6.2.2 Tollway Network in 2000 A.D.

Fig. 6.2.8 shows the proposed tollway network in the year 2000 A.D. which comprises three tollways as follows.

i) Belawan-Medan-Tg. Morawa Tollway

This tollway is scheduled to be completed within Pelita III (1979 ∿ 1984) and it is planned to be a 4-laned road, 34.1km long and of design speed 100km/h, on which the toll collection system is proposed to be the zone tariff system.

ii) Binjei Bypass

This bypass is planned to be of a 4-laned road, 24km long, linking Binjei with Belawan-Medan-Tg. Morawa Tollway with two interchanges on the way.

iii) Outer Ring Road

This Ring Road is planned as a 4-laned road, 20km in length to connect above-mentioned two tollways and to detour the Medan City at approximately 6km in radius from the center of the CBD. Interchanges are to be provided wherever it intersects with radial arterial roads.

The proposed total road length of tollway network is to be approximately 76km and the proposed total number of access points to arterial roads are to be 13 locations, 2 of which on Binjei Bypass do not appear in Fig.6.2.8. The toll collection system of this tollway network is proposed to be the zone tariff system due to the following reasons:

i) The zone tariff system is suitable to two regional tollways.

ii) The uniform toll collection system is desirable because it is convenient to those who want to use two or more tollway sections.

iii) It is anticipated that the long-trip traffic will occupy the majority of the traffic demands of Outer Ring Road.

Fig. 6.2.9 shows the assigned traffic volume on the tollway network in Case 5-B in the year 2000 A.D.

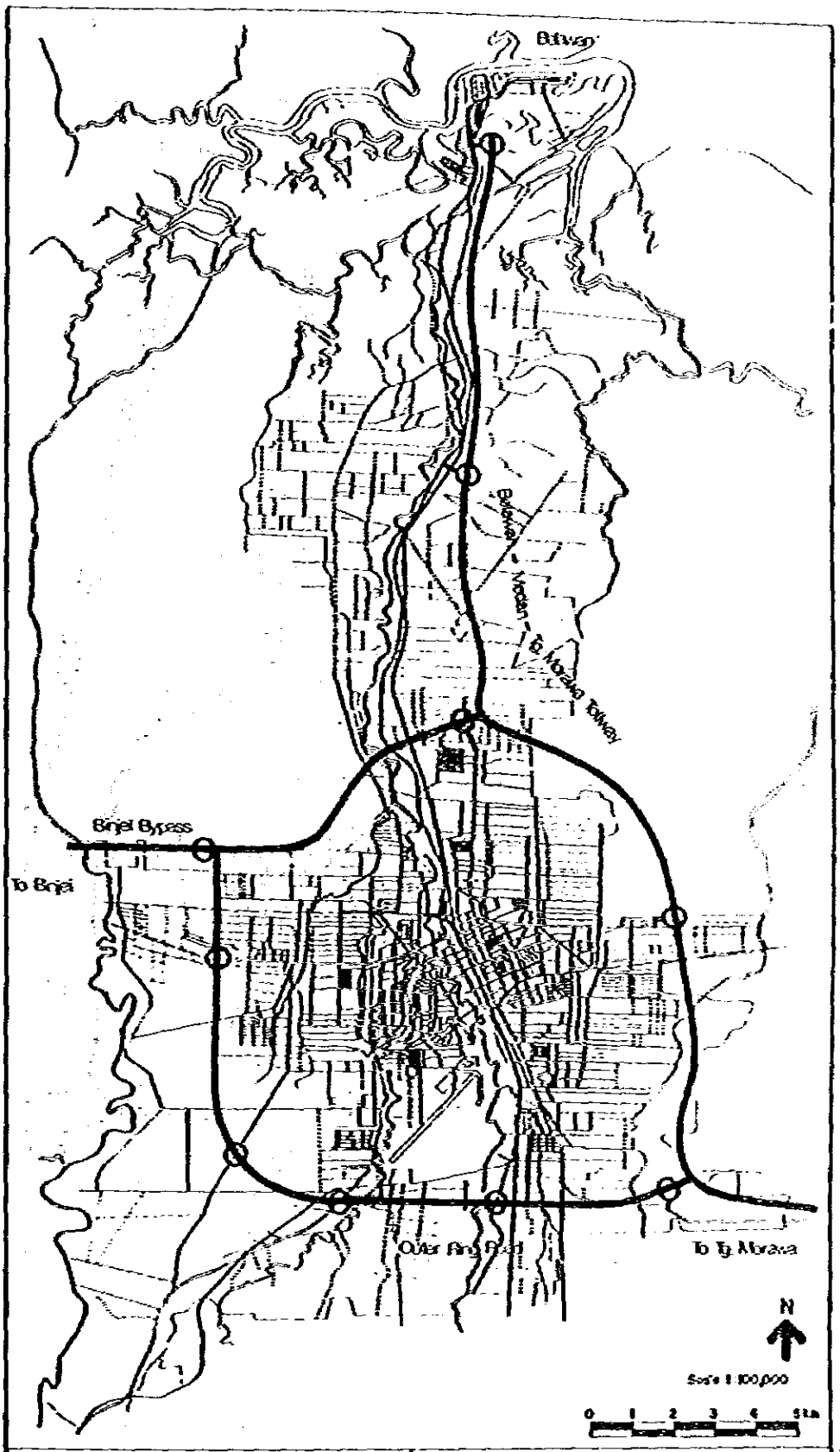


Fig. 6.2.8

Proposed Tollway Network in 2000 A.D.

Legend

Tollway (Zone Tariff System)

Interchange with On/Off Ramp

Medan Area Transportation Study

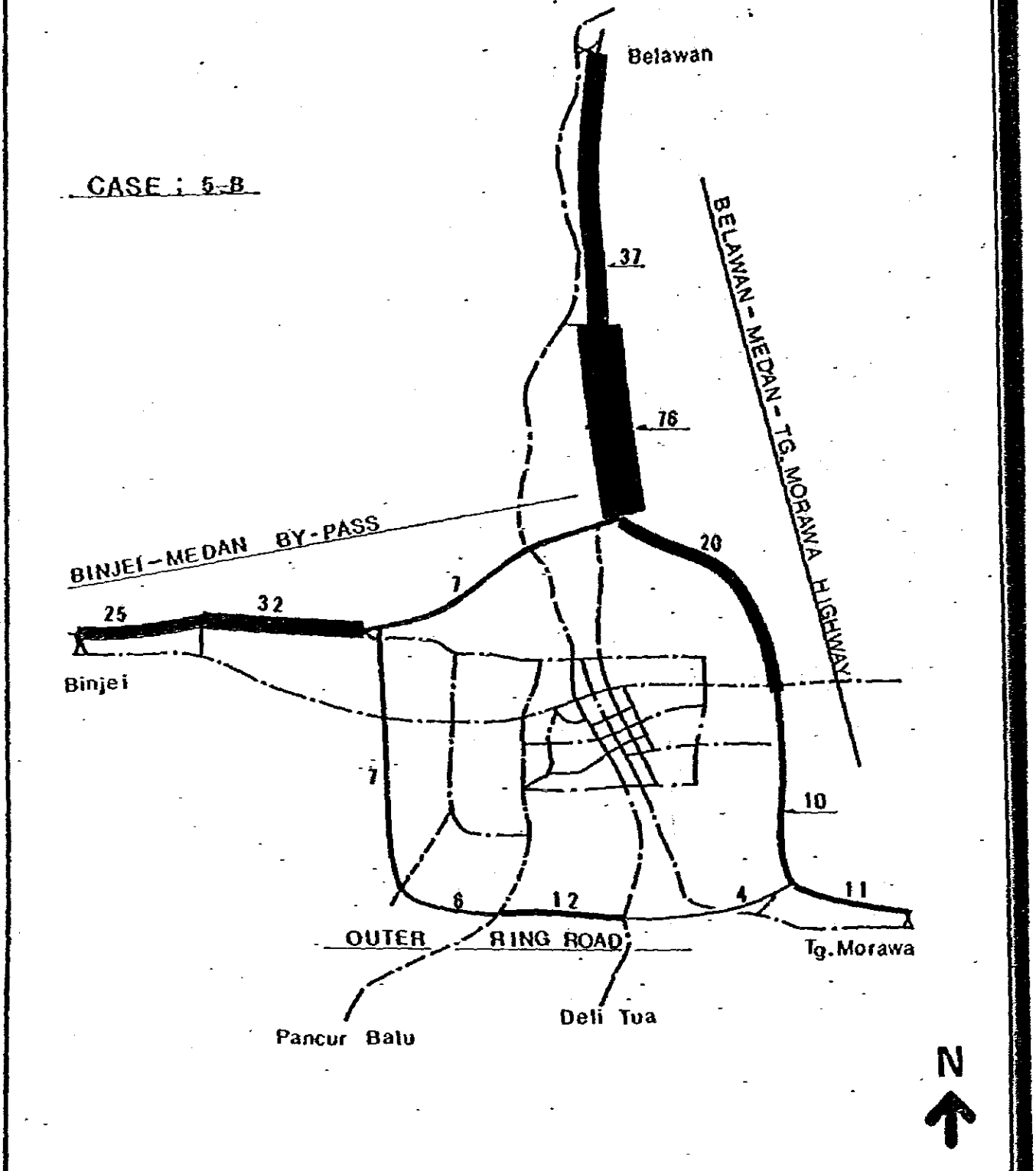


Fig. 6.2.9 Assigned Traffic Volume on the Tollway Network in Case 5-B (2000 A.D.)

6.2.3 Recommended Plan and Implementation

The Implementation Plan of the road network improvements are established taking into account the railway improvement plan based on the Urban Transport Master Plan 2000 A.D. and the extension of the Short Term Improvement Plan 1985 A.D.

The summary of road network improvements for the year 2000 A.D. is tabulated as follow;

Table 6.2.3 Summary of Road Improvements

Functional Classification	Road length	Breakdown		
Tollway	87.0km	Throughway 78km	(new construction	78.0km)
		Rampway 9km	(ditto	9.0km)
Major Arterial Roads	91.5km	6-laned 9.8km	(new construction	1.4km)
			(widening	8.4km)
		4-laned 81.7km	(new construction	2.3km)
			(widening	79.4km)
Arterial Roads	93.9km	6-laned 2km	(widening	2.0km)
		4-laned 91.9km	(new construction	7.2km)
			(widening	77.4km)
			(existing	7.3km)
Supplementary Arterial Roads	388.6km	4-laned 9.9km	(existing	9.9km)
		2-laned 378.7km	(new construction	17.6km)
			(widening	42.0km)
			(existing	319.1km)
Total Road length	661.0km			

(1) Recommended Plan 1990 A.D. (Fig. 6.2.10)

Six radial major arterial roads and the northern part and the southern part of Intermediate Ring Road are proposed to be improved and at the intersecting points between railways and those roads, 8 grade separation structures are proposed to be completed.

The summary of the improvement plan 1990 A.D. is tabulated as follows:

Table 6.2.4 Summary of Improvement Plan 1990 A.D.

		Improvement Contents		Investment cost (Rp x 10^6Rp)	
Tollway				sub total	o
Artery	Railway flyover 8 locs	1) North line 1 loc.	Intermediate Ring Road		
		2) South line 5 locs.	Intermediate Ring Road 1 JL. Pancur Batu 3, JL. Deli Tua 1.		
		3) West line 2 locs.	Intermediate Ring Road 1 JL. Sudarso 1.		
	Summary 1) Improvement road length 78.5km 6-lane 5.7km 4-lane 65.8km 2-lane 7km 2) Road flyover 1 loc.	1) JL. Belawan 8.4km 4-lane			6,181
		2) Intermediate Ring Road Northen part 4.7km 4-lane/6-lane			18,052
		3) JL. Percut 3.9km 4-lane			1,740
		4) JL. Denai 3.5km 4-lane			3,149
		5) Intermediate Ring Road Southern part 4.9km 4-lane			15,399
		6) JL. Tg. Morawa 9.0km 4-lane			7,039
		7) JL. Deli Tua 6.2km 4-lane			4,942
		8) JL. Pancur Batu 12.6km 4-lane			12,217
		9) JL. Binjei 6.7km 4-lane			5,717
		10) Intermediate Ring Road Western part 1.7km 4-lane			3,273
		11) JL. Katamso ∿ JL. Sudarso 4.2km 6-lane			11,511
		12) Frontage road along B-M-Tg. Morawa TWY 7km 2-lane			2,497
		13) JL. Pemkalagian 4km 4-lane			1,085
		14) JL. Yamin 1.7km 4-lane			2,375
				sub total	95,177
				Total	95,177

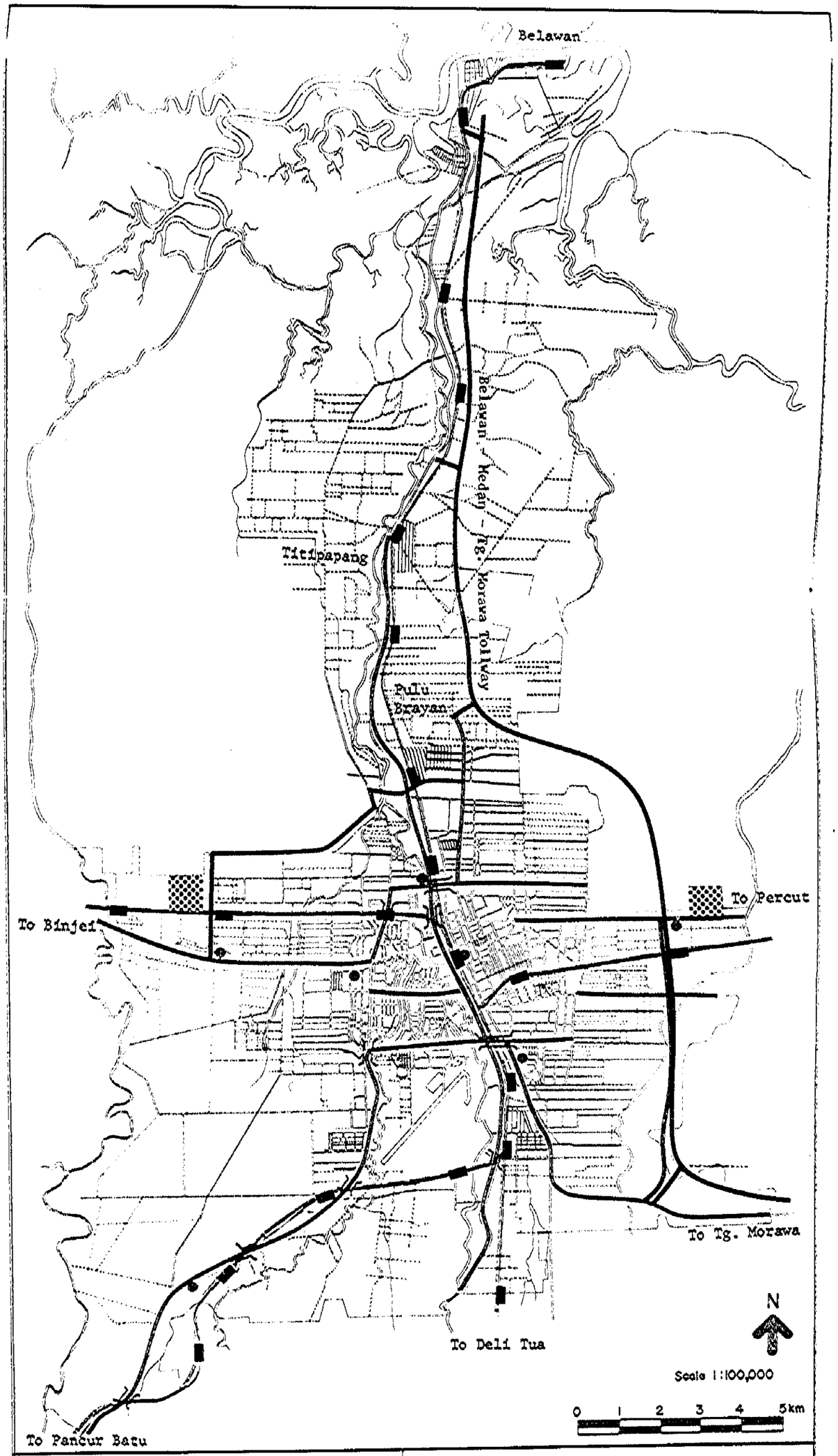


Fig. 6.2.10

Road Network Construction Stage
1986 ~ 1990

Medan Area Transportation Study

Legend (The portions colored are to be improved)

- Major Arterial Road
- Arterial Road
- Frontage Road
- Bus Terminal
- Grade Separation Structure
- Railway Station
- Railway, single track
- Railway related facilities
- Truck Terminal Warehouse

(2) Recomended Plan 1995 A.D. (Fig. 6.2.11)

Binjei Bypass Tollway and Intermediate Ring Road are proposed to be completed. Binjei Bypass are to connect Belawan-Medan-Tg. Morawa Tollway, which is proposed to be completed by the year 1985 A.D.

Furthermore, in order to supplement these tollways and major arterial roads, the access roads to Binjei Bypass and the two main roads in the East-West direction within Intermediate Ring Road are proposed to be completed.

The summary of the improvement plan 1995 A.D. is tabulated as follows:

Table 6.2.5 Summary of Improvement Plan 1995 A.D.

		Improvement Contents	Investment cost (Rp x 10^6Rp)
Tollway		1) Binjei Bypass 24km 4-lane	32,808
			sub total 32,808
Artery	Railway flyover 2 locs	1) North line 1 loc. JL. Jati 2) East line 1 loc. Intermediate Ring Road	
	Summary 1) Improvement road length 37.3km 4-lane 34.3km 2-lane 3km 2) Road flyover 3 locs	1) JL. Belawan 14.0km 4-lane 2) Intermediate Ring Road Eastern part 3.6km 4-lane 3) JL. Gatot Subroto ∿ JL. Yanin 3.7km 4-lane 4) JL. Gajah Mada ∿ JL. Haryono 5.4km 4-lane 5) Intermediate Ring Road Western part 2.1km 4-lane 6) Binjei Bypass Western access road 5.5km 4-lane 7) Frontage road along Binjei Bypass 3km 2-lane	6,641 12,710 13,349 9,728 6,219 3,484 2,713 sub total 54,844
			Total 87,652

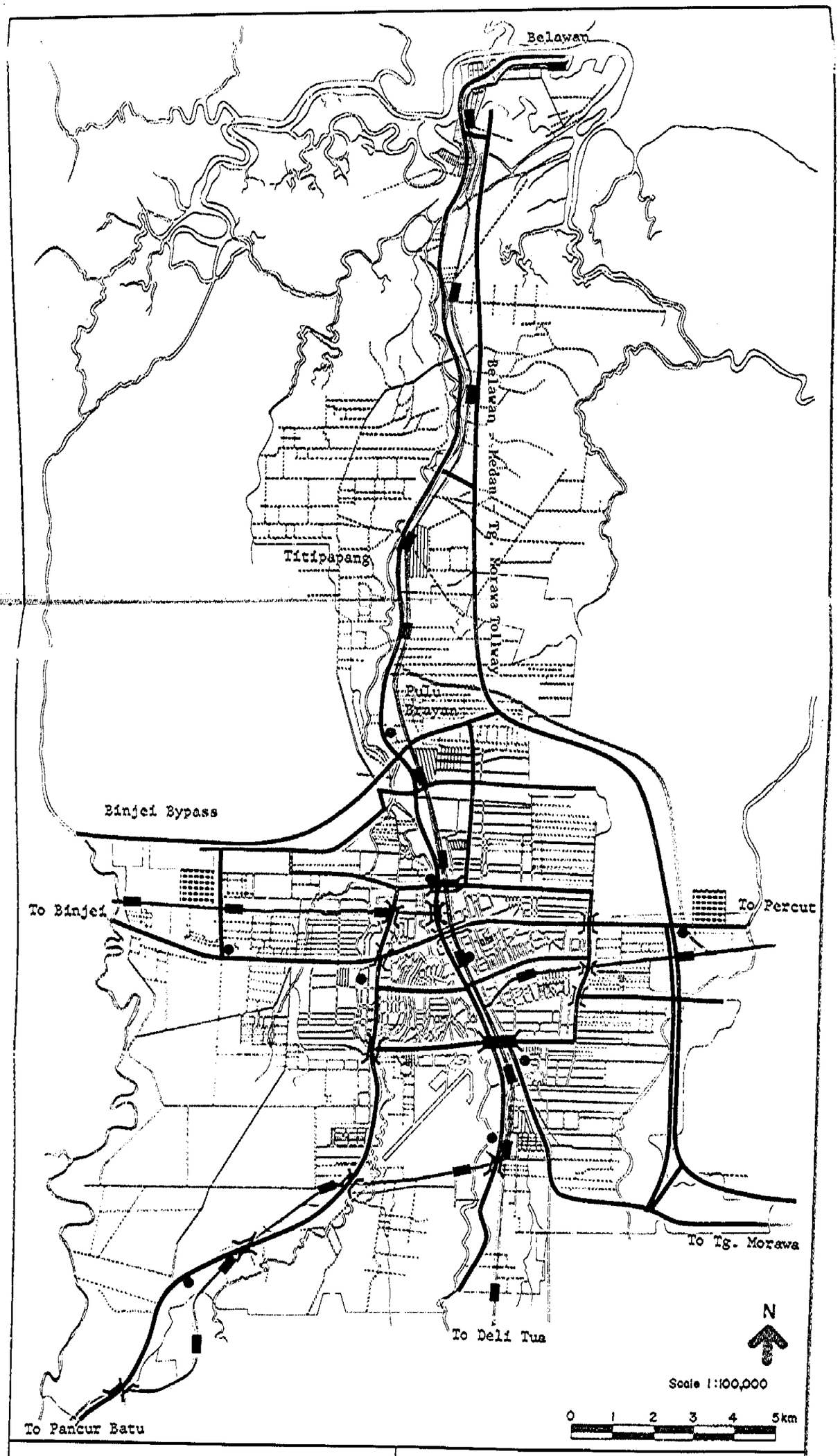


Fig. 6.2.11

Road Network Construction Stage

1991 ~ 1995

Medan Area Transportation Study

Legend (The portions colored are to be improved)

- Tollway
- Major Arterial Road
- Arterial Road
- Frontage Road
- Bus Terminal
- Grade Separation Structure
- Railway Station
- Railway, single track
- Railway, double track
- Railway related facilities
- Truck Terminal Warehouse

(3) Recommended Plan 2000 A.D. (Fig. 6.2.12)

Outer Ring Road that is to connect between the eastern part of Binjei Bypass and the southern part of Belawan-Medan-Tg. Morawa Tollway is proposed to be completed, while the progress the improvement of arterial roads, mainly within Intermediate Ring Road, will perfect the road network based on the Master Plan 2000.

The summary of the improvement plan 2000 A.D. is tabulated as follows:

Table 6.2.6 Summary of Improvement Plan 2000 A.D.

		Improvement Contents	Investment cost ($Rp \times 10^6 Rp$)
Tollway		1) Outer Ring Road 20km 4-lane	27,340
			sub total 27,340
Artery	Railway flyover 2 locs	1) East line 1 loc. JL. Thamrin 2) West line 1 loc. JL. Kapten Muslim	
	Summary 1) Improvement road length 47.8km 6-lane 2km 4-lane 35.8km 2-lane 10km 2) Road flyover 1 loc.	1) JL. Singamangaraja ∿ JL. Gaharu 4.2km 6-lane	8,926
		2) JL. Sutomo 3km 4-lane	6,562
		3) JL. Thamrin 2km 6-lane	7,313
		4) JL. Veteran-JL. Yani VII 1.3km 4-lane	1,747
		5) JL. Patimura-JL. S. Parman 2.6km 4-lane	2,229
		6) JL. Sudirman ∿ JL. Asia 3.2km 4-lane	3,082
		7) JL. Kapten Maulana Lubis ∿ JL. Raden Saleh 1.2km 4-lane	1,571
		8) JL. Sutrisno 2.2km 4-lane	2,979
		9) JL. Bakti ∿ Gang Bahagia 1km 4-lane	986
		10) JL. Olahraga-Gang Turi 3.8km 4-lane	2,637
		11) Outer Ring Road South-Western access road 2.4km 4-lane	1,420
		12) JL. Kapten Muslin 7.4km 4-lane	7,216
		13) Northern access road to Intercediate R.R 2.4km 4-lane	1,791
		14) JL. Bakaran-JL. Halat connection road 1.1km 4-lane	1,895
		15) Frontage road along Outer R.R 10km 2-lane	3,674
			sub total 54,028
			Total 81,368

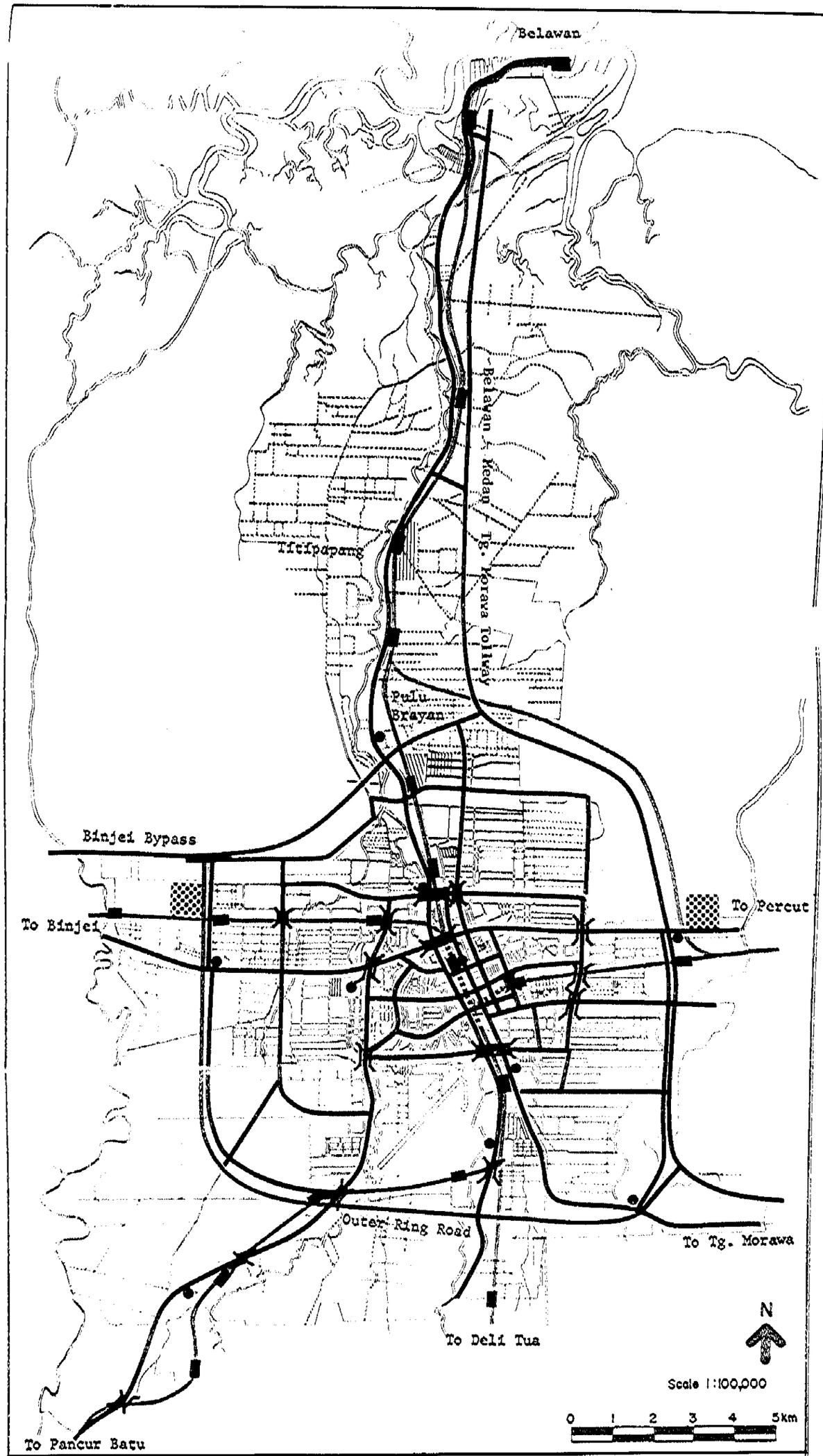


Fig. 6.2.12

Road Network Construction Stage
1996 ~ 2000

Medan Area Transportation Study

Legend (The portions colored are to be improved)

- Tollway
- Major Arterial Road
- Arterial Road
- Frontage Road
- Bus Terminal
- Grade Separation Structure
- Railway Station
- Railway, single track
- Railway, double track
- Railway, elevated
- Railway related facilities
- Truck Terminal Warehouse

6.3 Bus Transport

6.3.1 Bus Network

(1) Bus Transport System

It is expected to increase the share of bus transport in the urban transport demand of Medan Area based on the premise that the public transport system should be strengthened in future. At present so-called Bemo and Daihatsu are operating to cope with public demands and it cannot be said that the bus transport system has been sufficiently developed partly due to on the unsatisfactory development of road facilities.

In Medan Master Plan of 2000 A.D, Becak is presumed to be abolished basically except a part of peripharal area of the city and surrounding areas and Bemo and Daihatsu are still expected to share short-trip service without duplication on bus survice in the area where the road facilities will remain unchanged although the coordination is preferable among bus, Bemo and Daihatsu in Medan City. But all Bemo and Daihatsu should be replaced by bus system completely by 2000 A.D. when large buses should operate on the arterial road network and the mini buses on minor arterial roads of 2 lanes.

Furthermore, it seems to be necessary to improve such a present system that buses stop at anywhere to pick up passengers and to allow passengers to get off, into such a system that the bus passengers can get on and get off buses only at the bus stops and/or bus terminals.

(2) Bus Passenger Demand

In the results of traffic demand estimation by transport mode, 894.7 thousand trips per day of bus passenger are anticipated for the year 2000 A.D. in the case of Low Motorization Model. The estimated desire-lines of bus passenger consolidated into twelve zones are shown in Fig. 6.3.1. The bus passenger trips by type of service such as Intra- and Inter-city trips are tabulated in the following table.

Table 6.3.1 Bus Passenger Trips by Type in Medan Area in 2000 A.D. (Case 5-B)

(Unit: 1000 trips/day)

Type of service	Trips
Intra-City	630.9 (70.5%)
Inter-City	254.9 (28.5%)
Others	8.9 (1.0%)
Total	894.7 (100%)

Table 6.3.2 Bus Passenger O.D. Matrix of Medan Area in 2000 A.D. Consolidated Into 12 Zones

(Unit : Passenger trips/day)

O/D	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	
(1)	139,590	26,711	74,574	66,884	56,355	100,067	35,937	4,228	18,902	19,631	8,234	16,681	707,384
(2)		1,143	8,013	5,947	4,506	10,183	3,277	237	1,512	2,266	709	1,450	67,097
(3)			10,649	20,057	13,246	24,094	10,492	1,675	5,025	6,862	2,497	5,332	193,165
(4)				7,333	11,837	19,168	9,191	911	4,200	5,383	2,043	4,046	164,333
(5)					4,445	19,708	6,974	655	2,677	3,269	1,278	2,517	131,912
(6)						21,418	13,211	1,016	7,167	7,339	2,764	4,681	252,234
(7)							4,909	403	2,682	3,121	1,692	2,397	99,195
(8)								2	89	146	85	91	9,540
(9)									527	996	510	686	45,500
(10)										447	968	1,222	52,097
(11)											131	461	21,503
(12)												237	40,038
Total													1,783,998

Although the intra-city trips are dominant in the estimate, the intercity trips as well occupy rather a large share of around 28.5%. Attention must be paid on the fact that a noticeable concentration to the east side of Medan Railway Station is observed in the bus passenger desire-lines.

Fig. 6.3.2 shows the result of traffic assignment of bus passengers in case 5-B-3 on the road network, in which the traffic demands assigned on radial arterial roads and Intermediate Ring Road are noticeable.

(3) Bus Network Service

Followings are the principles in planning concept of bus network service in the case of Low Motorization:

i) Providing a bus lane in each direction on arterial roads constituting the basic frame of the road network, those arterial roads constitute the basic bus route network;

ii) An average walking distance of citizens to be covered from their homes or offices to the nearest bus route and from the nearest bus stops to railway stations are presumed to be 300 m; and

iii) The areas which cannot be covered by the average walking distance are to be served by the mini-bus system.

By such a concept, major areas in Medan City can be served either by the bus and mini-bus routes and/or railway stations as are shown in Fig. 6.3.3.

(4) Intermediate-Term

It is expected to take place some uncontinuousness in the transport system of Medan City during the transition period from the present transport conditions to those of the target system in the long-term. Although, it is natural of course that some changes will take place in modes of transport during the stage of such transition period, an important thing is what kinds of measure should be taken during such transition period in order to realize smooth transitions.
The followings are the substantial measures for such purpose.

i) Replacement of such modes as Bemo and Daihatsu with the large bus system; and

ii) Abolishment of Becak system, except for the peripheral areas.

Concerning the change of transport modes mentioned in item (i), although Bemo and Daihatsu are convenient for citizens in their utilization presently, it is desirable Bemo and Daihatsu to be replaced by the bus system including mini bus judging from the transport efficiencies and unfavorable effects of such old modes on the urban traffic congestion, and this is also the policy of the Indonesian Government.

In this case some issues will be expected to take place in the employment of their drivers and in the service to their users etc. if the replace-

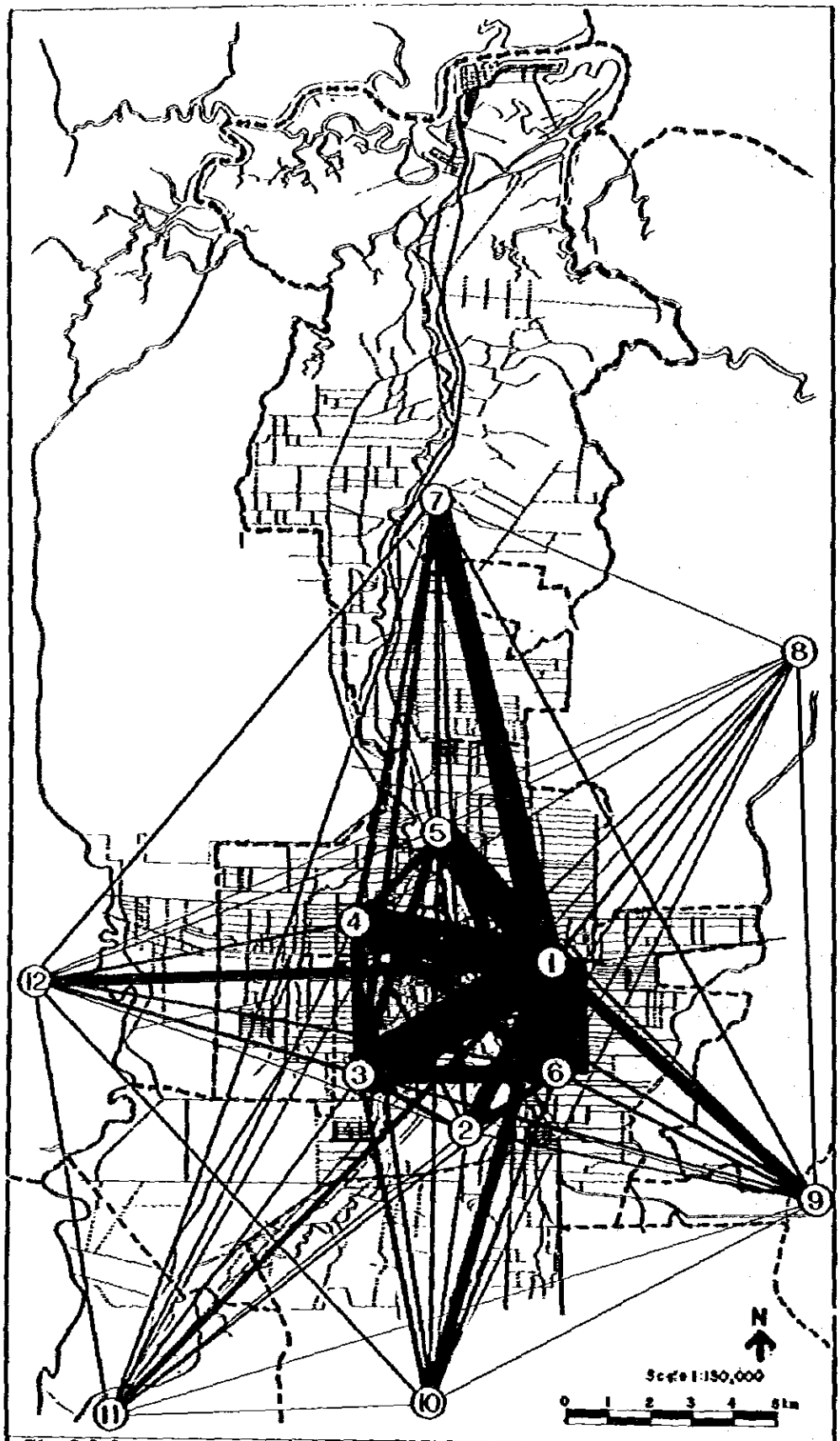


Fig. 6.3.1
Estimated Desire-Line Pattern of Bus Passengers (2,000 A.D.) (Case 5-B-3)

Medan Area Transportation Study

Legend

x 10^3 Person/day

100 80 60 40 20 5

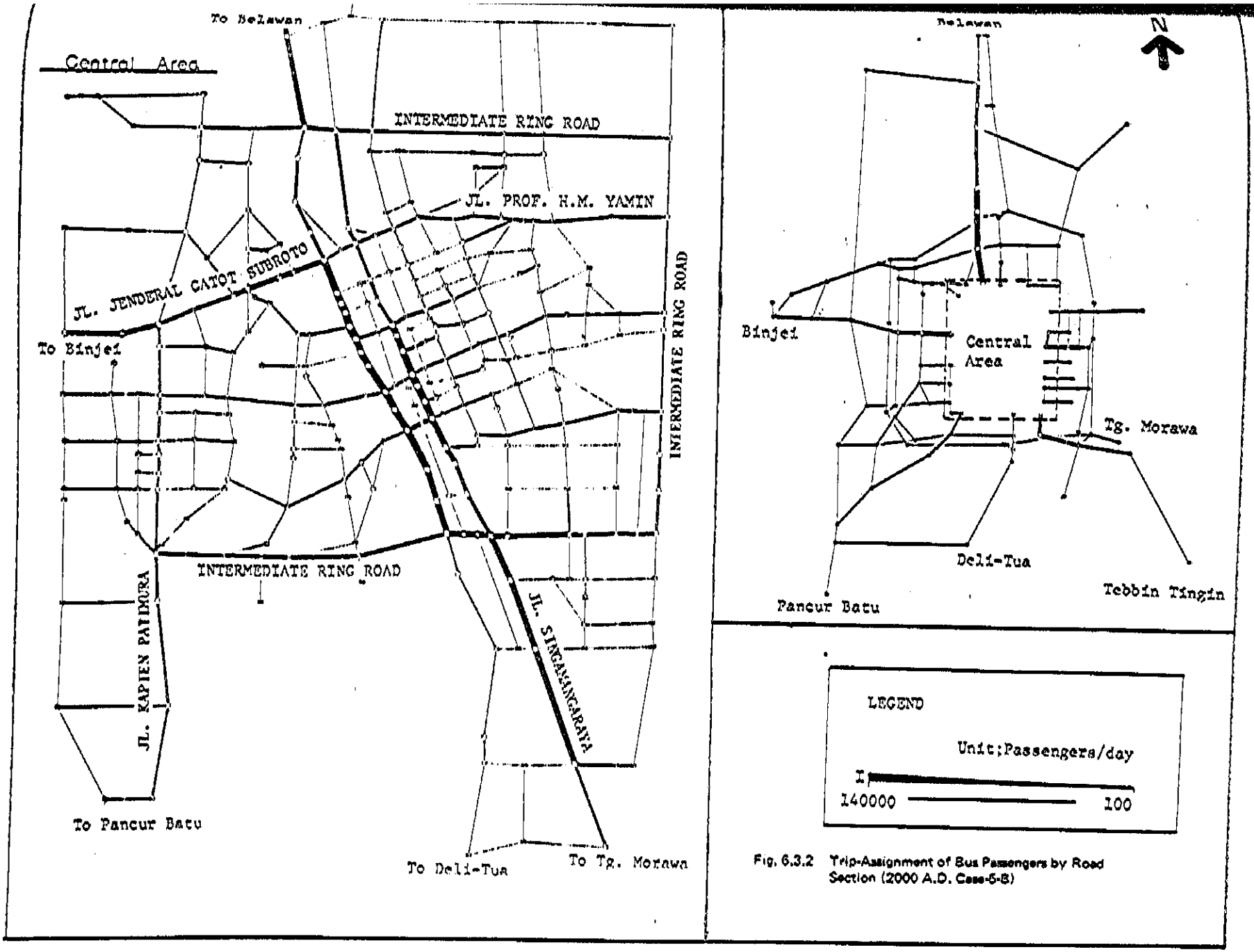


Fig. 6.3.2 Trip-Assignment of Bus Passengers by Road Section (2000 A.D. Case-5-B)

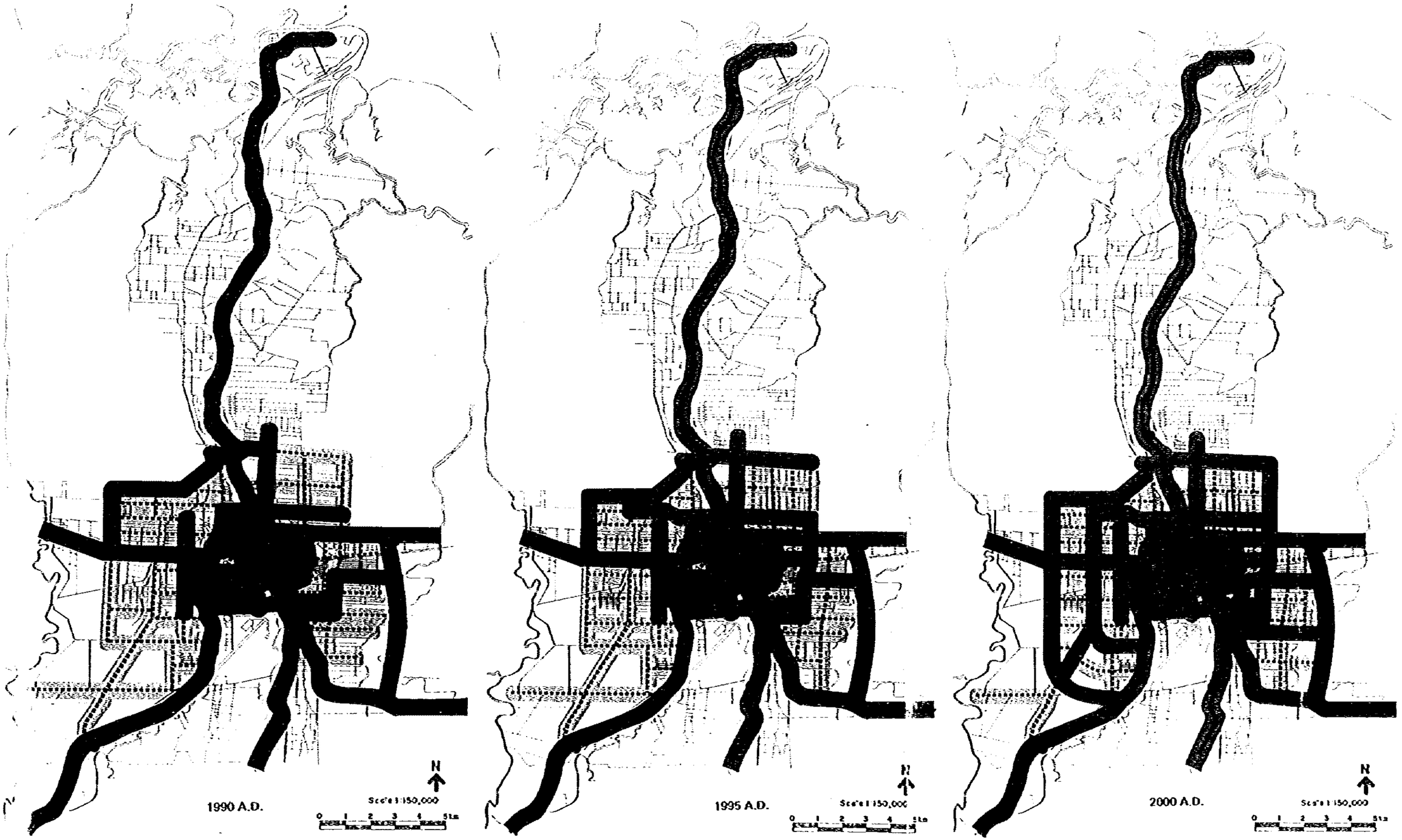


Fig. 6.3.3 Estimated Areas to be Served by Large-Bus & Mini-Bus Systems (1990 A.D. ~ 2,000 A.D.)

ment with the bus system is carried out rapidly; and consequently, the gradual replacement is proposed as the appropriate solution so as not to take place any confusion.

The transport system in the intermediate-term has been considered under the premise that Bemo and Daihatsu shall be gradually replaced.

As for the abolishment of Becak, this can be considered similar to the problems of Bemo and Daihatsu. Especially the existence of Becak is presently one of the direct causes of traffic congestion in Medan City because of its excessive lateral width and low operating speed. Judging from these facts it is also inevitable to abolish the Becak system at the appropriate time in the future except for in the peripheral areas of the city. However, some alternative means of transport should be provided to keep the similar convenient service to their users instead of Becak.

The appropriate urban transport system for the intermediate-term is sought for from the viewpoint of smooth transferring to the long-term transport system for 2000 A.D.,

Although the exclusive bus system including mini-bus is eventually proposed for 2000 A.D., it is considered to be a problem in the inter-mediate-term how to adjust the Bemo system and the bus system, and how to transfer smoothly from the intermediate-term to the bus system in 2000 A.D.,

The bus transportation system in the stage of intermediate-term is to be planned taking into account the following categories:

i) Anticipated Progress in Land Use Development.

ii) Appropriate adjustments between the Bus and the Bemo Systems are considered as follows;

- Bus routes development shall cope with the road development;
- The routes on which the mini-bus system is scheduled to serve in 2000 A.D. are to be operated by Bemo and Daihatsu;
- The elemination of Bemo and Daihatsu operations on those routes where the Bus System is operated.

Consequently, the basic bus transportation is to be served by the bus system supplemented by Bemo and Daihatsu only on such roads which have not been improved enough for the bus operation.

Judging from the facts described above, the bus system in the Inter-mediate-Term which is around 1990 A.D. is proposed as shown in Fig. 6.3.4 and Fig. 6.3.5.

(5) Number of Buses to be assigned in 2000 A.D.

In this report it is considered to separate the City Bus system from the Inter-City Bus system and the bus terminals are planned to serve for transferring between those two systems. By this way the necessary number

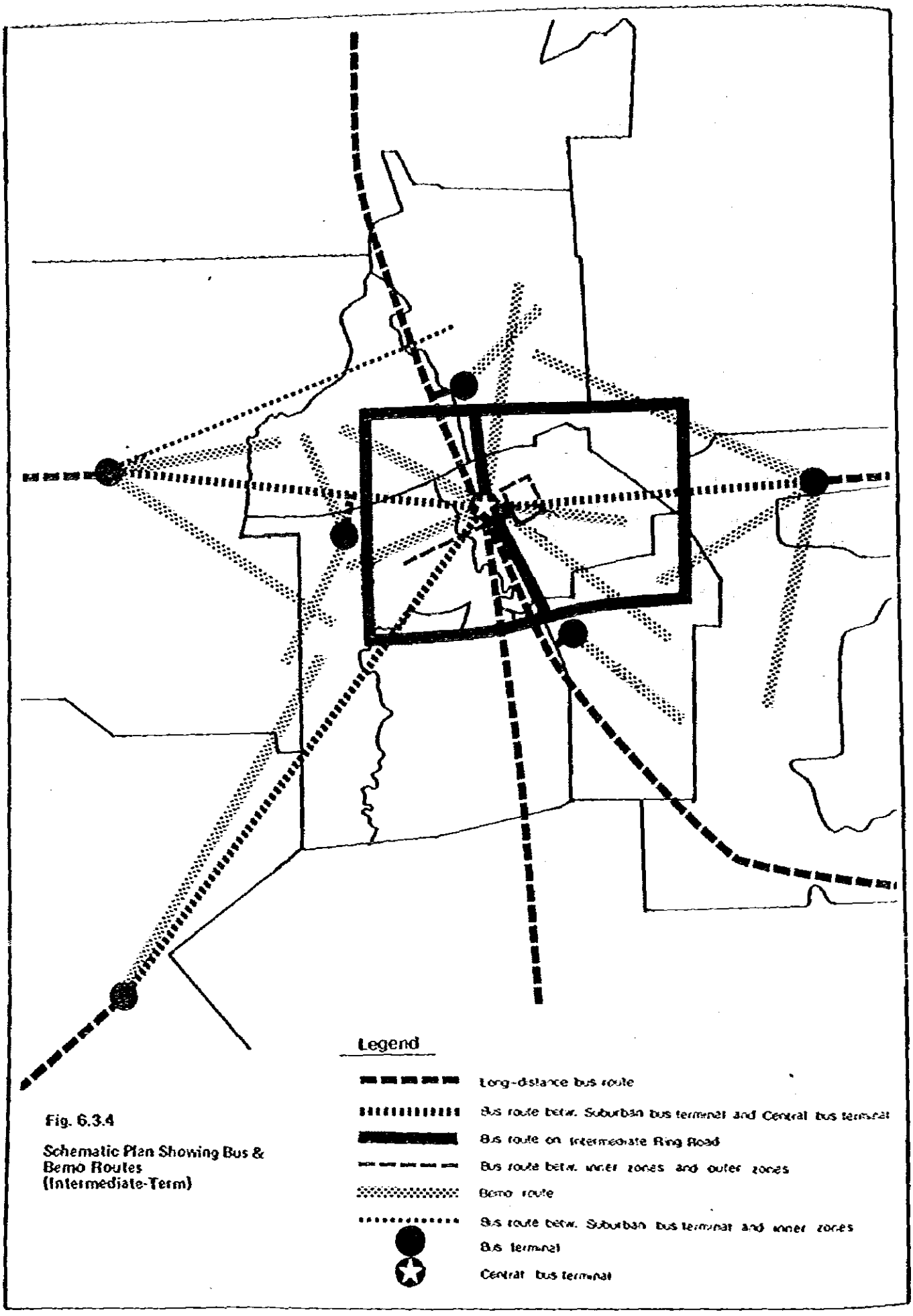


Fig. 6.3.4

Schematic Plan Showing Bus & Bemo Routes (Intermediate-Term)

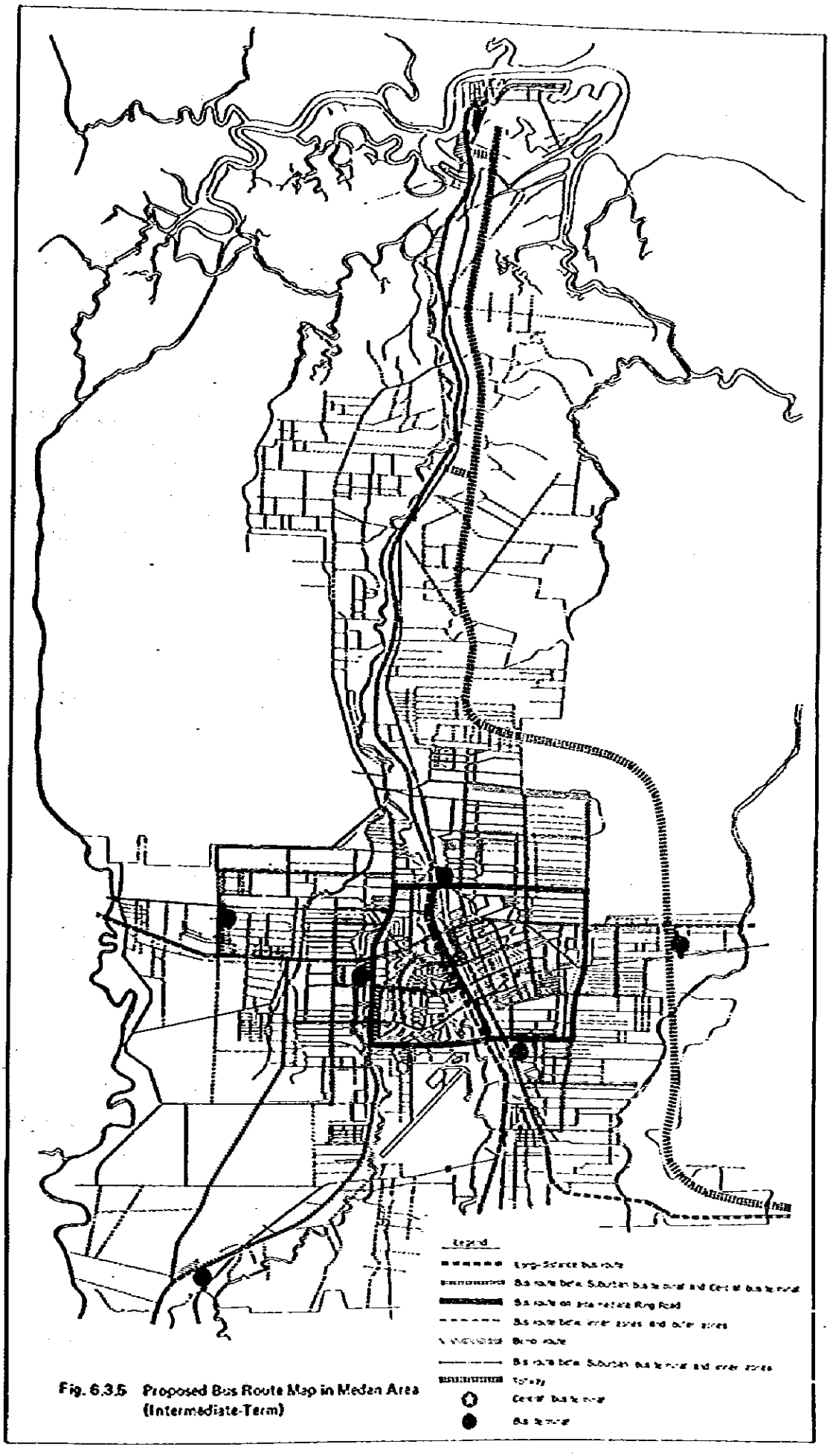


Fig. 6.3.5 Proposed Bus Route Map in Medan Area (Intermediate-Term)

of buses to be assigned in 2000 A.D. is estimated as follows:

i) City Bus

$$N = \frac{D}{A}$$

whereas N : the necessary number of bus units to be assigned

D : daily traffic demands

A : average number of passengers transportable by a bus per day

The daily traffic demands are shown in Table 6.3.4 and the approximate current number of passengers transported by a bus in 1979 in Medan City were counted as 900 passengers/bus. However, the present bus transport in Medan City seems to be kept in rather poor level of service. Therefore in this study for the long-term the congestion levels in service are presumed as half of the current status as shown in the following table.

Table 6.3.3 Average Number of passengers to be transported by a Bus in Medan City in 2000 A.D.

(Unit : passengers/bus/day)

Type	Number of passengers per bus per day
Large bus	500
Mini-bus	250

Moreover, the numbers of bus passengers to be transported by City Bus including transferring passengers from and to Inter-City Bus routes in 1990 A.D., 1995 A.D. and 2000 A.D. are estimated as follows:

Table 6.3.4 Average Daily Bus Passenger Demands for City Bus in Medan Area.

(Unit: passengers x 10^3/bus/day)

Type	1990	1995	2000
Large Bus	405.6	549.2	744.0
Mini-bus	135.2	164.1	141.7
Total	540.8	713.3	885.7

Note: City bus passengers whose trips are within the town of Binjei are excluded.

According to the results mentioned above, the necessary numbers of buses to be assigned in 1990 A.D., 1995 A.D. and 2000 A.D. are tabulated as follows:

Table 6.3.5 Number of Buses for City Bus to be assigned in Medan Area

(Unit: Bus unit)

Type	1990	1995	2000
Large Bus	811	1098	1488
Mini-bus	541	656	567
Total	1352	1754	2055

ii) Inter-City Bus

The necessary number of buses to be assigned for Inter-City service is estimated by the following formula:

$$N = \frac{D}{2} \times (P/Ap/F) \times R$$

where,

N : Necessary number of bus units
D : Daily traffic demands (round trips)
P : Peak hour ratio
Ap: Average number of bus passengers in a bus in peak hour
F : {60 minutes} ÷ {round trip time (minutes)}
R : Rate of spare bus units due to maintenance and repair

Actual numbers of the respective factors are presumed as follow in order to estimate the number of buses to be assigned:

Table 6.3.6 Respective Parameters

Item	Parameter
Peak Hour Ratio	16%
Average No. of Passengers in a bus in Peak Hour	45 passengers
Running Speed	30 km/h
Waiting Time at Origin & Destination	10 min.
Rate of spare bus units due to maintenance and repair	20%

According to the results described above, the necessary number of buses to be assigned in 1990 A.D., 1995 A.D. and 2000 A.D. are as follows:

Table 6.3.7 Estimated No. of Buses for Inter-City Bus

(Unit: Bus unit)

Routes bound for	1990	1995	2000
Belawan	213	198	237
Binjei	124	145	166
P. Batu	34	39	43
Delitua	48	32	39
Tg. Morawa	166	192	168
Percut	15	16	17
Total	600	622	670

However, the numbers of buses estimated above show only for the main routes as a whole, and the detailed analysis shall be made separately for each bus operating firm including of extremely small size.

(6) Other Facilities

It seems to be important from the traffic point of view to determine how to appropriately diminish the traffic friction between the general traffic flows and the bus flows. Therefore installation of bus bays at main bus stops are desirable as shown in Fig. 6.3.6.

6.3.2 Bus Terminals

Appropriate considerations in planning bus terminal are summarized as follows:

i) To meet respective traffic demands;

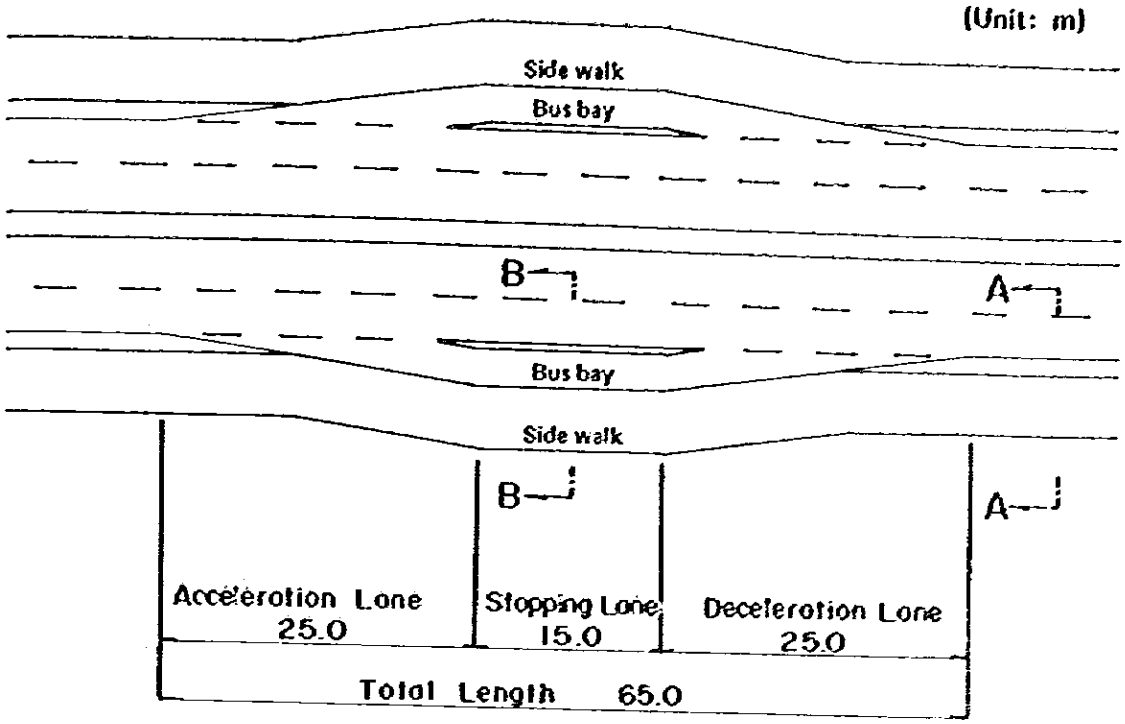
ii) To facilitate bus passengers in transferring to other bus routes;

iii) To alleviate the overlapping and/or complication by crossing of traffic flows;

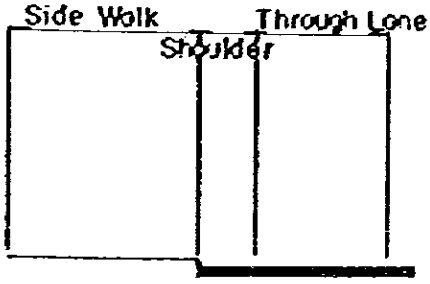
iv) Adjustment of the relation with other transport modes at railway station plazas and others to facilitate transferring to railway and other modes.

In Medan Area two conspicuous types of bus passengers' flows are observed presently, namely, that of inter-city bus traffic and that of intra-city bus traffic; and a portion of the latter presently concentrating to the central part of the CBD attracts a particular attention.

As for securing the transferring convenience, one can deem it as a matter



A - A Section



B - B Section

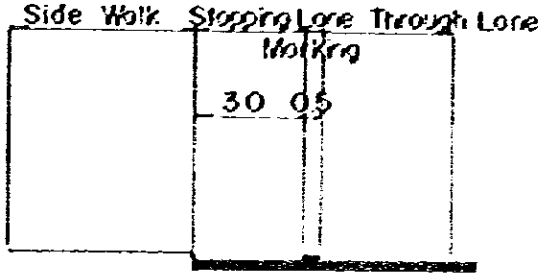


Fig. 6.3.6 Typical Design of Bus Bay

of bus route system and an appropriate attention should be paid in minimizing the number of transferring and avoiding the concentration of traffic movements to one location in the CBD.

One can deem it as a matter of bus route system to avoid the overlapping and/or the complication by crossing of traffic flows.

As for the matter of adjustment with other transport modes, it is inevitable to provide suitable number of bus berths at each railway station plaza to receive bus passengers because the transport planning in Medan Area is based on the premise that bus system links with railway at stations, functioning as its feeder routes. Appropriate considerations should be paid in planning station plazas so as to facilitate transferring between bus and railway systems.

Judging from these facts mentioned above, the planning policies of bus terminals can be summarized as follows:

i) To provide bus terminals for the inter-city traffic at nodes located along Outer Ring Road where it makes easy to transfer between the inter-city bus routes and the intra-city bus routes.

ii) To make use of railway station plazas for junctions between bus routes and the railway;

iii) To provide transferring junctions between main-bus routes and mini-bus routes;

(a) Locations and Sizes of Proposed Bus Terminals

The necessary numbers of berths and their sizes of proposed bus terminals in 1990 A.D., 1995 A.D. and 2000 A.D. are tabulated in the following table.

Table 6.3.8 Recommended Sizes of Proposed Inter-City Bus Terminals by Route

Bus route for	1990		1995		2000	
	No. of Berths	Area ($\times 10^3 m^2$)	No. of Berths	Area ($\times 10^3 m^2$)	No. of Berths	Area ($\times 10^3 m^2$)
Belawan	-	-	22	6.6	28	8.4
Binjei	10	3.0	12	3.6	12	3.6
Pancur Batu	6	1.8	6	1.8	8	2.4
Deli Tua	-	-	12	3.6	16	4.8
T. Morawa	-	-	-	-	14	4.2
Percut	4	1.2	4	1.2	4	1.2
Total	20	6.0	56	16.8	82	24.6

Fig. 6.3.7

Schematic Bus Route Map of Medan Area (2,000 A.D.)

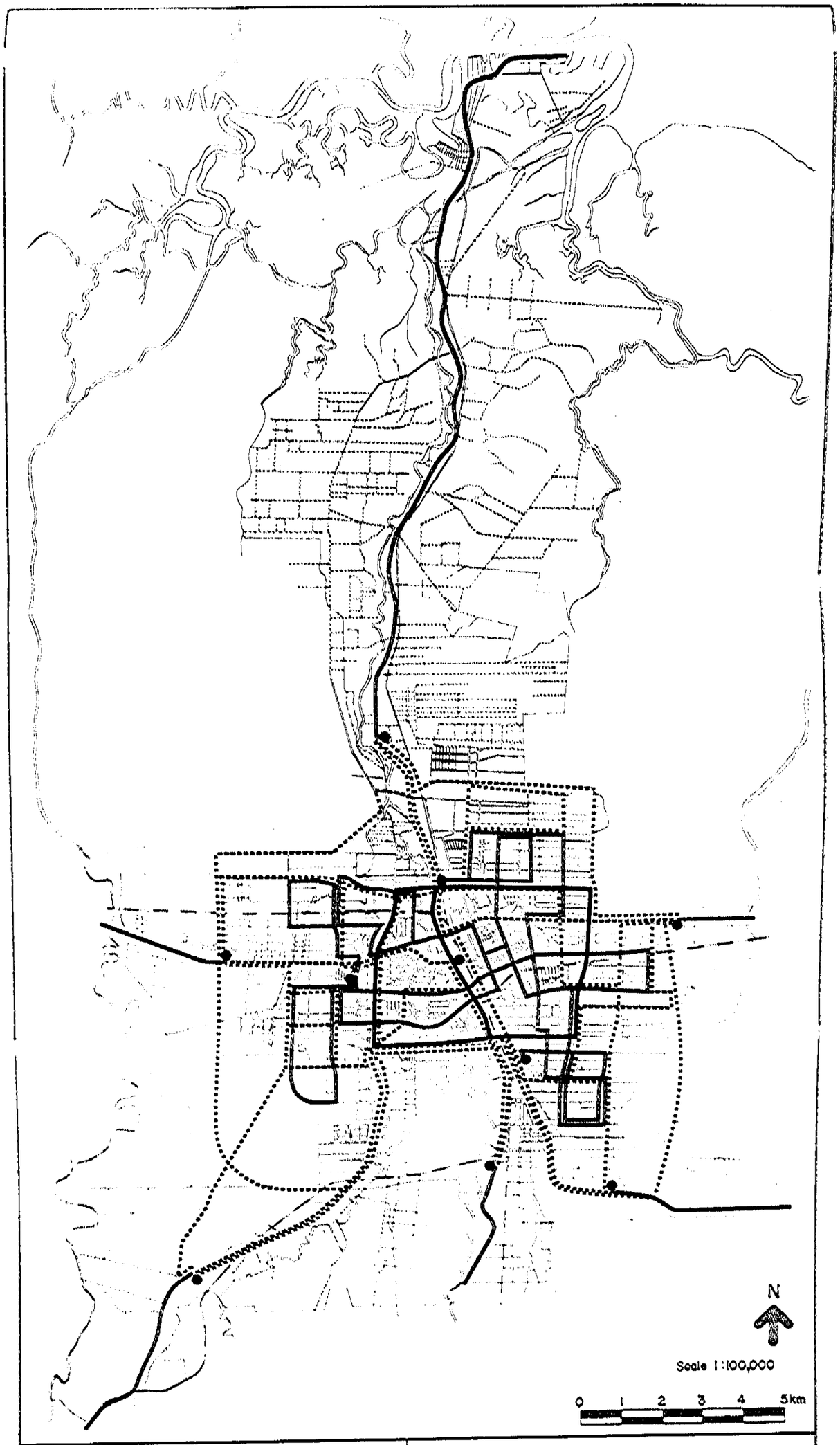


Fig. 6.3.8

Proposed Bus Route Map in Medan Area
(2,000 A.D.)

Medan Area Transportation Study

Legend

- Bus route on Intermediate Ring Road
- Long-distance bus route
- Bus route betw. Suburban bus terminal & Central bus terminal
- Bus route betw. inner zones & outer zones
- Bus route betw. Suburban bus terminal & inner zones
- Bus route betw. Intermediate bus terminal & partially urbanized areas
- Bus route betw. Suburban bus terminal
- Bus terminal

Futhermore, such three proposed bus terminals as at Teladan, Sei Wampu and Gelugur are presumed to be utilized as junctions between the large bus system and the mini bus system.

Such bus terminals as for routes bound for Binjei, Pancur Batu, Deli Tua and Percut are those which can be considered as junctions between inter-city bus routes and suburban bus routes just as in railway station plazas as junctions between the bus system and the railway system. As not so many number of bus berths can be seen at respective bus terminals in front of railway stations, it is desirable to utilize the station plazas as some public open spaces where buses do not stop long. In Indonesia such conditions can be usually observed that traffic jams have taken place often because of inadequate terminal facilities to meet the bus passenger demands. However such traffic congestion would be solved by providing well-planned appropriate space for bus terminals.

6.4 Parking System

In this section vehicle parking facilities to be established in the CBD are described, which are classified into following categories:

i) Public Vehicle Parking Facility

To be provided by the municipal government as a part of city planning.

ii) Road-side Parking Facilities

This can be seen as the usual type of parking facility existing presently in Medan City.

iii) Parking Facilities in Buildings

Being anticipated that the public and road-side parking facilities will not be able to meet the parking demands, some spaces have to be compulsorily provided in large buildings in the CBD by applying an appropriate regulation on such buildings, by which earlier perfection of parking facilities in the city can be stimulated.

iv) Others

Others means small parking lots owned and managed by private firms or offices and others.

Necessary parking facilities by type within an area of 500m in radius are estimated as shown in Table 6.4.1.

Table 6.4.1 Proposed Parking Facilities by Type in an Urban Area of 500m in Radius

Type of Parking Facility	Parking * Capacity (Vehicles)	%
Public	650	11
Road-side	1,200	20
Large Buildings	3,400	58
Others	650	11
Total	5,900	100

Note: The area of 500m in radius corresponds to 78.5ha.

According to such figures of essential parking facilities, the capacity of public parking facilities to be provided by the municipal government in every 78.5ha of urban area is 650 vehicles, which require a land of approximately 2.0 ha corresponding to 2.5% of the said urban area. Applying this rate of public parking spaces to the central 4 Kecamatans in Medan City the necessary areas to be used as the public vehicle parking spaces are calculated as shown in Table 6.4.2.

Table 6.4.2 Proposed Public Parking Spaces in Central 4 Kecamatans

(Unit: ha)

Name of Kecamatan	Kecamatan Area	Parking Space	Percentage
Medan Baru*	1,759	35.0	2.0
Medan Kota	1,049	26.2	2.5
Medan Timur*	1,244	24.9	2.0
Medan Barat*	1,088	21.8	2.0
Total	5,140	107.9	8.5

Note: (*) The ratio of parking spaces is assumed 80% of the criteria in Kecamatans * marked in view of character of those Kecamatans.

Based on the required area of public parking spaces in the central 4 Kecamatans in year 2000 A.D., figures in intermediate years are estimated as shown in Table 6.4.3 using the increase rates of total trip ends during '79 ∿ '00 in the case of low motorization.

Table 6.4.3 Public Parking Spaces in Intermediate Years

(Unit: ha)

Name of Kecamatan	1979	1985	1990	1995	2000
Medan Baru	8.8	14.5	17.5	25.0	35.0
Medan Kota	6.6	10.9	13.1	18.7	26.2
Medan Timur	6.2	10.3	12.5	17.8	24.9
Medan Barat	5.5	9.0	10.9	15.6	21.8
Total	27.1	44.7	54.0	77.1	107.9

Those figures in parking demands are in the case of low motorization. The figures in the case of high motorization it is expected not necessary to provide capacities more than those figures from the viewpoint of characteristics of vehicle trips in Medan.

On the other hand, such a legislative step is proposed to be taken that driving into the CBD in private vehicles for commuting purpose shall be discouraged as much as possible in order to reduce the parking demands there and also to enhance the dependence on the public transport system, by which relieving the traffic situation in the CBD can be expected.

Table 6.4.4 Summary of Public Parking Costs

(Unit: Rp x 10^6)

	1986 ∿ 1990	1991 ∿ 1995	1996 ∿ 2000
Cost of Construction	2,424	5,078	6,976

6.5 Truck Terminals

(1) General

It is one of the urban transportation problems in Medan City that the commodities imported through Port of Belawan whould be transported by large trucks directly into the center of Medan City even in future, by which the traffic situation in the CBD is expected to be disturbed. In order to solve this problem it is necessary to control the direct inflow of large trucks from the outside into the central area of Medan City, and therefore, stopping those trucks once at the peripheral area and storing commodities at warehouses to be established there is proposed as the appropriate solution of this problem. By this plan, the imported commodities can be redistributed periodically into the inside of Medan City not by large trucks but by small trucks and this system will alleviate the burden of road traffic in the central area of the city.

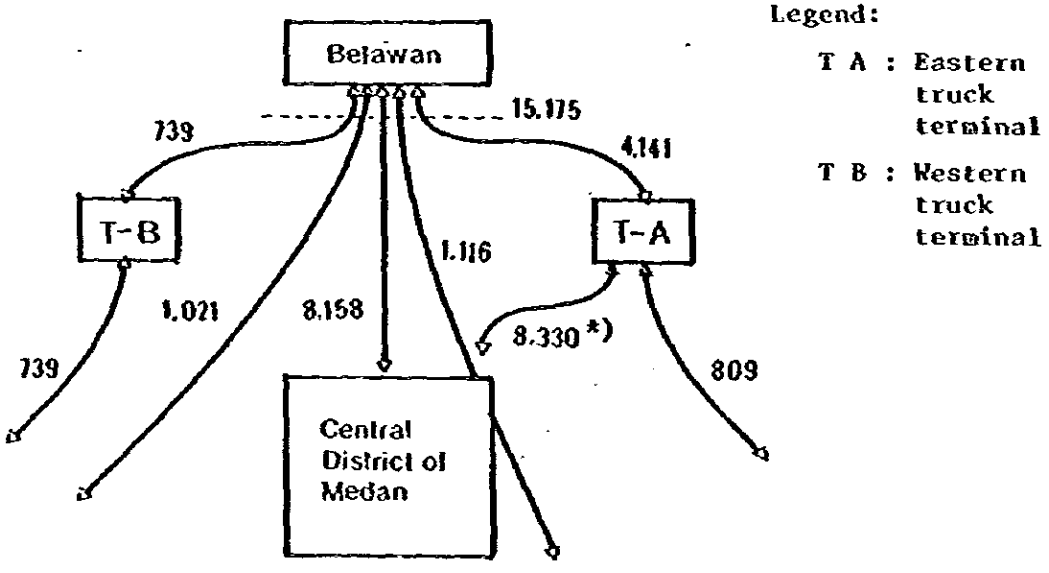
For this purpose it is proposed to construct truck terminals, having also the function of warehouses, at locations in the north-eastern and the north-western peripheral areas where the existing warehouses are planned to be moved out from the present central area. Realizing such a concept it is possible to provide the commodity distributing function, possessing the combined functions of truck terminal and of warehouse. Proposed locations of such truck terminals are shown in Fig. 6.5.2.

(2) Truck Traffic Demand

The estimated number of trucks generated at and attracted from Belawan Port handling imported commodities are shown in the following figure.

Fig. 6.5.1 Estimated Truck Traffic to & from Port of Belawan in 2000 A.D.

(Unit: Trucks/day)



Note: It is assumed that the average pay load per truck be 1.0 ton/truck in the case of * marked traffic, and 2.5 tons/truck in other traffic without * mark.

(3) Size of Terminals

Sizes of proposed truck terminals are estimated as shown in Table 6.5.1.

Table 6.5.1 Proposed Sizes of Truck Terminals in 2000 A.D.

Truck Terminal	Truck Traffic (truck/day)	Area (ha)
T_A	13,280	40.0
T_B	1,478	4.4

However, the warehouses presently existing in the CBD area of Medan City are planned to be relocated to the same site of TA Truck Terminal. Originally 85 ha of land is planned for such warehouses by SAUTI in Medan-Padang Highway Study. A total of 100 ha of land will be enough for TA truck terminal possessing the combined functions of terminal as well as warehouses under the assumption that 20% of the areas for terminal as well as for warehouses can be commonly used.

Sizes of the Truck Terminals in intermediate years are estimated as shown in the following table.

Table 6.5.2 Sizes of Truck Terminals in Intermediate Years

(Unit: ha)

Truck Terminal	1985	1990	1995	2000
T_A	-	10.0	25.0	40.0
T_B	-	1.1	2.75	4.4
Total	-	11.1	27.75	44.4

Table 6.5.3 Summary of Construction Costs of Truck Terminals for Medan Area

(Unit: Rp x 10^6)

	1986 ∿ 1990	1991 ∿ 1995	1996 ∿ 2000
Cost of Construction	11,506	15,536	15,162

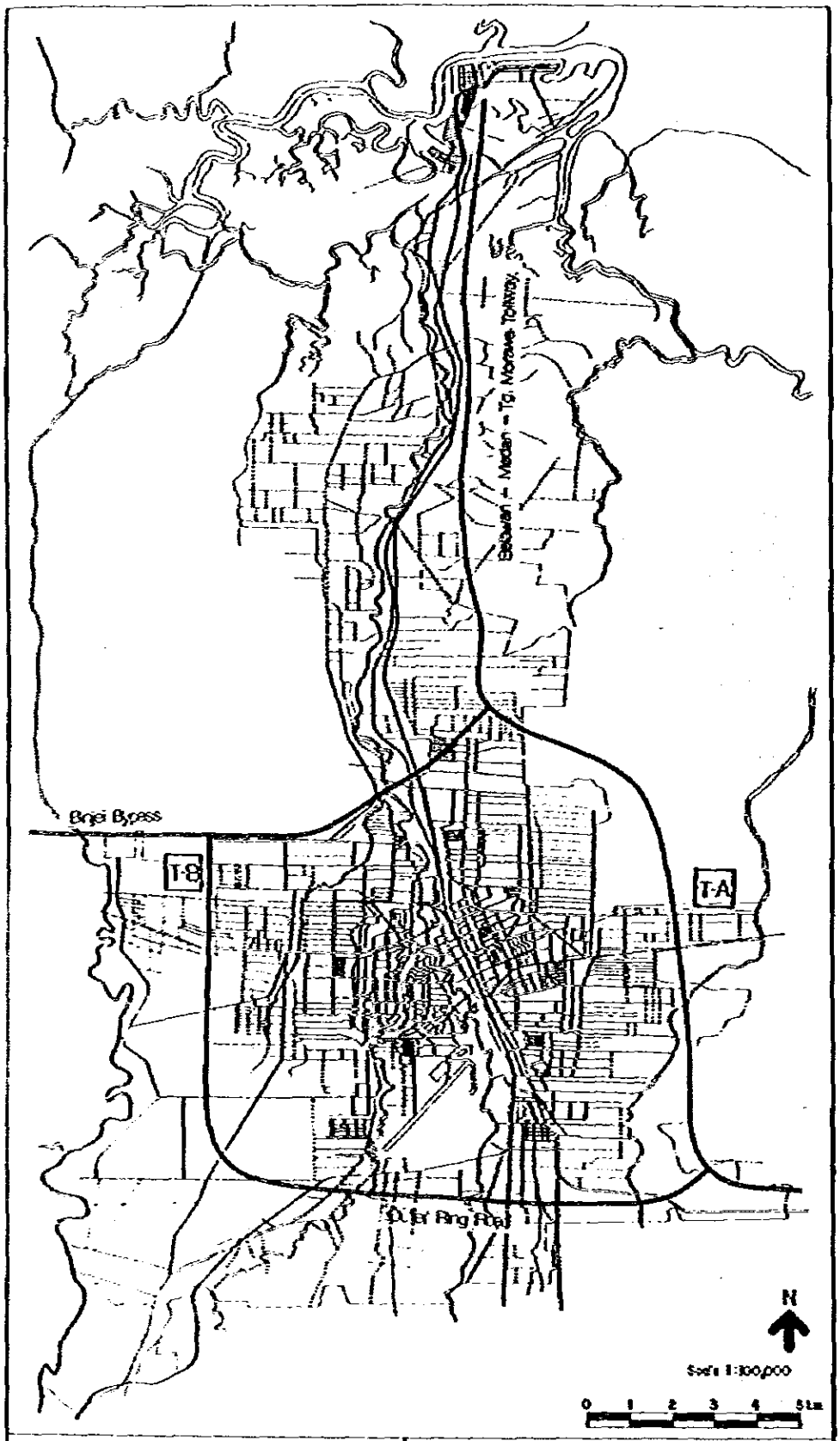


Fig. 6.5.2 Proposed Locations of Truck Terminal

Medan Area Transportation Study

Legend

- Tollway Alignment
- Interchange
- T — Proposed Truck Terminal Site

6.6 Airport Development Plan

To cope with the anticipated future growth of air transport through Polonia Airport the Government of Indonesia intends not to relocate the airport but to expand it at the present location by extending the existing runway of 2,445 m in length up to 4,000 m to aim at enabling landing and taking off of large air transport such as Boeing 747 typed jet planes flying over long distance from abroad such as, for example, from Tokyo or over short distance of domestic route with anticipated large number of passengers, for example, from Jakarta.

From the viewpoint of the existing runway which north end is located only 3 km away from the center of the CBD of Medan City, it is inevitable that the runway has to extend to south-west direction.

The following are the anticipated problems which will take place in future when the existing runway is extended up to 4,000 m at the present location to the south-west direction:

i) It is necessary to reconsider the location of the present airport terminal building to save the taxiing time of aircrafts particularly of large transports;

ii) It is necessary to provide a taxiway parallel to the runway particulary for maneuvering of large transports such as of Boeing 747 type even if the landing and taking off of large transports are not frequent because the turning of large transport is difficult at the ends of runway.

iii) It is necessary particularly to relocate the existing railway line bound for Pancur-Batu and the road bound for the same direction from the existing locations in addition to the runway extension across Babura River of 40 m in width otherwise the runway will cross those railway and road;

iv) The portion of the planned Outer Ring Road will be necessary somewhat to be realigned southward because it is anticipated that its proposed flyover bridge at its crossing with JL. Patimura might invade into the possible transition slope of approach air path when the runway is extended;

v) It is necessary carefully to study the mutual adjustments among the possible transition slope of approach air path, grade-separations among the railway, the Outer Ring Road and JL. Patimura and also the relocation and training of Babura River;

vi) The solution for the noise abatement problem in the CBD to be caused by particularly by large air transport taking-off shall be seriously studied.

Therefore, it is proposed to conduct separately a feasibility study on the expansion problem of the existing Polonia Airport to confirm its feasibility technically as well as economically comparing withits relocation as mentioned in Chapter 10 in this report.

Presently when the feasibility of expansion of the present Polonia Airport has not been confirmed yet, the airport expansion problem is not taken into account in this Medan Area Transportation Study.

6.7 Summary of Investment Costs for Long Term Improvement

Investment Costs for Master Plan 2000 A.D. based on the facility plans which have been discribed in chapter 6 are summarized in Table 6.7.1. Estimation of investment costs is on the basis of the following assumptions:

i) Calculation is based on the cost level in January 1980.

ii) The exchange rates are assumed as follow:

Rp.625 = US$1.00 = ¥240

Table 6.7.1 Summary of Investment Costs for Long Term Improvements

	1986 ∿ 1990			1991 ∿ 1995			1996 ∿ 2000			
	Financial Cost Rp.x10^9			Financial Cost Rp.x10^9			Financial Cost Rp.x10^9			10^{9}Rp.
	For-eign	Local	Total	For-eign	Local	Total	For-eign	Local	Total	Grand Total
1. Construction Cost										
a. Railway										
1) Medan station and elevated railway	1.5	0.6	2.1	6.8	3.1	9.9	9.1	4.2	13.3	25.3
2) Railway network	14.1	8.4	22.5	26.7	9.9	36.6	32.8	14.7	47.5	106.6
3) Related facilities	6.9	3.2	10.1	5.7	3.3	9.0	5.6	12.7	18.3	37.4
Sub-total	22.5	12.2	34.7	39.2	16.3	55.5	47.5	31.6	79.1	169.3
b. Road										
1) Tollway network	0	0	0	14.4	18.4	32.8	11.0	16.3	27.3	60.1
2) Arterial road network	49.5	45.7	95.2	27.8	27.0	54.8	24.3	29.7	54.0	204.0
3) Related facilities	6.0	7.8	13.8	9.1	12.6	21.7	9.4	14.1	23.5	59.0
Sub-total	55.5	53.5	109.0	51.3	58.0	109.3	44.7	60.1	104.8	323.1
Total	78.0	65.7	143.7	90.5	74.3	164.8	92.2	91.7	183.9	492.4
2. Rolling Stocks										
1) Railway car	8.5	0	8.5	14.7	0	14.7	38.2	0	38.2	61.4
2) Bus	35.7	0	35.7	43.5	0	43.5	51.5	0	51.5	130.7
Total	44.2	0	44.2	58.2	0	58.2	89.7	0	89.7	192.1
Grand total	122.2	65.7	187.9	148.7	74.3	223.0	181.9	91.7	273.6	684.5
	Financial Cost Rp.x10^6			Financial Cost Rp.x10^6			Financial Cost Rp.x10^6			10^{6}Rp.
	For-eign	Local	Total	For-eign	Local	Total	For-eign	Local	Total	Grand Total
1. Maintenance Cost										
1) Railway network	–	–	–	–	–	–	–	–	–	–
2) Tollway network	0	0	0	0	1,523	1,523	0	4,588	4,588	6,111
3) Arterial road network	0	2,967	2,967	0	8,351	8,351	0	13,165	13,165	24,483
Sub total	0	2,967	2,967	0	9,874	9,874	0	17,753	17,753	30,594
2. Operation Cost										
1) Railway system	394	1,798	2,592	1,796	5,162	6,958	1,860	11,068	12,928	22,478
2) Bus system	9,150	11,183	20,333	20,287	24,796	45,083	23,911	29,224	53,135	118,551
Sub total	9,944	12,981	22,925	22,083	29,958	52,041	25,771	40,292	66,063	141,029
Total	9,944	15,948	25,892	22,083	39,832	61,915	25,771	58,045	83,816	171,623

Chapter 7 FINANCIAL ANALYSIS

Chapter 7 FINANCIAL ANALYSIS

7.1 General

In this chapter, financial analysis on the following projects will be taken into account to reach the conclusion and make comments from the view point of the financial aspects.

- Railway Project
- Bus Transport Project
- Tollway Project

The following items for each project are considered in the financial analysis;

- Investment cost (construction cost and cost of rolling stocks and buses)
- Annual financial expenditure (maintenance and operating cost)
- Revenue
- Repayment Program

The common assumptions for the calculation of each project are listed below:

- Investment cost comprising construction cost and cost of rolling stocks and buses have to be divided into two currency portions (foreign and local currency).
- The interest rate for local loans is 12 percent per annum, and for foreign loans, 3.5 percent per annum.
- The interest rate for the short-term local loan which is needed to cover the deficits each year, if any, will be the as same as that of local loans (12% p.a.).
- Financial analysis for each project is carried out based on the Master plan for Case 5-B-3.
- The cost is calculated based on financial cost in 1980 prices.

7.2 Railway Project

7.2.1 Basic Assumptions

Basic conditions assumed for the financial analysis of railway are described below:

1) The estimated costs for this analysis were divided into four categories: Construction cost, cost of railway rolling stocks, maintenance and operating expenditures and debt service.

2) Alternative calculation for the repayment program for which PJKA has responsibility were as shown below:

   Case 1: PJKA has only the responsibility for financing of maintenance and operating costs, but not for cost of rolling stocks and construction cost.

   Case 2: The cost of rolling stocks is added to Case 1.

   Case 3: In this case, all investment costs, maintenance and operating costs were considered as part of PJKA's responsibility.

3) Revenues and construction cost of the detouring lines for freight trains is not considered in this railway financial analysis.

4) The period of calculation for the repayment program was adopted as 30 years both between 1986 and 2010 and between 2001 and 2025. The alternatives of railway financial analysis are summarized in Table 7.2.1 showing the different elements of the investment cost for railway project.

Table 7.2.1 Alternatives for Railway Projects Financial Analysis

	Construction Cost	Cost of Rolling Stocks	Maintenance & Operating cost	Repayment Period	
				1986-2010	2001-2025
Case 1-1			Yes	Yes	
Case 2-1		Yes	Yes	Yes	
Case 3-1	Yes	Yes	Yes	Yes	
Case 1-2			Yes		Yes
Case 2-2		Yes	Yes		Yes

5) Revenues from the railway transport services were calculated on the basis of the following conditions:

   (1) Annual total revenues for each year in the period between 1986 and 2010 were calculated by using the demand curve of future railway passengers which is shown in Fig. 6-1-2.

(2) In order to obtain net revenues, the discount rate for commuters was set up as follows:

- 80% was used for working commuters and
- 60% was used for schooling commuters.

(3) The growth rate of 2.8% which is the average growth rate of population in the period between 1985 and 2000 in the Medan Area was adopted as the growth rate of railway passenger demand after 2000 A.D.

7.2.2 Results of Repayment Program

The results of the repayment program for each case are summarized in the following Table 7.2.2. This table shows the accumulated net profits for the 30-year period.

Table 7.2.2 Results of Repayment Program

(Unit: 10^6Rp)

Case	Total Cost	Total Revenue	Accumulated Profits for 30 Years
1-1	56,945	64,367	7,153
2-1	205,815	64,367	-931,750
3-1	267,215	64,367	-1,273,683
1-2	86,150	112,636	26,046
2-2	113,050	112,636	-55,260

Case 1 which includes only expenditure for maintenance and operating costs is financially feasible from the viewpoint of accumulated profit. Other cases are not feasible in this analysis.

The repayment program for case 1 is shown in Table 7.2.3, and other cases are shown in Appendix.

In case 1, the break-even-point is in 1990.

7.2.2 Conclusion

Based on the results of the Repayment Program for each case, the railway project in the case 1 is financially feasible if the Government of Indonesia assumes responsibility for the investment cost of construction and cost of the railway rolling stocks.

Table 7.2.3 Railway Repayment Program (Case 1)

(Unit: $x10^6$ Rp)

Year	Cost Disbursement for Loans (including interest)			Revenue	Profit	
	Foreign	Local	Total		Annual	Accumulated
1986	159	360	519	127	-392	-392
1987	159	360	519	294	-225	-664
1988	159	360	519	541	22	-721
1989	159	360	519	856	337	-470
1990	159	360	519	1205	686	159
1991	359	1033	1392	1551	159	318
1992	359	1033	1392	1876	484	802
1993	359	1033	1392	2160	768	1570
1994	359	1033	1392	2398	1006	2576
1995	359	1033	1392	2593	1201	3777
1996	372	2214	2586	2747	161	3938
1997	372	2214	2586	2871	285	4223
1998	372	2214	2586	2963	377	4600
1999	372	2214	2586	3033	447	5047
2000	372	2214	2586	3090	504	5551
2001	221	3225	3446	3176	-270	5281
2002	221	3225	3446	3265	-181	5100
2003	221	3225	3446	3356	-90	5010
2004	221	3225	3446	3450	4	5014
2005	221	3225	3446	3546	100	5114
2006	221	3225	3446	3645	199	5313
2007	221	3225	3446	3746	300	5613
2008	221	3225	3446	3851	405	6018
2009	221	3225	3446	3958	512	6530
2010	221	3225	3446	4069	623	7153
Total	6660	50285	56945	64367	-	-

7.3 Bus Transport Project

7.3.1 Basic Assumptions

Financial Analysis of Bus Transport was executed based on the following general assumptions:

1) The financial analysis of two bus systems (city buses and inter-city buses) were made.

2) The cost of purchasing buses, and costs of maintaining and operating them were considered as the expenditure in this analysis. The construction cost of the bus terminal was not taken into account in this analysis.

3) For bus financial analysis, two alternative bus operating systems were considered: a "one-man bus system which is a bus system without a conductor"and the "existing system" with a driver and a conductor.

4) The repayment program was carried out on both alternatives over a 25-year period between 1986 and 2010 and for a 25-year period between 2001 and 2025 which means that all investment costs for the bus system were completed by 2000 A.D. and the repayment program was started from 2001 A.D.

5) Two alternative cases of a flat charge system for the city bus fares were considered: 60 Rp and 70 Rp per passenger respectively. The fare system for inter-city buses was fixed at 6 Rp per passenger-km.

6) The annual number of bus passenger for each year in the period between 1985 and 2000 was estimated by the trend which was interpolated from the estimated number of bus passengers for 1985, 1990 and 2000 A.D.

   After 2000 A.D., the growth rate of 2.8% per annum (which is forecasted as the annual average growth rate of population during 15-year period from 1986 to 2000 year) was applied to the projections of annual bus passengers.

7) The bus purchase price in Medan for large-size buses was adopted as 20.8 million Rp per unit, and for micro-buses, as 11.7 million Rp.

8) The depreciation period for buses was taken as 5 years with a salvage value of 10 percent of the purchase price.

The alternatives for bus financial analysis to be examined are summarized in Table 7.3.1.

Table 7.3.1 Alternatives for the Bus Financial Analysis

Case	Bus operator system	Fare*	Bus service area	Opening year
1	One-man bus	60	City	1986
2	One-man bus	60	City	2001
3	Present system	60	City	1986
4	Present system	60	City	2001
5	One-man bus	70	City	1986
6	One-man bus	70	City	2001
7	One-man bus	6	Inter-city	1986
8	One-man bus	6	Inter-city	2001
9	Present system	6	Inter-city	1986
10	Present system	6	Inter-city	2001

* Flat fare (Rp) for city routes and distance fares (Rp) per passenger-kilometer for inter-city routes.

7.3.2 Results of Repayment Program

Based on the assumptions mentioned above, the results of calculation of the repayment program for each case are summarized in Table 7.3.2 showing the accumulated net profits.

Table 7.3.2 Results of Bus Financial Analysis

(Unit: x 10^6Rp)

Case		Total cost	Total Revenue	Accumulated Profits
City bus	1	318,380	333,396	15,016
	2	382,945	398,550	15,605
	3	357,206	333,396	-34,391
	4	432,195	398,550	-77,131
	5	318,380	388,962	70,582
	6	382,945	464,975	82,030
Inter-city bus	7	125,546	176,021	50,475
	8	132,420	183,325	50,905
	9	140,530	176,021	35,491
	10	148,495	183,325	34,830

City Bus: According to the results of repayment program for city buses, the present bus operator system (driver and conductor) in case 3 is judged as not feasible. But if the present system changes to the one-man bus system (driver only) as in case-1, the public bus transport project will be financially feasible.

However, the present system in case-3 becomes feasible if the bus fare is raised from a flat charge of 60 to 70 Rp.

Inter-city bus: The inter-city bus transport system is feasible according to the results of financial analysis. However, bus fares should be raised from 4.0 Rp per passenger-kilometer to 6.0 Rp/passenger-km in the future.

Table 7.3.3, Table 7.3.4 show the results of the repayment program by years in both case-1 and case 3. Other cases are shown in appendix.

7.3.3 Conclusion of Bus Financial Analysis

From the view-point of the results of the bus financial analysis, city-bus transport system has options in terms of number of conductors and fare charges. It is recommended that a one-man bus system should be introduced to city buses, even after taking into consideration the low and reasonable fares for this type of public transport.

On the other hand, the present operator system of the inter-city bus would have no financial problems in the future if its unit fare of 4.0 Rp per passenger-km is raised to 6.0 Rp.

Table 7.3.3 Bus Repayment Program (Case 1)

(Unit: $x10^6$ Rp)

Year	Cost Disbursement for Loans (including interest)			Revenue	Profit	
	Foreign	Local	Total		Annual	Accumulated
1986	1112	1359	2471	7254	4783	4783
1987	1112	1359	2471	7872	5401	10184
1988	1112	1359	2471	8496	6025	16209
1989	1112	1359	2471	9114	6643	22852
1990	23381	3098	26479	9738	-16741	6111
1991	2535	3098	5633	10356	4723	10834
1992	2535	3098	5633	10980	5347	16181
1993	2535	3098	5633	11598	5965	22146
1994	2535	3098	5633	12222	6589	28735
1995	30710	4020	34730	12840	-21890	6845
1996	3289	4020	7309	13458	6149	12994
1997	3289	4020	7309	14082	6773	19767
1998	3289	4020	7309	14700	7391	27158
1999	3289	4020	7309	15324	8015	35173
2000	37632	4709	42341	15942	-26399	8774
2001	3853	4709	8562	15942	7380	16154
2002	3853	4709	8562	15942	7380	23534
2003	3853	4709	8562	15942	7380	30914
2004	3853	4709	8562	15942	7380	38294
2005	37632	4709	42341	15942	-26399	11895
2006	3853	4709	8562	15942	7380	19275
2007	3853	4709	8562	15942	7380	26655
2008	3853	4709	8562	15942	7380	34035
2009	3853	4709	8562	15942	7380	41415
2010	37632	4709	42341	15942	-26399	15016
Total	225555	92825	318380	333396	-	-

Table 7.3.4 Bus Repayment (Case 3)

(Unit: $x10^6$ Rp)

Year	Cost Disbursement for Loans (including interest)			Revenue	Profit	
	Foreign	Local	Total		Annual	Accumulated
1986	1368	1672	3040	7254	4214	4214
1987	1368	1672	3040	7872	4832	9046
1988	1368	1672	3040	8496	5456	14502
1989	1368	1672	3040	9114	6074	20576
1990	23964	3811	27775	9738	-18037	2539
1991	3118	3811	6929	10356	3472	5966
1992	3118	3811	6929	10980	4051	10017
1993	3118	3811	6929	11598	4669	14686
1994	3118	3811	6929	12222	5293	19979
1995	31466	4944	36410	12840	-23570	-3591
1996	4045	4944	8989	13458	4469	447
1997	4045	4944	8989	14082	5093	5540
1998	4045	4944	8989	14700	5711	11251
1999	4045	4944	8989	15324	6335	17586
2000	38518	5793	44311	15942	-28369	-10783
2001	4739	5793	10532	15942	5410	-6666
2002	4739	5793	10532	15942	5410	-2055
2003	4739	5793	10532	15942	5410	3108
2004	4739	5793	10532	15942	5410	8518
2005	38518	5793	44311	15942	-28369	-19851
2006	4739	5793	10532	15942	5410	-16823
2007	4739	5793	10532	15942	5410	-13431
2008	4739	5793	10532	15942	5410	-9632
2009	4739	5793	10532	15942	5410	-5377
2010	38518	5793	44311	15942	-28369	-34391
Total	243020	114186	357206	333396	-	-

7.4 Tollway Project

The following three tollway sections of Medan city are financially analized in this section:

(a) Belawan-Medan-Tg. Marawa Highway;

(b) Binjei-Medan Bypass; and

(c) Outer Ring Road.

7.4.1 Basic Assumptions

1) Financial analyses of each tollway section during its life span of 30 years after the opening of each project were made.

2) Annual average traffic volumes for each year were estimated by using the growth rate of trip-ends in the period between 1985 and 2000 A.D., and the rate in 2000 A.D. was adopted for the yearly traffic volumes after 2000 A.D.

3) Vehicle tolls were established in proportion to the running distance (km), based on an average unit charge of 15 Rp per vehicle-km for both sedans and trucks.

   The gross revenues for each year were calculated by section based on the assumptions mentioned above.

4) Repayments of the initial construction cost estimates of those tollway sections including interest were divided into equal installements. The pay-back period for foreign loans was set at 30 years with a 7-year grace period; for local loans, 15 years with a 5-year grace.

5) In this repayment program, maintenance and operating cost were not shown separately.

6) Table 7.4.1 shows the investment cost of construction of each tollway section.

Table 7.4.1 Investment Cost of Each Tollway

(Unit x 10^6 Rp)

Tollway Section	Initial Investment Cost	
	Foreign	Local
Belawan-Med-Tg. Morawa	20,587	25,894
Binjei Bypass	14,436	18,373
Outer Ring Road	11,056	16,284

Consequently, the basic assumptions for each tollway to be examined in the financial analysis are summarized in Table 7.4.2.

Table 7.4.2 The Conditions of Repayment Program for Each Tollway

Tollway	Opening year	Repayment Period		Interest Rate per annum		Alternative toll rates
		Foreign	Local	Foreign	Local	
Belawan - Medan - Tg. Morawa	1986	30 years with a 7 year grace period.	15 years with a 5 year grace period.	3.5%	* 12.0%	(Rp/km-Vehicle) Case 1 15, Case 2 20, Case 3 25, Case 4 30
Binjei Bypass	1993					
Outer Ring Road	1998					

* Interest Rate of 12% per annual is used for short-term local loans.

7.4.2 Repayment Program Results

The results of the repayment program of each tollway section are summarized in Table 7.4.3.

Those figures show the gross amount to be paid back, the gross revenues and the accumulated net profits for 30 years period.

Table 7.4.3 Results of the Repayment Program of the Tollways

Case	Tollway	Alternative Toll Rate	Total amount to be paid back	Total Revenue	Total Accumulated Profits	Break-even point from opening yr.
1	Belawan - Medan - Tg. Malawa	15 Rp	109,824	207,649	59,259	2010
		20	109,824	276,863	167,039	
		25	109,824	346,099	236,275	
		30	109,824	430,700	320,876	
3	Binjei Bypass	15	79,150	126,455	-58,318	2011
		20	79,150	168,603	82,346	
		25	79,150	210,253	131,103	
		30	79,150	252,297	173,147	
2	Outer Ring Road	15	70,001	51,025	-363,689	
		20	70,001	68,047	-277,127	
		25	70,001	85,047	-190,682	
		30	70,001	102,040	-140,313	

Unit: $x10^6$ Rp for 30 years period.

The repayment program of the three tollway sections in case of a toll rate of 15 Rp per vehicle per km is shown in Tables 7.4.4, 7.4.5 and 7.4.6 res-

Other cases are shown in Appendix.

7.4.3 Conclusion

Based on the results of financial analysis of each tollway section, the following conclusions are made:

1) Belawan - Medan - Tg. Morawa Highway

   This project is financially feasible if the unit charge is 15 Rp per vehicle-km.

   However, it is expected that break-even point of this project from opening year will occur in 2010 A.D., therefore, a short-term local loan for each year up to 2009 A.D. will be required to cover the deficits of each year.

2) Binjei - Medan Bypass

   This project is not feasible based on a unit charge of 15 Rp per vehicle-km. Although the project would be feasible if the unit charge is raised to 20 Rp, it is not appropriate to set a different rate from the Belawan - Medan - Tg. Marawa Highway. In this case, therefore, it is suggested that the schedule of construction of this project should implement gradually, in stages corresponding to the future traffic volume.

   The project is planned to be a 4-lane road; however, some parts of this tollway could be constructed as a 2-lane road. Based on gradual construction mentioned above, the project would be financially feasible.

3) Outer-Ring Road

   This project is not financially feasible even if the unit charge is 30 Rp per vehicle-km.

   Therefore, the possibility of this project must be examined again in a future study of the urban development of Medan city and its surrounding areas.

Table 7.4.4 Repayment Program (Case 1-1)
- Belawan-Medan-Tg. Marawa Highway -

(Unit: x 10^6 Rp)

Year	(1) Cost Disbursement for loans (including interest)		(2) Operation & Maintenance cost	(1)+(2) Total cost	Revenue	Profit	
	Foreign	Local				Annual	Accumulated
1983	0	0	0	0	0	0	0
1984	0	0	0	0	0	0	0
1985	0	0	0	0	0	0	0
1986	0	0	790	790	2735	1945	1945
1987	0	0	790	790	2893	2103	4048
1988	0	3802	790	4592	3060	-1532	2516
1989	0	3802	790	4592	3236	-1356	1160
1990	1119	3802	790	5711	3423	-2288	-1128
1991	1119	3802	790	5711	3620	-2091	-3354
1992	1119	3802	790	5711	3828	-1883	-5639
1993	1119	3802	790	5711	4049	-1662	-7977
1994	1119	3802	790	5711	4283	-1428	-10362
1995	1119	3802	790	5711	4529	-1182	-12787
1996	1119	3802	790	5711	4790	-921	-15242
1997	1119	3802	790	5711	5066	-645	-17716
1998	1119	3802	790	5711	5358	-353	-20194
1999	1119	3802	790	5711	5666	-45	-22662
2000	1119	3802	790	5711	5994	283	-25098
2001	1119	3802	790	5711	6340	629	-27480
2002	1119	3802	790	5711	6706	995	-29782
2003	1119	0	790	1909	7094	5185	-28170
2004	1119	0	790	1909	7504	5595	-23955
2005	1119	0	790	1909	7938	6029	-23040
2006	1119	0	790	1909	8397	6488	-19316
2007	1119	0	790	1909	8882	6973	-14660
2008	1119	0	790	1909	9395	7486	-8933
2009	1119	0	790	1909	9938	8029	-1975
2010	1119	0	790	1909	10513	8604	6392
2011	1119	0	790	1909	11121	9212	15604
2012	1119	0	790	1909	11763	9854	25458
2013	1119	0	790	1909	12443	10534	35992
2014	1119	0	790	1909	13162	11253	47245
2015	1119	0	790	1909	13923	12014	59259
Total	29094	57030	23700	109824	207649	—	—

Table 7.4.5 Repayment Program (Case 2-1)
- Outer Ring Road -

(Unit: x10^6 Rp)

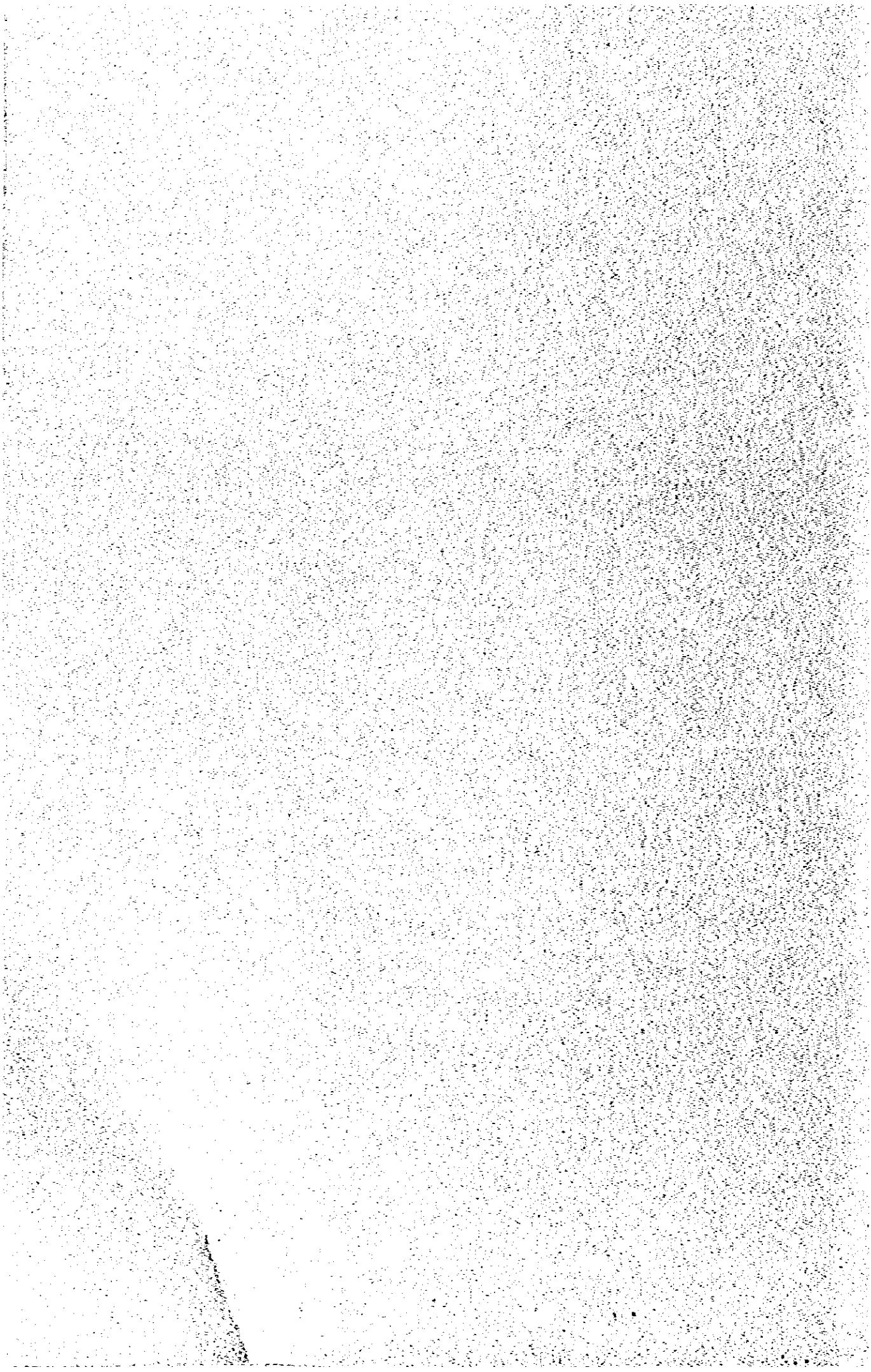
Year	(1) Cost Disbursement for loans (including interest)		(2) Operation & Maintenance cost	(1)+(2) Total Cost	Revenue	Profit	
	Foreign	Local				Annual	Accumulated
1995	0	0	0	0	0	0	0
1996	0	0	0	0	0	0	0
1997	0	0	0	0	0	0	0
1998	0	0	617	617	671	54	54
1999	0	0	617	617	711	94	148
2000	0	2391	617	3008	751	-2257	-2109
2001	0	2391	617	3008	794	-2214	-4576
2002	601	2391	617	3609	840	-2769	-7894
2003	601	2391	617	3609	888	-2721	-11562
2004	601	2391	617	3609	940	-2669	-15618
2005	601	2391	617	3609	994	-2615	-20107
2006	601	2391	617	3609	1052	-2557	-25076
2007	601	2391	617	3609	1112	-2497	-30582
2008	601	2391	617	3609	1177	-2432	-36683
2009	601	2391	617	3609	1245	-2364	-43448
2010	601	2391	617	3609	1317	-2292	-50953
2011	601	2391	617	3609	1393	-2216	-59283
2012	601	2391	617	3609	1473	-2136	-68532
2013	601	2391	617	3609	1558	-2051	-78806
2014	601	2391	617	3609	1648	-1961	-90223
2015	601	0	617	1218	1744	526	-100523
2016	601	0	617	1218	1844	626	-111959
2017	601	0	617	1218	1951	733	-124461
2018	601	0	617	1218	2064	846	-138774
2019	601	0	617	1218	2183	965	-154461
2020	601	0	617	1218	2309	1091	-171905
2021	610	0	617	1218	2443	1225	-191308
2022	601	0	617	1218	2584	1366	-212898
2023	601	0	617	1218	2733	1515	-236930
2024	601	0	617	1218	2891	1673	-263688
2025	601	0	617	1218	3058	1840	-293490
2026	601	0	617	1218	3235	2017	-326692
2027	601	0	617	1218	3422	2204	-363689
Total	15626	35865	18510	70001	51025	—	—

Table 7.4.6 Repayment Program (Case 3-1)
- Binjei Bypass-

(Unit: $\times 10^6$ Rp)

Year	(1) Cost Disbursement for loans (including interest)		(2) Operation & Maintenance Cost	(1) + (2) Total Cost	Revenue	Profit	
	Foreign	Local				Annual	Accumulated
1990	0	0	0	0		0	0
1991	0	0	0	0	0	0	0
1992	0	0	0	0	0	0	0
1993	0	0	0	0	0	0	0
1994	0	0	609	609	1660	1051	1051
1995	0	2698	609	609	1756	1147	2198
1996	0	2698	609	3307	1858	-1449	749
1997	785	2698	609	3307	1965	-1342	-593
1998	785	2698	609	4092	2078	-2014	-2673
1999	785	2698	609	4092	2198	-1894	-4893
2000	785	2698	609	4092	2324	-1768	-7248
2001	785	2698	609	4092	2458	-1634	-9751
2002	785	2698	609	4092	2600	-1492	-12413
2003	785	2698	609	4092	2751	-1341	-15243
2004	785	2698	609	4092	2911	-1181	-18253
2005	785	2698	609	4092	3080	-1012	-21455
2006	785	2693	609	4092	3258	-834	-24863
2007	785	2698	609	4092	3447	-645	-28491
2008	785	2698	609	4092	3647	-445	-32354
2009	785	2698	609	4092	3859	-233	-36469
2010	785	0	609	1394	4083	-9	-40854
2011	785	0	609	1394	4320	2926	-42830
2012	785	0	609	1394	4570	3176	-44793
2013	785	0	609	1394	4835	3441	-46727
2014	785	0	609	1394	5116	3722	-48612
2015	785	0	609	1394	5412	4018	-50427
2016	785	0	609	1394	5726	4332	-52146
2017	785	0	609	1394	6058	4664	-53739
2018	785	0	609	1394	6410	5016	-55171
2019	785	0	609	1394	6781	5387	-56404
2020	785	0	609	1394	7175	5781	-57391
2021	785	0	609	1394	7591	6197	-58080
2022	785	0	609	1394	8031	6637	-58412
Total	20410	40470	18270	79150	8497	7103	-58318
					126455	—	—

Chapter 8 ADMINISTRATIVE MEASURES



Chapter 8. ADMINISTRATIVE MEASURES

8.1 Traffic Control System

8.1.1 Social Education

The increase of traffic capacity and of safety of roads cannot be achieved without cooperative participation by drivers. Observing the current traffic situation in Medan City, efficient social education for drivers seems to be urgently needed. Each driver is required to know and understand the role he plays and what consequences result from his actions. Training of proper traffic behavior of citizens should be started as early as at their pre-school age and should be continued through schools and university as well as at drivers schools.

However, no efficient social education for drivers is possible without utilizing wider variety of media in use at present. An interdisciplinary research group should be organized for:

- Preparation of appropriate television and radio spot-programmes as well as article-contribution to newspapers in which causes and consequences of traffic flow disturbances are clearly explained;

- Reorganization of the drivers' school system, preparation of appropriate instruction programs and strict driver examination procedures, review of legal prerequisites, and necessary revisions of laws to prevent licensing to those without preparatory driving training; and

- Preparation of re-education program for such drivers who violated traffic laws and regulations or caused traffic accidents.

8.1.2 Road Markings

Road markings are usually essential road facilities to guide vehicles and pedestrians safely and smoothly on urban roads particularly at road intersections. General examples of such application are presented in the Report on Short-Term Improvements already. In the Long-Term Master Plan road markings are proposed to apply to main arterial roads in the city for the purpose to make the bus system functions efficiently as one of the important public transport modes of the city by providing a bus lane on such roads in each direction. In this paragraph explanations are made on the function of bus lanes, their effects on traffic flows and their practical application and its administration from the traffic control point of view.

(1) Function and Effects of Bus Lanes

Bus lanes, which are to be utilized solely by authorized public buses, are usually established one lane in each direction on main arterial roads only in specified peak hours in morning and evening in order to keep the regular bus operation free from traffic jams in peak hours,

consequenty the system will result in speeding up of bus operation. By establishing bus lanes the convenience of bus passengers is enhanced and the dependence of passengers on the public transport particularly in rush hours will be noticeably increased. The time legally to establish such bus lanes is usually specified from 7:00 to 9:00 or 9:30 A.M. and not many examples of establishing bus lanes in evening rush hours can be seen in other countries where such system is already under application. Because the peak hour ratio is usually lower in evening than in morning. In case of Medan Area it is proposed to establish bus lanes only in the period between 7:00 and 9:00 A.M. due to the traffic characteristics of the city.

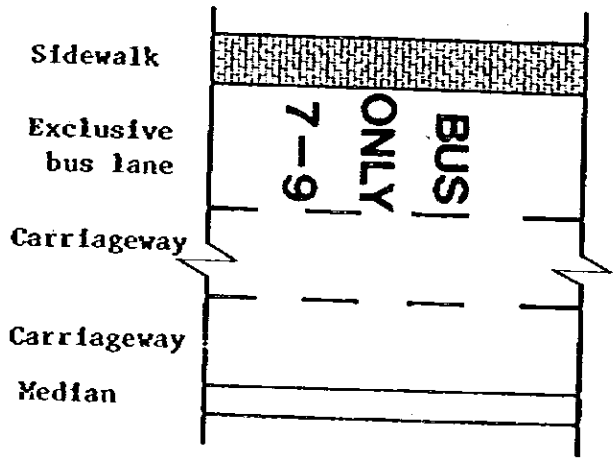
According to the examples in Tokyo, Japan, where the citizens have enjoyed the benefits of establishing bus lanes for years already, they could save about 25% of their travelling time in an average due to the stabilized running speed of bus operation, freedom from the traffic jams and increase in safety of general traffic. Such facts reveal that establishing bus lanes in peak hours has stabilized the noticeable dependence by citizens on the public transport system.

(2) Practice of Road Markings

In practice road markings are applied to the road surface and functions well being supplemented by installing adequate traffic signs, reflecting traffic nails, and bus priority signals. Particularly road markings and traffic signs are essential in informing drivers the existence of bus lanes and specified bus-lane hours. The followings are proposed in application of this system to Medan Area:

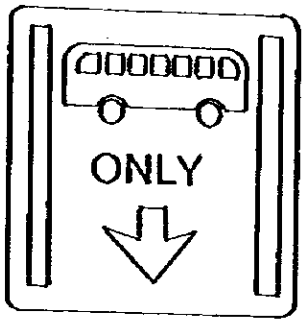
(a) Road Markings

A bus lane shall be installed alongside the sidewalk for the convenience of passengers at bus stop, and Words "BUS ONLY 7-9" are marked on the lane.



(b) Traffic Sign

The existence of bus lane shall be informed to general drivers by installing the traffic signs of the following type on the roadside.



(c) Reflecting Traffic Nails

On the lane mark between the bus lane and other lane there is cases where reflecting traffic nails are driven as delinators in order to inform the existence of bus lane to general drivers, which reflect headlights of vehicles in night time.

(d) Bus Priority Signals

A bus sensing device is installed 100 meters in advance of the intersection, which senses the existence of bus running on the bus lane and inform the traffic of signal approaching bus on bus lane and automatically change the traffic signal to green for the free crossing of intersection by buses. At such intersections where right-turning bus traffic is dominant the right-turning bus priority signal is installed so as to avoid the crossings between right-turning bus traffic flow and through-going general traffic flow, by which it enables to relieve traffic jams, to reduce traffic accidents and to keep the bus operation regularly.

(e) Necessary Legislative and Administrative Steps

The functions of bus lanes could not be maintained in their full capacities without enforcing adequate traffic control so as buses can use bus lanes fully, otherwise the traffic capacities of bus lanes will be reduced.

Consequently, when the Municipal Government of Medan City intends to enforce the bus lane system in peak hours it is necessary to take appropriate legislative step to proclaim such a new traffic regulation firstly, in advance of commencing the system, to hold successive adequate social education of general drivers utilizing radio, TV and newspapers not to enter the bus lane in specified peak hours and to hold training of bus drivers how to efficiently use bus lanes in such peak hours. On the other hand the Municipal Traffic Police shall strictly enforce the penalty to offending drivers.

8.1.3 Area Traffic Control

Development of traffic control system in Medan Area has to follow successively each stage of the following systems:

- Individually operating traffic signal system;
- Route-Coordinated traffic signal system; and
- Area-Coordinated traffic signal system

i) Individually Operating Fixed-Time Traffic Signal System

This type of traffic signal is of 'Fixed-time' control in individual operation according to the time table memorized in a signal timer.

For 'Coordinated' signals time-differences among the starting time of a Green-Yellow-Red time-cycle for each individual signal are set in advance.

Characteristics of timing for this coordinated signal is determined by three factors such as:

- Time-cycle : Amount of time between the beginning of a cycle of Green-Yellow-Red and the next cycle.
- Split : The proportion between the Green-Yellow period and a time-cycle.
- Off-set : Time difference among the starting time of Green-Yellow-Red operation for traffic signals.

ii) Route-Coordinated Traffic Signal System

A system which enables to change the traffic control characteristics by selecting suitable programs (or various combination of the previously mentioned three kinds of time factors) for particular traffic conditions is called 'Multi-programmed' fixed-time control. Usually, programs are prepared for a route-coordinated time-band during the daytime.

iii) Area-Coordinated Traffic Control System with Traffic Detectors

In this system, based on the information regarding traffic volume, average travel speed, etc., collected by traffic detectors, a suitable programs coordinated for area is selected.

The most advanced traffic control system today is coordinated traffic control system with detectors applied for a region which is called the 'Area Traffic Control System'. Traffic detectors feed collected information into the central electronic computer system, and then it selects suitable programs for such particular traffic situation of the area, and also does minor adjustments of split and off-set. Usually, it requires many traffic detectors. *)

Note: *) In a Japanese case (Fukuoka-city) 190 detectors are installed for only 37 intersections.

8.2 Statistical Procedures of Traffic Accident Recording

A survey of a traffic accidents includes to interview from persons who caused and observed it, to record the actual accident situation in details, and to analyze their data. Data of this survey are recorded in the form of a standard recording format. Recording items include:

- Date and time, location, road conditions, etc;
- Type of accident;
- Kind of damages;
- Occupation, age, sex of person or persons involved in accident;
- Causes of accident;
- Sketch of the accident spot; and
- etc.

The aim of compiling traffic accidents' statistics is to analyze the relationship among accidents, traffic conditions, and related social conditions for the purpose to formulate counter-measures of traffic accidents based on the information recorded in formats.

In the process of compiling traffic accidents statistics and an electric computer is fully utilized. In Japan the results of such analyses are compiled in 'National Traffic Accidents Statistics' issued annually by the Central Traffic Police Department. The major contents of the above publication are roughly explained below.

i) Past Development of Traffic Accidents and Present Situation

The annual number of traffic accidents and that of casualties are recorded every year by administrative regency. The results of the analyses are often expressed with the word 'the rate of accidents' which is the ratio between the number of accidents or casualties and the regional residential population, the number of vehicles registered in the region or vehicle-km in the region.

ii) Items of Recording

Recording items of traffic accidents are categorized such as:

- Month, time band, climate, etc.;
- Road type, road conditions, road width, traffic signal type, etc.
- Driver's age, occupation, travel purpose, etc; and
- Place of accidents and vehicle registration.

8.3 Railway Elevation

(1) Synopsis of Railway Elevation

This plan aims to elevate the railway track extending over the distance of 2.9 km within the CBD Area involving Medan Station. Items which constitute this elevation project are as follows:

- Elevation, of Medan Station and approach main tracks
- Relocation of the Medan freight yard and freight facilities to other sites.
- Relocation of the Medan coach-yard to some other proper site.
- Relocation of the Medan diesel engine-shed to some other proper site.
- Installation of a new freight train detouring line linking Bandar Chalipah on the East Line with Titipapan.
- Installing a new freight-train short-cut line linking the West Line with North Line.

The estimated construction cost which is necessary for the above-mentioned items will reach Rp.58.4 billion.

(2) How to Share the Required Costs

The railway elevation will contribute to reduction of operating costs of vehicles and saving cost of accidents at crossings and operating and maintenance cost of crossing by elimination of crossings and to the improvement of the traffic safety.
Since the benefit through the elevation is to relieve the road traffic jam by eliminating crossings, it is desirable that these project cost of elevation be shared among the municipal government and the State Railway.

The sharing ratio could be decided based upon the amount of benefits to be received upon each side and upon the existing financial circumstances, etc. As one example, the sharing standard for such costs in Japan is shown in Table 8.3.1 and 8.3.2. If the Japanese standard is applied to this case, the cost of the railway elevation and other railway improvement projects would be as follows:

The amount covered by the railways;

- Ten per cent of the elevation construction cost.
- Relocating costs of Medan Station yard and rolling stock base.
- New construction costs of freight detour line and short-cut line.

Cost to Railways: Total Rp.35.6 billion (61%)

The amount covered by the urban authorities;

- 90 per cent of the elevation construction cost.

Cost of Municipal Authority: Total Rp.22.7 billion (39%)

It is necessary for the Indonesian Government to make decisions as to the problems how to share the relevant costs since the budgeting procedures of the Republic are also involved. The important point, however, is to deal with the overall problems of urban transportation simultaneously. This also calls for annual programming for undertaking this project with further research into the relevant costs. A Commission comprising Medan Municipality, the State Railway, Bina Marga, Cipta Karya, etc. is proposed to be established. This organization will aim at maintaining coordination among the authorities concerned. Furthermore, through this organization, it would be possible to establish an appropriate and concrete cost-sharing ratio. The case study in Japan is to be used for reference only.

Table 8.3.1 Divided Sharing of Construction Costs Relative to Grade Separation in Japan

A. Legal Principles

Grade separation planning costs necessary for implementation of structural improvement planning	The railway entrepreneur and the highway executive agency share the costs through well-coordinated negotiations. (In accordance with the Grade Separation Agreement)
Costs necessary for implementation of Signal and Safety Devices	The railway entrepreneur shares the costs.

Furthermore, the Minister of Transportation strives to secure the necessary funds for the railway entrepreneur concerning the improvement of crossings according to legal principles.

B. Principles of Grade Separation Agreement (Outstanding ones only)

Items	Cost Sharing
i. In cases where the grade separations are newly installed through the construction work concerning the new installation or improvement or highways or railways.	Planners of the work in question share the construction cost necessary for the grade separation.
ii. In cases where the existing grade crossings are removed through remodeling into the grade separation or through reconstruction work so that highways and railways may not cross over each other.	The highways share two thirds of the costs, while the railways shares are third thereof in case of a station compound the railways there between one third and one half of the costs.
iii. In cases where the crossings are not removed even if the grade separation works are effected.	The railways do not share the cost.
iv. In cases where the railways are benefited through the grade separation in connection with the change of its description, etc., even through the crossings are not removed.	The railways share the costs as much as 15 times the balance of the yearly operating costs for the crossings already established and those remaining within the limit not exceeding one third of the construction cost.
v. In cases where the grade separation is removed so that highways and railways may not cross over each other.	Negotiations are carried out.
vi. In cases where the crossings are removed through elevating the railways by way of improvement.	The sharing ratio is shown below.

Classification by line \ Sharing agency	Sharing ratio	Sharing at access to site	Sharing ratio at crossings			Sharing ratio at elevated section (between two highways)
			Newly established	Embankment widened	Already established	
Established line	Highways	1/2	1	1	1/2	1/2
	Railways	1/2	0	0	1/2	1/2
Added line	Highways	0	1/2	1/2	0	0
	Railways	1	1/2	1/2	1	1

vii. In case when grade crossings are removed through grade separation, road relocation, etc; and in addition other private railway lines, etc., are in operation in parallel over the crossings in question.	The sharing ratio for railways is limited to within the boundary in accordance with the railway width.

Table 8.3.2 Consecutive Grade Separation Agreement on Railways and Highways in Urban Areas

The Consecutive Grade Separation Agreement on Railways and Highways in Urban Areas was concluded between the Ministry of Transportation and the Ministry of Construction in September 1969. This is based on the key principle that the railways would share a percentage of benefits; the sharing scheme is mentioned hereunder.

i) In cases of simple consecutive grade separation

		Railway entrepreneur	Urban planning executive agency
Elevating installation cost	Railways already installed	Amount benefited to railways	Remainder
	Railways newly reinforced	Full amount	–
Relocation cost of freight facilities, etc	Railways already installed	Newly established R.O-way and roadbed	Amount necessary for relocating facilities
	Railways newly reinforced	Full amount	–

ii) In case of track addition and/or consecutive grade separation

		Railway entrepreneur	Urban planning executive agency
Elevating installation cost	Railways already installed	Railway entrepreneur amount of R.O.Way and corresponding ben benefits to railways	Remainder
	Railways newly reinforced	Full amount	–
Relocation cost of freight facilities, etc.		Full amount	–

iii) In cases of the part of station which forms the boundary of simple consecutive grade separations and track addition and/or consecutive grade separation.

		Railway entrepreneur	Urban planning executive agency
Elevating installation cost	Railways already installed	Railway entrepreneur newly established R.O-way and corresponding benefits to railways	Remainder
	Railways newly reinforced	Full amount	–
Relocation cost of freight facilities, etc.	Railways already installed	1/2 amount necessary for relocating facilities and the amount necessary for newly installed roadbed	1/2 amount of relocating facilities
	Railways newly reinforced	Full amount	–

Remarks: 1. The amount of benefit to railways is stipulated for the time being to be 10 percent of that which corresponds to elevating installation cost of the railways already installed.

2. The scope of relocation for freight facilities, etc.

i. The necessary facilities for freight handling.

ii. The field offices relative to train operation, including marshalling yard, rolling stock base, locomotive depot, passenger car depot, passenger and freight car depot, etc.

iii. The various organizations including maintenance of way section, machinery section, material maintenance and repair shop, communications section, signal section, electric power section, stores depot, testing center, work shop, etc.

8.4 Tariff System of Public Transport

8.4.1 General

The following are the key points to discuss the tariff system of public transport.

(1) Relationship between the tariff system and the favorable state of the public transport system;

(2) Tariff system itself; and

(3) Discount rate for commuters.

The details of optimum railway tariff system are described as follows:

(1) Relationship between the tariff system and the favorable public transport system.

As the item "The favorable state of public transport system" is already discussed in the Final Report on Short-Term Improvement Plan, only its brief summary is presented as below.

i) To reduce or avoid the reasons of road traffic congestion by diverting the traffic from private vehicles to the public transportation;

ii) To save the energy consumption; and

iii) To secure the transportation for majority of citizens who have no private means of transport.

Furthermore, the following two items are to be discussed in view of the tariff system of public transport in general.

i) To maintain the self-support financing system, and,

ii) To receive subsidies from the Central Government.

It is evident that the low fare is more preferable for users of the public transport system from the viewpoint of the favorable state of public transport, however, it is anticipated that the fare will become higher than the favorable one from the viewpoint of self-support financing system. Therefore, the balance between such two points of views mentioned above will become important in order to find its solution.

The importance of this problem is clearly observed in real examples in the world through the fact that small cities can usually maintain a balance between revenues and expenditures of their public transports.

(2) Tariff System

In this paragraph the tariff system of passenger transport is mentioned. The tariff system proportional to travel distance is generally applied in many countries in the world, in which such two types of systems can be seen, namely, the inter-zone tariff system and the per kilometer

tariff system. And recently such an unified tariff system is often applied over several modes of public transport in a city as if they are operated in an unified system in order to give a more convenient service to their users and also to induce more traffic demand on the public transport.

(3) Discount Rate for Commuters

As is described later, the rate discount system for commuters has been applied in almost all countries in the world and rather high discounting rates have been usually adopted. This reason is to carry so many passengers in peak hours and the discount rate for commuters is decided keeping approximately a balance between the decrease in revenues and the saving in necessary costs.

8.4.2 Tariff System in Medan Area

(1) Tariff System of Railway

Although the passenger transport service by diesel-railcar trains is expected to be opened between Belawan and Medan in 1981, it goes without saying that it is really difficult to decide the optimum tariff system theoretically at present. In other words, it is inevitable to decide it practically case by case. However, the attention shall be paid to the following items to discuss the tariff system:

i) Self-support financing system or public subsidizing system;

ii) Comparison with the tariff system of public transport in Jakarta;

iii) Comparison with the tariff system of bus; and

iv) Selection and application of a tariff system to Medan Area.

The detailed descriptions on these items are as follows:

i) Self-support financing system or public subsidizing system

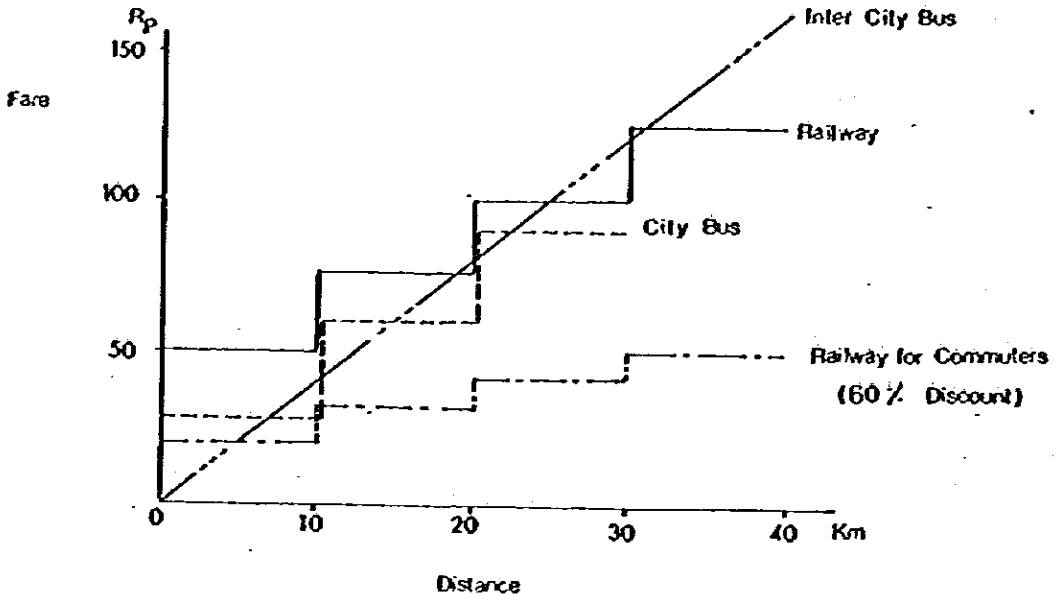
It seems generally to be difficult to maintain the self-support financing in case of new railway system for urban transport and it is also anticipated to decrease the passenger traffic demands if the railway fare is decided on the basis of self-support financing. Judging from these facts mentioned above the public subsidizing system is considered to be desirable.

ii) Comparison with the case of public transport in Jakarta

In Medan, the same tariff system as that in Jakarta is adopted for the long-distance passenger transport at present. No modification is considered necessary unless any particular problem arises concerning this system.

iii) Comparison with the tariff system of bus

The existing bus routes are presently operated by P.N. DAMRI and several private firms, and it seems that the bus tariff system depends on self-support financing system for the time being although the present tariff system is inducing slight deficit on the side of P.N. DAMRI. The following is a comparison table of the present tariff system by mode of public transport.



The present railway tariff system is such that is higher than that of city bus system and lower than that of inter-city bus system. However, considering the discounting system for commuters, the railway fare becomes rather low comparing to that of city bus system. Summarization can lead to the fact that in the case of commuters the railway system has an attractive point in its present tariff system comparing to the bus system if the present discounting to railway commuters is applied continuously.

iv) Application to Medan Area

The present railway tariff in Medan area seems to have no problem; however, it is necessary to prepare a tariff system which is able to respond flexibly to its future trend of traffic demand and its affiliated conditions including the discount rate to commuters.

(a) Discount Rate for Commuters

Although it could be qualitatively discussed in previous paragraph, it is actually difficult to judge what discount rate for commuters is favorable as is mentioned in section 1 "General". The following table shows some examples of discount rate to railway commuters in major countries.

Table 8.4.1 Discount Rates for Commuters in Various Countries

(Unit: %)

Name of Country	For Workers	For Students
United Kingdom	10	50
Holland	-	-
Germany	30 - 70	60 - 80
Switzerland	-	35 - 45
Japan	50	70
Indonesia	60	80

Note: (1) Discount rates in the table show the cases of three-month commuter ticket.

(2) Values of discount rate are all approximate percentages.

Although it cannot be easily concluded by those examples mentioned above whether the present discount rates in Medan Area are too high or not; for example in Japan, the discount rate has been diminished year by year due to the increase of deficit on the railway account. In Medan, it seems, first of all, to be necessary to apply the same tariff system in Jakarta to keep the passenger demands as much as possible, as this is the first trial to open the railway passenger service for urban transport in the area.

(b) Conclusions

As is described above it is difficult to decide the optimum railway tariff system theoretically and it seems to be preferable to adopt the tariff system that has been presently applied in Jakarta for the time being because no unreasonableness can be found in such a procedure so that a stable demand of railway passengers can be maintained in Medan area. Furthermore, it is necessary to take into consideration the railway tariff system that can be modified flexible judging from the future tendency of local traffic demand.

(2) Tariff System of Bus System

As for the matter of bus tariff system, it is usually decided to keep the financial self-support not only in case of Medan City but also in general case and this concept is applied for public cooporation as well as private firms. As the bus system consists of City Bus and Inter-City Bus in Medan City, the charge is presently 30 Rp/ride for the former and is 4 Rp/km for the latter. Although a few percentage of deficit seems to be observed in DAMRI at present, some profits seen to be brought forth in private firms. The problem is how the present tendency will change in future, and how much is the average passenger transport efficiency will be a key point. The present passenger transport efficiency is considered to be kept rather in low level due to its insufficient transport service level. When the present condition is improved as preferable level of service, the economic balance of bus system will be oppresive, and the following measures seems to be necessary to correspond to the above-mentioned.

i) Transferring from two-man crew system to one-man crew system to reduce the burden of labor cost.

ii) Rise in price from 30 Rp to 60 Rp per passenger per ride for City Bus and from 4 Rp/km to 6 Rp/km for Inter-City Bus.

Although the above-mentioned are the measures to be improved judging from the view point of economic feasibility, concerning the transferring from two-man crew system to one-man crew system, it is necessary to prepare a flexible system enabling to revise upto 2000 A.D because it seems to be difficult to transfer immediately judging from the view point of current employment situation in Indonesia.

However, the above-mentioned are just described from the view point of economic feasibility, therefore it is necessary to make appropriate administrative decisions on the tariff system and in this case some subsidizing provisions seem to be necessary in view of the burden of private firms.

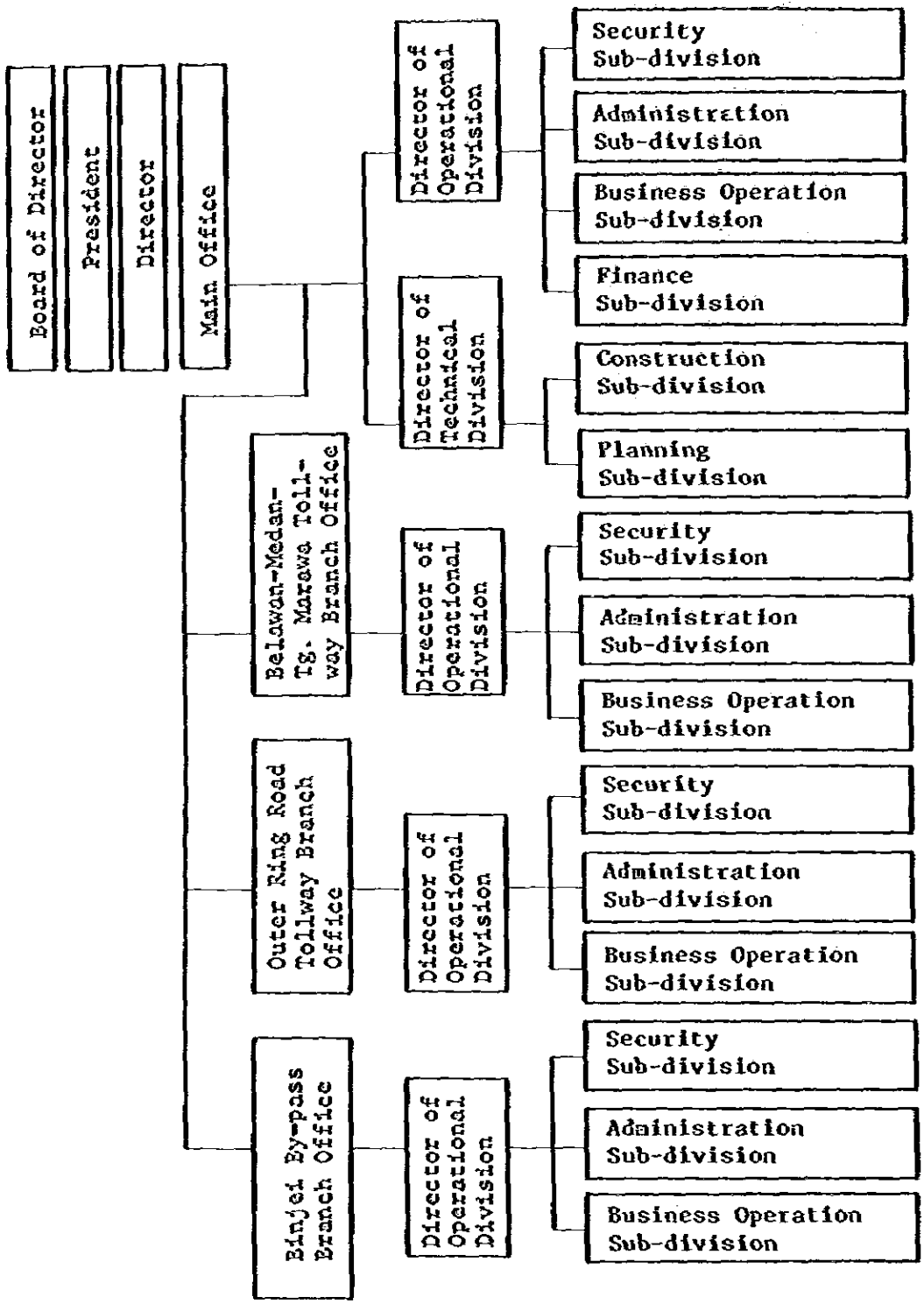
8.6 Tollway Administrative System

The Tollway Network based on the Master Plan 2000 A.D. consists of 3 tollways and the total length of tollways is to be 86 km. In order to operate and maintain those tollways in good efficiency, it will require to establish a new organization.

In Indonesia there exists Jagorawi Freeway, which has been operating in Jakarta area since March 1978; while, before the construction of this tollway, the Indonesian Government perfected the legislation on tollway construction, promulgating the Government Regulation No. 4 on February 25, 1978. Apart from Bina Marga of the Ministry of Public Works that took charge to plan and construct this tollway, an Indonesian Highway Corporation (P.T. Jasa Marga) was newly organized based on the Regulation for the purpose of the operation and maintenance of the tollway network to be planned in Jakarta area including Jagorawi Freeway.

Consequently, the establishment of an organization to operate and maintain tollways in Medan Area is assumed to be the same type as in the case of Jakarta. Fig. 8.5.1 shows the proposed organization for tollway operation in Medan Area, referring to the organization example of the case of Jakarta.

Fig. 8.5.1 Proposed Organization for Tollway Operation in Medan Area



8.6 Measures to Promote Low Motorization

In this report as one of the conditions to formulate alternatives, two grades of road transport motorization, namely low- and high- motorizations, are considered. In the case of low-motorization the utilization of private transport modes is assumed smaller than in the case of high-motorization by discouraging the utilization of private transport modes and by encouraging the utilization of public transport modes to enter into the CBD.

However, in order to realize the low motorization in road transport, measures to be adopted have to be designed based on consideration of variety of possibilities. In this section several examples of actual measures considered realistic are described, but as mentioned in chapter 4: 'Estimation of Future Transport Demands' the effect of enforcement of these measures is extremely difficult to estimate quantitatively.

A set of measures proposed below are classified into two, and they are:

- To discourage private transport utilization; and
- To encourage public transport utilization.

(a) Measures To Discourage Private Transport Utilization

Measures classified in this category are those to control private vehicles usage for commuting purposes particularly in the CBD.

i) Control on Private Vehicles Ownership

To control manufacturing and imports of vehicles is the most direct and effective to attain low motorization in road transport. However, this is not only a transportation issue but also should be discussed from national and international economic aspects. Control on licensing to those people who inhabit in the specified central business district is another issue to be studied.

On the other hand, control by a system of taxation is the most common and is already in effect in the Republic. Variety of taxation to be discussed are:

- Vehicle Price Tax;
- Registration Tax;
- Tax on Parts and Repair;
- Gasoline Tax;
- Tax on Toll Road Usage;
- Etc.

ii) Control on Private Vehicles Operation

The most effective way to control private vehicles operation would be parking restriction. This is to control on the vehicles operation within the central business district by prohibiting road-side parking and often enforced with prohibition of or surcharge for vehicles operation within specific districts.

The effective retardation on driving into the specified central areas by private vehicles may be attained by charging successively higher parking costs to those who wants to park inside of the areas and their effective collection.

Also, to specify a lane for bus operation during peak hours is one of measures to control private vehicles operation.

Other measures by traffic control in general are, for example, speed limitation, reduction of green hours, etc. should be considered as a part of comprehensive measures.

(b) Measures to Encourage Public Transport Utilization

i) Tariff System

It has been experienced in many developed countries that to increasing of the public transport's share by decreasing of their tariff is not so effective compared to the method to increase frequency of services mentioned later.

ii) Frequency of Services

To increase frequency of services has been proven to be most effective in encouraging public transport usage.

iii) Transferring Conveniences

To up-grade the level of services by establishing the transferring facilities among various modes of public transport or by applying an integrated tariff system for a public transportation network as a whole is essential to increase the share of public transport.

iv) Park and Ride

This is a measure which is recently widely discussed in many large cities in developed countries to combine advantages of mass-transit system and private transport by preparing sufficient parking lots around railway stations. This will be effective when either measures are enforced simultaneously.

8.7 Cooperation among Government Agencies Concerned

The successful key in realizing the master plan is the finalization of the implementation program of those improvement under the harmonious cooperation among the government agencies concerned to enable those plans to function as a whole in any stage of their implementing progress and the establishment of necessary administrative measures timely to be taken to make improvement effective enough in their integration even in any stage of their implementing progress as well as their final completion.

It is also proposed to organize an inter-ministrial committee in the Central Government and guide the whole implementation program and coordinate various programs to be implemented by various government agencies and to prepare necessary budgets linking to appropriate foreign loans as well as the domestic funds and distribute them to respective government agencies concerned according to the sharing rates agreed among them in advance.

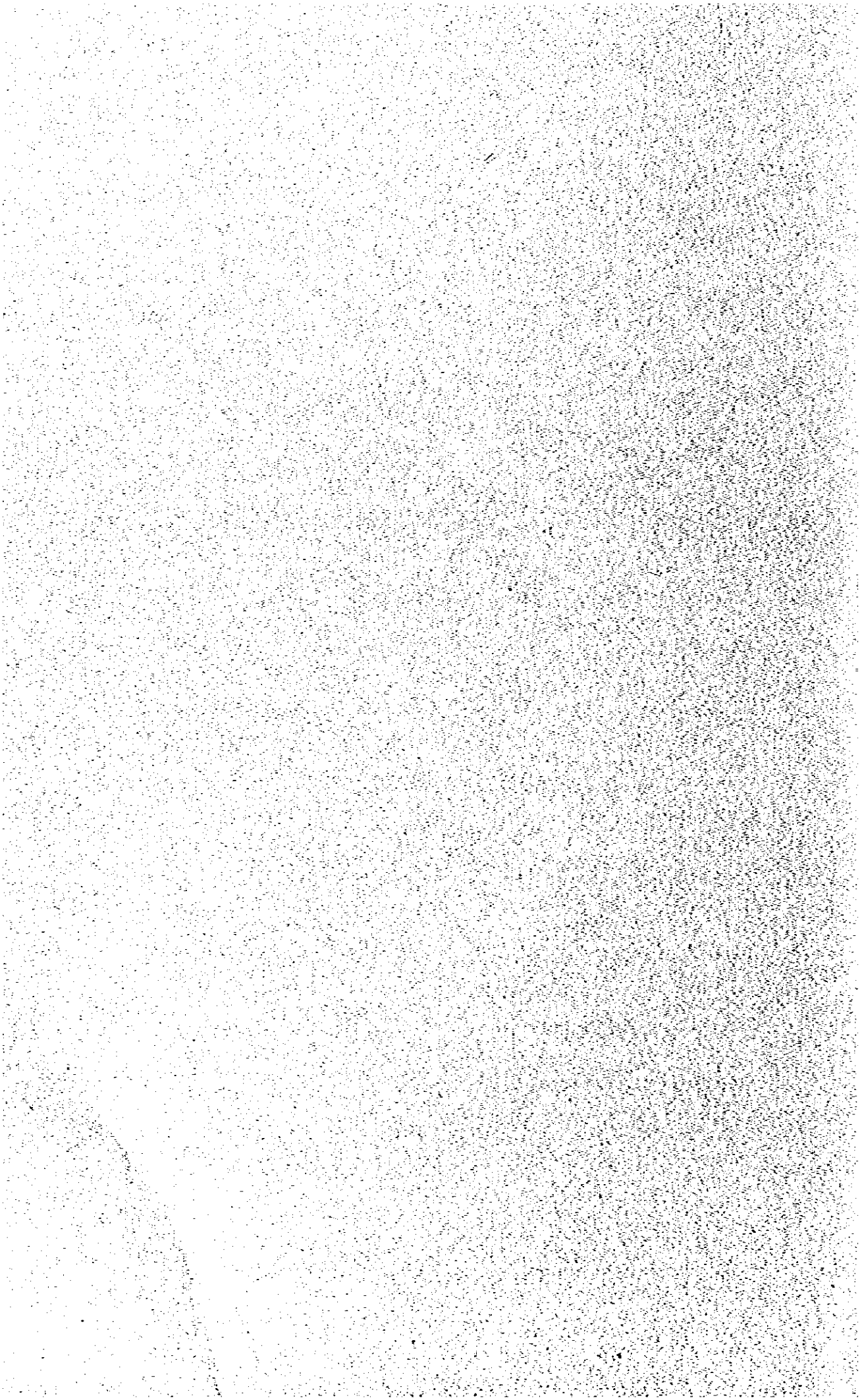
8.8 Training of Public Transport Officials

It is considered essential to carry out some kinds of education for public transport officials to fully understand the new concept and setup of the porposed comprehensive public transport system of Medan Area and also the on-the-job training so as to operate the every part of the system efficiently and smoothly.

8.9 Others

One of the problems to make the transport planning more economical is how to weaken the peak factor in urban transport which is characteristic in every locality. In Japan there are examples of municipal government encouraging local government offices, business offices, institutes and schools to adopt the lagged office-hours or the lagged school-hours, where many offices and schools are presently cooperating with such a municipal policy by lagging their office hours or school hours by 30 minutes or one hour than their normal office-hours or school-hours, which results in slowing down the intensified peak factor of public transport system.

Chapter 9 SPECIFIC PROPOSAL FOR PROSPECTIVE STUDIES



Chapter 9. SPECIFIC PROPOSAL FOR PROSPECTIVE STUDIES

In completing this first comprehensive study of long-term transport planning for Medan City, the basis established by this study should be widened, detailed, and followed-up, wherever necessary.

In the next stage, it is necessary to carry out feasibility studies on each specific items, such as:

- Railway;
- Tollway;
- Bus Transport;
- Polonia Airport;
- Truck Terminals;
- Parking System; and
- Urban Development.

9.1 Railway

The Indonesian Authorities expressed their strong interests in electrification of railway operation, and in this urban transport study it was studied in a considerable extent as one of improvement alternatives with the first priority.

However, it would be necessary to execute a feasibility investigation on railway electrification as an independent project. This should include a more detailed study on the first stage commuter service by diesel cars and its electrification both from aspects of timing and technological problems and future power supplying aspect of the area.

Also, a more detailed financial investigation is proposed to be carried out as well as a study on its organization.

9.2 Tollway

For the Belawan-Medan-Tg. Morawa Toll Road section of the whole tollway network in the study area which is scheduled to be in operation shortly, a detailed design has been already completed and it is reported to go into the construction stage in 1980/81.

On the other hand, the Binjei By-pass and the rest of the Outer Ring Road sections require more detailed investigations including cost estimates and financial study.

9.3 Bus System

In this study one-man operating bus system is recommended from the financial aspect. However, this should be re-examined from a social aspect, too.

Also, this study is focused upon urban transport and a further study on the operation over long-distance by inter-city buses will be necessary.

9.4 Polonia Airport

The possibility of runway extension at the Polonia Airport should be studied in relation with its relocation project. Decision on this matter will have to wait for a feasibility investigation on this matter.

9.5 Truck Terminals

In this study two truck terminals are proposed one on the east and another on the west. Their realization requires more detailed studied on commodities flow in general, as well as its financial feasibility.

Also, its organization aspects, or how to organize independent truck owners to utilize the facilities and what sort of agency should be formed to carry out the project and operate them, needs to be studied on the basis of actual situation.

9.6 Parking System

In order to prepare enough parking lots for the demand created within the central district, the existing parking situation will have to be surveyed, then, the portion of demands to be satisfied by the public parking lots prepared by the municipal anthorities should be determined.

Also, a series of legislative measures which requires commercial/administrative facilities with more than a certain floor area to satisfy their own parking demand, on which enable the authority to subsidize individual enterprizes in preparing their own parking lots.

9.7 Necessity of Legislative Measures for Landuse Control

Generally, there are two main objectives for the landuse study, and they are:

- To provide a landuse Master Plan to be realized by a target year:
- To establish a series of legislative measures for its realization.

The main issue of the 'Master Plan Kotamadya Medan' is a proposal of neighbourhood districts. A neighbourhood district with an area of approximately 100 ha and population of 10,000 persons centered by a central district with commercial and public facilities is widely accepted by urban planners' community as a basic unit for residential development.

However, observing the past trace of Medan Area's development since the above mentioned Master Plan was promulgated in 1974, it is difficult to recognize that those neighbourhoods planned have been formulated as planned. This would be due to the unsuitability of the Master Plan's scheme, and also to the lack of legislative measures.

On the other hand, the adjusted landuse scheme made by the MUDS ('Medan Urban Development Study') is a classification of areas to be developed and those to be refrained from development in each planning period. And it does not indicate the use of each area. This proposal is, therefore, not so specified as that by the 'Master Plan Kotamadya Medan', but have more actual effect upon control of development.

Therefore, the further landuse study should be focused upon to enrich the contents of the landuse Master Plan reflecting the actual situation, and at the same time to reorganize the legislative system to control and guide the development potential and to implement various types of project smoothly.

More detailed description on the further landuse study for Medan City is contained in Sec. 2-7: Growth Poles.

9.8 Urban Redevelopment Around Medan Station

After the railway in the CBD is elevated continuously, then the urban redevelopment around Medan Station including such area formally occupied by railway yard, locomotive depot, coach yard and warehouses should be carefully studied by the Municipal Government by conducting its feasibility study.

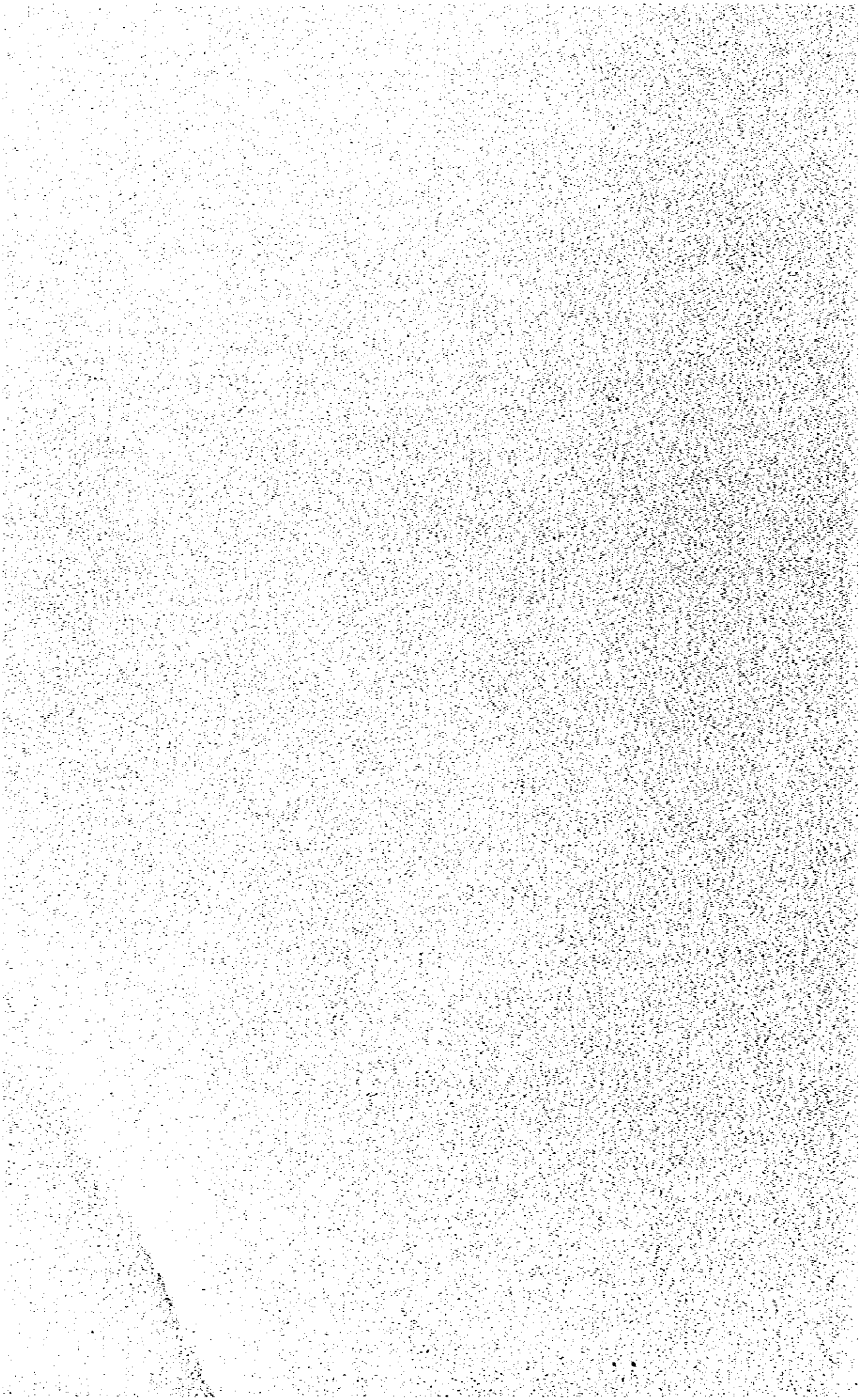
9.9 Area Coordinated Road Traffic Signalling

In the Final Report on Short-Term Improvement Sec. 7.3.2. the proposed the Route Coordinated Road Traffic Signalling is suggested to be developed in future into the Area Coordinated Road Traffic Signalling when the city area expands and traffic increased, needing traffic control not by route but by area. An appropriate feasibility study should be conducted before the introduction of such Area Coordinated Road Traffic Signalling.

9.10 Flood Control and Possibility of Introducing Waterway Transport

This problem was not discussed in this report. But floodings have been observed in the northern city area almost in five year interval presently and its control is also one of the important public works to be carried out in the near future. When flood control project is carried out the existing rivers in the city area will be improved and it is necessary to check the possibility to introduce waterway transport into the city area. This problem should be carefully studied by conducting a respective feasibility study.

Appendix



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C. Road Facilities

D. Financial Analysis