share of the existing commercial and business sectors in the Study Area are

as follows:

Penang Island	210 hectares
Province Wellesley	160 hectares
Total	370 hectares

It is assumed that the existing employment density in the commercial and business areas is about 400 per hectare. In this study, it is assumed that this density will decrease from 400 in 1979 to 300 by the year 2000. On the basis of this assumption, the need for commercial and business areas by the year 2000 will be 920 hectares in the Study Area.

C. Industrial Area

At present, the following industrial development plans exist.

1. In Province Wellesley
   1) Prai Industrial Estate
   2) Mak Mandin Industrial Estate
   3) Bagan Serai Industrial Estate
2. In Penang Island
   1) Bayan Lepas Industrial Estate
   2) Bayan Lepas Free Trade Zone
   3) Pulau Jerejak Free Trade Zone

The size and present situation of these industrial areas are as follows:

	Present Situation	Ultimate Plan
1. In Province Wellesley	(ha.)	(ha.)
1) Prai Industrial Estate	64 has.	847 has.
2) Mak Mandin Industrial Estate	54	114
3) Bagan Serai Industrial Estate	19	80
2. In Penang Island		
1) Bayan Lepas Industrial Estate	1	50
2) Bayan Lepas Free Trade Zone	46	140
3) Pulau Jerejak Free Trade Zone	18	160

Note: Present situation of industrial development is defined to be those areas that are occupied by factories.

This situation is summed up as follows:

Total ultimate area	1,390 has.
Total land occupied at present	200 has.
Balance	1,190 has.

Available industrial land presently occupies more than 1,190 hectares.

According to the employment projection in the manufacturing industry, the figure is expected to increase from 83,000 in 1979 to 230,000 by the year 2000.
Thus the actual increase in the number employed in the manufacturing industry will be about 147,000 by the year 2000.

Assuming that the employment density of the manufacturing industry is 80 workers per hectare, the shortage of industrial area will be as follows:

Employment on Planned Estates 1,190 has. x 80 workers/ha. = 95,200 workers

147,000 workers - 95,200 workers = 51,800 workers

51,800 workers ÷ 80 workers/ha. = 650 has.

In the land use plan, it was proposed that the following industrial area be expanded and constructed.

1. Prai Industrial Estate (Phase 2)	520 hectares
2. Kg. Pisang Industrial Estate	50 hectares
3. Permatang Keling Industrial Estate	80 hectares
Total	650 hectares

D. Total Demand

According to these assumptions, the increase in area for urban activities total about 6,000 hectares.

Residentital Area	4,800 ha.
Commercial Area	550 ha.
Industrial Area	650 ha.
Total	6,000 ha.

This required area will be supplied by converting waste land, cultivated land and unused land, also, in this Study Area, reclamation will also be expected to meet demand for more space.

2.3.4.2 Allocation of Demand

Taking on-going and committed development projects into account, the future land use pattern was studied in detail. Although the plan alternative C provides the guide - lines for planning at the conceptural level, it does not take into account details. Therefore, the following policies for each category of land use were prepared.

A. Residential Area

In Penang Island recent trends show that residential developments have concentrated in and around Bayan Lepas. This trend is expected to continue in the future. Within the city of George Town, an adequate urban renewel programme is being undertaken. However, no increase of residential area is expected except through land reclamation.

In Province Wellesley, there are many areas for residential development which will expand towards Bukit Mertajm along the existing Federal Route No. 1.

B. Commercial and Business Area

1. The Central Business District (C.B.D.) in George Town is defined as the Regional Center of the State of Penang. The importance of this Regional Center will increase in propotion to the development of the State of Penang. The C.B.D. will expand towards the north of the reclamation site where the Dispersal Road will be constructed and this area will then become a commercial and business area.
2. Allocation will be made for a commercial area in the Bayan Baru Development Project which will serve the Bayan Baru area as well as the Bayan Lepas corridor. This area will comprise the second urban core of George Town.
3. The tourist industry will grow at a rapid rate along the seaside area in the north. This trend will continue in the future.

4. Butterworth is defined as the sub-regional center as well as the center of the district. The commercial area will increase in propotion to the growth in population and other activities. An extension to the northern part of the existing marine port is being planned whereby, the residential area in this vicinity will be converted into a business area.

5. In the Seberang Jaya Development Project, a commercial and institutional area has been planned which is defined as the center of the district. This center will serve the eastern areas of Sungai Perai.

6. The commercial area of Bukit Mertajam, another district center, will also increase in proportion to its population growth.

C. Industrial Area

Most of the factories in Penang are located in the industrial estates in an attempt to reduce environmental problems. Therefore, future demand for industrial activities will be supplied in new industrial estates as far as possible.

In the Central Business District (C.B.D.) of George Town, there exists small-scale industrial factories which produce consumer goods. In the future, the team recommends that these factories be re-located at new industrial estates specified for small-scale industries.

The reasons for this recommendation are as follows:

1. There is no room for expansion of these facilities. If this situation is not remined, productivity will be affected and will not be expected to increase.

2. These factories tend to affect the surrounding environment adversely, therefore, it is neccessary to have safeguards so that a better environment in the future is not an impossible goal to achieve.

Regarding the distribution of cargo and commodities, Province Wellesley will have more advantages than Penang Island because

of the development of the industrial estates, the benefits of a new port, the Federal Route 1 and the East-West Highway.

In Penang Island, the reclaimed area along the Dispersal Road which is developed mainly for residence and commerce will provide space for commodity services and distributions.

D. Open Space and Others

It is desirable to prepare sports fields and public parks of about 30 hectares in the reclamation area where the Dispersal Road will be constructed.

To maintain the urban environment, it is proposed that effective usage of land must be made along rivers, ponds and seashores. Also, the development of Penang Hill should be restrained in order to maintain its pleasant landscape.

To preserve the rich agricultural land in Seberang Prai future development in this area should not be allowed, thus, helping to preserve the urban environment of the surrounding residential areas.

Based on these considerations, the land use plan in the year 2000 is illustrated in Figs. 2.12 and 2.13.

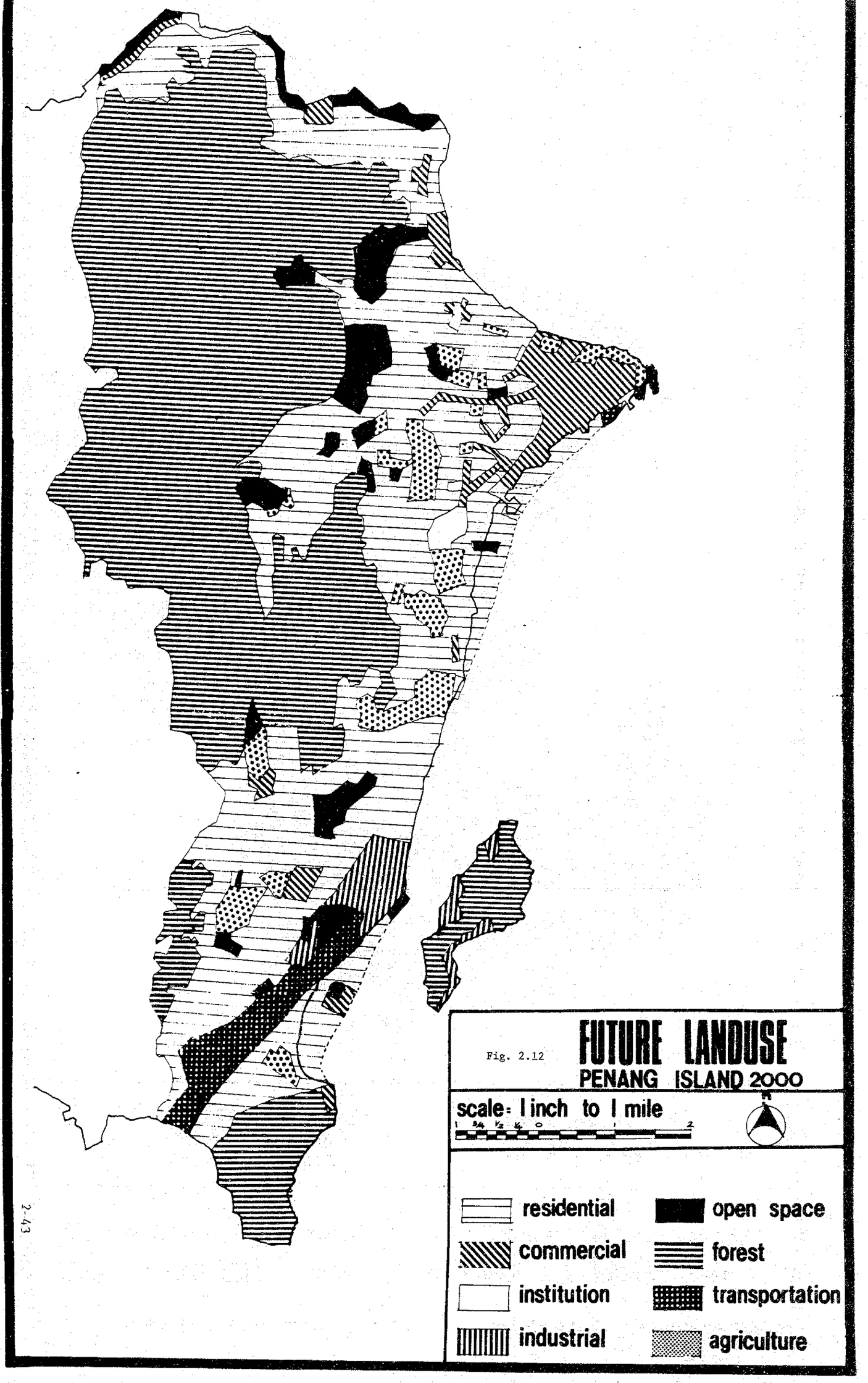
FUTURE LANDUSE
PENANG ISLAND 2000
scale: 1 inch to 1 mile
residential
commercial
institution
industrial
open space
forest
transportation
agriculture

Fig. 2.12