

and it should also encourage the private sector through efficient parking control and financial incentives. For this purpose, it is suggested that the present parking charge for on-street parking be gradually increased.

The estimated capacity of off-street parking to be developed in the C.B.D. is shown below, although the extent to which on-street parking is prohibited and future parking demand is restrained, so as not to produce serious traffic congestion, has a great deal of bearing on this.

Table 8.12 Plan of Off-Street Parking Development in C.B.D

	1981	1990	2000
Recommended Parking Supply	5,990	6,280	6,630
On-Street Parking	2,020	1,430	560
Off-Street Parking	3,970	4,850	6,070

Source: Study Team estimates.

#### 8-4 Investment Requirements

##### 1 Total Investment Requirements and Road Construction/Improvement

Capital investment in transport facilities and equipment by both the public and private sectors in the years to 2000 is estimated at M\$1,437,596,000. Table 8.13 shows that new and improved roads will require investment totalling nearly M\$981,370,000. Short and medium-term traffic engineering and management improvements will entail a further M\$15,600,000. Public transport will require M\$395,140,000, about ten (10) percent of which will be for buses and equipment to be provided by the private sector. See Tables 8.13 to 8.17.

Table 8.13 Investment Requirements by Transport Facility 1983-2000

<u>Transport Facility</u>	<u>Capital Cost ('000 \$)</u>
<u>Road</u>	
Improvements of Existing Roads and Construction of New Roads	939,870
Interchanges and Grade Separations	41,500
Sub-Total	981,370
<u>Public Transport</u>	
New Transit System	341,480
Exclusive Bus Lane	670
Buses and Other Equipment	48,500
Improvements of Bus Stops	4,490
Sub-Total	395,140
<u>Traffic Management</u>	
Improvements of Critical Intersections	2,000
Traffic Circulation System in C.B.D.	10,150
Traffic Signal Improvement	1,530
Pedestrian Facilities and Others	1,920
Sub-Total	15,600
<u>Parking</u>	
Off-Street Parking in Central Business Area	20,360
<u>Transport Terminals</u>	
Passenger Terminal Complex/Bus Terminal	17,677
Freight Terminal	9,449
Sub-Total	27,126
Total investment for all Programmes	1,439,596

**Table 8.14 Implementation Programme for Road Constructions and Improvements**

No. of Roads	Name of Roads	Number of Lanes	Total Length (km)	Phase			Project cost ('000 \$)
				1	2	3	
1	Johor Bahru - Pasir Gudang Southern Link	4 & 6	14.0		-----		113,720
2	East Coast Road in MPJB	4 & 6	9.7		-----		109,940
3	West Coast Road in MPJB	4 & 6	7.3			-----	32,260
4	Federal Route 1 in MPJB	6	10.8		-----		17,250
5	Jalan Tebrau	6	11.0	-----			49,070
6	West Access to Toll Expressway	2 4	6.2	-----		-----	19,640
7	Inner Ring Road	4	5.1		-----	-----	58,960
8	Lorry Route	2	2.7		-----		16,040
9	Jalan Tampoi	4	7.4			-----	19,050
10	Jalan Yahya Awal	4	3.8			-----	10,690
11	Jalan Kebun Teh and its Extension	4	3.8		-----	-----	13,300
12	Jalan Langkasuka and its Crossing	2 4	6.0	-----		-----	22,610
13	Jalan Stulang Baru	2 4	2.0	-----		-----	6,260
14	Jalan Serampang	4	2.0		-----		4,940
15	Jalan Pasir Pelangi	2 & 4	3.0		-----	-----	12,250
16	Tampoi - Skudai Road	4	8.5			-----	19,230
17	Pelentong Road	4	10.6			-----	18,720
18	Masai Road	2	14.8			-----	47,980
19	North South Connectors	4	4.0		-----		8,560
20	Road Improvement in Taman Century	2	3.5	-----			1,750
21	Road Improvement in New Development Area	2	5.2	-----			2,600
	JB - P. Gudang Sub - Total		141.4	50,350	260,196	294,274	604,820

Table 8.14 (Cont'd)

No. of Roads	Name of Roads	Number of Lanes	Total Length (km)	Phase			Project Cost ('000 \$)
				1	2	3	
31	East Coast Federal Road	4	40.0				68,040
32	Federal Route 1	4	13.6				23,500
33	Senai - Pengerang Road	2	44.1				81,070
34	P. Gudang - Kota Tinggi Road	2	24.6				34,550
35	Port Access Extension	4	8.4				44,570
36	Skudai - Pontian Road	2 & 4	13.6				20,000
37	Seelong - Sg. Danga Road	2	27.4				10,960
38	Airport Access Extension	2 & 4	8.2				16,360
	Outer Area Sub-Total		179.9	77,420	23,500	198,130	299,050
S-1	Causeway Improvement Scheme (Medium Term)						
S-2	Second Causeway and its Related Roads						
	Special Project Sub-Total				36,000	(246,650)	36,000 (282,650)
	Total		321.3	127,770	319,696	492,404 (739,054)	939,870 (1,186,520)

2 Phase I (Short-Term: 1983 - 1985); Implementation Programme and Investments

Table 8.15 Phase I (Short Term: 1983-1985); Implementation Programme and Investments

Programme Category	Action to be Taken	Major Facility Cost ( x 1,000 \$ )
1. Traffic Engineering	<ul style="list-style-type: none"> <li>a. Implementation of the interim traffic disposal and circulation plan.</li> <li>b. Improvement of traffic regulatory measures such as marking and traffic signs.</li> <li>c. Improvement of visibility and timing of existing signals extension of signal lights and introduction of pedestrian signals at key locations.</li> <li>d. Installation of pedestrian crossings and sidewalks in CBD including introduction of pedestrian mall on the Jalan Meldrum.</li> <li>e. Implementation of intersection improvements.</li> <li>f. Installation of information boards.</li> <li>g. Covering Sungai Segget.</li> </ul>	
	<b>SUB-TOTAL</b>	<b>4,120</b>
2. Construction and Improvement of Roads	<ul style="list-style-type: none"> <li>a. Widening of Jalan Tebrau ..</li> <li>b. Upgrading of two federal roads -- Jalan Kota Tinggi and Jalan Pontian.</li> <li>c. Engineering study of the projects for phase 2.</li> <li>d. Construction and improvement of Senai - Ulu Tiram Road.</li> <li>e. Implementation of renovation plan on the causeway.</li> <li>f. Engineering and economic study on the causeway.</li> </ul>	
	<b>SUB-TOTAL</b>	<b>127,770</b>
3. Public Transport System; Bus Transport/Taxi	<ul style="list-style-type: none"> <li>a. Improvement of bus operations to enhance reliability, punctuality and comfort.</li> <li>b. Realignment of bus routes and expansion of bus routes to serve newly developed area.</li> <li>c. Courtesy campaign aimed at bus-users.</li> <li>d. Replacement of over-age buses and addition of new buses; establishment of cooperative work shop for repair and maintenance.</li> <li>e. Review management system of bus company including accounting and reporting procedure.</li> <li>f. Establishment of public transport committee.</li> </ul>	

Table 8.15 (Cont'd)

Programme Category	Action to be Taken	Major Facility Cost ( x 1,000 \$)
	g. Provision of both town taxi and out-of-town taxi stands. h. Elimination of pirate taxis.	
	<b>SUB-TOTAL</b>	8,540
4. Urban Transport Facility	a. Design study for urban transport passenger terminal complex. b. Improvement of Jalan Trus bus terminal. c. Engineering study for bus terminal and freight terminal.	
	<b>SUB-TOTAL</b>	2,466
5. Private Vehicle Restraint	a. Enforcement of control parking. b. Development and adoption of parking provision for building. c. Elimination of on-street parking on primary and district distributors and provision of off-street parking facilities.	
	<b>SUB-TOTAL</b>	4,650
<b>TOTAL</b>		<b>147,546</b>

Fig. 8.1 Recommended Implementation Plan Outside MPJB Phase 1 (1983 – 1985)

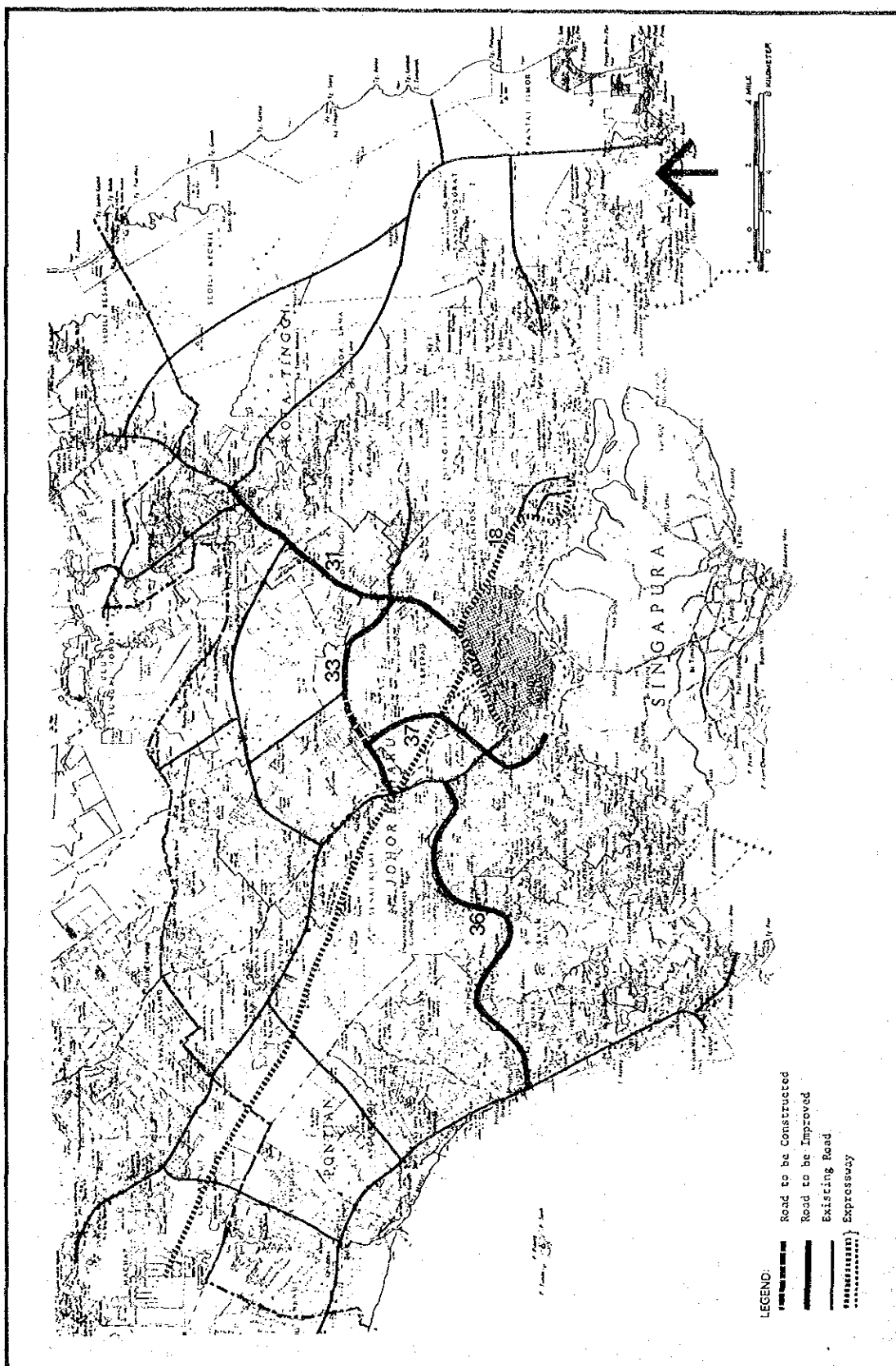
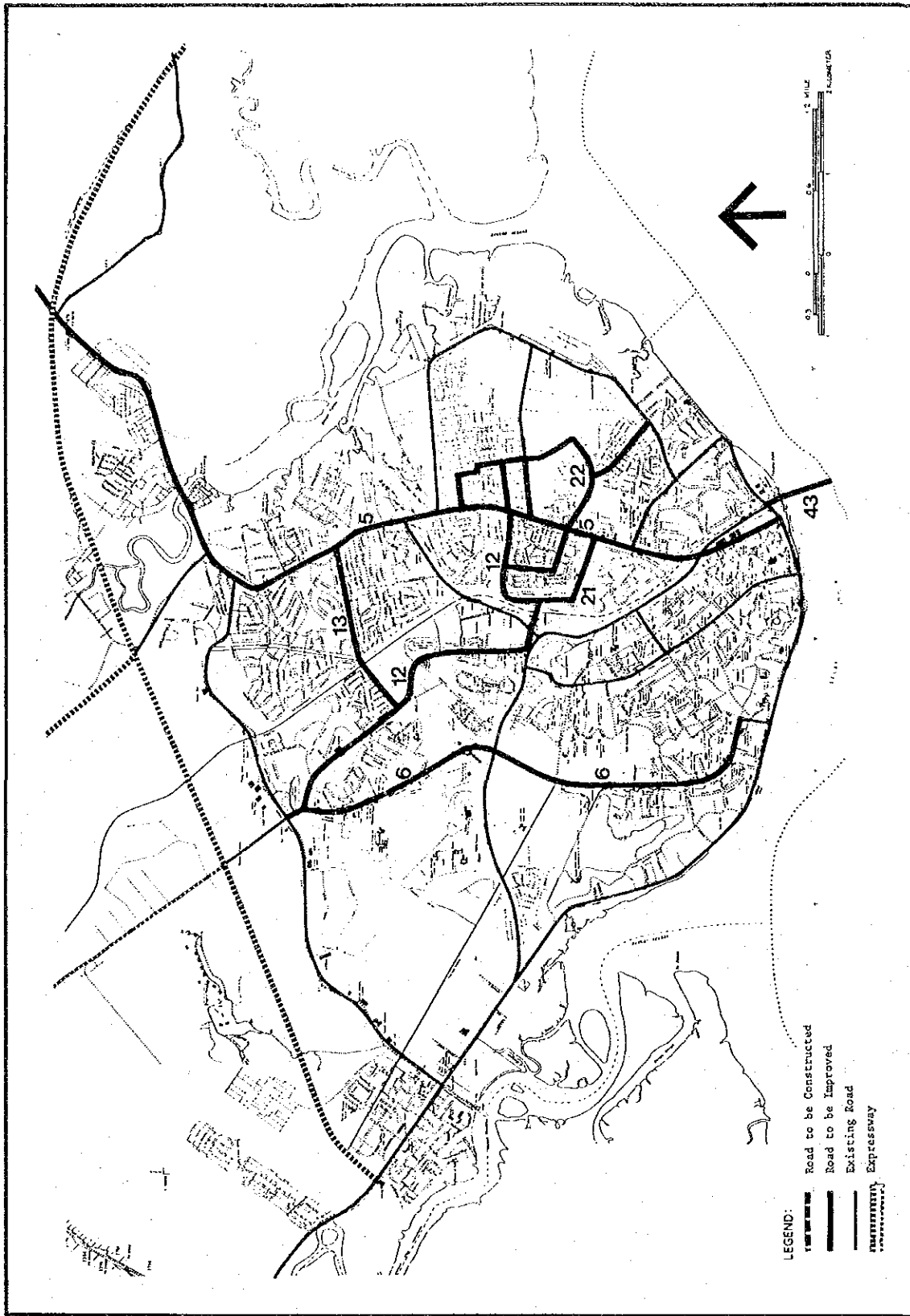


Fig. 8.2 Recommended Implementation Plan in MPJB  
Phase 1 (1983 - 2985)





3 Phase II (Medium Term: 1986 - 1990); Implementation Programme & Investments

Table 8.16 Phase II (Medium Term: 1986 - 1990); Implementation Programme and Investments

Programme Category	Action to be Taken	Major Facility Cost ( x 1,000 \$)
1. Traffic Engineering and Management	a. Implement the causeway traffic disposal scheme.	
	<b>SUB-TOTAL</b>	<b>11,480</b>
2. Construction and Improvement of Roads	a. Widening of Jalan Tebrau to six-lane.	
	b. Construction and Improvement of Toll Expressway Access Road.	
	c. Construction of Johor Bahru - Pasir Gudang Southern Linkage and Related Roads.	
	d. Construction and improvement of Inner Ring Road/Lorry Route.	
	e. Widening of Federal Route No. 1 from Senai to Kulai.	
	f. Interchanges and Grade Separations	
	<b>SUB-TOTAL</b>	<b>355,196</b>
3. Public Transport System	a. Continued improvement of bus operation.	
	b. Continued route realignments and expansion of bus routings.	
	c. Introduction of exclusive bus lane on Jalan Tebrau and Johor Bahru - Pasir Gudang Southern Linkage.	
	d. Revision of CBD bus routing and introduction of bus lane in CBD.	
	e. Replacement of over-age buses and addition of more buses.	
	f. Study for introduction of public transport system between Johor Bahru and Pasir Gudang.	
	<b>SUB-TOTAL</b>	<b>11,920</b>
4. Urban Transport Facilities	a. Construction of transport passenger terminal complex facility.	
	b. Construction of bus and freight terminals.	
	<b>SUB-TOTAL</b>	<b>24,660</b>
5. Private Vehicle Restraint	a. Continued enforcement of control parking.	
	b. Continued elimination of on-street parking.	
	c. Provision of off-street parking.	<b>5,570</b>
<b>TOTAL</b>		<b>408,826</b>

Fig. 8.3 Recommended Implementation Plan Outside MPJB Phase 2 (1986-1990)

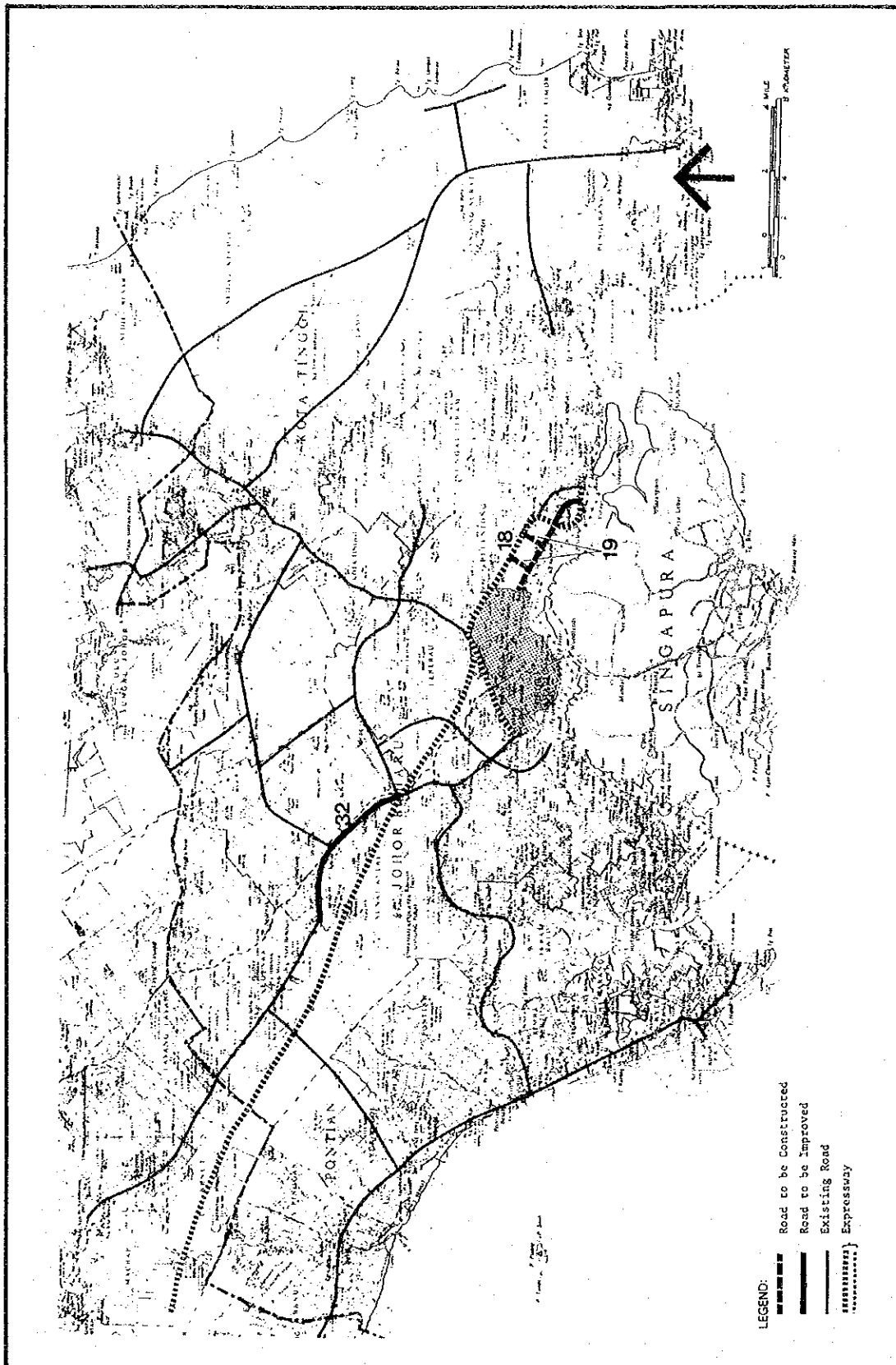
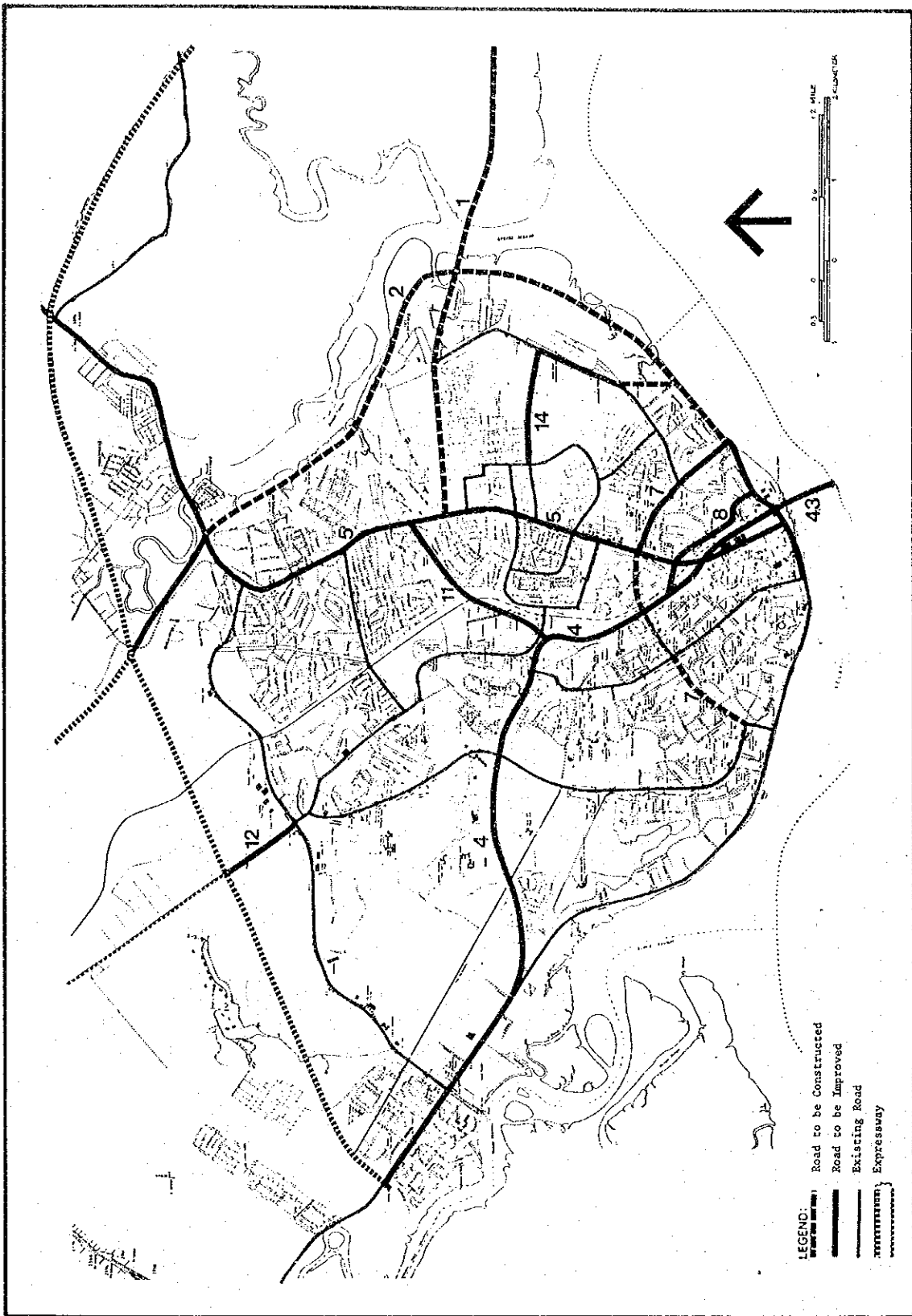


Fig. 8.4 Recommended Implementation Plan in MPJB Phase 2 (1986 – 1990)



4 Phase III (Long Term: 1991 - 2000); Implementation Programme and Investments

Table 8.17 Phase III (Long Term: 1991 - 2000); Implementation Programme and Investments

Programme Category	Action to be Taken	Major Facility Cost (x 1,000 \$)
1. Construction and Improvement of Roads	a. Implementation of all phase 3 and 4 road construction and improvement projects.	
	b. Interchanges and grade separations.	
	<b>SUB-TOTAL</b>	<b>498,404</b>
2. Public Transport	a. Continued expansion of bus routing.	
	b. Introduction of new transit system between Johor Bahru and Pasir Gudang.	
	c. Introduction of commuter services for Malayan Railway.	
	d. Replacement of over-age buses and addition of more buses.	
	<b>SUB-TOTAL</b>	<b>374,680</b>
3. Private Vehicle Restraints	a. Continued review and monitoring of traffic operating conditions.	
	b. Examination of possibility of introducing cordon pricing to the CBD.	
	c. Off-street parking in CBD.	
	<b>SUB-TOTAL</b>	<b>10,140</b>
<b>TOTAL</b>		<b>883,224</b>

Fig. 8.5 Recommended Implementation Plan Outside MPJB Phase 3 (1991 – 2000)

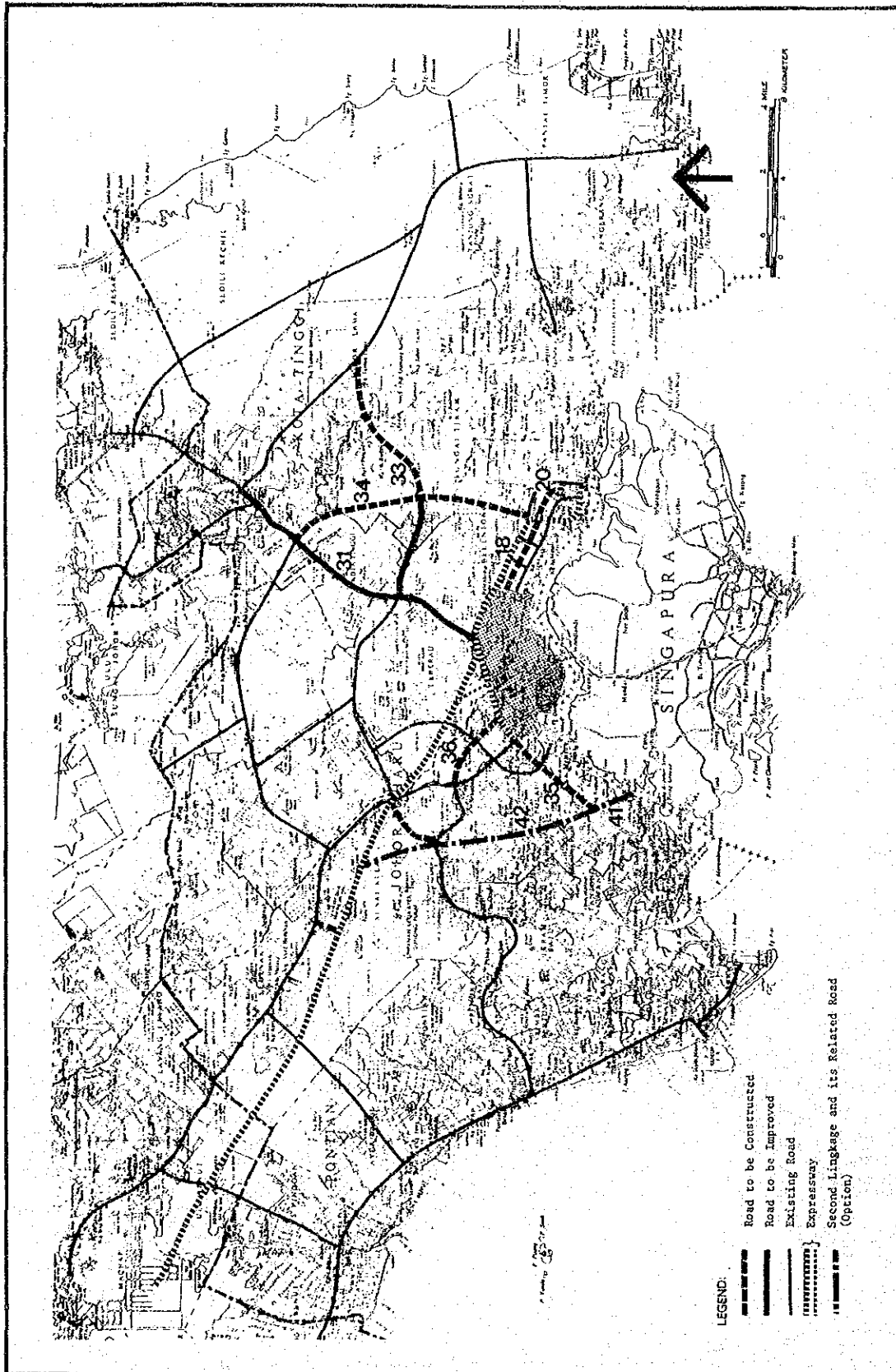
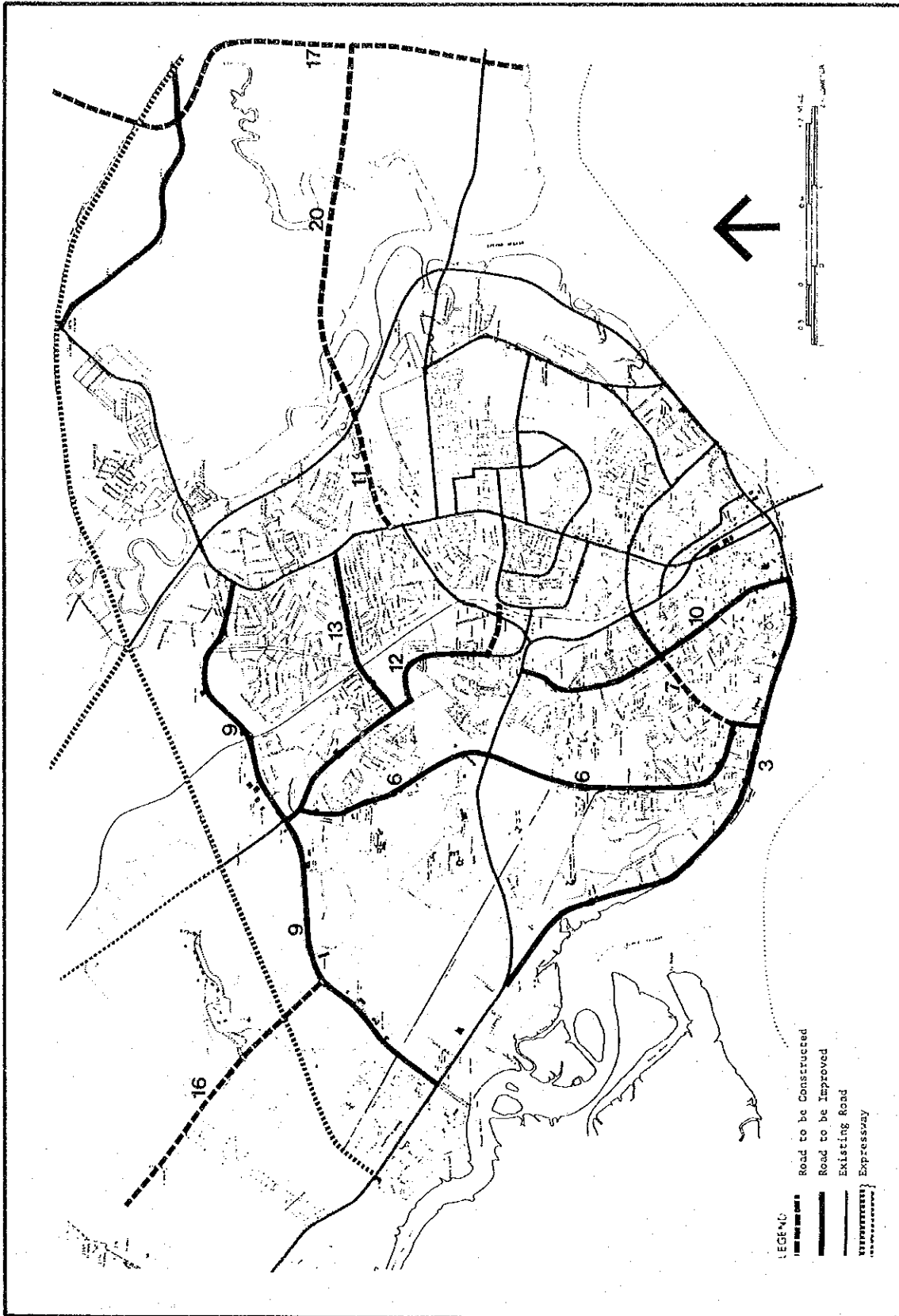
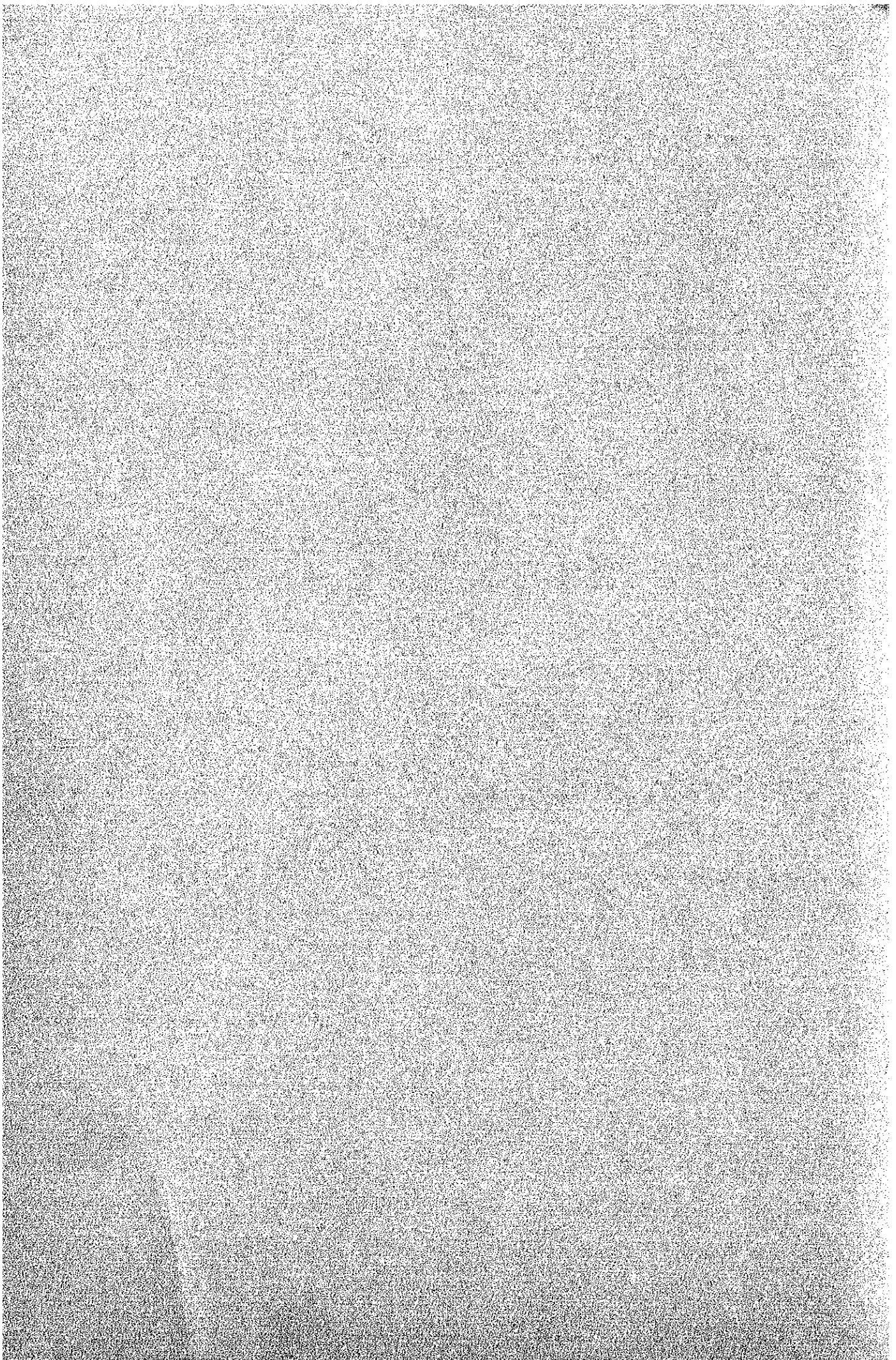


Fig. 8.6 Recommended Implementation Plan in MPJB Phase 3 (1991 - 2000)



## **APPENDICES**

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## APPENDIX A

STUDY AREA AND ITS ZONING1. Study Area

The Primary Study Area defined by the scope of work covers the Johor Bahru district and Kota Tinggi: Johor Bahru Town, Kota Tinggi Town, Senai Kulai, Sedenak, Pulai, Tanjong Kupang, Plentong, Ulu Tiram, Sungai Tiram and Tebrau.

The Secondary Study Area covers Pontian district and part of the Kota Tinggi district.

2. Traffic Zoning System

The zones have been delineated generally on the basis of the following criteria.

- a. The boundary of a traffic zone shall conform to the boundary of enumeration blocks or group of enumerations of the 1980 housing and population census. The boundary of a group of zones shall also conform to the boundary of the district, mukim, kampung or town. This will facilitate the collection of available data on land use and socio-economic data.
- b. The boundary of a zone shall follow natural and man-made physical features, such as rivers, railway and roads.
- c. The area covered by a zone shall define the area served by roads or public transport routes to reflect the intensity of the transport networks.
- d. The sizes of the zones shall be variables, generally increasing with distance from the urban center, to reflect the intensity of the transport network.
- e. As a result, the Primary Study Area is sub-divided into 72 internal traffic zones. The number of zones at each town and mukim is as follows:

Johor Bahru Town	47 Zones
Plentong	8 Zones
Tanjong Kupang	1 Zone
Pulai	3 Zones
Senai Kulai	4 Zones
Sedenak	2 Zones
Tebrau	4 Zones
Kota Tinggi	3 Zones

The Secondary Study Area is sub-divided into 4 zones as follows:

Pontian District	3 Zones
Sedili Kecil	
Johor Lama	1 Zone
Tanjong Surat	
Pengerang	
Pantai Timur	

The external area is sub-divided into 20 zones including Singapore and Thailand.

The zone cost list is shown in Table A.1 and zoning map is shown in Figures A.1, A.2 and A.3.

Table A.1 Traffic Zone

Zone No.			Town, District	Zone No.			Town, District
A	B	C		A	B	C	
1	1	1	Johor Bahru, Johor Bahru District	3	1	1	Johor Bahru, Johor Bahru District
		2	"			2	"
		3	"			3	"
		4	"			4	"
1	2	1	"			5	"
		2	"	3	2	1	"
		3	"			2	"
2	1	1	"			3	"
		2	"			4	"
		3	"			5	"
2	2	1	"	3	3	1	"
		2	"			2	"
		3	"			3	"
		4	"	3	4	1	"
		5	"			2	"
2	3	1	"			3	"
		2	"	3	5	1	"
2	4	1	"	3	6	1	Plentong, Johor Bahru District
		2	"			2	"
		3	"			3	Pasir Gudang Port, Johor Bahru District
2	5	1	"			4	Plentong, Johor Bahru District
		2	"	3	7	1	"
2	6	1	"			2	"
		2	"			3	"
		3	"			4	"
2	7	1	"				
		2	"				
2	8	1	"				

Table A.1 Traffic Zone (cont'd)

Zone No.			District, State, Country	Zone No.			District, State, Country
A	B	C		A	B	C	
4	1	1	Tanjong Kupang, JB District	9	1	1	Batu Pahat Johor
		2	Pulai, Tanjong Kupang, JB District			2	Kluang, Johor
		3	"			3	Ulu Sungai Sedili Besar, KT
		4	"			4	Mersing, Johor
4	2	1	Senai Kulai, JB District	9	2	5	Segamat, Johor
		2	"			6	Muar, Johor
		3	"			1	Melaka
		4	"			2	Negeri Sembilan
4	3	1	Sedenak, JB District	9	3	3	Selangor
		2	"			1	Pahang
4	4	1	Tebrau, JB District	9	4	2	Trengganu
		2	"			3	Kelantan
		3	"			1	Perak
		4	"			2	Penang
4	5	1	Ulu Sungai Johor, KT District	9	5	3	Kedah & Perlis
		2	Kota Tinggi, KT District			1	Western Part of Singapore
		3	"			2	North Central of Singapore
4	6	1	Sungai Tiram, JB District	9	6	3	Eastern Part of Singapore
		2	"			4	South Central of Singapore
5	1	1	Pontian District	9	6	1	Thailand
		2	"				
		3	"				
5	2	1	Pantai Timor				

Fig. A.1 Traffic Zoning in Johor Bahru Cnurbation

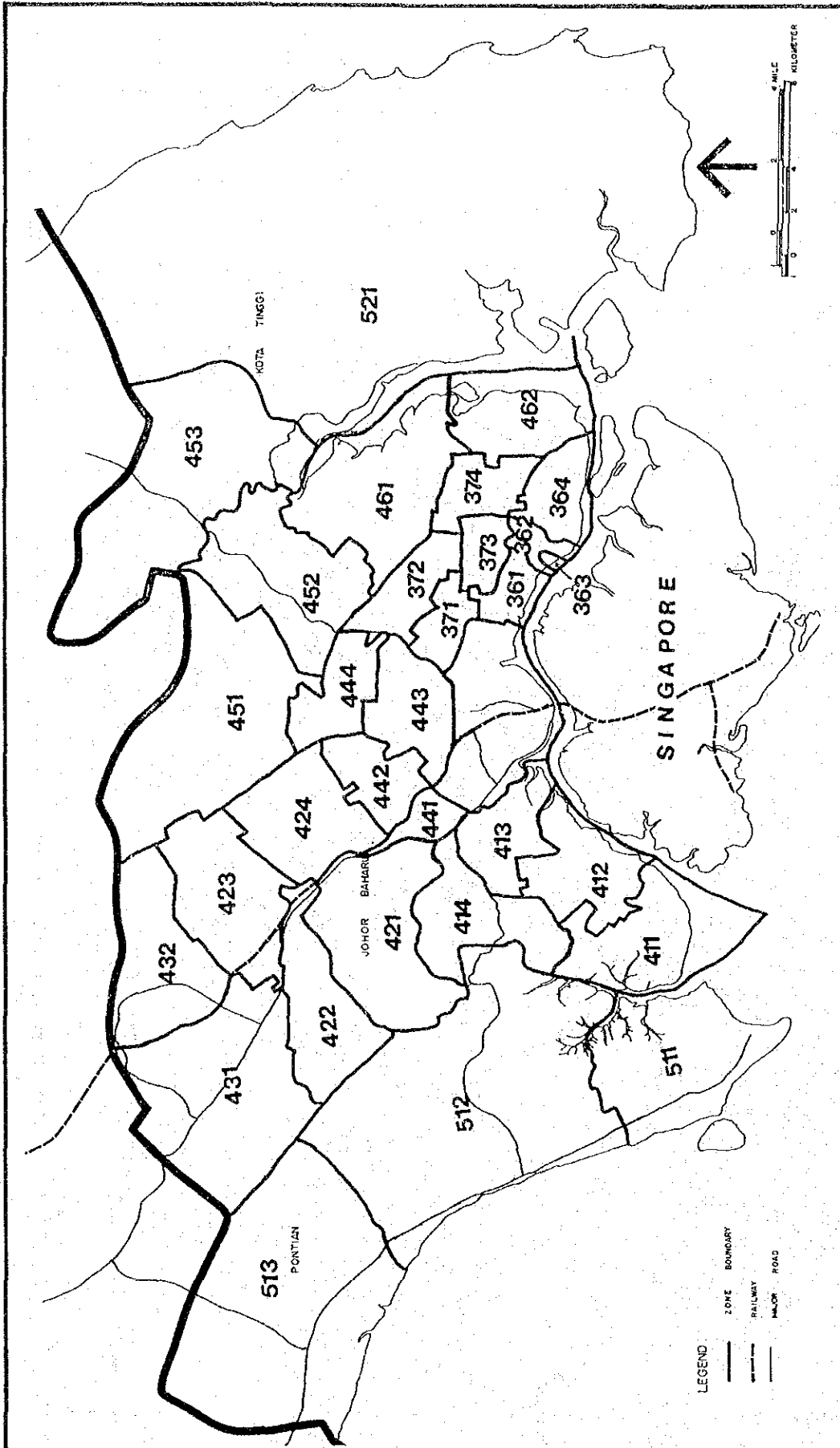


Fig. A.2 Traffic Zoning in Johor Bahru Town

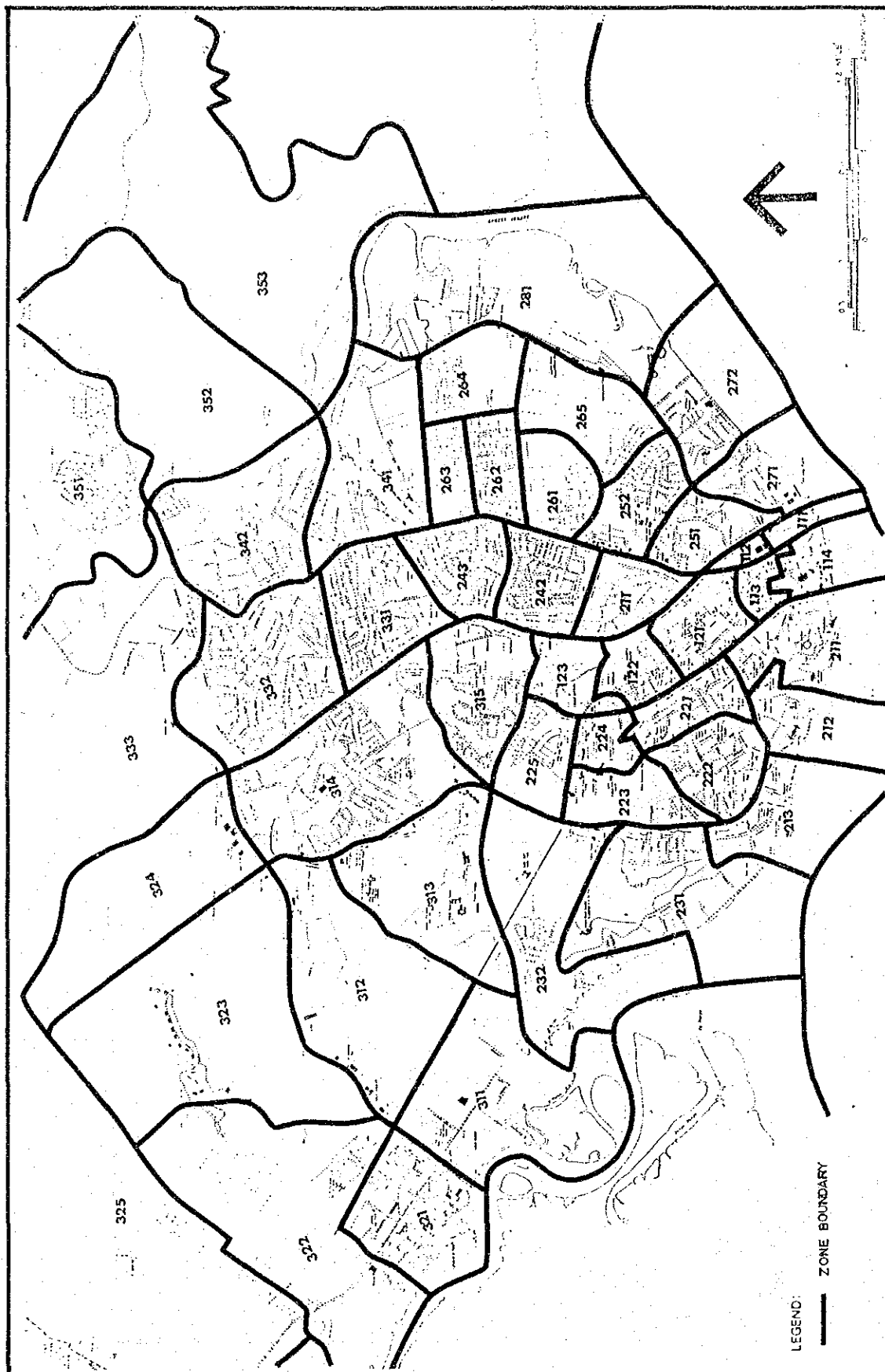


Fig. A.3 Traffic Zoning in External Area

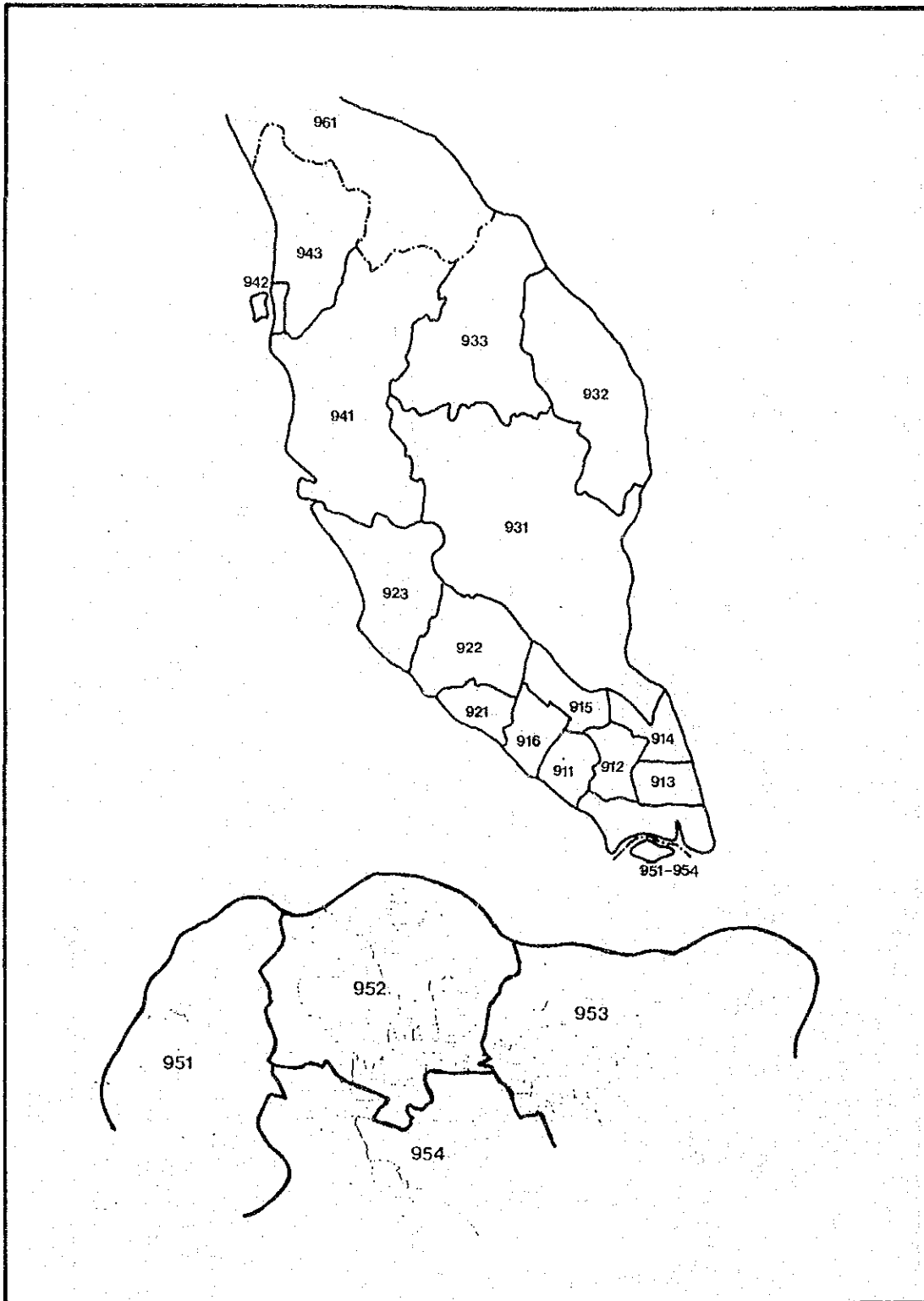
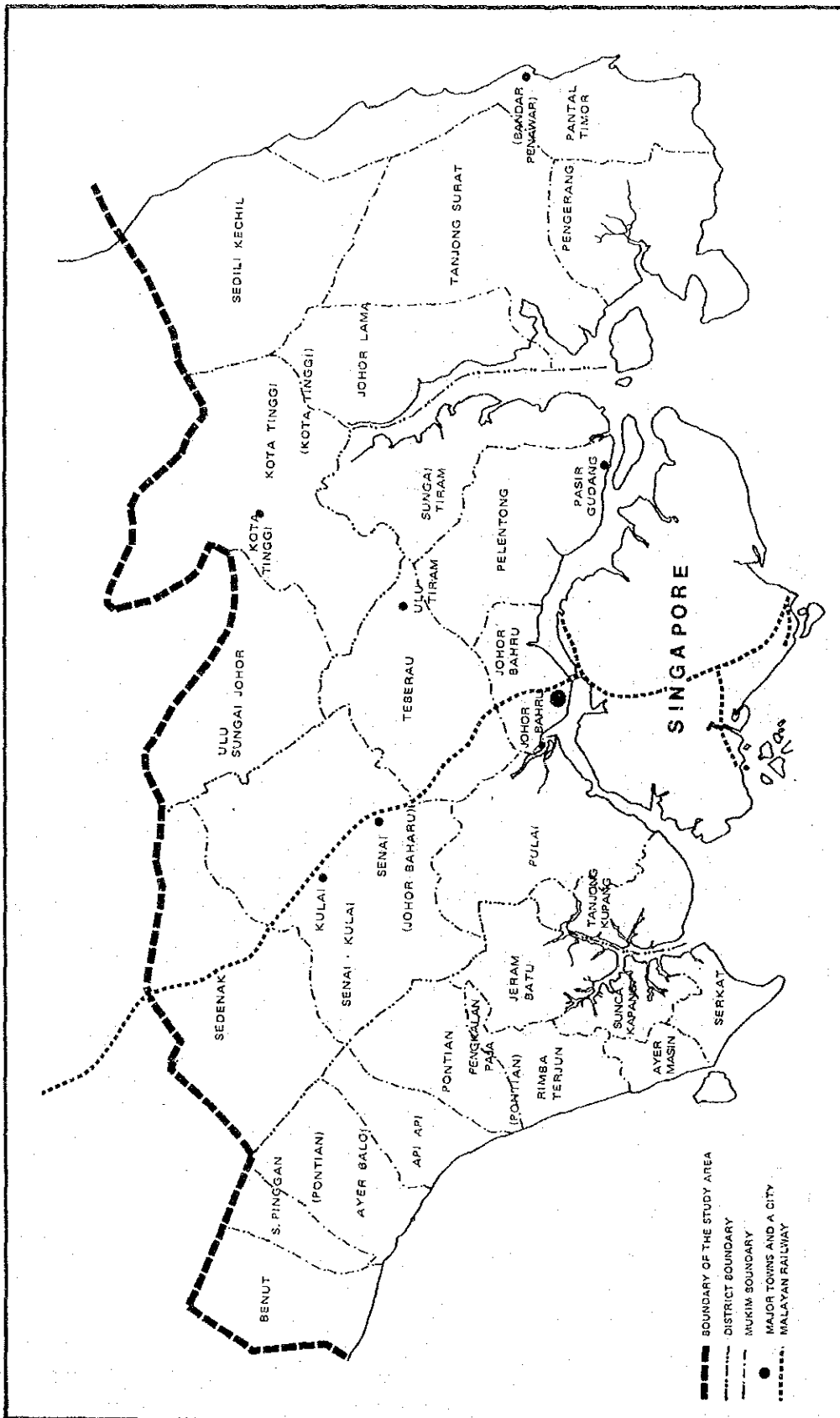


Fig. A.4 Mukims in the Study Area





## APPENDIX B

## POPULATION AND EMPLOYMENT DISTRIBUTION PLANS

**Table B.1 Comparison between Structure Plan and JICA Study of Population Distribution**

(Person)

Traffic Zone (Medium)	Structure Plan Study Strategy				JICA Study	
	I	II	III	IV	Original Plan	Sensibility Analysis
A	62,400	36,400	41,600	62,400	36,600	62,400
B	93,600	88,400	88,400	83,200	91,330	83,200
C	20,800	20,800	26,000	20,800	20,680	20,800
D	72,800	72,800	67,600	104,000	73,880	104,000
E	20,800	20,800	20,800	20,800	21,560	20,800
F	41,600	52,000	52,000	41,600	51,070	41,600
G	20,800	20,800	31,200	20,800	21,670	20,800
H	62,400	67,600	57,200	52,000	63,110	52,000
I	78,000	83,200	78,000	62,400	81,910	62,400
J	26,000	36,400	36,400	31,200	36,570	31,200
K	20,800	20,800	20,800	20,800	21,620	20,800
Total	520,000	520,000	520,000	520,000	520,000	520,000

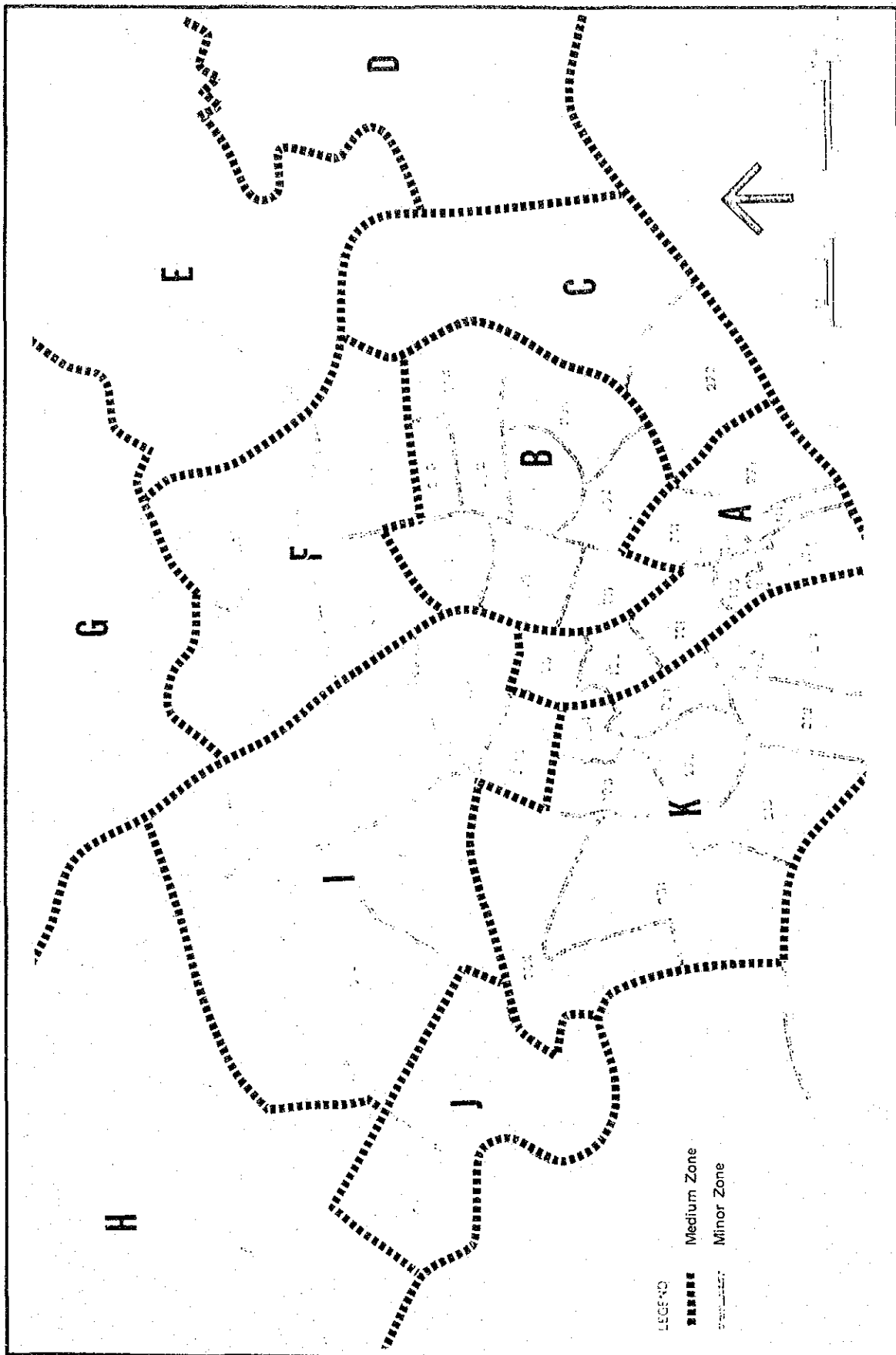
**Table B.2 Comparison between Structure Plan and JICA Study of Population Distribution**

(Person)

Traffic Zone (Medium)	Structure Plan Study Strategy*				JICA Study	
	I	II	III	IV	Original Plan	Sensibility Analysis
A	27,270	14,750	17,830	29,170	25,700	33,070
B	18,240	23,860	18,860	15,710	22,820	17,820
C	3,400	7,330	7,630	2,450	7,960	2,480
D	8,870	24,810	9,610	17,120	24,900	19,650
E	8,650	6,050	9,660	5,080	9,150	5,760
F	14,590	19,380	18,470	31,500	19,380	35,720
G	18,070	6,180	18,520	3,820	16,050	4,340
H	17,010	21,470	10,320	6,840	17,190	6,530
I	43,200	25,510	36,370	26,120	27,220	30,840
J	4,980	11,530	17,590	30,750	14,730	33,760
K	5,790	8,830	4,810	1,510	7,700	2,830
Total	170,070	170,070	170,070	170,070	192,800	192,800

Note: \* Construction workers, about 20,000 will be distributed to the construction sites of each zone.

Fig. B.1 Traffic Zone (Medium and Minor) Map in MPJB



## APPENDIX C

ALTERNATIVE ALIGNMENT IN THE EASTERN PART OF MPJB1. Purpose of Study

Without the east coast road in the eastern part of MPJB, traffic congestion on Jalan Tebrau and Jalan Kebun Teh is expected to be greater in the year 2000 even if some of the traffic control measures are implemented. However, if there is no possibility at all of this road being built in the future, the Study Team must provide other alternatives for the in and outgoing traffic of Pasir Gudang and Toll Expressway and these are shown below:

2. Alternative Alignments (Refer to Figs. C.1 to C.4 and Table C.1)

Scheme 1 : Implemented if passageway by the foreshore of the Polo Ground is granted.

Scheme 2 : This scheme has been proposed in case the foreshore alignment on Jalan Pasir Pelangi is acceptable.

Scheme 3 : This scheme has been proposed in case Schemes 1 and 2 are not acceptable and if some land along Jalan Bakar Batu can be acquired.

Scheme 4 : This scheme has been proposed in case some land along Jalan Bakar Batu cannot be acquired.

3. Recommendation

The Study Team believes that Scheme 1 is the most desirable and appropriate network configuration in the year 2000 even with the difficulties arising from the construction of an off-shore road on the Polo Ground and partial acquisition of land from the Army Camp. This is an important matter, and the Study Team would like to

request the related committees to keep this proposal in mind as a conceptual plan for the year 2000 for the following reasons.

- a. The impact of the development of the housing estates and the commercial and industrial sectors in Pasir Gudang, just across Sg. Tebrau, upon the East Coast Federal Road (Jalan Kota Tinggi, Jalan Tebrau). Without an alternative road by-passing Jalan Tebrau and the densely populated residential areas, it is doubtful if any measures taken to relieve traffic congestion in the eastern sector and the C.B.D. will be effective.
- b. In case Scheme 1 can never be realized, then it would be necessary to construct a double deck structure on Jalan Tebrau by the year 2000.

Table C.1 Alternative Road Network in Eastern Area of MPJB

Legend: Good Fair Bad

	Scheme - 1	Scheme - 2	Scheme - 3	Scheme - 4
Conceptual Plan				
Land Acquisition	<p>Required Partially</p> <p>Army Camp</p> <p>East Coast (Polo Ground)</p> <p>Improvement of J. Pasir Pelangi</p>	<p>Required Partially</p> <p>Not Required</p> <p>Required</p>	<p>Required Partially</p> <p>Not Required</p> <p>Not Required</p>	<p>Required Partially</p> <p>Not Required</p> <p>Not Required</p>
Traffic Flow and Network Configuration	<p>Affect the residents along Jalan Kebun Teh partially</p> <p>Smooth Traffic Flow</p> <p>Desired Simple Network</p>	<p>Some land from the Army, along Jalan Bakar Batu is required</p> <p>Affect the residents of Taman Kebun Teh</p> <p>Some of Sultan's land and structures affected</p> <p>Smooth Traffic Flow</p> <p>Desired Simple Network</p>	<p>Some land from the Army, along Jalan Bakar Batu is required</p> <p>Undesirable traffic congestion on Jalan Tebrau and narrow Jalan Pasir Pelangi (Sultan's area)</p> <p>Traffic control at the junction of Jalan Tebrau and Jalan Tun Abdul Razak is difficult</p> <p>Smooth Traffic Flow</p> <p>Desired Simple Network</p>	<p>Some residents to the north-side of the Army camp affected</p> <p>The residents of Taman Kebun Teh affected</p> <p>Undesirable traffic congestion on Jalan Tebrau and narrow Jalan Pasir Pelangi (Sultan's area)</p> <p>Difficult to regulate traffic at Jalan Tebrau - Jalan Tun Abdul Razak junction</p> <p>Smooth Traffic Flow</p> <p>Desired Simple Network</p>
Road Structures Alternatives	<p>Johor Bahru East Coast Road</p> <ol style="list-style-type: none"> <li>1. Ground Level</li> <li>2. Tunnel (Box Culvert)</li> </ol> <p>Johor Bahru - Pasir Gudang (Army Camp Area) Depressed</p>	<p>Jalan Pasir Pelangi (Sultan's area)</p> <ol style="list-style-type: none"> <li>1. Ground Level</li> <li>2. Tunnel (Box Culvert)</li> </ol>	<p>Jalan Tebrau</p> <ol style="list-style-type: none"> <li>1. Widen to 6-8 lanes</li> <li>2. Construct 4-lane viaduct along the road</li> </ol>	<p>Jalan Tebrau</p> <ol style="list-style-type: none"> <li>1. Widen to 6-8 lanes</li> <li>2. Construct 4-lane viaduct along the road</li> </ol>
Improvement Cost	<ol style="list-style-type: none"> <li>1. Ground Level M\$ 91 Million</li> <li>2. Tunnel M\$123 Million</li> </ol>	<p>Viaduct Plan M\$131 Million</p>	<p>Viaduct Plan M\$151 Million</p>	<p>Viaduct Plan M\$151 Million</p>
Running Cost	○	○	○	△
Recommendation	◎	△	○	△

Fig. C.1 Alternative Schemes for J.B. Eastern Sector-Scheme 1

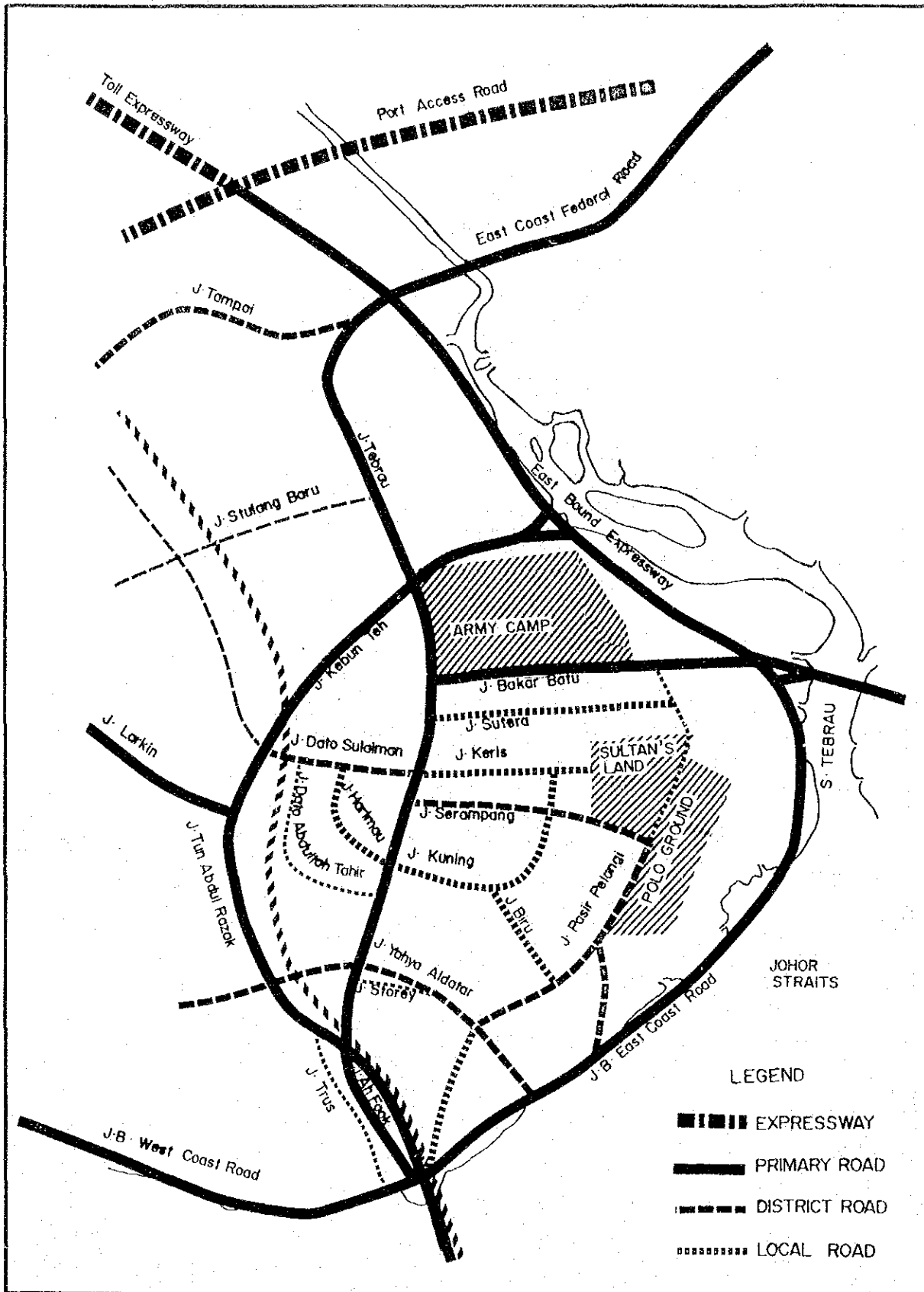


Fig. C.2 Alternative Schemes for J.B. Eastern Sector-Scheme 2

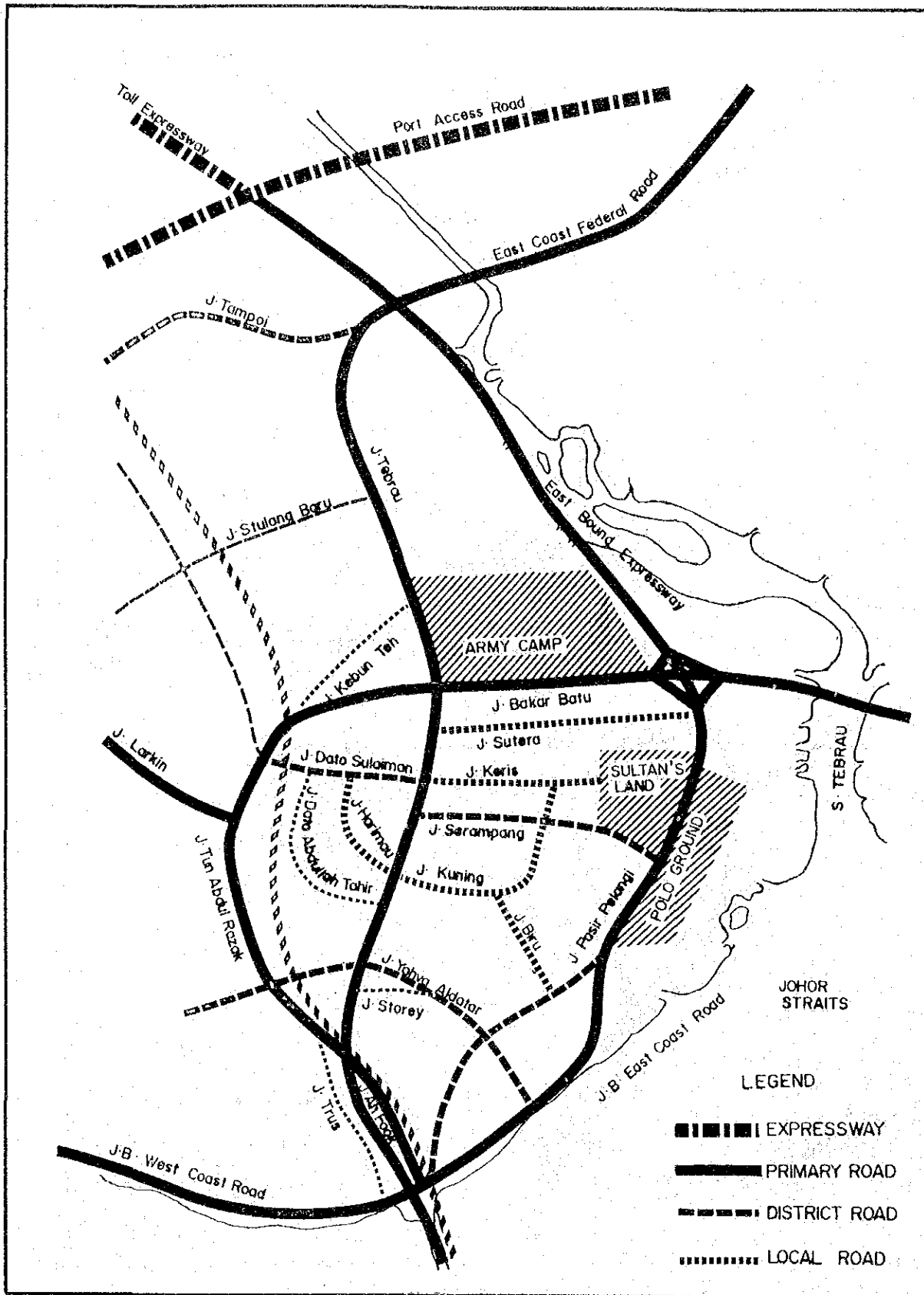


Fig. C.3 Alternative Schemes for J.B. Eastern Sector-Scheme 3

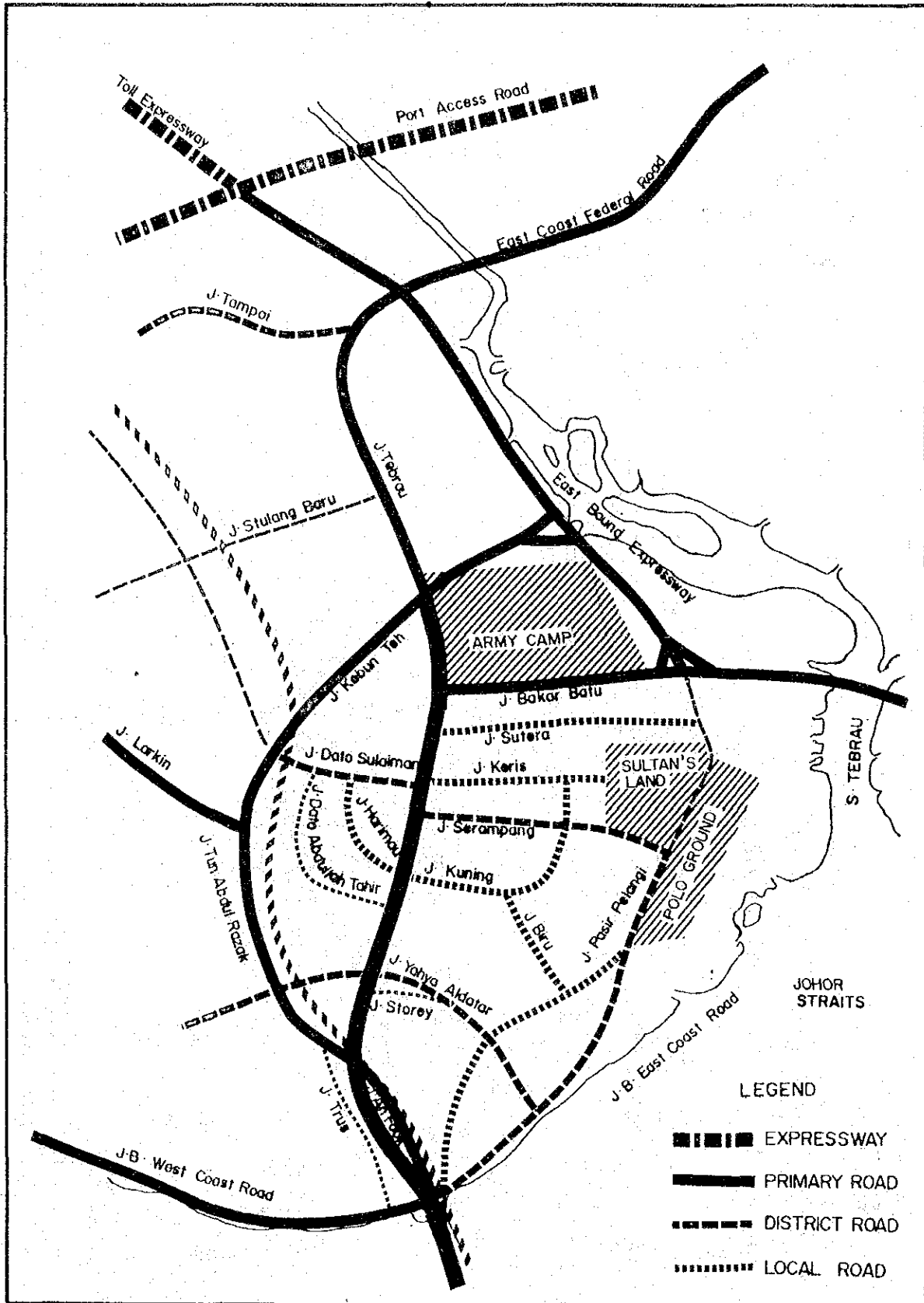
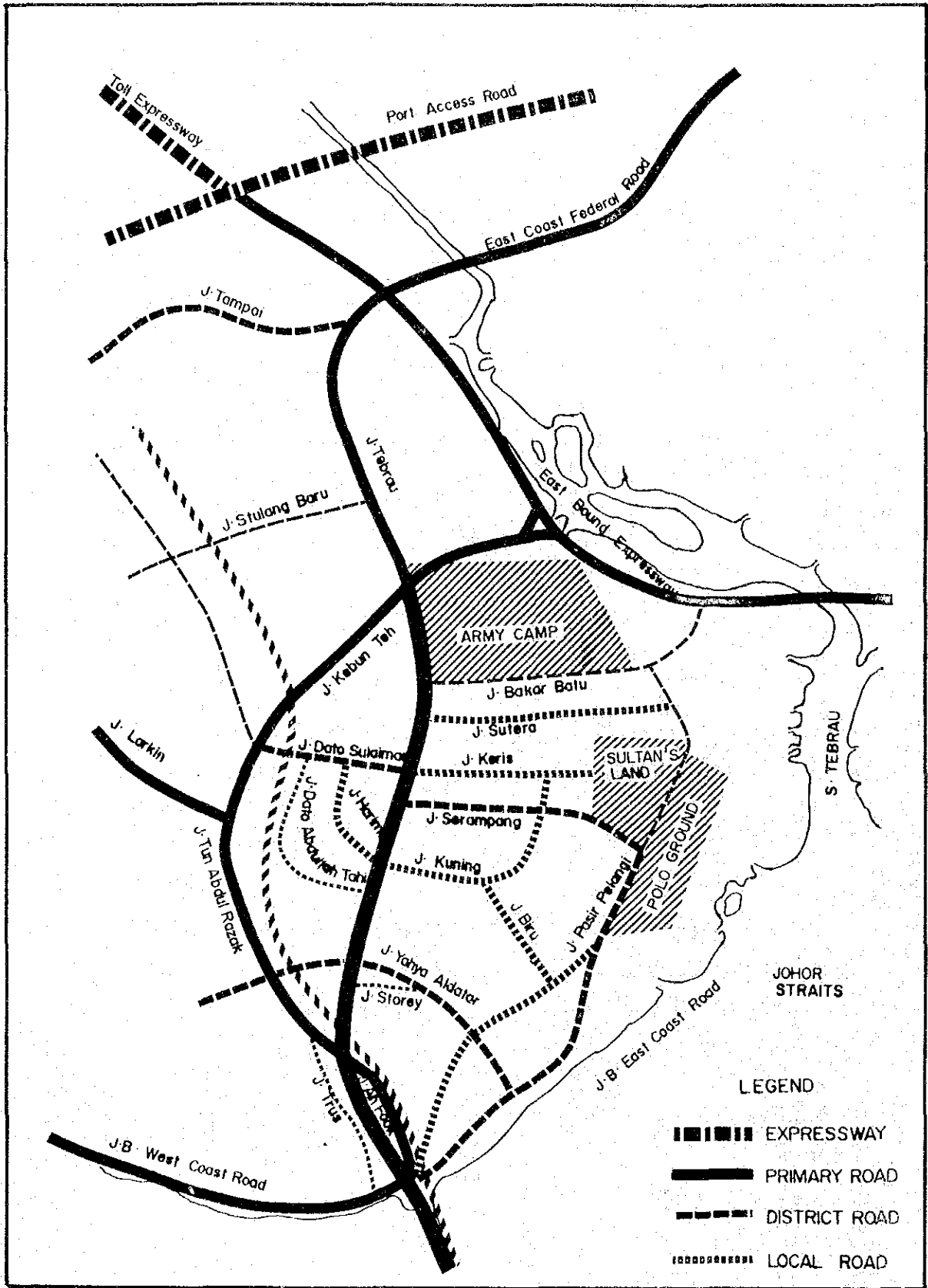




Fig. C.4 Alternative Schemes for J.B. Eastern Sector-Scheme 4





## APPENDIX D

PRELIMINARY STUDY OF SENAI - ULU TIRAM ROAD1. Brief Description of the Project

The proposed road is to connect Senai on the west to Ulu Tiram in the east. This linkage will be of about 21 km in length and divided into 4 sections as shown in Fig. D.1. Section 1 which is about 1.4 km in length is the existing Airport Access Road and as this road is newly completed, no improvement is necessary. Section 2 which is 4.94 km in length is part of the Seelong - Maju Jaya Road. At present this road is to be built up to the laterite surface only, and hence improvement is necessary. Section 3 which is 4.02 km in length is at present non-existent. It is proposed that this road be newly constructed by cutting through the oil palm estate. Section 4 is the existing Ulu Tiram - Ulu Tebrau road which is 10.5 km long. This road needs to be improved, since certain stretches are in need of repairs.

2. Socio-Economic Input

Socio-economic data used are mainly from the Johor Bahru Urban Transport Masterplan Study and are as listed below:

3. Population

Table D.1 Population Distribution in 1981 - 2000

Year	Population
1980	55,350
1990	63,624
2000	76,340

4. Employment

Table D.2 Employment Distribution

Year	Primary	Secondary	Tertiary	Total
1980	18,039	2,388	2,961	23,388
1990	19,379	3,751	3,351	26,481
2000	20,860	8,750	4,820	34,480

5. Vehicle Ownership

Table D.3 Vehicle Ownership Pattern

Year	Car	Motorcycle	Good Vehicle	Total
1980	2,904	7,210	572	10,686
1990	5,940	10,532	1,134	17,606
2000	10,581	24,007	1,914	36,502

6. Traffic Volume

Traffic volume using the route, by section, obtained from the traffic count survey and by traffic assignment is as tabulated below:

Table D.4 Traffic Volume

Section	Volume by Traffic Count Survey (12 hrs count)	Volume by Traffic Assignment		Growth (%)
		1981	2000	
1	2.4	4.7	19.8	7.9
2	0.8	2.2	10.2	8.3
3	non-existence	2.4	10.2	7.9
4	0.7	3.1	12.4	7.7

7. Geometric Design Standard

The Malaysian Design Standard is adopted for this proposed road and the Geometric Design Standard is as shown below:

Fig. D.1 Proposed Road by Section

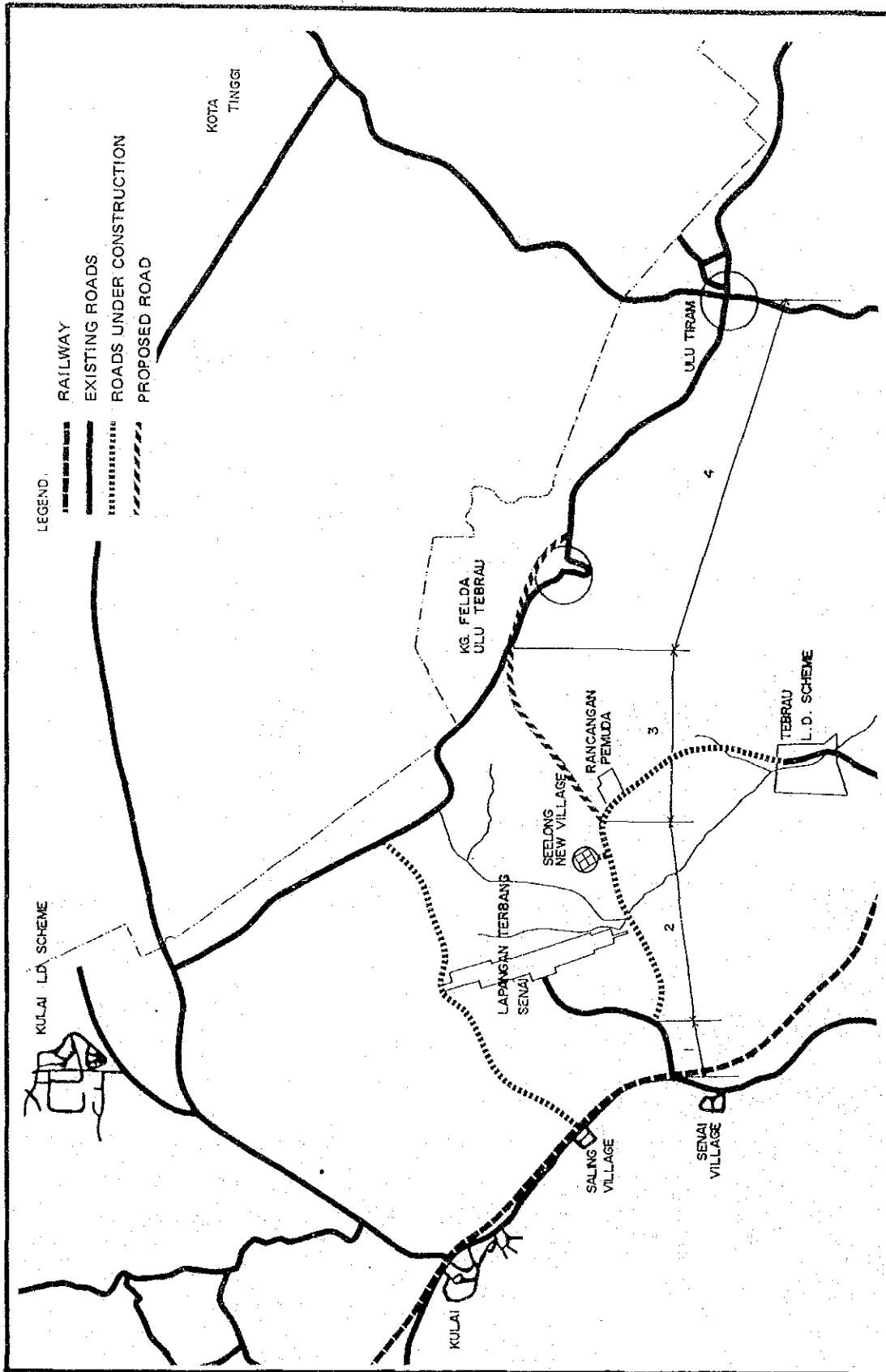


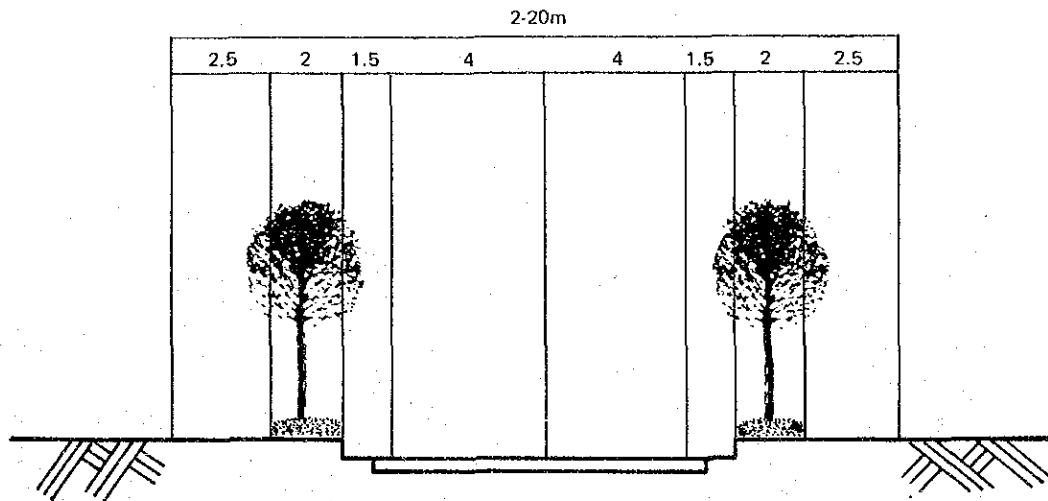
Table D.5 Design Standard

Items	Unit	Description
Adopted Group	-	02
Design Vehicles	-	All Vehicle
Design Speed	Km.p.h.	40
Carriageway Width	m	7.5
Shoulder Width	m	1.5

### 8. Preliminary Design

The Malaysian Geometric Design Criteria is adopted for this route and the typical cross-section is as shown below:

Fig. D.2 Malaysian Typical Geometrical Design of Roads



### 9. Project Cost Estimates

As described earlier, the Senai - Ulu Tiram road is divided into 4 sections.

However, for economic evaluation purposes, estimated costs are only for constructing section (3) and paving section (2). The summary of project cost estimates are as shown in the Table below:

Table D.6 Summary of Project Cost Estimates

Section	Construction Cost							Row Cost	Project Cost			
	Road	Structure	Inter-change	F.C.	L.C.	Tax	Total		F.C.	L.C.	Tax	Total
1	Existing Airport Access Road											
2	2.27	-	-	0.86	1.30	0.11	2.27	-	0.86	1.30	0.11	2.27
3	3.58	0.81	0.044	1.84	2.37	0.22	4.43	0.81	1.84	3.18	0.22	5.24
4	Existing Ulu Tiram - Pelda Ulu Tebrau Road											
Total Project Cost											7.51	

#### 10. Annual Maintenance Cost

After some discussion with the J.K.R. it was estimated that the cost of maintaining a similar road would be about M\$6,250.00 per kilometer.

#### 11. Economic Evaluation

For project appraisal, three types of economic indicators are used:

- a. Internal Rate of Return (IRR)
- b. Net Present Value (NPV)
- c. Benefit Cost (B/C) Ratio

To obtain the economic indicator, the following conditions are assumed:

1. Project Life of 20 years
2. Opening year for Traffic - 1986
3. Opportunity Cost of Capital - 12%

The result of the economic evaluation is as listed below, and it shows that the proposed project is feasible.

Discounted Benefits	=	\$11,670,219
Discounted Cost	=	\$ 6,086,476
B/C Ratio	=	1.92%
Net Present Value	=	\$ 5,583,743
IRR	=	23.3%

#### 12. Sensitivity Analysis

The sensitivity analysis of the project is made by

postulating a change in the following conditions:

1. Increase in Project Cost
2. Decrease in Project Benefit
3. Increase in the Project Cost and a Decrease in the Project Benefit
4. Shortening of Project Life

**Table D.7 Result of Sensitivity Analysis**

Condition	B/C Ratio	NPV M\$ ('000)	IRR (%)
1. Original Results	1.92	5,584	23.3
2. 20% Cost Increase	1.60	4,393	19.0
3. 20% Benefit Decrease	1.53	3,250	18.9
4. 20% Cost Increase 20% Benefit Decrease	1.28	2,059	16.0
5. Project Life 15 Years	1.57	3,463	21.5



## APPENDIX E

PRELIMINARY STUDY FOR THE WIDENING OF JALAN TEBRAU1. Introduction

Jalan Tebrau is part of the East Coast Federal Route which links Johor Bahru with the east coast area of Johor as an arterial road.

The importance of this road is increasing year by year with the rapid development of housing schemes along the road as well as the industrial and housing developments in the Pasir Gudang area.

In addition to these various development programmes, the Port Access and the Toll Expressway are expected to be completed in 1983 and 1986 respectively; thus the importance of the road will further increase.

Jalan Tebrau is a single carriageway, while the existing traffic volume is about 30,000 p.c.u/day. Thus, the demand is nearing full capacity and traffic jams can sometimes be observed.

To cope with this situation and to meet the future demand, an engineering study for this widening is now being undertaken by J.K.R.

Hence this paper aims to examine the economic viability of the project which is "Widening of Jalan Tebrau to a 6-lane road".

The section to be widened is:

Interchange with Jalan Tun Abdul Razak

Interchange with the Port Access

The location of the project road is shown in Fig. E.1.

2. Widening Plan and Construction Cost

The outline of the widening plan is as follows:

Project Road Length : 10.45 kilometers

No. of Lanes : 6 lanes

Typical Cross-Section: Refer to Fig. E.2

Fig. E.1 Location Map of Project Road

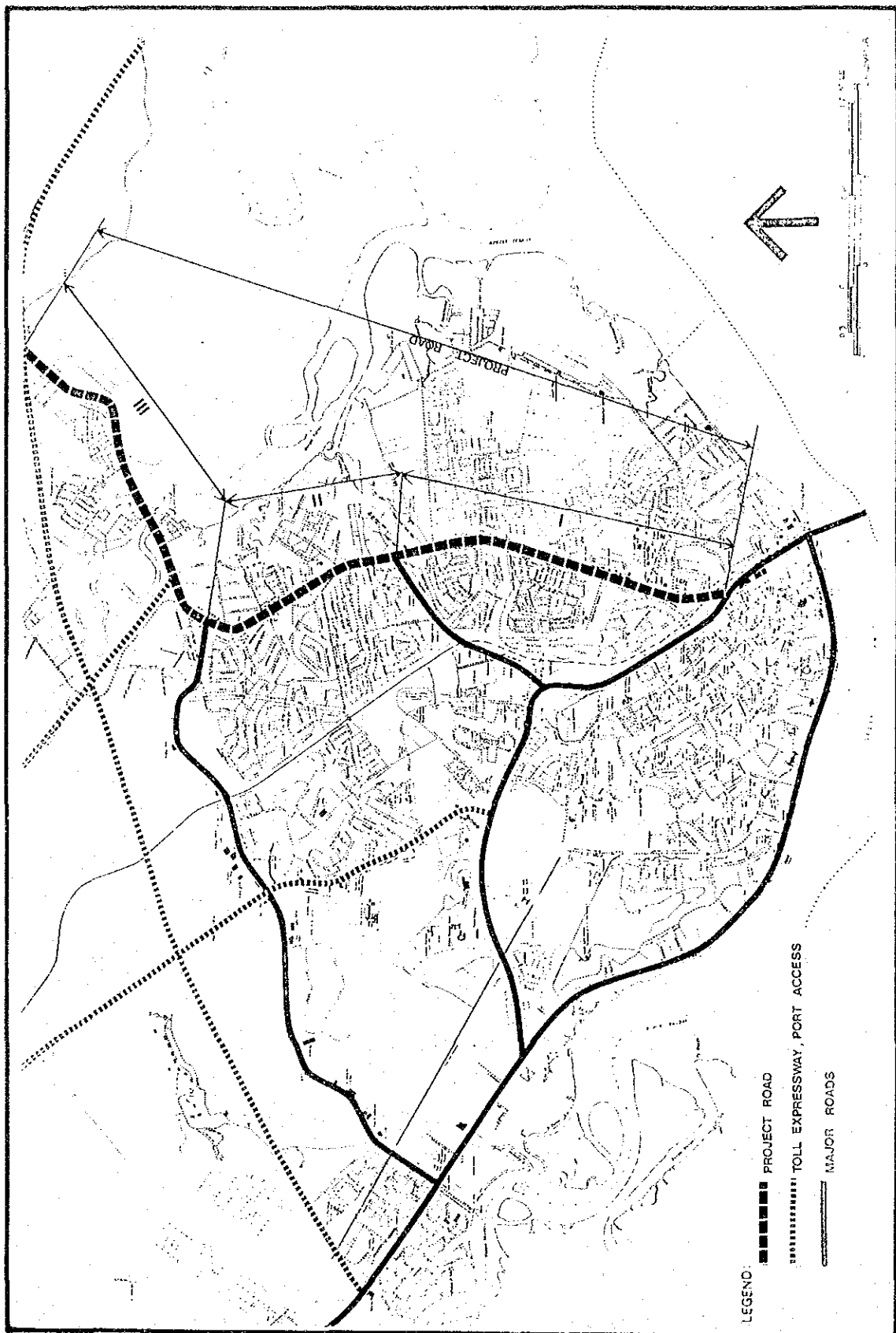
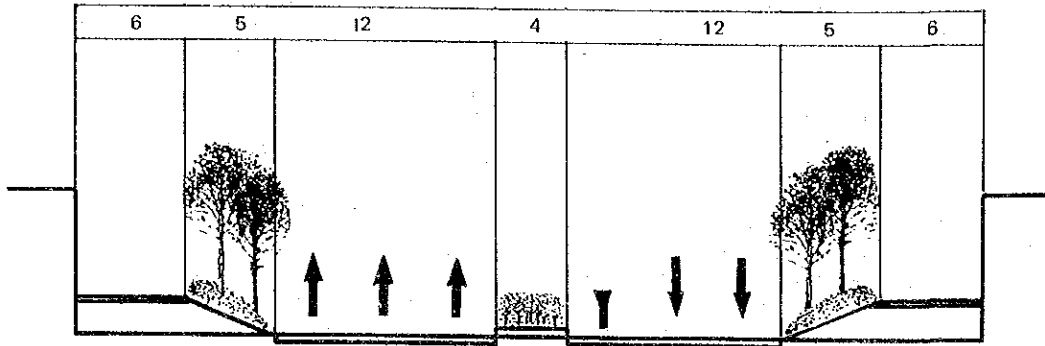


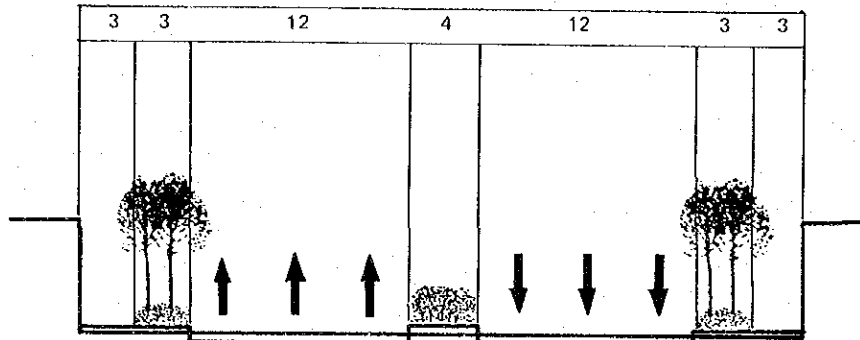
Fig. E.2 Typical Cross-Section

FEDERAL RD NO. 1 - JLN BAKAR BATU

50m

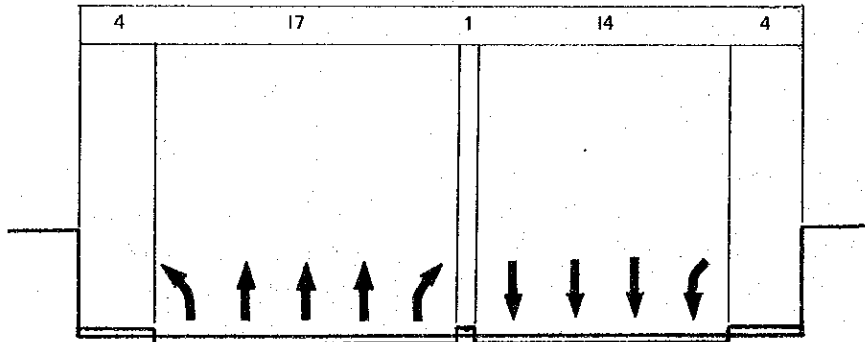


JLN BAKAR BATU - PORT ACCESS ROAD



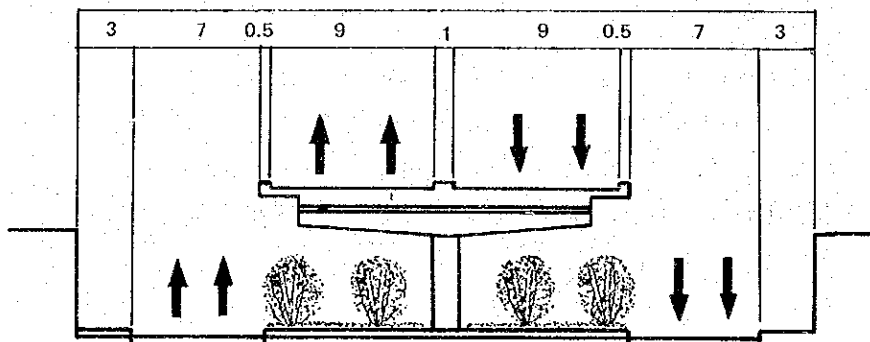
INTERSECTION

40m



INTERCHANGE

40m



Based on the plan, the construction cost was estimated for the two cases: widening from 2 lanes to 4 lanes, and widening from 2 lanes to 6 lanes as shown in Table E.1.

Table E.1 Cost Estimates -- (in M\$ Million at 1981 Prices)

Contents of Widening	Construction Cost
From 2 lanes to 4 lanes	39.35
From 2 lanes to 6 lanes	53.37

Note: For more detail, refer to the Technical Report "Cost Estimation".

In this working paper, the economic evaluation is made for the case in which Jalan Tebrau is widened from 4 lanes to 6 lanes.

Accordingly, the project cost for the widening from 4 lanes to 6 lanes is regarded as the difference of the above costs: namely

Project Cost : \$14.02 million

### 3. Effects of the Project

In order to classify the effects desired of the project, the assignment of traffic demand in 1980 was made for the following road networks.

#### 1. Base Network

Base network consists of the existing roads and the committed road projects. In this case, Jalan Tebrau is regarded as a 4-lane road for the section from the junction with Jalan Tun Abdul Razak to the interchange with the Port Access Road.

#### 2. Network with Widened Tebrau

In this case, Jalan Tebrau is regarded as a 6-lane road for the corresponding section. Other roads are exactly the same as the base case.

It can be seen from the figures that the widening of Jalan Tebrau concentrates traffic flow more on Jalan Tebrau, and that the traffic volumes on the minor district roads such as Jalan Yahy Awal are reduced.

These changes in traffic flow pattern indicate the following:

1. The traffic demand for Jalan Tebrau is considerably high.
2. In the base network case, some traffic penetrates minor roads to reduce travel time since the primary roads including Jalan Tebrau are congested.

To understand the effect of the project on the traffic flow as a whole, the total vehicle-kilometers and the total vehicle-hours were calculated for each case.

Table E.2 Vehicle-Kilometers in 1990  
(1000 vehicle kms)

	MPJB	Other Area	Total
Base Network	3,971.5	7,427.1	11,398.6
Network with widened Tebrau	3,953.2	7,636.3	11,589.5

Table E.3 Vehicle - Hours (1000 vehicle hrs)

Base Network	289.4
Network with widened Tebrau	247.2

(Note: Local and Access Roads are excluded)

Compared with the base network case, the total vehicle hours is expected to decrease while the total vehicle kilometers has slightly increased due to the widening of Jalan Tebrau.

#### 4. Preliminary Economic Evaluation

In the project evaluation, the following assumptions were made:

1. The project will be completed by the end of 1984, and then service for traffic is started at the beginning of 1985.
2. The project life is assumed to be 15 years.
3. For maintenance purposes, overlay is provided every 5 years after completion.
4. The annual benefit increases at a constant growth rate for the years 1985 - 1990 and remains at constant value after the year 1990, since the travel speed becomes unstable and the traffic volume approaches full capacity.
5. Annual discount rate is assumed to be 12%.

Based on the above assumptions, the benefit and cost stream is as shown in Table E.4.

The calculation results of the indicators for the project evaluation are shown in Table E.5.

**Table E.4 Benefit and Cost Stream  
(M\$'000 at 1981 Prices)**

Year	Project Cost	Benefit
1983	10,500	
1984	3,500	
1986		7,104
1987		8,342
1988		9,796
1989	1,670	13,509
1990		15,863
1991		15,863
1992		15,863
1993		15,863
1994	1,670	15,863
1995		15,863
1996		15,863
1997		15,863
1998		15,863
1999	1,670	15,863

Table E.5 Project Evaluation  
(in 1981 Prices)

Discounted Benefit (M\$'000)	61,070
Discounted Cost (M\$'000)	12,150
Net Present Value (M\$'000)	48,920
B/C Ratio	5.0
Internal Rate of Return	50.0%

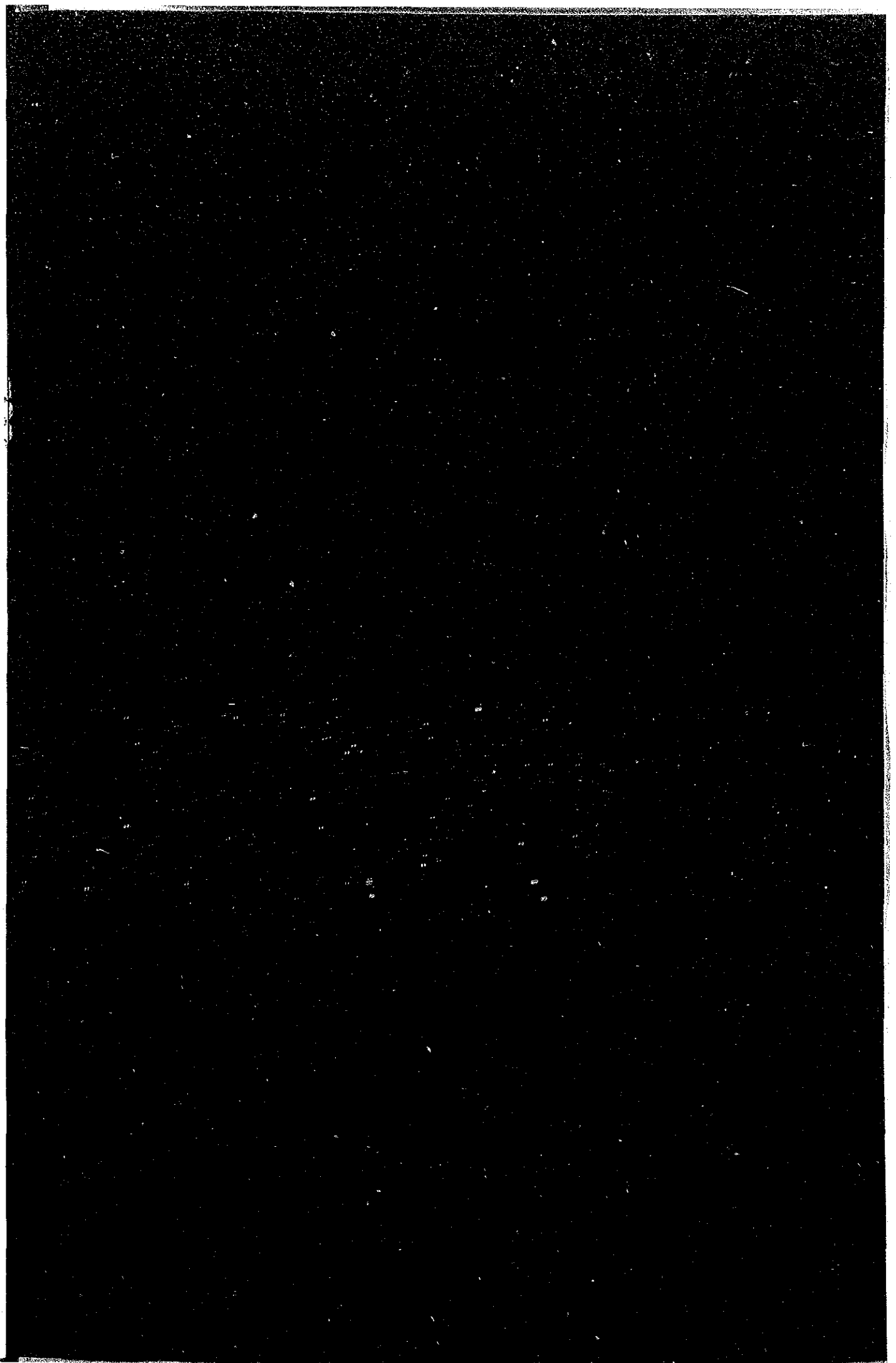
As shown above, the project is economically justified.

#### 6. Conclusion and Recommendations

1. It is found that the project "Widening of Jalan Tebrau into a Six-Lane Road" is economically feasible.
2. Accordingly, it is recommended that the project be implemented immediately.
3. After the completion of the project, it is recommended that an exclusive bus lane be introduced to promote the development of public transport.
4. Even if the project is implemented, the traffic demand is expected to exceed the capacity expanded by the project in the early 1990's. Additional road construction such as a coastal road, therefore, will be required to disperse the traffic.
5. With traffic growth, the urban environment might be aggravated. It is recommended that sufficient space for sidewalk and crossing facilities for pedestrians be provided and that adequate counter-measures for public nuisance be taken.







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