the CBD because the traffic demands to use the bus system is so large. The traffic complication and duplication are also the problems of bus network. The convenient links with other modes of transport essentially necessitates the establishment of a bus terminal at each railway station to feed to and receive from the railway considerable number of passengers at major railway stations because the railway and the bus system are expected to supplement strongly one another in the urban transport planning of Medan Area in the Long-Term.

The basic concepts in planning bus terminals for Medan Area is formulated under the policy to separate the service areas between the intra-city service and the inter city service as the Outer Ring Road as their boundaries:

(i) To receive inter-city bus passengers in the vicinity of Outer Ring Road at its intersections with radiating arterial roads;

(ii) To utilize the railway station plazas fully for transferring between the railway and the bus system;

(iii) To provide bus terminals for transferring between the large buses and mini-buses.

The proposed locations and sizes of bus terminal of Medan Area for 2000 A.D. are presented in Table 18.

Table 18 Proposed Inter-City Bus Terminals in Medan Area in 2000 A.D.

Bus Route for	Number of Berths to be provided	Area ($m^2 \times 10^3$)
Belawan	28	8.4
Binjei*	12	3.6
Pancur Batu*	8	2.4
Deri Tua*	16	4.8
Tanjung Morawa	14	4.2
Percut*	4	1.2
Total	82	24.6

Note: * marked locations bus terminals are proposed to be located at adjacent to railway stations plazas or appropriate spaces to be provided within station plazas because the neccesary numbers of berths are no so large.

In the case of intra-city service the existing bus terminals at Teladan, Sei Wampu and Gelugur are proposed to be utilized as bus terminals for transferring between the large-bus system and the mini-bus system. On the other hand at Medan

Station plaza it is proposed to establish the central bus terminal of 35 berths as the most important linking point between the railway and the bus system in Medan Area. The bus terminal at Pasau Sambu improved in the Short-Term is proposed to be abolished in the long-term by remodelling it into a kind mall.

The construction cost of bus terminal is included in the road related facilities in Table 21.

7.4 Truck Terminals

The basic policy to establish truck terminals in Medan Area is based on the following concepts:

(1) To relieve the traffic congestion in the CBD by establishing of truck terminals in the peripheral area in order to receive and store commodities imported through Port of Belawan and carried by large trucks and to distribute them to the city as well as deep into the hinterland according to local demands to be carried by small trucks. Avoiding the direct entry of large loaded trucks into the CBD is expected to be efficient enough to relieve the traffic congestion due to the truck traffic.

(2) To relocate railway warehouses existing in the CBD which are presently do not store the railway freight carried from the hinterland but store only imported commodities as aforementioned which are carried into only by trucks. The existence of those railway warehouses, which do not handle the railway freight at all, are posing one of the reasons of traffic congestion in the CBD. From such point of view it is strongly proposed to establish truck terminals possessing the additional function of warehouses in the peripheral areas in the long-term.

In this report the estimated truck traffic in 2000 A.D. to and from Port of Belawan including those to and from proposed truck terminals are shown in Fig. 27., and the necessary size of lands to be assigned for those proposed truck terminals are shown in Table 19.

Table 19 Proposed Sizes of Truck Terminals in Medan Area in 2000 A.D.

East truck terminal (T-A)	40.0 ha.
West truck terminal (T-B)	4.4 ha.
Total	44.4 ha.

The construction cost of truch termicals is included in the road related facilities in Table 21.

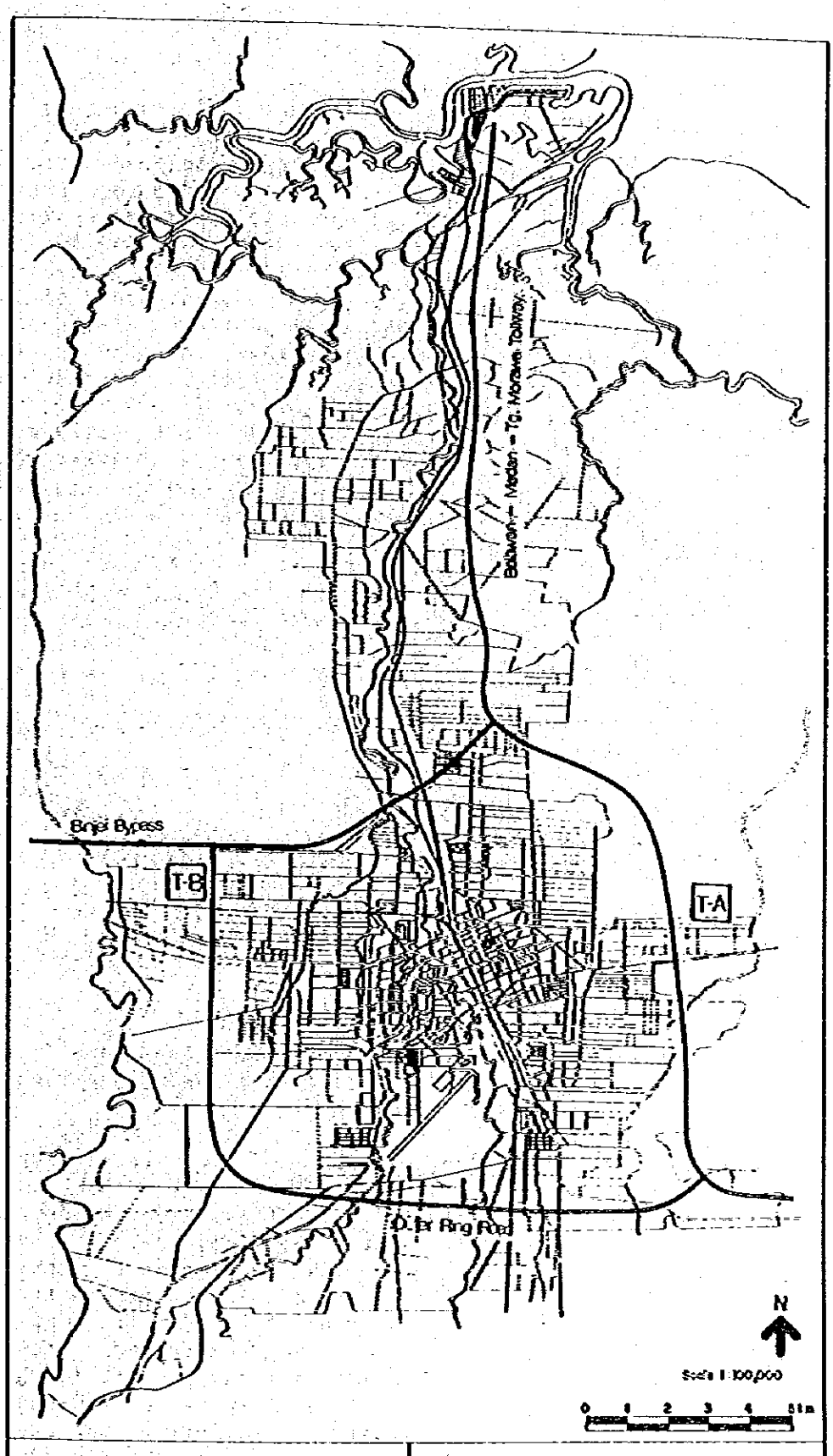

Fig. 21 Proposed Locations of Truck Terminal

Legend

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

Medan Area Transportation Study

7.5 Vehicle Parking Facilities

It is of course necessary to enhance the dependence of urban traffic on the public transport system in order to maintain the urban function of Medan City efficiently, when it is also necessary to establish the public vehicle parking facilities to cope with the private-vehicle parking demands in the CBD. In establishing of such parking facilities in the CBD it is proposed to build them partly by the municipal government as public parking spaces with charge, partly to give an obligation to building owners to build them by private investors and partly to allow the roadside parking so as the total capacity of those facilities to satisfy the parking demands. Table 20 shows the sizes of land to be assigned to the proposed public parking spaces in the central four kecamatans of Medan City in 2000 A.D. The construction cost of public vehicle parking facilities is included in the road related facilities in Table 21.

Table 20 Proposed Areas of Land to be assigned to Proposed Public Parking Spaces in Central Four Kecamatans in 2000 .A.D

Name of Kecamatan	Kecamatan Area (ha)	Parking Space (ha)	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	

Note: The rate of parking spaces of those kecamatans * marked is assumed 80% of the criteria in view of their character.

7.6 Urban Redevelopment Project of Urbanized Area around Medan Station

The present central district of Medan City is on the development stage to form the central business district, where the business facilities and commercial facilities are mingled together with residential facilities although the population growth trend is gradually slowing down. As the central district changes into a genuine business district without being controlled by administrative measures, the more the residential environment in the CBD will get worse. Generally, in the primary stage of urbanization the business district of centrally concentrating type starts the eccentric expansions or linear expansions, as the secondary cores are formed thus the multicore typed business district is gradually formed by the formation of secondary urban core. In such a case the secondary urban core is usually formed in the relationship with the co-action of major transport terminal.

Presently, in the central district the urbanized area is separated into the east and the west sides by the railway and the mutual relation between both sides of the railway is weak; namely in the west side there situate administrative buildings and commercial and business facilities of comparatively large scale, while in the east side, there exist many retailing and whole-sale commercial facilities where the residential population density is presently very high.

The urban re-development project has an important meaning of urban redevelopment of the areas around the railway station and in railway right-of-way, which should be implemented in parallel with the road widening project of arterial roads and also the railway elevation project.

In this redevelopment project the relocation of warehouses of commodity distribution purpose existing in the CBD and posing one of the major causes of traffic congestion, and also the relocation of educational facilities is proposed because the reason of their present existence in the CBD is weakening due to the existing trend of out-flows of population from such area. On the other hand from the urban disaster preventing point of view the securing of pedestrians' areas and the preservation of historic buildings will need much precaution and care in planning.

In the implementation of urban redevelopment project it is necessary to improve the legislative process for trading of land, to limit the land-use by regulation due to authorized city master plan to establish the regulation to limit building height and floor area ratio*.

Note: * Floor Area Ratio: [Floor Area]/[Ground Area]

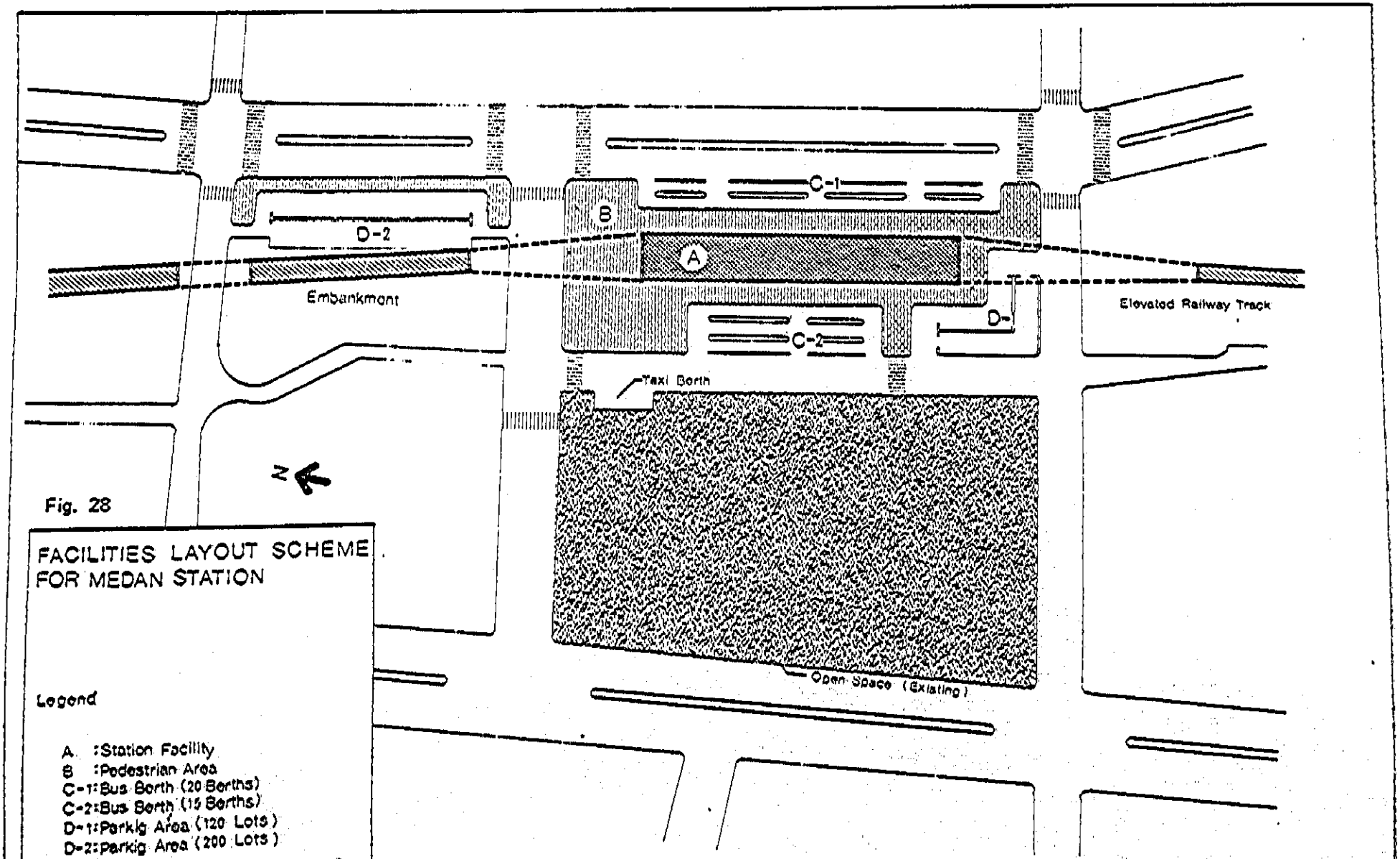

Fig. 28

FACILITIES LAYOUT SCHEME FOR MEDAN STATION

Legend

A :Station Facility
B :Pedestrian Area
C-1:Bus Berth (20 Berths)
C-2:Bus Berth (15 Berths)
D-1:Parkig Area (120 Lots)
D-2:Parkig Area (200 Lots)

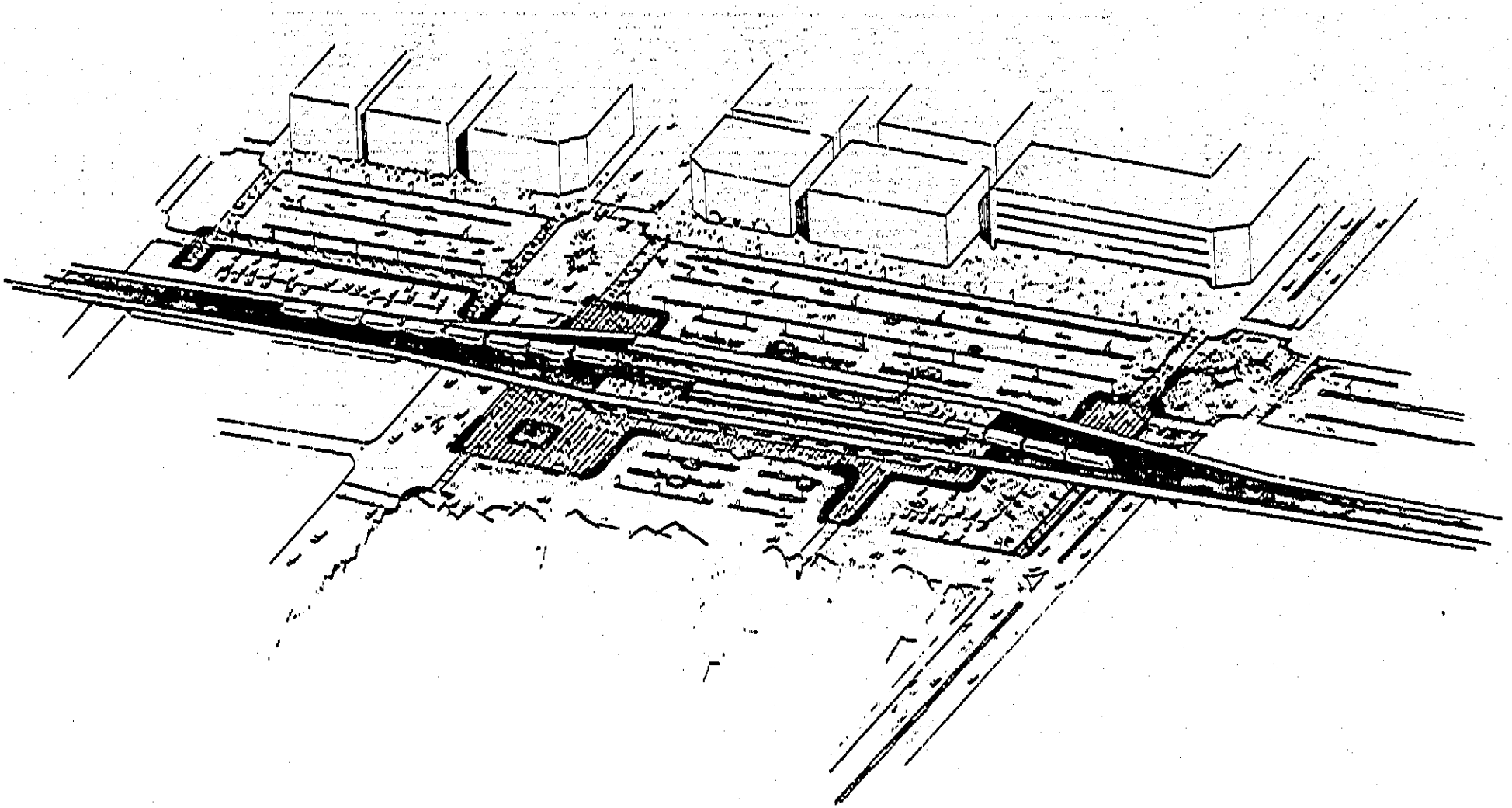

Fig. 29 Bird's-Eye View of Medan Station Area

7.7 Summary of Public Investment Costs of Long-Term Improvements

The costs of public investment of the long-term improvements can be summarized as follow:

Table 21 Summary of Public Investment Costs of Long-Term Improvements in Medan Area (In the price level in January 1980)

	1986 ~ 1990 Financial Cost ($Rp.x10^9$)			1991 ~ 1995 Financial Cost ($Rp.x10^9$)			1996 ~ 2000 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	10.0	36.7	32.8	14.6	47.4	106.6
3) Related facilities	6.5	2.9	9.4	5.4	3.2	8.6	5.5	13.9	19.4	37.4
Sub-total	22.1	11.9	34.0	38.9	16.3	55.2	47.4	32.7	80.1	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	54.5	109.0	51.3	58.0	109.3	44.7	60.1	104.8	323.1
Total	77.6	65.4	143.0	90.2	74.3	164.5	92.1	92.7	184.9	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	121.8	65.4	187.2	148.4	74.3	222.7	181.8	92.7	274.6	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	794	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

7.8 Improvement Policies in Intermediate-Term

In transferring from the existing condition in the Short-Term to the final proposed state in 2000 A.D. several uncontinuation of conditions are expected to take place in the urban transport system. It is natural that the present transport modes will change themselves into the future modes of transport, and the important thing to think over is how to cope with the change of transport modes as follows:

(i) Transferring from the diesel operation into the electric operation in railway;

(ii) Bemo and Daihatsu's replacement by the bus system;

(iii) Complete abolishment of Becak, although Becak will survive in some peripheral areas.

(1) Transition from Diesel into Electric Operations of Railway

In this study the urban transport by railway is considered to cope with the share of railway by commencing the service by the diesel traction which is changed into its electric traction later in the last stage. Such change is considered tentatively after 1995 although the optimum time of this change should be studied carefully taking into account the national policy of railway electrification as well as the future power aspect, particularly the cost of oil which is still expected to hike in future and the electric power aspect in North Sumatra due to the future expansion of Asahan Hydro-Power Generating Project.

(2) Replacement of Bemo and Daihatsu with Bus System

Although existing Bemo and Daihatsu are convenient modes of transport at present to the citizens they are feared to become the causes of the future traffic congestion due to their low transporting efficiency and they are proposed to be replaced by the bus system including mini-bus of 30 seats. But this replacement should not be carried out abruptly, otherwise it will cause confusion of urban transport in short distance, because it is expected to take place the unemployment problem of Bemo and Daihatsu's drivers, the solution of which will take time for the city. Consequently, this replacement is proposed gradually to carry out. Under the premise that Bemo and Daihatsu should be replaced in the long-term, they are proposed to be assigned in the intermediate term to the urban short-distance transport which is to be assigned to the mini-bus system in future, and consequently it is proposed to arrange their operating service routes not to compete with the large bus routes, co-existing with the large buses and being replaced gradually by the mini-bus services.

(3) Complete Abolishment of Becak

Becak is considered to reduce the traffic efficiency noticeably when the majority of urban road traffic becomes automoble in the long-term, and consequently Becak is proposed to be abolished completely in the major parts of the city area except some peripheral areas.

In transferring from mode to mode of transport particularly as those mentioned in (2) and (3) it is proposed to take appropriate administrative steps to render service taking care of employment of those professional drivers of Bemo, Daihatsu and Becak who will loose their jobs in such transferring stage, by which steps the transition from mode to mode is expected to be performed smoothly.

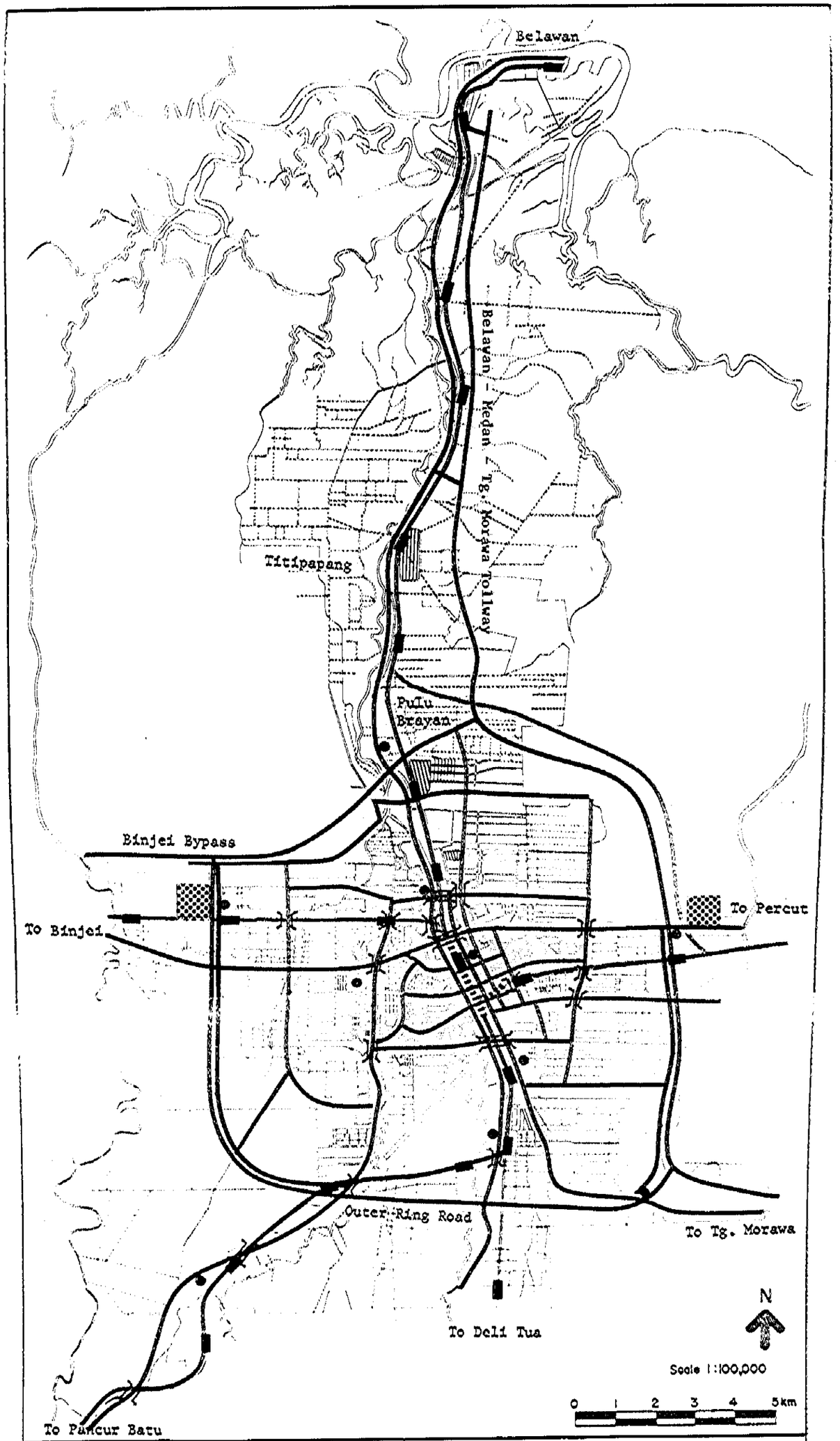

Fig. 30
Comprehensive Urban Transportation Network Plan in 2,000 A.D.

Medan Area Transportation Study

Legend

- 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

8. Financial Analyses

The financial analyses are performed in this study report only in those public investment to be financed by loans. The categories of those public investment are the followings:

(1) Railway Improvements;

(2) Improvements in Bus Transport; and

(3) Improvements in Road Improvements.

8.1 Basic Conditions of Analyses

The most important factors in such financial analyses are the proportions of foreign currency portion and domestic currency portion and their conditions of interest and paying-back method. In this financial evaluation the following conditions are set as the premise of analyses:

(i) Interest Rate of Loans

- Domestic loans: 12% per annum
- Foreign loans: Without paying interest for seven years, and then paying interest of 3.5% per annum afterwards, paying back for thirty years in a uniform amount every year including interest.

(ii) The financial costs of investments are calculated in the price level of January 1980.

8.2 Financial Analyses of Railway Improvements

(i) Premises:

The financial analyses on the railway improvements are performed under the following premises to simplify the analyses because various items are involved in improvements:

- The State Railway is considered to be the agency responsible for the implementation of those railway improvements;
- The railway urban passenger transport is solely considered in the analyses and the railway freight transport together with the freight revenues is excluded from the analyses, which are expected to be included in the North Sumatra Transport Study and its affiliated projects except the costs of relocation of freight yard, locomotive depot and the construction of detouring line for freight trains in Medan Area;

- The 30 years period between 1986 and 2015 A.D. is considered in the analyses of railway revenues and expenditures. And the tariff for urban railway passengers is assumed to be same as that of the current tariff under the application of commuter's reduction;

- Two analysis alternatives are considered as those with and without the cost of construction and the cost of procurement of rolling stock;

- The annual growth rate of the urban railway passenger traffic after 2000 A.D. is assumed to be same as that of the population in 2000 A.D.

(ii) Results of Analyses:

According to the results of financial analyses of railway improvemets, successive deficits are expected to take place in the beginning four years in the balance between the passenger revenues and the costs of maintenance and operation, but the deficits are expected to disappear after 1990 and the gradual increase of profits is expected, the general trend of this balance is presented in Table 22.

Table 22 Estimated Financial Balance Between Annual Revenues and Expenditures of Maintenance and Operation in Urban Railway Passenger Transport in Medan Area

(Unit: Rp x 10^6)

Year	Annual Expenditures	Annual Revenues	Annual Balance	Accumulated Accounts
1986	519	127	-392	-392
1990	519	1,205	337	159
1995	1,392	2,593	1,201	3,777
2000	2,586	3,090	504	5,551
2010	3,446	4,069	623	7,153

8.3 Bus Financial Analyses of Bus Transport

(i) Premises:

The financial analyses on the bus transport are performed under the following premises;

- The organization to perform the urban bus transport service is assumed to be under a single capable operator such as P.N. DAMRI of self supporting carrier and consequently the government subsidy is not considered at all.

- The intra-city service is analized separately from the inter-city service.

- The tariff is assumed to be a uniform fare of Rp 60 to 70 per ride in the intra-city service, and Rp 6/km in the inter-city service.

- The cost of bus is assumed to be depreciated in five years and the remaining value after depreciation to be 10% of the original cost.

- The analysis period is assumed for the 30 years commencing from 1986.

(ii) Alternatives of Bus Operation

Alternatives of bus operation for financial analyses are formulated by the combination of different bus crew system, bus fares and the commencing years of such services as follows:

Table 23 Alternative Bus Operations for Financial Analyses of Medan Area Bus Transport Service

Name of Alternative	Bus crew system	Fare (Rp/ride)	Type of Service	Commencing year
Case 1	One-man system	60	Intra-city	1986
Case 2	One-man system	60	Intra-city	2001
Case 3	Two-men system	60	Intra-city	1986
Case 4	Two-men system	60	Intra-city	2001
Case 5	One-man system	70	Intra-city	1986
Case 6	One-man system	70	Intra-city	2001
Case 7	One-man system	Rp 6/pass.km	Inter-city	1986
Case 8	One-man system	Rp 6/pass.km	Inter-city	2001
Case 9	Two-men system	Rp 6/pass.km	Inter-city	1986
Case 10	Two-men system	Rp 6/pass.km	Inter-city	2001

(iii) Results of Analyses

The results of financial analyses of bus transport service in the long-term are as follows:

- Intra-city Service

In order to level up the bus service in future, first of all it is necessary to mitigate the current congestion in bus, which means to reduce the average number of passengers per bus than the present situation. In order

to maintain the profitability under the reduced number of passengers per bus it is necessary to improve the present bus crew system at the appropriate time from the two-men system to the one-man system and also to raise the present bus fare up to Rp 60 per ride. Although the one-man system is really not easy to adopt in Indonesia, but it is one of the effective solutions to rationalize the present bus operation in Indonesia; and consequently, the study shall be conducted in the crew training to cope with the increase of bus units in future and it is proposed to start changing from the present two-men bus to the one-man bus at least in 1990. In the raising of the bus fare sudden hike will hurt the public feelings, and it should be raised gradually every time when any part of service is improved.

8.4 Financial Analyses of Tollways

The financial analyses are performed for two tollways; namely, one is Binjei-Medan Bypass and the other is Outer Ring Road.

(i) Premises of Analyses

In conducting the financial analyses the following premises are assumed;

- The project life-span is assumed thirty years after its opening for traffic;
- The toll is assumed to be Rp 15/km of the distance proportional system which is considered appropriate for both of those two tollways.

(ii) Results of Analyses

- Binjei Bypass

The four-laned tollway can be said as a little over-investment viewing from the estimated traffic. But its economic feasibility will be attained by reducing the primary investment by means of applying the stage construction because the estimated deficits are small in amount as a 4-laned tollway.

- Outer Ring Road

In the stage of formulating this master plan the economic feasibility of Outer Ring Road is not so bright because of insufficient estimated traffic. Such aspect is considered to be due to the fact that the traffic forecast was made based only on the basic arterial road network and large-scaled project under planning and also rough zoning.

Therefore, the financial analyses on those two tollways were performed results in finding only the estimated trend in future of both tollways; and consequently, the feasibility study should be carried out on them in order to confirm their specific economic as well as the technical feasibilities in order to implement both projects.

9. Administrative Measures to be Taken

Some of remaining items, which have not been mentioned so far, are described in this chapter referring to some Japanese examples. Most of those items are related to the administrative measures to be taken by the Indonesian Government to attain the effective functioning of the proposed urban transport system. Needless to say, Japanese examples are presented only for references but the specific administrative steps should be carried out timely by the Indonesian Government well reflecting the Indonesian domestic situation.

9.1 Traffic Control System

In this "Long-Term Master Plan" the specific final traffic control system is not proposed, but establishment of bus lanes on arterial roads and the area traffic control system are explained as the most efficient measures to be applied to Medan Area. Also, the importance of social education of citizens on urban traffic planning to enhance the traffic capacity and the safety of roads should be emphasized. The following categories and items are of major importance:

(i) Social Education:

An interdisciplinary research group is proposed to be formed to investigate the followings:

- Seeking for possibility to use much wider variety of mass media for such a social education on traffic problems;
- Reorganization of drivers' educational program;
- Revision of laws and regulations concerning traffic control;
- Reeducation program for drivers who violated traffic regulations.

(ii) Establishment of Bus Lanes:

- A bus lane is proposed to be established in each direction on each arterial road during specific peak hours on week days in order to secure the orderly bus operation irrespective of traffic congestion on the said arterial road.

(iii) Area Coordinated Traffic Control:

As one of the ultimate target in the urban traffic control the area coordinated traffic control system, which is operated by a centrally located electronic computer system to which various traffic information of the area are fed by traffic detectors installed, is proposed to introduce to Medan Area. This can be remodelled from the route coordinated traffic control system proposed to be installed in the Short-Term if appropriate considerations are paid in its design stage.

9.2 Procedure to Compile Traffic Accidents Statistics

The objective of compiling traffic accidents statistics is to analyse the relationship between the types of accident, traffic volume and surrounding conditions of accident site, with which appropriate counter-measures are studied or designed. In compiling traffic accident records an electronic computer is fully utilized in Japan. A Japanese example of recording sheet of road traffic accident data is shown in Appendices as reference.

9.3 Railway Elevation

The continuous elevation of railway lines in the CBD is of much benefit to the city side than to the railway side, benefitting the city side by elimination of railway crossings and affiliated traffic congestions in the CBD, the redevelopment of part of former railway right-of-way and station ground to be released by track elevation, and more closer contact of the CBD between the east and the west sides of the railway and also benefitting the railway side by elimination of accidents at railway crossings, elimination of maintenance and operating costs of railway crossing barriers and increase the financial value of the spaces under the elevated tracks and platforms by using them for passenger station facilities, concessions and vehicle parking facilities, etc.

Therefore, the cost of railway elevation is usually shared in Japan by both the railway and the city proportionately to their benefits. Japanese criteria of cost sharing in railway elevation in urbanized area is presented in Appendices as a reference.

9.4 Tariff System of Public Transport Services

Although in the railway tariff system particularly in urban passenger transport service such two types are prevailing, namely the type based on the self-supporting financing and the financing type based on the public subsidy by the government, the latter is considered as the usual case. It is difficult to determine its optimum rate of subsidy theoretically, but the important thing is to set up a system which can flexibly cope with the actual situation.

9.5 Toll Road Administration

For the operation of the tollway network proposed for Medan Area, an organization which is similar to the Highway Public Corporation for Freeway in Jakarta Metropolitan Region, is proposed to be adopted. Under this organization, it is assumed that each section of the network is taken care of by a branch office under its control of the regional office.

9.6 Measures to Realize Low Motorization

In order to attain the low motorization in the private-vehicle traffic the following concepts are strongly proposed to be taken

in administrative measures:

- To discourage citizens the direct entry into the CBD by using private vehicle, particularly in peak hours;

- To encourage citizens to use the public transport system, particularly in peak hours.

Usual measures to be taken in such cases are;

- Establishment of high parking charge in the CBD.

- Restriction on the number of passengers in an vehicle entering into the CBD particularly in peak hours.

- Establishing a bus lane in each direction on arterial roads during the specific peak hours.

- Prohibition of road side parking on majority roads in the CBD.

- Adoption of the park and ride system.

- Adoption of lagged office hours by organization and lagged school hours by institute which is effective enough in weakening peak factor in urban transport

10. Specific Proposal for Prospective Studies

It is proposed that the basis of this urban transport study to establish the "Long-Term Improvement Master Plan" be furthered, widened and detailed by following-up investigations by the respective government agencies concerned.

After the Master Plan is authorized by the Governmetn of Indonesia, then it would be necessary in the next stage to carry out feasibility studies on such specific projects as follows:

- Railway Improvement Project;
- Electrification Project of Railway Passenger Transport;
- Tollway Project;
- Expansion or Relocation of Polonia Airport;
- Investigation for Effective Implementation of Urban Transport Master Plan;
- Area Coordinated Road Traffic Signaling Project;
- Possibility of Introduction of New Transport System;
- Urban Redevelopment Project around Medan Station;
- Bus Transport Improvement Project;
- Track Terminal Project accompanied by Relocation of Warehouses;
- Public Parking Facilities Project; and
- Flood Control and Possibility of Waterway Transport; both of which are not covered in this report.

11. Conclusions

In view of the urban master plan of Medan Area for the target year 2000 A.D. its key points can be summarized into the following several categories. In considering Medan Area from the viewpoint of her ranking in the regional future aspect it is expected that Medan City will grow into the cultural, political and economic centers of North Sumatra Province as well as of Sumatra Island. Consequently, it is also hoped from the urban transport planning point of view that her urban improvements will cope with her expected future developments as follows:

(a) In the land-use pattern and the population frame it is proposed that the present situation in the Short-Term in the core area of the city, where commercial stores and residences are mingled under high population density, be redeveloped into a modern central business district where will be characterized with business office buildings separated from residences, being kept at the appropriate population density in its night population by relocating residences to the peripheral areas or the residence zones to be newly constructed. Such a re-development of the CBD is not merely the problem of land-use but should be realized together with the improvement of urban transport infrastructures such as the railway and roads of Medan Area.

(b) In the improvement of urban transport facilities of Medan Area the improvement of the public transport facilities should be considered as the core problem, where the future trend can be estimated appropriately in the process of evaluation of planning alternatives. For the purpose to realize such an optimum urban transport master plan, it was formulated under the premise of low motorization in the private-vehicle traffic by means of taking effective administrative measures. The importance of this master plan in its implementation is the way how to induce the substantial low motorization in order to enhance the citizens' dependence on the proposed public transport system.

In order to attain the low motorization it is proposed to control the private-vehicle traffic by specific means such as the taxation of those vehicles registered in the CBD, licensing of those vehicles, raising the parking charges in the CBD, restricting land-use accompanied with levying money etc., and on the other hand, it is necessary to increase the benefitability of utilization of the public transport system in entering into the CBD.

(c) In railway affiliated facilities, it seems desirable that the long distance trips be transported by the railway judging from its characteristics, and also it seems desirable that a part of commuting traffic be transported by railway, sharing the urban transport responsibility with the bus system.

The following improvements will be necessary to be carried out in order to realize such objectives:

(i) In the railway improvements the continuous elevation of railway in the CBD is expected to bring about tremendous benefits to both the city as well as to the railway, which will make Medan Station as the central symbolic establishment of the city, serving the city as an important and efficient urban transport node of Medan Area. The railway elevation is also expected to induce the urban redevelopment of the major portion of the station ground by means of relocation of freight yard, locomotive depot and warehouses presently occupying large tracks of land in and around Medan Station. By such a track elevation of railway it is expected that the development potential and the comfortableness of Medan's CBD will be noticeably enhanced.

(ii) In the railway operation a noticeable increase is expected in the number of trains on main lines in Medan Area in the long-term. Under such conditions as the national policy to preserve energy and such a large number transport demand in future it is proposed to open the urban transport service with the diesel operation in the short-term which is to be switched to the electric operation around in 2000 A.D. For the actual change into the electric operation a specifid feasibility study is proposed to be carried out timely.

(d) In the improvements of bus transport system such a concept is proposed to reflect on its program that the bus system has to share a considerable large part of the public transport demand and that such traffic is efficiently handled even in peak hours by providing a bus-lane in each direction on arterial roads during the specified peak hours on week days, strengthening the bus fleet, constructing several new bus terminals dispersed in the city area, opening the mini-bus routes to cover the areas where can not be served by large-bus routes, and by whose solutions the traffic potential of the bus system can be further developed.

In consideration of those categories mentioned above their key points from the viewpoint of consolidation of urban transport facilities can be summarized as follows:

(a) In the improvements of road system the priorities to be given are proposed to cope with the related local development projects, particularly the scheduled housing projects. Such a consideration is well reflected in the proposed implementation program of road improvements. Among those improvements, particularly that of the Intermediate Ring Road has such an importance that will function to balance the traffic on radiating arterial roads of the city's road network in the process of the estimated urban development although the existing radiating arterial roads are expected to function by themselves in certain extent in the present network.

(b) As for the tollway system its study in this master planning is only to find out its macromatic future aspects, namely their outlooks are estimated as follows:

(i) Binjei Bypass is proposed to be implemented in stages in order to be economically justified;

(ii) Outer Ring Road is evaluated in this master planning study not so favorable to be operated as a tollway; and consequently, this Ring Road is proposed to be restudied on its economic feasibility at an appropriate time in future after observing the trend of land-use developments and of its future vehicular traffic.

(c) As for railway facilities it is necessary to separate the freight line partly due to the urban environmental aspect and partly due to the restricted track capacity of the Eastern Line in the city area because of the possible satulated operation by urban passenger trains in the long-term, and it is also necessary to elevate main lines continuously in the CBD in order to grade-separate railway crossings at grade presently existing in the CBD.

(d) In order to handle the urban traffic smoothly as a whole of the area it is proposed to handle the bus traffic conveniently in the railway station plazas where inter-modal transferrings can be made easily.

(e) It is proposed to establish truck terminals accompanied by warehouses at strategic locations on Outer Ring Road in order to handle commodities efficiently and to avoid the direct inflow of large trucks particularly originating from Port of Belawan deep into the CBD by which the truck traffic in the CBD can be effectively reduced.

(f) In the railway operation it will be necessary to transfer from the diesel traction to the electric traction at an appropriate time in the long-term and also some endeavor should be done in future to introduce a new transport system when its technical development justifies its application to the urban transport system of the area.

(g) In the road facilities improvements of intersections including the construction of fly-overs should be implemented timely to cope with the actual traffic needs, and also the establishment public parking facilities in the CBD should be realized timely to cope with the actual parking needs.

(h) As administrative measures to be taken in implementing those imporvements above-mentioned the establishment of project implementing laws and regulations, the realization of the social education on transport and traffic affairs, establishment of the definite measures to control the private vehicle traffic in the CBD, and their financings and budgetary system should be jointly studied by governmental agencies concerned.

Before concluding this summary it is emphasized that a Master Plan for the future comprehensive urban transport system for Medan Area is presented in this report, in which various types of project are pointed out to be carried out in order to realize the Master Plan as a whole and that it is necessary to study in details by project by means of separate feasibility study before they are actually implemented.

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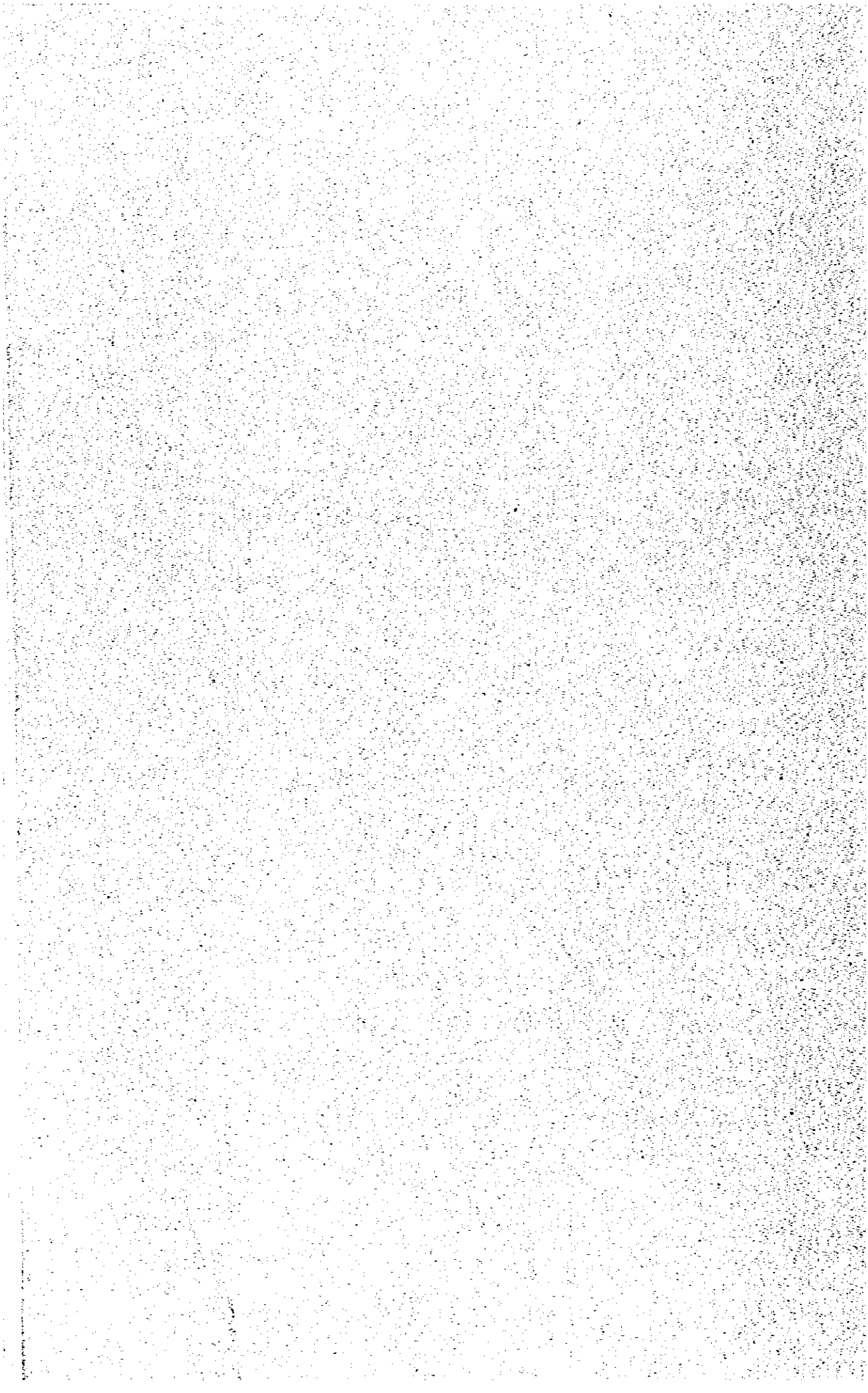

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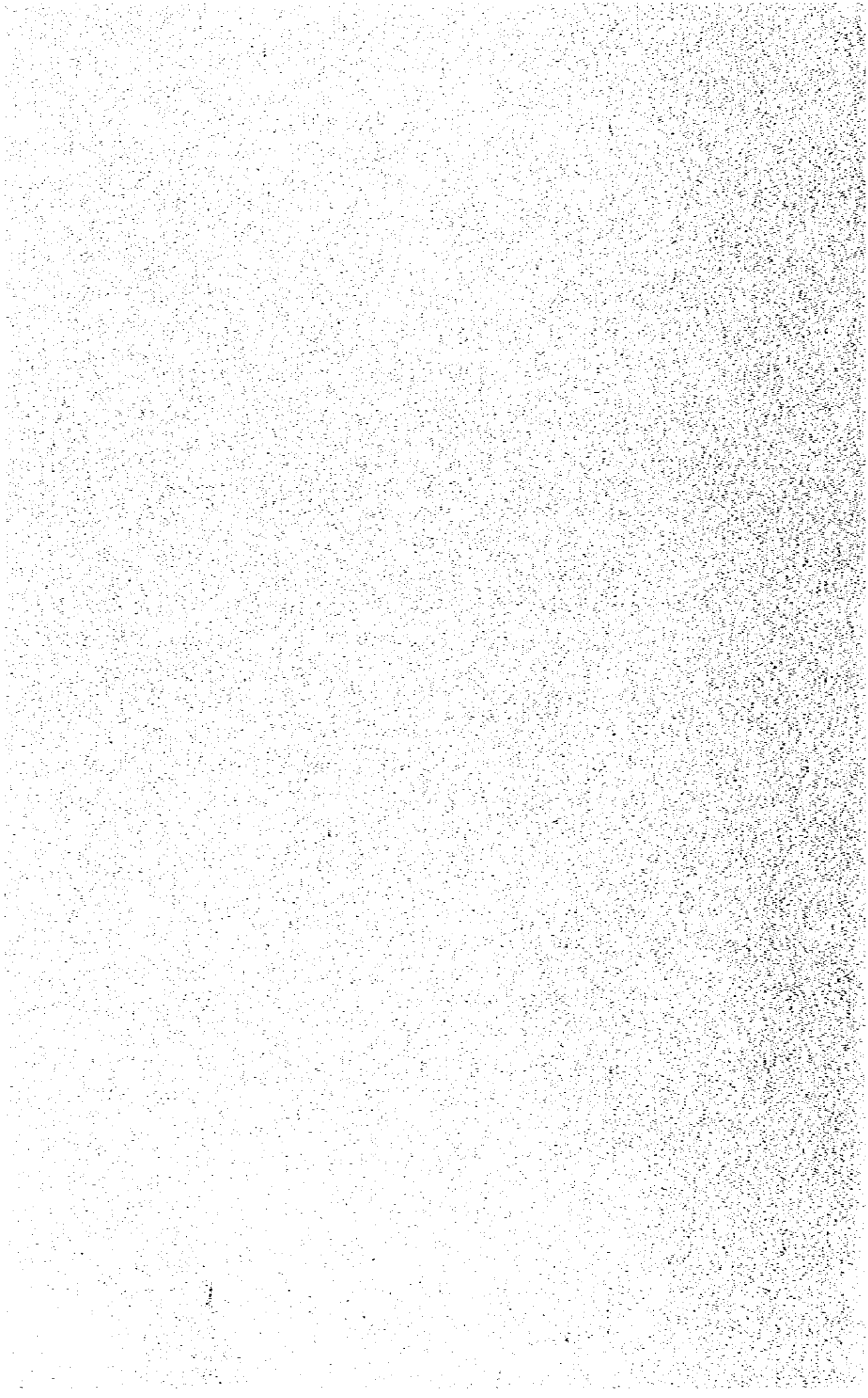
Chapter 1 INTRODUCTION



Chapter 1. INTRODUCTION

1.1 Background of the Study

The present urban transport condition of Medan area is in such a situation that causes daily serious traffic congestion in the CBD in peak hours due to several causes such as its high population density which is expanding its traffic demand successively, insufficient traffic capacities of the present road network, the insufficient number of bus fleet in the public transport system, the variety of transport modes, the inadequate one-way traffic control in certain parts of the existing CBD and the fact that the railway, which occupies a strategic position geographycally in the CBD, does not presently share commuter service substantially.

The Government of Republic of Indonesia has recognized the importance not only in solving the current traffic problems but also in formulating Master Plan of Integrated Urban Transport system for Medan City and its surrounding areas as the Third City in Indonesia to solve the urban transport problems succeeding Jakarta and Surabaya which were studied already.

Historically, the following studies relevant to the development of Medan City, were performed in past or are underway at present:

(a) Upon the request by Ministry of Public Works, Directorate General of Housing Building Planning and Urban Development (CYPTA KARYA), a British consultant formulated in 1973 Medan City Master Plan which was authorized in 1974. This Plan required the municipal legislative area to expand from that of the former plan of 5,130 ha in area up to the present one of 26,510 ha to accommodate the estimated population of 2.29 - 2.57 millions in 2,000 A.D. with an average annual growth rate of 3.28 - 3.74%;

(b) Upon the request by Ministry of Communication, Directorate General of Sea Communication, a British consultant formulated in 1975 an expansion plan of Port of Belawan to cope with the future traffic through the port in 1998;

(c) Upon the request by Ministry of Public Works, Directorate of Housing Building Planning and Urban Development, an consortium of American, Taiwanese and Indonesian consultants commenced the so-called "Medan Urban Development Study", in which the consultants are assigned to formulate the Long-Term Urban Development Plan and to conduct the feasibility study of the First Stage Housing Development Project. The study is still underway at present;

(d) Upon the request by Ministry of Communication, and Indonesian State Railway a French consultant commenced in May 1979 the study called "North Sumatra Transport Study Project", in which the consultant is assigned to survey the present situation of railway and road transports and their facilities, to forecast their future traffic demands and to propose their suitable improvement plans to cope with their forecasted traffic volume up to 1998.

(e) Upon the request by Ministry of Public Works, Directorate General of Highways, an Italian Consultant conducted in 1978 "Impact/Toll Study for Belawan-Medan and Medan Eastern Area". This tollway project is presently under the final engineering stage and is scheduled to commence its construction in 1981/1982.

Under such a situation the Government of Republic of Indonesia requested the Government of Japan to conduct "Medan Area Transportation Study" containing surveying on the present situation of existing transport and their facilities by mode, forecasting the future traffic demand by mode of transport, conducting feasibility study of short-term improvements and formulating Urban Transport Master Plan for long-term for Medan area covering Medan municipal legislative area and necessary surrounding area within a radius of approximately 20 km from the center of the existing CBD.

In response to this request, Japanese Government, as a part of its technical cooperation program, has undertaken to carry out this study. A preliminary survey mission organized by Japan International Cooperation Agency (JICA) in November 1978 was dispatched to Indonesia for the field reconnaissance and the preparation of Scope of Work. After a series of discussion with the Indonesian government agencies concerned, the Scope of Work was defined. JICA appointed a consortium of consultants consisting of Pacific Consultants International and Japan Transportation Consultants, to perform the study.

1.2 Objectives and Scope of Work

The Study Team's mission to carry out this study is specified in Scope of Work agreed upon by both governments as follows:

Objectives of the Study

(a) Feasibility study of Short-Term Medan Urban Transportation Improvement Plan is to be conducted; and

(b) Master Plan of Long-Term Urban Transport in Medan Area is to be formulated.

Scope of the Study

(a) Geographical Study Area

The study will be undertaken for the area of Medan City and her surroundings.

(b) Target Year

The target years will be taken for the study as:

i)	Short-Term Plan	1985 A.D.
ii)	Long-Term Master Plan	2000 A.D.

1.3 Activities of Study Team

As Step 1 and Step 2 as mentioned in the Study Team's Inception Report, the consortium, working under the guidance of Japanese Supervisory Committee, dispatched a 10-member study team to Indonesia for field works for the period from September 10, 1979 to November 10, 1979.

Upon the completion of field works by the Study Team under the close cooperation provided by Indonesian Counterpart experts in the field, and the cooperation extended by members of Indonesian Steering Committee on this project a Progress Report and an Interim Report on Short-Term Improvements were submitted to the Government of Indonesia by the Study Team on November 5, 1979; in the former were presented the descriptions on field works, collected informations and data, findings on site as the results of field works, while in the latter were presented the study on the present socio-economic situation of the study area, the present land-use pattern of Medan City and its surrounding areas, the present situation of urban transport, volume of traffic and existing facilities by mode of transport, relevant development projects in the study area, and approach and methodology for proposals of short-term improvements. Through the discussion between Indonesian Government agencies concerned and the Study Team an overall policies for Step 3 and Step 4 of the study was confirmed.

According to the policies confirmed the Study Team carried out the further works in Japan. In March 1980 the Study Team visited the Government of Indonesia submitting and briefing Draft Final Report on Short-Term Improvements and Interim Report on Long Term Master Plan of urban transport planning of Medan area. In the latter report the Study Team introduced seven alternatives in which the basic relation varies between the railway and road systems. After discussing and upon the recommendation by the Study Team an alternative was selected as the plan of the first priority in which it was confirmed that the railway will positively participate in the urban transport of Medan area supplementing one another with the road system, that the railway is to be elevated continuously in the CBD to eliminate the grade crossings with roads in the CBD and that all existing railway facilities of Medan Station except the passenger station are to be relocated to Titipapan.

The Study Team visited Jakarta again in July 1980 to submit the Final Report on Short-Term Improvements and an intermediate memorandum on the Long-Term Master Plan. In the latter the Study Team presented the estimated traffic demands in 2000 A.D., its modal splits, several alternatives of the already selected plan under the high dependence on the public transport and varying railway operating conditions and the road improvement conditions. After discussing the optimum plans of the first and second priorities were selected.

The Study Team prepared the Draft Final Report on Long-Term Master Plan containing all processes of formulating and selecting the optimum plan accompanied by their economic study and affiliated back data. The Study Team visited Jakarta in October 1980 to submit the Draft Final Report on Long-Term Master Plan on which contents the Study Team could fully discuss with the Steering Committee members of the Indonesian side.

The Study Team prepared the Final Report on Long-Term Master Plan through October and November 1980, well reflecting the comments given by the Indonesian side in the last joint meeting of October 1980. The Report was completed and was submitted to the Government of Indonesia in December 1980.

1.4 Concept of Study

The objective of the study for long-term solutions is to formulate after serious studying the optimum urban transport Master Plan of Medan area for the target year 2000 A.D. The problem in conducting the study is to consider how the basic transport system of Medan area should be. In this report Chapter 3 is assigned for the planning policy for the study, in which the basic considerations are summarized, but the followings are its key problems:

- Land Use Frame

  This is the problem of land use, in which it is required to accommodate a city of the size of 2.3 millions in population in future. In this problem the central part of the city, which has presently a high night-time population density due to inhabitants' short distances between their residences and their working places, is to be studied on the conception that it should be re-developed as the city's new CBD in future.

- Urban Size and Optimum Transport Modes

  The problem of railway's responsibility in the public transport system is studied in this report from such a point of view that it is anticipated that the rate of dependence on public transport modes will expand as the urban size of a city becomes bigger, particularly in such a case when the population exceeds 1.0 million as Medan area.

- Railway Crossings in CBD and Freight Transport

  It is strongly anticipated that railway crossings existing presently in the CBD, which handle presently noticeable volume of road traffic already and will need more and more closing time as the railway traffic increases, will present the most serious hindrance to the efficient road traffic flows there. On the other hand, it is evident from numerous examples in developed countries that it is not favorable that railway freight trains are operated traversing through big urbanized areas. This problem is also an important factor to be studies in conjunction with the former problem of optimum transport modes in urbanized areas.

In studying those problems the following presumptive conditions are taken into account:

- As the basis of land use planning the results of Medan Urban Development Study is applied if their findings are found reasonable after reviewing; and

- The relocation problem of Polonia Airport is intended to be studied by the Government authority concerned, but the present Medan Area Transport Study is proceeded under the assumption that the airport remains in the present location because the relocation problem has not reached its conclusion yet.

In addition, special considerations are paid to the following problems in this study:

- Study to operate Outer Ring Road and Binjei Bypass as a tollway;
- Feasibility to operate the railway commuter service on Belawan-Medan Line and other Lines; and
- Re-opening of the railway such as Pancur Batu and Batu Lines for the commuter service.

1.5 Organization

The organization of relevant committees and the Study Team are as follows:

(a) JICA Supervisory Committee

1.	Chairman	Dr. Y. Matsumoto	Professor, Faculty of Engineering, University of Tokyo
2.	Member (Railway Transport)	Mr. T. Horiki	Director, Rolling Stock Industry Division Railway Supervision Bureau, Ministry of Transport
3.	Member (Urban Transport)	Mr. M. Shiomi	Deputy Director, Regional Planning Division, Secretariat to Minister, Ministry of Transport
4.	Member (Highway Planning)	Mr. H. Tokuhiro	Director, First Research Division, International Construction Engineering Research Institute International Construction Engineering Association
5.	Member (City Planning)	Mr. M. Sato	Director of Urban Bureau, Chiba Municipal Government

(b) Indonesian Government Steering Committee

1.	Chairman	Ir. Giri S. Hadihardjono	Secretary to Directorate General of Land Transport and Inland Waterways, Ministry of Communication & Tourism
2.	Vice-Chairman	Ir. S. Abdulrachman	Chief of Planning Bureau, Ministry of Communication & Tourism
3.	Member	Mr. E.H. Daoe	Chief of Planning Division, Planning Bureau, Ministry of Communication & Tourism
4.	Member	Mr. Gatot Soedjantoko	Chief of Planning Division, Directorate General of Land Transport and Inland Waterways, Ministry of Communication & Tourism
5.	Member	Drs. Soekotjo	Chief of Urban Transport Division, Directorate General of Land Transport and Inland Waterways, Ministry of Communication & Tourism

6.	Member	Drs. Muchtarudin Siregar	Chief of Communication and Tourism Bureau, BAPPENAS
7.	Member	Drs. Saleh Siregar	Director of Development Budget, Ministry of Finance
8.	Member	Mr. Saleh Arifin	Mayor of Medan City
9.	Member	Prof. Dr. Hadibroto	Chief of BAPPEDA, North Sumatra
10.	Member	Ir. J.T. Situmorang	Chief of North Sumatra Regional Office, Indonesian State Railway
11.	Member	Drs. Iman Suwarso	Chief of Road Transport of North Sumatra
12.	Member	Ir. A. Harbani	Deputy Chief, Planning Center, Indonesian State Railway, Bandung

(c) JICA Study Team

1.	Team Leader	Mr. M. Inoue	Pacific Consultants International (PCI)
2.	Deputy Team Leader	Mr. K. Yasukawa	PCI
3.	Regional Planner/ Economist	Mr. N. Yamakawa	PCI
4.	Transport Economist	Mr. K. Mochizuki	PCI
5.	Transport Planner	Mr. Y. Nishiya	PCI
6.	Regional Planner/ Land Use Planner	Mr. F. Sugiyama	PCI
7.	Railway Operation & Management Planner	Mr. N. Koyama	Japan Transportation Consultants (JTC)
8.	Railway Civil Engineer	Mr. T. Tanabe	JTC
9.	Highway Engineer/ Civil Engineer	Mr. K. Maruoka	PCI
10.	Bus Operation Specialist	Mr. O. Mutoh	PCI

(d) Indonesian Counterpart Experts

1.	Chief Counterpart/ Coordinator/ Transport Planner	Mr. Hasyim NT.	DLLAJR MEDAN
2.	Counterpart/ Administrator	Drs. Poernomo	PHBD
3.	Counterpart/Transport Planner	Ir. Udji Atmono	PHBD
4.	Counterpart/Regional Planner	Ir. Sunarto	CIPTA KARYA
5.	Counterpart/Traffic Engineer	Ir. Purnarachman	Bina Marga
6.	Counterpart/Bus Operation Economist	Drs. Imam Roedjoe	P.N. DAMRI MEDAN
7.	Counterpart/Traffic Engineer	Mr. R.Rachmad Kondang	DLLAJR MEDAN
8.	Counterpart/Transport Economist	Mr. Jantipold Purba	KOTAMADYA MEDAN
9.	Counterpart/Transport Economist	Mr. Darwis	KOTAMADYA MEDAN
10.	Counterpart/Regional Planner	Ir. Amir T. Lumban Tobing	BAPPEDA-NORTH SUMATRA
11.	Counterpart/Transport Economist	Ir. Darwin Simbolon	PHBD
12.	Counterpart/Transport Economist	Mr. Adi Witjaksono	PJKA BANDONG
13.	Counterpart/Civil Engineer	Ir. Hardi	PJKA BANDONG

Chapter 2 SOCIO-ECONOMIC AND LAND USE STUDY

Chapter 2. SOCIO-ECONOMIC AND LAND USE STUDY

2.1 General

The two main objectives of this socio-economic and land use study are:

- To provide a set of statistical basis for the later traffic study, namely 'Chapter 4. Estimation of Transportation Demand'; and

- To outline probable future prospects for the study area, both from statistical and physical aspects.

For the provision of the statistical basis five kinds of planning parameters are to be dealt with, and they are:

- Residential Population;

- Employed Population*)-1;

- Jobs*)-2;

- Traffic-Relevant Students;*)-3 and

- Car Ownership.

Notes: *)-1 Employed Population: The employed portion of the residential population in an area including those who commute and work outside.

*)-2 Jobs: Workers at working places in an area including those who commute from outside.

*)-3 Traffic-Relevant Students: In this study, as for the number of students which should be reflected to the traffic study, students of high schools, universities, and academies which provide rather vocational education, are taken into considerations, because of their relatively high percentage of commuting by some modes of transportation crossing the zone border.

The base year and target years for the 'Short-Term Improvement Study' and the 'Long-Term Improvement Study' are set as:

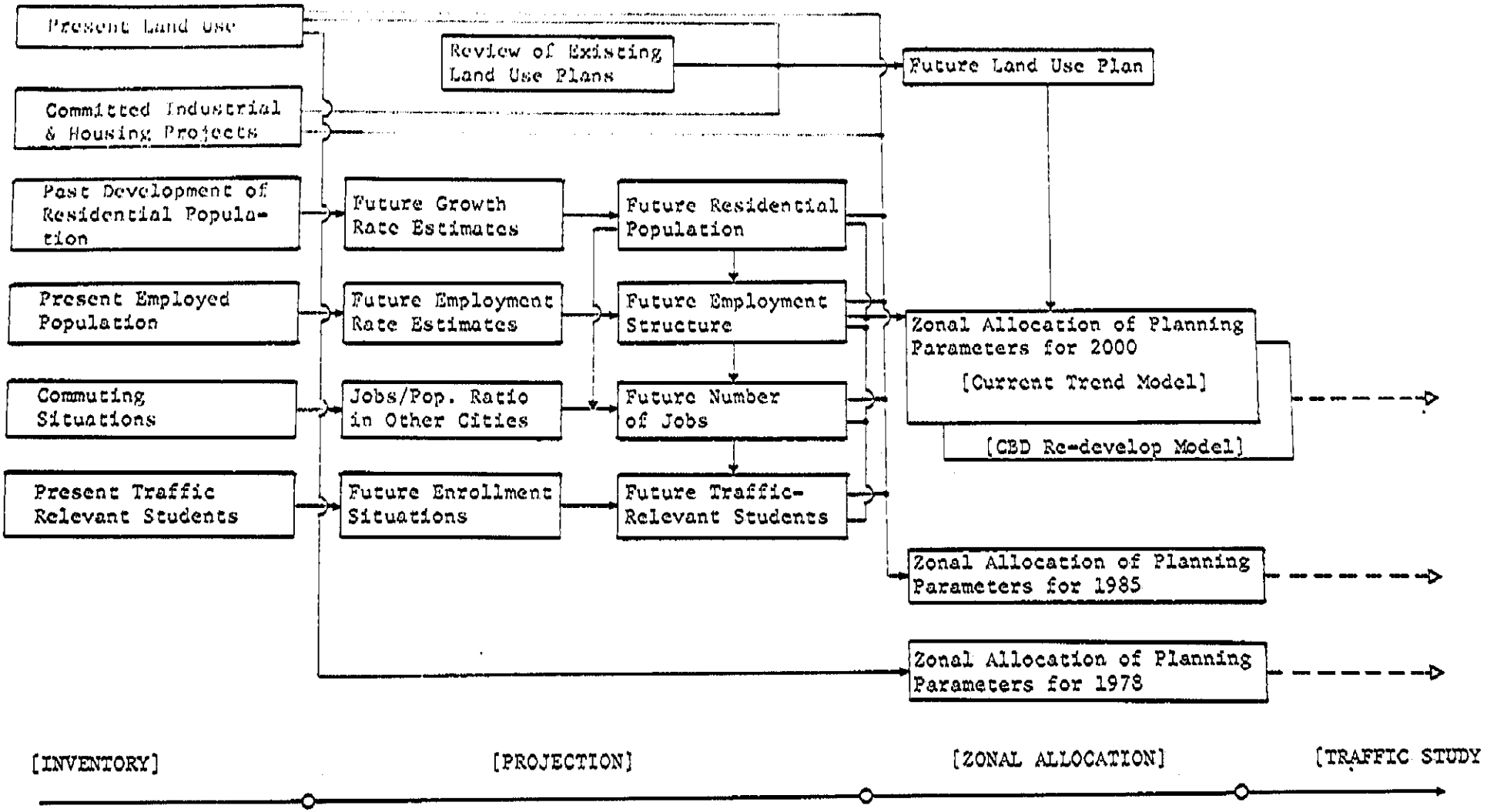
- Base Year - 1978;

- Short-Term Target Year - 1985; and

- Long-Term Target Year - 2000.

The studying procedure for the socio-economic and land use study is illustrated in Fig. 2-1-1: Flow Chart for Socio-Economic & Land Use Study. As in the above illustration the whole studying procedure is divided into three stages, such as:

Fig. 2.1.1 Flow-Chart for Socio-Economic & Land Use Study



- Inventory;

- Projection; and

- Zonal Allocation.

Among the above three stages, the study in the inventory stage is described in detail in Sec. 2.2. and Sec. 2.3.
The main study area includes the whole Kotamadya Medan*) (hereafter referred as Kot. Medan or Medan City) and its periphery outside within a 20 km radius, and in addition to it, the wide region including Kab. D. Serdang, Kot. T. Tinggi and Kab. Langkat is also included.

Notes: *) The administrative regency of the study area has a hierarchy as follows;

° Kabupaten, Kotamadya: The North Sumatra Province is divided into 3 Kotamadyas and 14 Kabupatens. Kotamadyas are relatively urbanized areas.
° Kecamatan: The above Kabupatens and Kotamadyas are further divided into Kecamatans, for example, Medan City is divided into 11 Kecamatans.
° Kampungs: The above Kecamatans are further divided into the smallest administrative units, Kampungs.

The zone division of study area is shown in Fig. 2-1-2: ZONE DIVISION FOR INTERNAL & INTERMEDIATE STUDY AREA and Fig. 2-1-3: ZONE DIVISION FOR EXTERNAL & OUTER STUDY AREA.

- Internal Study Area (Zone# 1. ∿ #46.): The old Medan City before the boundary change in 1973 which comprises of 4 Kecamatans.

- Intermediate Study Area (Zone# 47. ∿ #57.): The area within Medan City and outside the Internal Study Area.

- External Study Area (Zone# 58. ∿ #66): The area outside of Medan City and within a 20 km radius.

- Outer Study Area (Zone#67. ∿ #69.): The rest of the study area including Kot. T. Tinggi, and a part of Kab. D. Serdarrg and Kab. Langkat.

In allocating the estimated planning parameters to each study area or zone, two alternative models are developed, and they are:

- The Current Trend Model; and

- The CBD Re-development Model.

The difference in their characters is going to be made clear in the following sections*)-1. Basically, the former represents the case in which the present trend of mixed use of the central downtown district by residential and commercial/administrative activities continues*)-2. While the latter represents the case in which re-development of the

central area into a specialized commercial/administrative center is to occur in a future. Consequently, the central district accommodates more residential population in the current Trend Model than in the CBD Re-development Model, while it accommodates more jobs in the CBD Re-development Model than in the current Trend Model. Therefore, the CBD Re-development Model generates more massive commuting flows than the other.

Notes: *)-1 Allocating residential population to each study area is explained in Sec. 2.2.2: Residential Population, and zonal allocation of residential population and employment is explained in Sec.2.4.: Zonal Allocation of Planning Parameters.

*)-2 The present situation of the central districts is described in Sec.2.3.1.: Existing Conditions in the 'Short-Term Improvement Study'.

Fig. 2.1.2 Zone Division for Internal & Intermediate Study Area (Medan City)

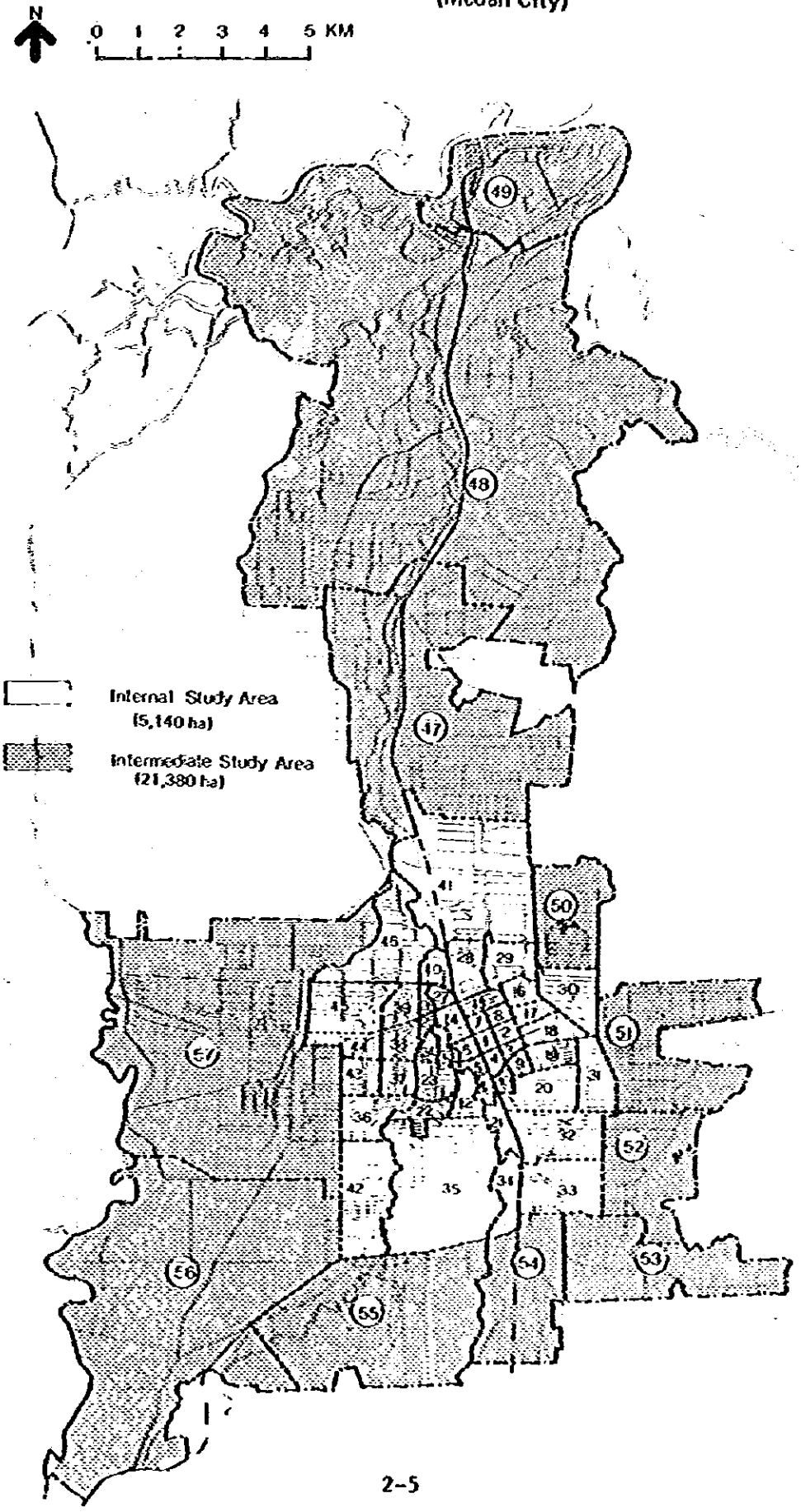


Fig. 2.1.3 Zone Division for External Study Area

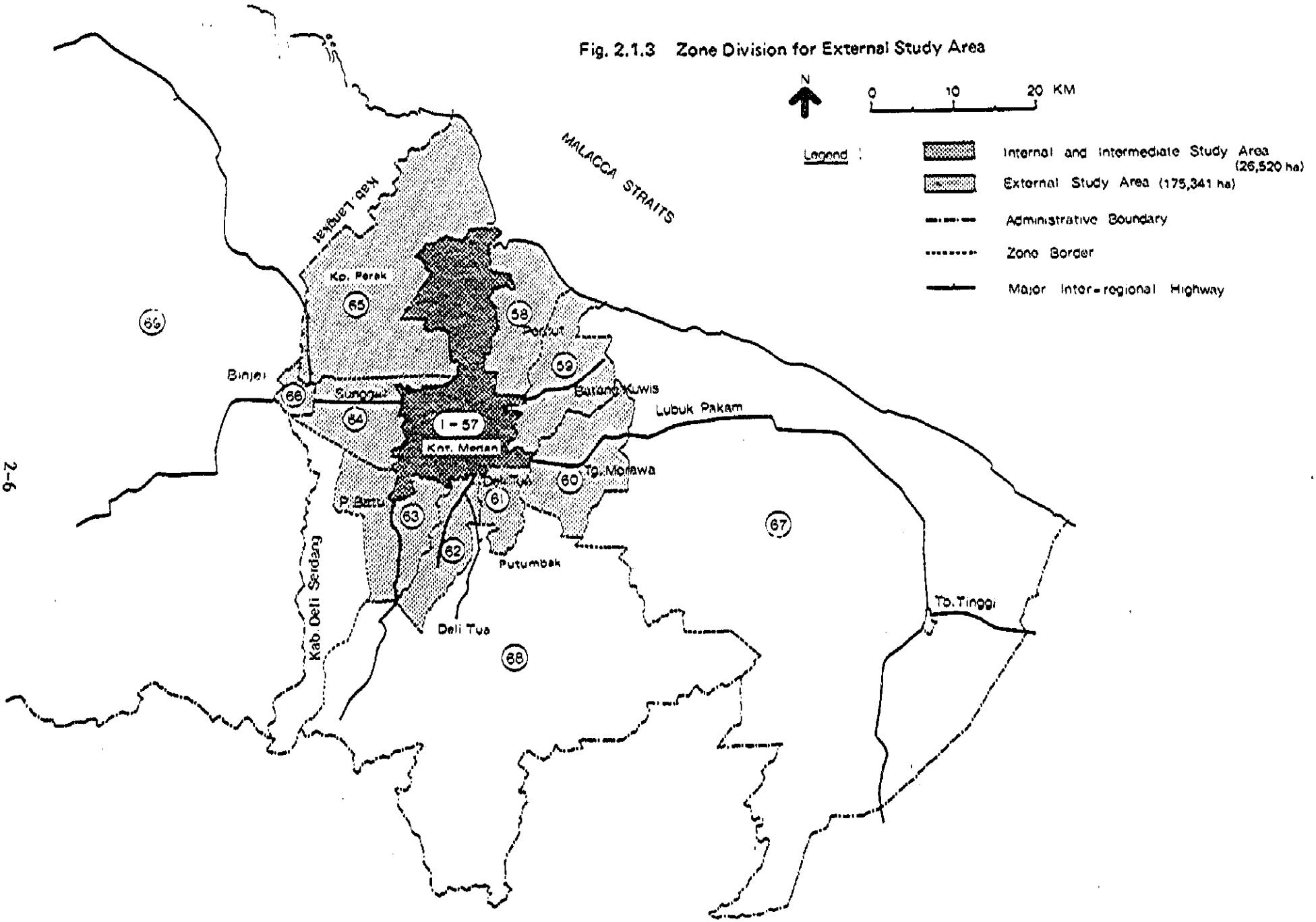


Table 2.1.1 Zone Code Table

Zone No.	Name of Zone	Area (Ha)	Bina Harga Zone No.	Kotamadya, Kecamatan, Kampung
1.	Gang Buntu I	21	1	Gang Buntu x 1/2
2.	Pusat Pasar I	27	2	Pusat Pasar x 3/5
3.	Pusat Pasar II	17	3	Pusat Pasar x 2/5
4.	Pasar Baru	25	4	Pasar Baru
5.	Aur I	24	5	Aur x 2/5
6.	Kesawan I	26	6	Kesawan x 1/4
7.	Gang Buntu II	20	7	Gang Buntu x 1/2
8.	Pandan Hilir I	35	8	Pandan Hilir x 1/3, Sidodadi x 1/5
9.	Sei Rengas I	28	9	Sei Rengas I x 1/2
10.	Sei Rengas II	28	10	Sei Rengas I x 1/3, Mesjid x 1/4
11.	Aur II	36	11	Aur x 3/5
12.	Hamdan	73	12, 22	Hamdan, Jati x 1/3
13.	Petisah Tengah I	32	13	Petisah Tengah x 1/4
14.	Kesawan II	44	14	Kesawan x 5/12
15.	Sidodadi I	38	15	Sidodadi x 2/5
16.	Sidodadi II	46	16	Sidodadi x 2/5, Sei Kera Hilir x 1/10
17.	Pandan Hilir II	31	17	Pandan Hilir x 2/3
18.	Pandan Hulu	76	18	Pandan Hulu I, II
19.	Sei Rengas II	30	19	Sei Rengas II
20.	Kotamatsum	167	20	Kotamatsum I, II, III, Mesjid x 3/4 Sei Rengas I x 1/6
21.	Sei Mati	40	21	Sakaraja, Sei Mati
22.	Anggrung	54	23	Jati x 2/3, Anggrung x 3/5
23.	Madras Hulu	65	24	Madras Hulu
24.	Petisah Tengah II	32	25	Petisah Tengah x 1/4
25.	Silalas I	23	26	Silalas x 1/4
26.	Silalas II	23	27	Silalas x 1/4
27.	Kesawan III	35	28	Kesawan x 1/3
28.	Durian	106	29	Durian
29.	Sidorame	128	30	Sidorame Barat, Sidorame Timur

(Continued)

Zone No.	Name of Zone	Area (Ha)	Bina Harga Zone No.	Kotamadya, Kecamatan, Kampung
30.	Sei Kera Hilir	136	31	Sei Kera Hulu, Sei Kera Hilir x 9/10
31.	Tegal Sari	153	32	Tegal Sari I, II, Sukaramai I, II
32.	Teladan	217	33	Teladan Timur, Teladan Barat Pasar Merah Timur, Pasar Merah Barat
33.	Sitirejo	281	34	Sitirejo, I, II, III
34.	Baru	127	35	Baru
35.	Polonia	744	36	Polonia, Anggrung x 2/5
36.	Darat	126	37, 44	Darat, Merdeka
37.	Petisah Hulu	62	38	Petisah Hulu
38.	Petisah Tengah III	63	39	Petisah Tengah x 1/2
39.	Sekip	61	40	Sekip
40.	Silalas	51	41	Silalas x 1/2, Sei Agul x 1/50
41.	Brayan	813	42	P. Brayan Bengkel, Glugur P. Brayan Darat, Kota, Glugur Darat, Tegal Rejo, P. Brayan Kota
42.	Padang Bulan	330	43	Padang Bulan, Titi Rantai
43.	Babura	78	45	Babura
44.	Sei Sikambing	71	46	Sei Sikambing
45.	Sei Putih	230	47	Sei Putih Barat, Sei Putih Timur
46.	Sei Agul	267	48	Sei Agul x 49/50
Internal Study Area		5,140		
47.	Deli	2,098	61	Kecamatan Medan Deli
48.	Labuhan	8,002	61	Kecamatan Medan Labuhan
49.	Belawan	768	61	Kecamatan Kota Belawan
50.	Sidorejo	371	62	Sidorejo, Indra Kasih
51.	Bandar	756	51	Bandar Selamat, Bantar, Tembung, Tegal Sari, Denai
52.	Kp. Binjei	698	51	Binjei, Amplas
53.	Timbang Deli	733	52	Bangun Mulia, Timbang Deli, Harjo Sari x 2/3
54.	Kedai Durian	675	53	Harjo Sari x 1/3, Titi Kuning, Sukamaju Kedai Durian

(Continued)

Zone No.	Name of Zone	Area (Ha)	Bina Marga Zone No.	Kotamadya, Kecamatan, Kampung
55.	Gedung Johor	1,376	54	Pangkalan Masyur, Gedung Johor, Kuala Bekala, Mangga
56.	Tuntungan	2,969	55	Kecamatan Medan Tuntungan
57.	Sungal	2,934	56	Kecamatan Medan Sunggal
Intermediate Study Area		21,380		
Kotamadya Medan		26,520		
58.	P. Sei Tuan	10,180	62	Kecamatan P. Sei Tuan x 1/2
59.	Btg. Kuwis	14,450	63	Kecamatan P. Sei Tuan x 1/2 Kecamatan Btg. Kuwis
60.	Tg. Morawa	13,890	64	Kecamatan Tg. Morawa
61.	Potumbak	4,410	65	Kecamatan Potumbak
62.	Deli Tua	7,570	65	Kecamatan Deli Tua
63.	P. Batu	12,820	66	Kecamatan P. Batu
64.	Sunggal	10,710		Kecamatan Sunggal
65.	Kp. Perak	31,520	61, 67	Kecamatan Kp. Perak, Namo Rambe
66.	Binjei	69,791	67	Kotamadya Binjei
External Study Area		175,341		
67.	East	389,950	64	Tg. Beringin, P. Cermin, Perbaungan, Bdr. Khalipah, Galang, Dlk. Masihul, Dlk. Melawan, Sei Rampah, Sipis-pis, Kod. T. Tinggi, Lbk. Pakam, P. Sei Tuan
68.	South	108,400	65, 66	S.T.M. Hilir, Biru-Giru, Sibolangit, Tlk. Mengkudu, S.T.M. Hulu, Tlk. Mengkudu, Bangur Purba, Kutarik, G. Meriah
69.	West	649,300	67	Kutaliurbaru, Kab. Langkat
Outer Study Area		1,147,650		
Grand Total		1,349,511		

2.2 Statistical Framework

2.2.1 General

The basic socio-economic figures are compiled and analyzed in Chapter 2: Socio-Economic and Land Use Study in the "Short-Term Improvement Study", and their target year estimates are made in this section due to the system of existing data compiling, the projection is made first for each of the administrative regency of:

- Medan City;
- Kot. T. Tinggi;
- Kot. Binjei; and
- Kab. D. Serdang*)

Notes: *) Besides the above four administration regencies, Kab. Langkat which is located west to the Kab. Deli Serdang is included in the Outer Study Area. However, due to the scarcity of data, projection of socio-economic figures is not made for Kab. Langkat, and the average growth rate of each parameter for Kot. T. Tinggi and Kab. D. Serdang is applied for the whole Outer Study Area. Then they are recompiled by Study Area.

2.2.2 Residential Population

The total residential population of Medan City, Kot. Binjei, Kot. T. Tinggi and Kab. Deli Serdang has increased by 2.3%/yr.*) in an average during 1971-1978 which was almost equal to the growth rate for the whole North Sumatra Province. Therefore, it is fair to say that the flow-in migration to the above four administrative regencies from the rest of the province is very limited. In this study the total residential population of the above region is estimated to increase at the same rate as the natural growth rate in the future.

Notes: *) The population growth rate for the whole nation during 1967-1976 was around 2.09%/yr. in an average which can be considered to be the natural growth rate, because immigration and emigration are very limited.

"MEDAN URBAN DEVELOPMENT STUDY" (MUDS)*)-1 estimates a Kot. Medan City's population of 1.95 million in 2000 A.D. or a population growth rate of 2.5%/yr. in an average in fugure.*)-2

Notes: *)-1 Formally, 'MEDAN URBAN DEVELOPMENT, HOUSING, WATER SUPPLY AND SANITATION PROJECT', Engineering-Science, Inc. and Sinotech Engineering Consultants, Inc., 1979-1980, and its major study areas are:

- Long-Term Urban Development Plan;
- A feasibility study for Kampung Improvement Program,

- Sites and Services and Low Cost Housing Scheme;

- Master Plan for Water Supply and Sanitation Project;

- A Feasibility Study for the 1st Stage Water Supply and Sanitation Project; and

- A Detailed Design for Sites and Services and Low Cost Housing Scheme.

*)-2 'The specific projection estimate of 1.95 million in the year 2000 A.D. can contain a margin error of between 10 and 15 percent either way .....' (from 'Technical Memorandum No. 21', Oct. 1979.)

However, the average population growth rate during the last 5 years has been as high as 3,6%/yr. in an average. And when the average growth of 2,5% up to 2000 A.D. is accepted, under an assumption that the growth rate will decrease constantly up to the year 2000 A.D., it is estimated to decline down to 1,6%/yr. in 2000 A.D. This figure is, in fact, rather lower than the future estimated natural growth rate, 1,7%/yr., forecasted by Biro Pusat Statistik*). Taking the future average gross population density in Medan City, about 75 persons/Ha, into account, it is difficult to imagine that the growth of Kot. Medan will stop by then.*)-2

Notes: *)-1 'STATISTICAL YEARBOOK OF INDONESIA', Biro Pusat Statistik, 1976 (The regional differences about natural growth rate are very limitted, and the national average is applicable for Medan City.)

*)-2 In other words no flow-in migration into Kot. Medan.

'Master Plan Kotamadya Medan', Dinas Planologi Kotamadya Medan, 1974, estimates the future population of Medan City in 2000 to be between 2,567 and 2,288 thousands. However, it has to be taken into consideration that the population growth rate of Medan City in Master Plan around 4.0%/yr. which is much higher than the present one. Consequently, in this study the average population growth rate during the period 1979-2000 is estimated to be between 2.5%/yr. and 3.0%/yr.

Note: *) It has to be remembered that the population growth rates at the period when the Master Plan was compiled was much higher than the present one.

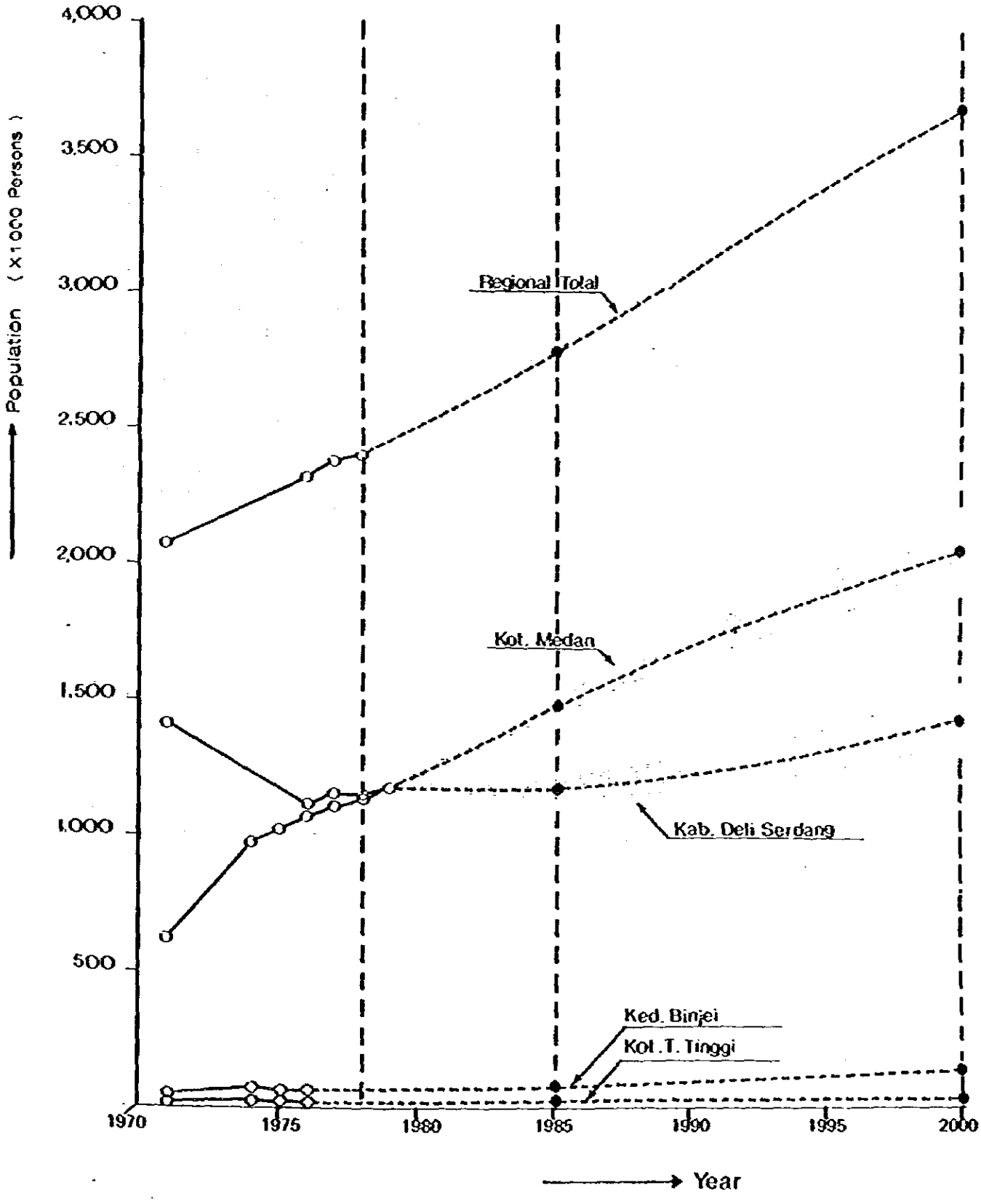
The population of Kot. Binjei has increased by 2.2%/yr. during the period 1971-1978. In future it is anticipated to grow faster than before as one of the satellite towns of Medan City. In this study the average annual growth rate is estimated to be 3.0%/yr. up to 2000 A.D.
The population density of Kot. T. Tinggi has been rather stable in recent years because of its relatively high density such as 100 persons/Ha. It is estimated to remain as it is up to 2000 A.D.
By deducting the total future population of Medan City, Binjei and T. Tinggi from the regional controlling total estimated in the beginning of this section, the population of Kab. Deli Serdang of predominantly rural

Table 2.2.1 Population Projection for Medan City & Its Surroundings (Unit: Person)

		1971	1974	1975	1976	1977	1978	1979	1985	2000
Kod. Medan	Permanent	635,562 *)-1	987,661 *)-2	1,032,106 *)-2	1,079,370 *)-2	1,104,441 *)-2	1,140,116 *)-2	1,180,378 *)-2	1,492,000	A 2,196,000 B 2,097,000 C 1,983,000
	Temporary	63,556	98,766	103,211	107,937	110,444	114,012	118,030	149,000	A 219,600 B 208,700 C 198,300
	Total	699,118	1,086,427	1,135,317	1,187,307	1,214,885	1,254,128	1,298,416	1,641,000	A 2,415,600 B 2,295,700 C 2,181,300
Kod. Binjei	Permanent	59,868 *)-1	-	-	70,673 *)-3	71,994 *)-3	69,791 *)-4	-	86,000	141,000
Kod. T. T. Tinggi		30,299 *)-1	-	-	32,488 *)-3	33,659 *)-3	27,719 *)-4	-	30,000	30,000
Kod. D. Serdang	Permanent	1,430,237 *)-1	-	-	1,119,549 *)-3	1,177,406 *)-3	1,158,855 *)-4	-	1,182,799	A 1,338,000 B 1,447,000 C 1,551,000
	Temporary	Δ63,556	-	-	Δ892,063	Δ110,444	Δ114,012	-	149,000	A Δ219,600 B Δ208,700 C Δ198,300
	Total	1,366,681	-	-	1,011,612	1,066,962	1,044,843	-	1,033,798	A 1,118,400 B 1,238,300 C 1,352,700
Total		2,155,966	-	-	2,302,080	2,387,500	2,396,481	-	2,790,798	3,705,000

Notes: Figures are taken from the following sources, and others are estimated.
*)-1 'Sensus Penduduk 1971'
*)-2 Kantor Sensus and Statistics
*)-3 'Bulen Statistik Tahunan, 1976 and 1977'
*)-4 'Punduduk Sumatora Akhir 1978'

Fig. 2.2.1 Population Projection for Medan City & Its Surroundings
(Seasonal workers and tourists and excluded)



character is obtained. It shows a small growth rate between 1.3%/yr. and 0.7%/yr. which is less than the natural growth rate, which means that a rather massive migrating flow is identifiable from rural areas into urban areas.

Besides the permanent population which appears in the census, a considerable mass of temporary population including seasonal workers, tourists or visitors who stay for a certain period of time would have to be reflected in the traffic study. However, in the case of Medan City it is extremely difficult to estimate this temporary population without any attempt of estimation so far. According to "SURABAYA AREA TRANSPORTATION STUDY', Halcrow Fox and Associates, 1977, the temporary population of Surabaya city which is the second largest city in the nation with 2,295 thousands in 1976 is 18% of the total population. In this study 10%, based on the information from Biro Pusat Statistik of Medan's permanent population is assumed to be temporary. Also, most of the temporary population are assumed to be seasonal workers from the surrounding rural areas.

In allocating the residential population estimated above to each study area, a case in which the population in the Internal Study Area keeps increasing as it has been, which is called the current Trend Model in this report, and another case in which its character is transferred into a specialized commercial/administrative center, which is called the CBD Re-development Model, are designed. The average annual growth rate of the Internal Study Area's population was 2.1%/yr. during the period 1975-1979 which is approximately equal to the natural growth rate of the nation.

In the Trend Model it is anticipated that this trend will continue even in the future, and the future population growth rate is estimated to decrease at the same speed as the natural growth rate decreases following the Biro Pusat Statistik's estimation.*)-2

In the Re-development Model it is anticipated to grow in a lower growth rate (1.3%/yr. in an average during the period 1978-2000) for the Internal Study Area, and therefore the population growth rate in the Intermediate Study Area is higher in the CBD Re-development Model than in the current Trend Model.

Notes: *)-1 This adjusted population figure including temporary population is adopted to figure out the hidden employment which does not appear in the employment census, as will be seen in Sec. 2.2.3 : Employment Structure.

*)-2 Biro Pusat Statistik forecasted that the natural growth rate per year which is equal to that of the national population growth declines down to around 1.0%/yr. by 2000 A.D.

Table 2.2.2 Residential Population by Study Area

(Unit: 1,000 Persons)

Study Area	1978	1985	2000	
			Current Trend	CBD-Re development
Internal Study Area	727.9	836.1	1,131.9	970.7
Intermediate Study Area	526.2	804.3	1,163.8	1,325.0
Medan City	1,254.1	1,641.0	2,295.7	2,295.7
External/Outer Study Area*)	1,783.5	1,794.8	2,211.0	2,211.0
Study Area Total	3,037.6	3,435.8	4,506.7	4,506.7

Notes: *) The Outer Study Area includes Kab. Langkat for which the population projection has not been made in Table 2-2-2: POPULATION PROJECTION FOR KOT. MEDAN & ITS SURROUNDINGS. The population growth rate for the estimated total population of Kot. Binjei, Kot. T. Tinggi and Kab. D. Serdang was applied for Kab. Rangkat, as well.

Table 2.2.3 Employment Structure in Medan City & Its Surroundings

(Unit: 1,000 Persons)

		1971 *)-1	1978	1985	2000
Kod. Medan	Resid. Pop.	-	1,254.1	1,641.0	2,295.7
	Employed	-	351.1	459.5	688.7
	(%)	-	(28)	(28)	(30)
	Sector I	-	31.6 (9) *)-2	32.2 (7)	20.7 (3)
	Sector II	-	52.7 (15) *)-2	78.1 (17)	137.7 (20)
	Sector III	-	266.8 (76) *)-2	343.2 (76)	530.3 (77)
Kod. I. Tinggi	Resid. Pop.	-	27.7	30.0	30.0
	Employed	-	7.2	8.1	9.0
	(%)	(23)	(26)	(27)	(30)
	Sector I	(3)	0.2 (3)	0.2 (3)	0.3 (3)
	Sector II	(13)	0.9 (13)	1.1 (13)	1.2 (13)
	Sector III	(84)	6.1 (84)	6.8 (84)	7.6 (84)
Kod. Binjei	Resid. Pop.	-	69.8	86.0	141.0
	Employed	-	18.1	23.2	42.3
	(%)	(23)	(26)	(27)	(30)
	Sector I	(13)	2.0 (11)	2.6 (11)	3.8 (9)
	Sector II	(12)	2.5 (14)	3.3 (14)	6.3 (15)
	Sector III	(75)	3.6 (75)	17.4 (75)	32.1 (76)
Kab. D. Serdang	Resid. Pop.	-	1,044.8	1,033.8	1,238.3
	Employed	-	313.4	320.5	396.3
	(%)	(30)	(30)	(31)	(32)
	Sector I	(70)	172.4 (55)	152.0 (43)	126.8 (35)
	Sector II	(6)	34.5 (11)	41.7 (13)	62.4 (17)
	Sector III	(24)	106.6 (34)	121.8 (48)	190.2 (48)

Source: *)-1: 'SENSUS PUNDUBUK 1971', Biro Pusat Statistik, 1974

*)-2: 'LAPORAN PEMBANGUNAN, DAERAH TINGKAT II, KOTAMADYA MEDAN, SELAMA PELITA II', Walilaoto Medan, 1979

2.2.3 Employment Structure

(1) Employed Population

In this study, the employed population and the number of jobs in a region are estimated separately for the purpose to figure out the commuting flow. The employed population and its sectoral classification*) are listed in Table 2.2.5: Employed Population by Sector in 1971 in the 'Short-Term Improvement Study'.

Notes: *) The sectoral classification is shown in Table 2.2.3: Sectoral Classification of Industry in the 'Short-Term Improvement Study'.

The ratio between the employed population and residential population (the so-called employment activity rate) in the above table is applied to the total population including the seasonal portion in order to figure out the hidden employment which does not appear in the census.
The future employment activity rate is estimated referring to those in other studies.

Table 2.2.4 Employment Activity Rates Estimated in Other Cities

Name of Study	Year	Economic Activity Rate
"Surabaya Area Transportation Study"*)-1	1971	30.0%
	1996	30.0%
"Jakarta Intra-urban Tollway Study"*)-2	1976	26.5%
	1985	28.2%
	1995	30.1%
	2000	31.9%
"Bangkok Suburban Transportation Study"*)-3	1977	27.1%
	1990	29.8%
	2000	31.4%

Source: *)-1 "SURABAYA AREA TRANSPORTATION STUDY", Halcrow Fox and Associates, 1977.

*)-2 "THE CONSULTING ENGINEERING SERVICES FOR JAKARTA INTRA-URBAN TOLLWAY", Pacific Consultants International, 1979.

*)-3 "THE COMPREHENSIVE STUDY FOR BANGKOK SUBURBAN TRANSPORTATION PROJECT", Japan International Cooperation Agency, 1979.

Table 2.2.5 Employed Population by Study Area

(Unit: 1,000 Persons)

Study Area	Sector	1978	1985	2000 Current Trend Model	2000 CBD Re-development Model
Internal	I*)-1	1.4	1.4	-	-
	II + III	202.4	232.7	333.6	291.2
	Total	203.8	234.1	339.6	291.2
Intermediate	I	30.2	30.8	20.7	20.7
	II + III	117.1	194.6	328.4	376.8
	Total	147.3	225.4	349.1	397.5
Medan City	I	31.6	32.2	20.7	20.7
	II + III	319.5	427.3	668.0	668.0
	Total	351.1	459.5	688.7	688.7
External Outer*)-2	I	278.3	250.4	205.2	205.2
	II + III	256.8	306.0	502.3	502.3
	Total	535.1	556.4	707.5	707.5
Study Area Total	I	309.9	282.6	225.5	225.5
	II + III	506.3	733.3	1,170.3	1,170.3
	Total	886.2	1,015.9	1,395.8	1,395.8

Notes: *)-1 The total Sector I economically active population is distributed over the Internal and Intermediate Study Areas proportionately to the area of agricultural land use.

*)-2 For Kab. Langkat for which there is no employment data, the employment activity rate and sectoral composition ratio of the total area including Kot. To Tinggi, Kot. Binjei and Kab. D. Serdang is applied.

(2) Jobs

(a) Commuting Situation at Present

The number of existing jobs in Medan City and its surroundings is figured out from the commuting situation*) among study areas and the employed population mentioned in the previous section.

Notes: *) In describing the commuting situation the following terms appear rather frequently.

- Flow-in Commuters: Workers or Students who commute into a region from outside.
- Flow-out Commuters: Workers or Students who commute from a region to outside.
- Excessive Flow-in Commuters: [Flow-in Commuters] - [Flow-out Commuters]
- Jobs: [Employed Population] + [Excessive Flow-in Commuters]

From the result of the O.D survey conducted by Bina Marga in 1978, the commuting population among study areas are roughly figured out. However, according to it the flow-in commuting population for the Internal Study Area is below zero, which seems to contradict the reality. On the other hand, from the result of the cross-sectional traffic counting survey conducted by the study team, the commuting situation at present can be figured out through various assumptions. From the results of the above two surveys, the number of commuting workers at present is assumed as follows.

Table 2.2.6 Commuting Workers among Study Areas

(Unit: 1,000 persons)

A	25.8	A'	10.5
B	14.8	B'	6.0
C	1.6	C'	0.7

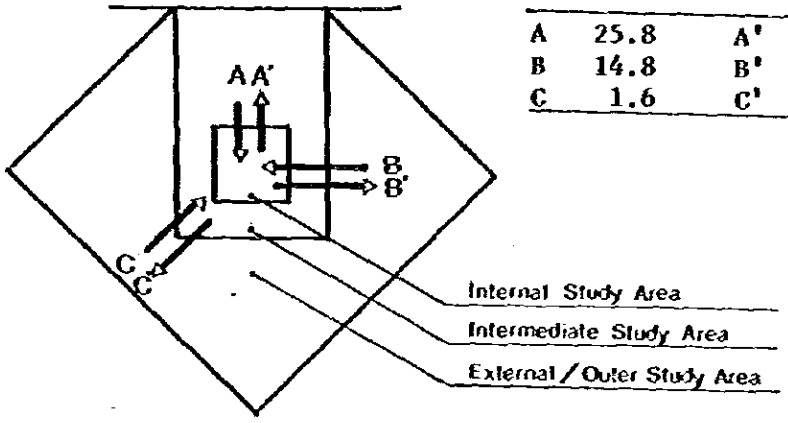


Table 2.2.7 Commuting Workers for Medan City (1978)

(Unit: 1,000 persons)

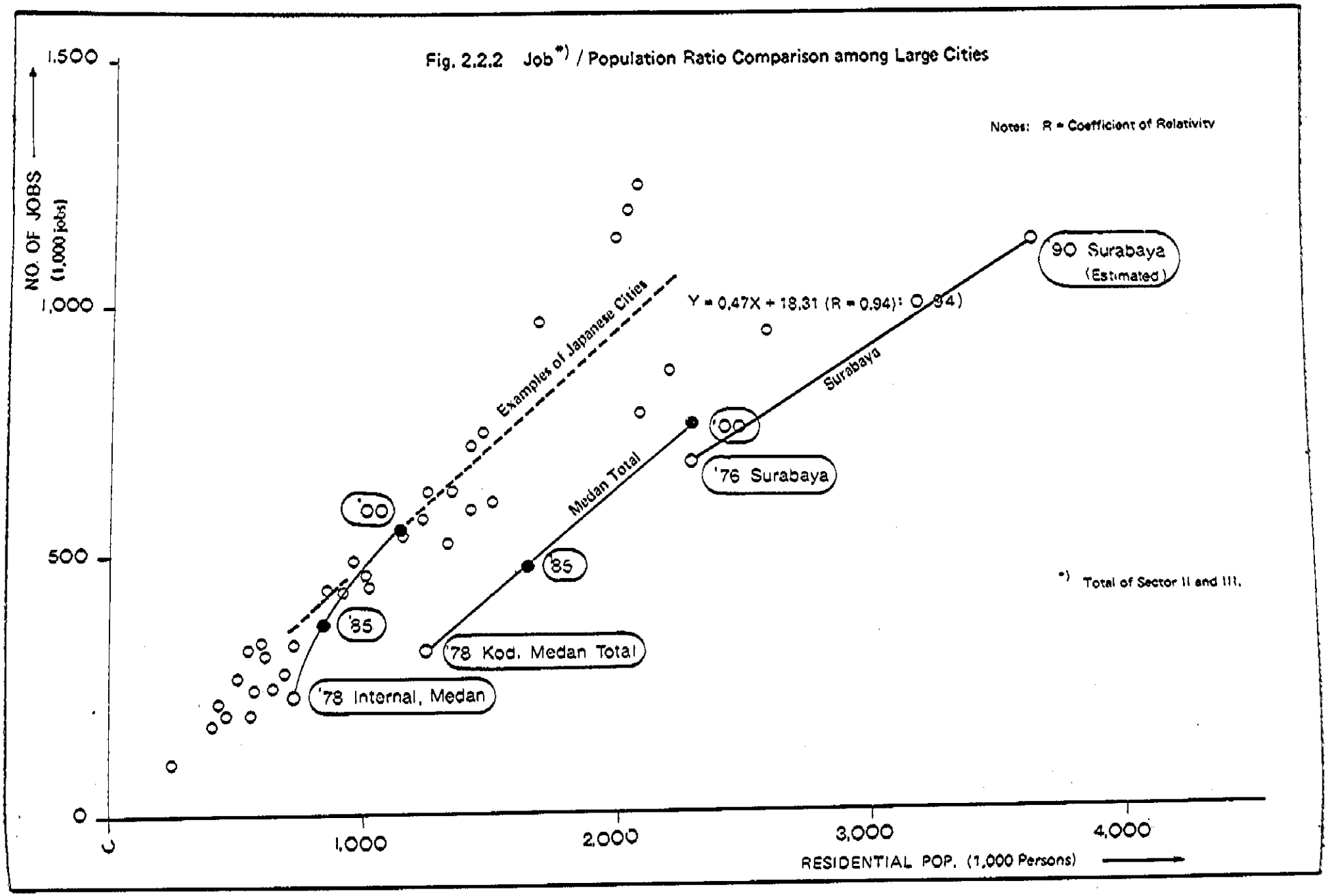
Study Area	[In]	[Out]	[In]-[Out]	[In]+[Out]
Internal	40.6	16.5	24.1	57.1
Intermediate	12.1	26.5	Δ14.4	38.6
Medan City	16.4	6.7	9.7	23.1

Among the employed population estimated in the previous section, the Sector I workers are not considered to commute, therefore by adding the excessive flow-in commuting workers to the employed population in the Sector II+III, the number of jobs in each study area in 1978 is obtained as shown in Table 2.2.8: Number of Jobs by Study Area.

(b) Jobs in the Future

The number of jobs in future is estimated as the total of the Sector II+III workers at working places based on the number of jobs in cities with various sizes.
As in Fig. 2.2.2: Job/Pop. Ratio Comparison among Cities, the ratio between the number of jobs in Sector II and III and residential population for Japanese cities exceeds that for Indonesian cities.

Fig. 2.2.2 Job*) / Population Ratio Comparison among Large Cities



Notes: *) Examples in Japanese cities are taken from Hiroshima, Sakai, Sendai, Chiba, Sapporo, Kawasaki, Kobe, etc.

Here, an assumption is made that for the Internal Study Area which is relatively urbanized in Kot. Medan, the ratio between the number of jobs and residential population would reach the average of Japanese cases by 2000. For the whole Kot. Medan, it is assumed that the job/population ratio would exceed the present level of Kot. Surabaya by 2000.
From the number of jobs estimated above and the employed population in Table 2.2.5: Employed Population by Study Area, the future commuting situation is figured out.

Table 2.2.8 Number of Jobs in Sectors (II+III) by Study Area

(Unit: 1,000 Persons)

		1978	1985	2000	
				Current Trend	CBD Re-development
Internal	Employed	202.4	232.7	339.6	291.2
	[In]-[Out]	24.1	137.3	210.7	259.1
	Jobs	226.5	370.0	550.3	550.3
Intermediate	Employed	117.1	194.6	328.4	376.8
	[In]-[Out]	Δ14.4	Δ84.6	Δ104.9	Δ127.7
	Jobs	102.7	110.0	223.5	249.1
Kod. Medan	Employed	319.5	427.3	668.0	668.0
	[In]-[Out]	9.7	52.7	105.8	131.4
	Jobs	329.2	480.0	773.8	799.4
External·Outer	Employed	246.8	306.0	502.3	502.3
	[In]-[Out]	Δ9.7	Δ52.7	Δ105.8	Δ131.4
	Jobs	247.1	253.3	396.5	370.9
Study Area Total	Employed	576.3	233.3	1,070.3	1,070.3
	[In]-[Out]	-	-	-	-
	Jobs	576.3	733.3	1,070.3	1,070.3

2.2.4 Traffic-Relevant Students

(1) Traffic-Relevant Students at Studying Places

In this study, as for students which should be reflected in the traffic study those of high schools and universities*) are dealt with.

Notes: *) Besides universities, academies which provede more vocational education are also included.

As mentioned in Sec. 2.2.4 Traffic-Relevant Students in the "Short-Term Improvement Study", the present number of students at studying places is obtained for SD, SLP, SLA*) and universities/academies.

Notes: *) SD: Primary School
SLP: Junior High School
SLA: Senior High School

Medan Urban Development Study sets the future enrollment standards for SD, SLP and SLA, and estimates the future school age population at each level.

Notes: *) "TECHNICAL MEMORANDUM NO. 21", Medan Urban Development, Housing, Water Supply and Sanitation Project, 1979.

The future traffic-relevant students are estimated based on the above enrollment standards*) and the future school age population adjusted for the population projection in Sec. 2.2.2: Residential Population".

Notes: *) The future enrollment standard for the university/academy level is assumed by this study.

For the area outside Kot. Medan, the present situation and the enrollment standard for Kot. Medan in the future are taken into consideration in estimating the future traffic-relevant students.
Allocation of the future traffic-relevant students at studying places to each study area is made, because scarcity of relevant information, based on an assumption that the increase portion of students are distributed over study areas proportionatelly to the increased residential population. The rational behind it is that in the future SLA construction will be encouraged in the area of new development along with the residential population increase, and that universities and academies will also move out of the central districts seeking for better environment; in other words no location of new school is specified because of its large impacts upon commuting flows and lack of information.

Table 2.2.9 Traffic-Relevant Students at Studying Places by Study Area

(Unit: 1,000 Persons)

Study Area	1978	1985	2000 Trend	2000 Development
Internal Study Area	55.7	73.9	110.7	90.6
Intermediate Study Area	5.0	52.0	96.6	116.7
Kod. Medan	60.7	125.9	207.3	207.3
External/Outer Study Area	23.2	46.7	90.7	90.7
Study Area Total	83.9	172.6	298.0	298.0

(2) Traffic-Relevant Students at Residential Places

The flow of commuting students at present is identified from the results of O-D survey by Bina Marga conducted in 1978, and from the above-obtained number of traffic-relevant students at studying places along with this commuting students, the number of traffic-relevant students at residential places is figured out as shown in Table 2.2.10: Traffic-relevant Students at Residential Places by Study Area.

Note: *) All commuting students are assumed to be the traffic-relevant students.

The future figures are obtained based upon the premises such as:

- The ratio between the excessive flow-in commuting students and the number of traffic-relevant students at studying places for Kot. Medan, around 3.0% at present, will remain same in the future; and

- The ratio between the traffic-relevant students at residential places and the residential population which is 1.5 times higher in the Internal Study Area than that of Kotamadya total*), will become homogenious in the future.

Note: *) At present, due to the high enrollment rate for SLA and universities/academies and lodging/rooming situation, the enrollment rate (number of students/residential population) is higher within the central area.

Table 2.2.10 Traffic-Relevant Students at Residential Places by Study Area

(Unit: 1,000 Persons)

Study Area		1978	1985	2000	
				Trend	Development
Internal Study Area	At Study Places	55.7	73.9	110.7	90.6
	[In] - [Out]	5.2	6.1	14.6	8.2
	At Resid. Places	50.5	67.8	96.1	82.4
Intermediate Study Area	At Study Places	5.0	52.0	96.6	116.7
	[In] - [Out]	Δ 3.4	Δ 2.3	Δ 8.4	Δ 2.0
	At Resid. Places	8.4	54.3	105.0	118.7
Kod. Medan	At Study Places	60.7	125.9	207.3	207.3
	[In] - [Out]	1.8	3.8	6.2	6.2
	At Resid. Places	58.9	122.1	201.1	201.1
External-Outer	At Study Places	23.2	46.7	90.7	90.7
	[In] - [Out]	Δ 1.8	Δ 3.8	Δ 6.2	Δ 6.2
	At Resid. Places	25.0	50.5	96.9	96.9
Study Area Total	At Study Places	83.9	172.6	298.0	298.0
	[In] - [Out]	-	-	-	-
	At Resid. Places	83.9	172.6	298.0	298.0

2.2.5 Motor Vehicle Ownership

(1) Car Motorization*)-1

The car ownership data provided by the municipal government is classified into:

- Sedan*)-2;
- Bus;
- Truck; and
- Motorcycle.

Notes: *)-1 Car Motorization: The number of registered motor vehicles excluding motorcycles per 1,000 residents.

*)-2 Sedans include motorized Becaks (combined motor vehicles of motorcycles and side-cars).

'JAKARTA-TANGERANG FREEWAY FINANCIAL STUDY', Japan International Cooperation Agency, 1979, forecasts the growth rates for DKI Jakarta's regional income up to 2000 A.D.

In this study an assumption was made that the above future growth rates are applicable for the case of Medan City. The above future growth rates are converted into per capita figures by the population growth rates estimated in Sec. 2.2.2: Residential Population.

Table 2.2.11 Growth Rates for Various Indices

(Unit: %/Yr.)

	Moteri-zation	'76	'77∿'80	'81∿'85	'86∿'95	'96∿'00
Regional Income	High	13.2	10.0	9.0	8.0	7.0
	Law	10.0	7.3	6.6	5.8	5.1
Residential Population		3.6	3.5	3.2	2.6	2.0
Per Capita Regional Income	High	9.7	6.3	5.6	5.3	4.9
	Law	6.2	3.7	3.3	3.1	3.0

(2) Trucks

A clear relationship between the car motorization and the percentage of of truck is observed as shown in Fig. 2.2.3: COMMERCIAL VEHICLES & MOTORIZATION. This relationship is represented by the following formula*).

$$\text{Trucks' Percentage} = 13.14/\log M \cdot 0.284$$

where, M: Car Motorization

Notes: *) 'TRAVEL CHARACTERISTICS IN CITIES OF DEVELOPING & DEVELOPED COUNTRIES'. World Bank Staff Working Paper, No. 230, 1976.

(3) Passenger Vehicles

The number of passenger vehicles is obtained extracting the number of trucks from that of cars estimated in the previous sections.

The municipal government intends to drive motorized Becaks out of the central city, and has refrained from issueing their operation license, recently. Therefore, the number of motorized Bacaks are assumed to remain the same up to 1985, and then to be absorbed by Taxicabs (sedans).

The present ratio between the number of buses and sedans is assumed to be the same even in the future.

(4) Motorcycles

Observing the motorization development in various cities, a tendency is observed that the number of motorcycles increases as quickly as that of motor cars during the stage where the car motorization is below 35 vehicles/1,000 residents. But when the car motorization exceeds the above level, the motorcycle increase slows down.

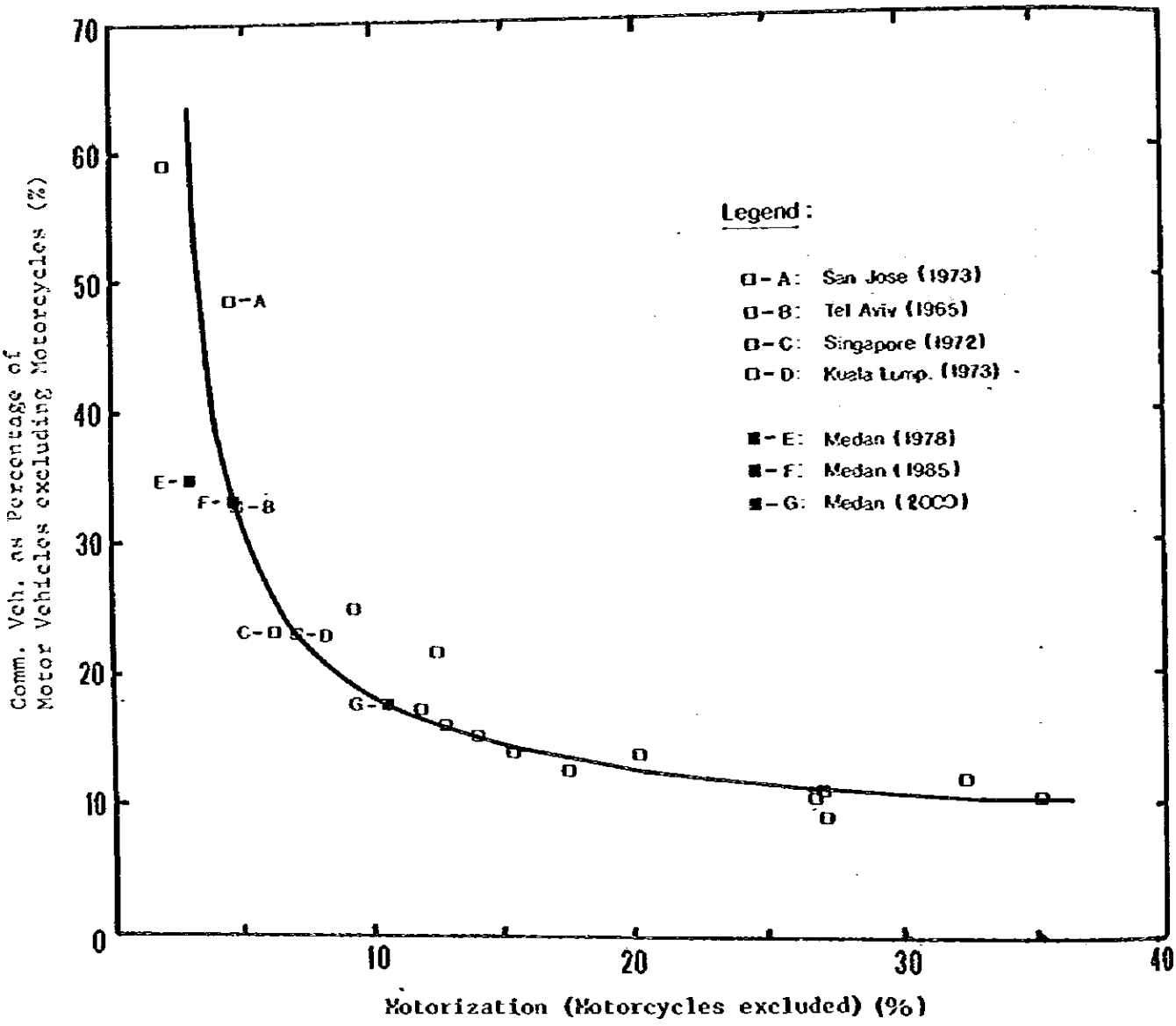
Fig. 2.2.4: MOTORIZATION & MOTORCYCLES OWNERSHIP shows the relationship between the number of motorcycles and motorization in Japan. As seen in the diagram, the percentage of motorcycles in Mod. Medan in 1978 is 20% higher than in Japan in 1964 despite of the same motorization rate. This difference is expected to become smaller in the future.

Table 2.2.12 Motor Vehicle Ownership

(Unit: 1,000 Vehicles)

Type of Vehicles	'78	'85	'00
- Sedan	22.0	39.3	152.3
- Motorized Becak	1.9	1.9	-
- Bus	2.9	5.0	18.5
- Passenger Vehicles Total	26.8	46.2	170.8
- Truck	13.9	23.8	38.5
- Car Total	40.7	70.0	209.3
(Vehicles/1,000 Residents)	(35.7)	(46.9)	(99.8)
- Motorcycles	121.0	145.4	171.2
- Grand Total	161.7	215.4	380.5

Fig. 2.2.3 Commercial Vehicles & Motorization



Source: 'TRAVEL CHARACTERISTICS IN CITIES OF DEVELOPING AND DEVELOPED COUNTRIES', World Bank Staff Working Paper, 1976

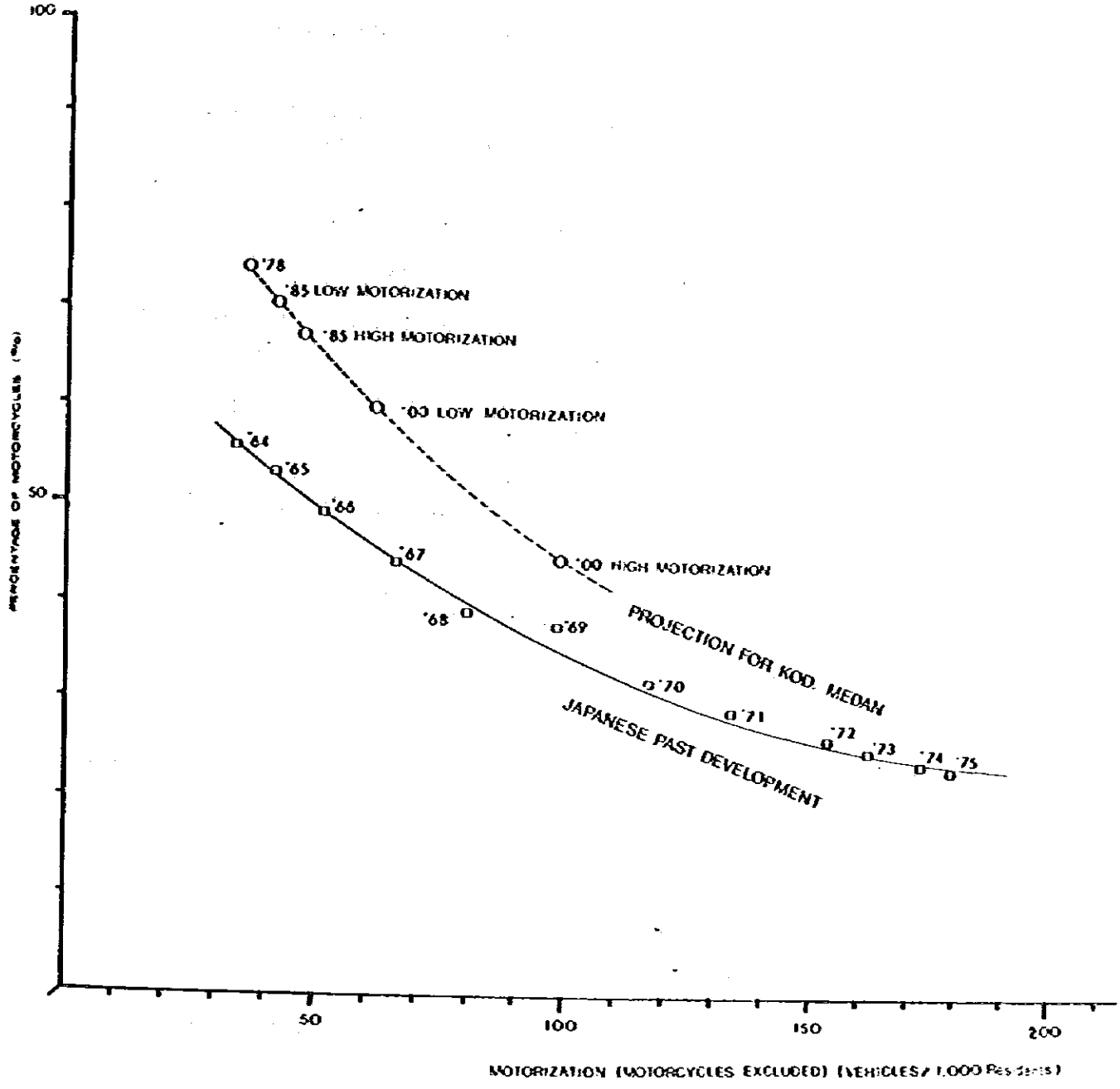



Fig. 2.2.4 Motorization & Motorcycles Ownership