

REPUBLIC OF INDONESIA

**THE MEDAN AREA TRANSPORTATION STUDY**

**FINAL REPORT**

**ON**

**SHORT TERM IMPROVEMENTS**

JULY 1980

**JAPAN INTERNATIONAL COOPERATION AGENCY**

SDF

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国際協力事業団	
受入 月日 '84. 9. 13	108
登録No. 09543	90
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## PREFACE

It is with a great pleasure that I present this report entitled "The Final Report on Short-Term Improvements, The Medan Area Transportation Study" to the Government of Republic of Indonesia.

This report embodies the result of the field survey which was carried out in Medan City and its surrounding areas from September 10 to November 10, 1979 by the Japanese Survey Team commissioned by the Japan International Cooperation Agency following the request of the Government of Republic of Indonesia to the Government of Japan.

The Survey Team, headed by Mr. N. Inoue, had a series of consultations with the officials concerned of the Government of Republic of Indonesia and conducted an extensive field survey and data analyses.

I sincerely hope that this report will be useful as a basic reference for development of the study area.

I wish to express my deep appreciation to the officials concerned of the Government of the Republic of Indonesia for their close cooperation extended to the Japanese Team.

June, 1980



Keisuke Arita

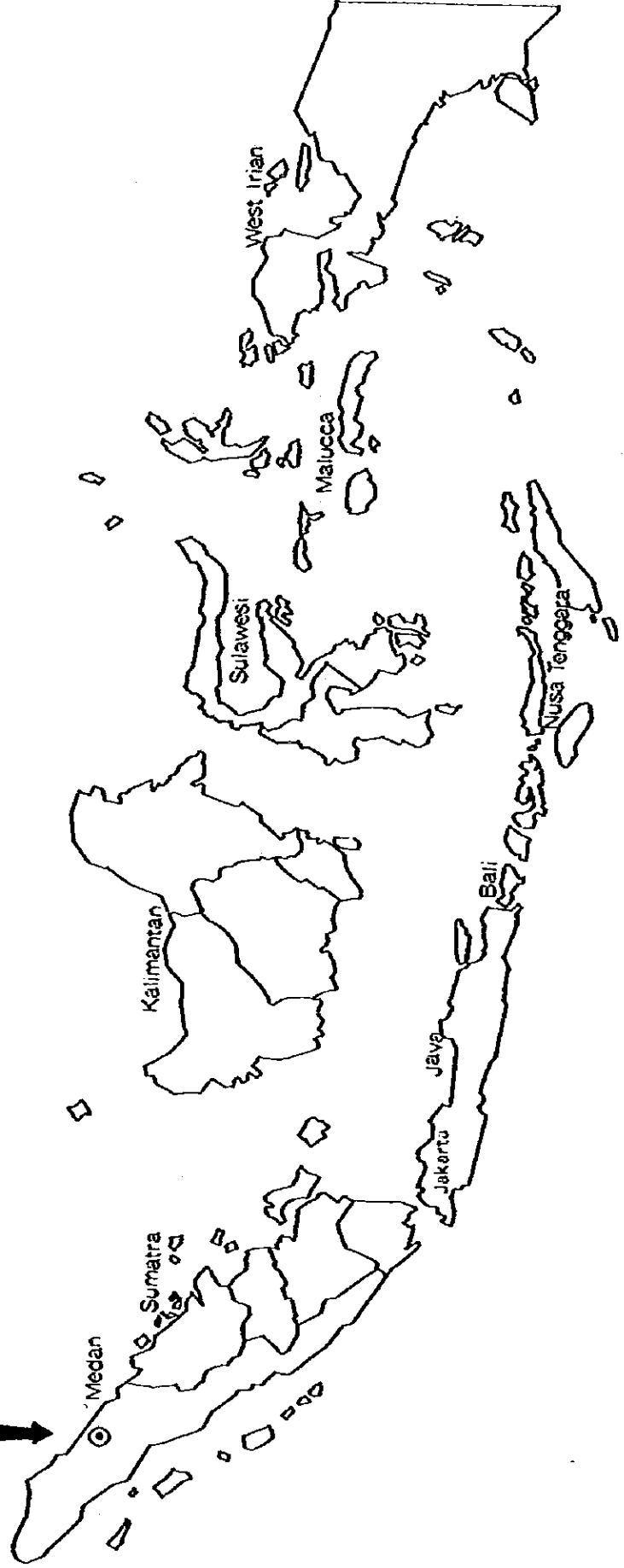
President

Japan International Cooperation Agency



PROJECT LOCATION MAP

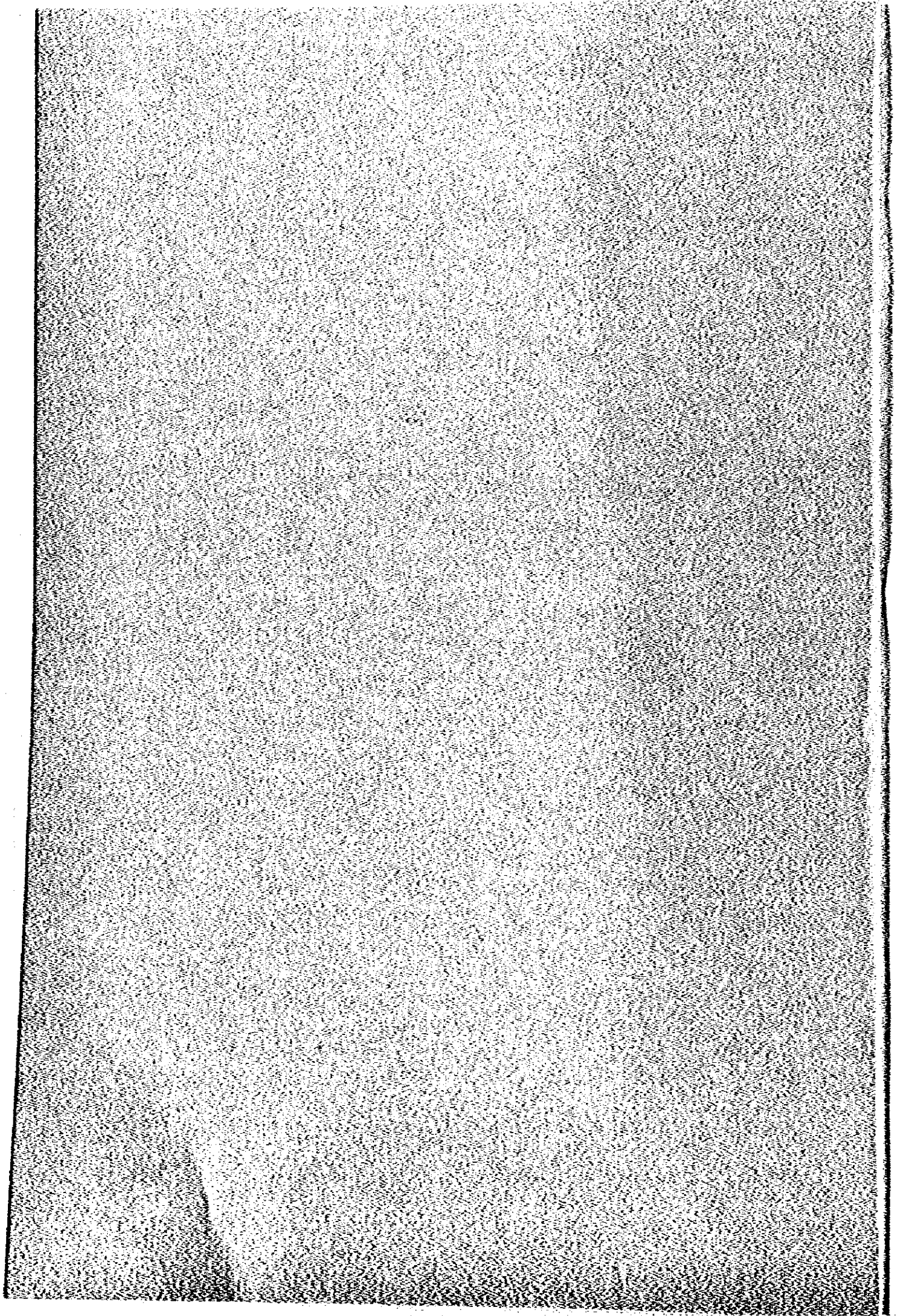
PROJECT AREA







**SUMMARY  
AND  
RECOMMENDATIONS**



# SUMMARY OF FINAL REPORT ON SHORT TERM IMPROVEMENT MEDAN AREA TRANSPORTATION STUDY

## 1. Summarized Recommendations

### 1.1 Forewords

This report was prepared by the JICA Study Team as the final fruit of Medan Area Transportation Study, upon the request made by the Government of Republic of Indonesia, to prepare the Short-Term solutions for the target year 1985 and also to prepare the Master Plan of Urban Transport Planning of the City for the Long-Term as the target year 2000 A.D.

The study was based on the informations and data collected by the JICA Study Team in the field survey conducted in the period between September 10 and November 10, 1979 and also on the results of analyzing and planning works domestically conducted in Japan till May 1980. The report reflects also on all official opinions of the Government of Indonesia expressed on the matter in the joint meeting of the Government of Indonesia and the JICA Study Team held on March 25 - 28, 1980 at General Directorate of Land Transport & Waterways, Ministry of Communication and Tourism, Jakarta.

This volume is the First Part of the report on the said study, while the Final Report on Long-Term Improvements, which will be submitted on later date, is the Second Part of the same, both volumes constituting the whole results of this study.

The Report on Short-Term Improvements consists of the following major categories:

- Outline of Study;
- Socio-Economic and Land Use Study;
- Present Transport Facilities & Traffic Conditions;
- Traffic Analysis of Present Situation;
- Relevant Development Projects;
- Evaluation of Present Situation;
- Short-Term Improvement Plans;
- Economic Analyses;
- Financial Analyses; and
- Implementation Programme.

### 1.2 Basic Policies and Summarized Recommendations

#### 1.2.1 Basic Policies

Short-Term Improvement Plan is formulated based on the following basic policies:

- (1) The Short-Term Improvement Plan contains improvements selected out of solutions urgently needed to solve the current traffic problems, feasibility studies of which show the possibility to attain rather larger benefits and favorable effects with

rather small amounts of additional public investment.

- (2) In this planning it is focused on securing the urban functions, aiming at attaining the following four objectives:
  - (a) Balance between transport demands and supplies;
  - (b) Increasing accessibility to any part of Medan area;
  - (c) Securing public transport measures available to the majority of citizens; and
  - (d) Securing the traffic safety of citizens.
- (3) In this planning it is aimed at a smooth transition to the implementation programme of the Long-Term Master Plan and also a consistency is kept with progress of relevant projects scheduled in the Third 5-Year Development Programme.
- (4) The size of the Study Area for the Short-Term is estimated as follows:

Name of Area	Area (km <sup>2</sup> )	Estimated Population in 1985 (Unit: 10 <sup>3</sup> )
Medan City Area	265.2	1,641.0
Surrounding Areas	1,377.2	574.3
Total:	1,642.4	2,215.3

#### 1.2.2 Major Recommendations

- (1) Major Proposed Improvements in Road Facilities:

As it is regarded as the pre-requisite condition of the basic road network in Medan Area that Belawan-Medan-T. Morawa Tollway be completed within the Third 5-Year Development Plan period; consequently, 2 access roads from the CBD reaching to this Tollway, namely, R-1 and R-2, are proposed to be constructed simultaneously with the completion of the Tollway.

On the other hand, for the purpose to reduce the high rate of congestions of roads in the CBD as well as to reduce the detouring traffic due to the present one-way traffic control it is proposed that the present one-way traffic control in the CBD be partially improved in combination with the improvement of the existing traffic signals on 9 routes, which are functioning independently at present, into the route coordinated signal system together with the improvement of 2 relevant intersections with rotary into model intersections with traffic signals.

It is proposed to widen two routes in the CBD, which affiliate with the partial improvement of one-way traffic control.

It is proposed to construct Jl. Gang Warni as it is scheduled in the Pelita III.

It is proposed to improve the existing Pasar Sambu Bus Terminal in order to relieve the present congestion taking place in and around this terminal area.

**(2) Major Proposed Improvements of Railway Facilities and Service:**

In view of the perfection of the public transport system including the mass transit by railway in the long-term the State Railway has already decided to re-open the railway passenger service on Belawan - Medan Line in the fiscal year 1980/81. Such a decision is considered appropriate from the viewpoint of maximum utilization of existing facilities and can be regarded as a trial for the realization of mass transport by railway in the long-term transport Master Plan.

On the other hand, the safety devices at railway crossings existing in the CBD are presently insufficient, where 80,000 - 100,000 vehicles are presently observed daily at each of those crossings. Because such crossings are expected to remain until the railway in the CBD is elevated in the long-term programme such crossings are proposed to be improved in their safety devices in the short-term in order to prevent traffic accidents at crossings until the railway is elevated.

**1.3 Improvement Categories and Items Studied/Recommended**

The followings are categories and items of improvement studied, some of them are proposed to be implemented as short-term solutions, but some are proposed to be postponed into the long-term solutions due to agreeable reasons.

**(1) Improvement of Road Affiliated Facilities & Service:**

**(a) General:**

- Drainage;
- Street lighting facilities;
- Planting;
- Road reflectors.

**(b) Traffic Control Devices:**

- Road markings;
- Traffic control signals;
- Traffic signs.

**(c) Road Traffic Control System:**

- Partial improvement of the one-way traffic control system;
- Installation of the route coordinated traffic signal control system;
- Prohibition of the roadside vehicle parking and the installation of public parking spaces.

**(d) Betterment and Construction of Roads:**

- Access roads to Belawan-Medan-T.Morawa Tollway
  - Jl. Prof. Yamin SR (3,900 m long, 4 lanes);
  - Jl. Pembalagian (4,000 m long, 4-lanes).

- Improvement of roads affiliated with the partial improvement of one-way traffic control system and improvement of signals into the route-coordinated system:

Route-3

- Jl. Gajah Mada (600 m long, widening up-to 4-lanes)
- Jl. Zainul Arifin (900 m long, widening up-to 4-lanes)
- Jl. Palang Merah (600 m long)

Route-4

- Jl. Pemuda (400 m long)
- Jl. A. Yani (520 m long, widening up-to 4-lanes)
- Jl. Balai Kota (300 m long, widening up-to 4-lanes)
- Jl. Sudarso (300 m long, widening up-to 4-lanes)

- New Construction of road scheduled in Pelita III
- Jl. Gang Karni (950 m, 2-lanes)

- (e) Improvement of road intersections:
  - Intersection at Jl. Gatot Subroto and Jl. Gelugur By-pass;
  - Intersection at Jl. Jati and Jl. Prof. Yamin SH.

- (f) Improvement of Pasar Sambu bus terminal:
  - Pavement;
  - Separation between bus and Bemo;
  - Increasing bus berths;
  - Separation of vehicles from pedestrians;

- (g) Loop Route Service by Intra-city Bus.

- (h) Counter-measures for pedestrians.

- (2) Improvement of railway affiliated facilities and service:

- (a) Improvement of facilities for re-opening passenger service on Belawan-Medan-T.Morawa Line:

- Strengthening of tracks and bridges;
- Extension and rehabilitation of a platform at Titipapan Station;
- Improvement of signal and communication facilities;
- Procurement of diesel railcars;
- Improvement of the inspection facilities for diesel railcars;
- Train operating diagram;
- Additionally required numbers of personnel.

- (b) Improvement of railway crossings:
  - Devices to warn approaching of trains;
  - Crossing bars;
  - Cabins for gate-men;
  - Pavement at crossings.

- (c) Opening the Eastside gate of Medan Station:

- (d) Rehabilitation of a pedestrian over-bridge at Medan Station:

## 2. Introduction

### 2.1 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 reasons such as its high population density which has been expanding its traffic demand successively, insufficient traffic capacities of the road network, insufficient numbers of unit of the bus fleet in the public transport system, variety of transport modes, inadequate one-way traffic control in certain parts of the CBD and the fact that the railway, which occupies a strategic position geographically in the CBD, does not presently share the 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.

## 3. Existing Conditions of Socio-Economy, Land Use and Urban Transport of the Study Area

### 3.1 Socio-Economic and Land Use Study

Main objectives for the socio-economic and the land use study for the 'Short-Term Improvement Plans' are:

- To analyze the socio-economic situation of Medan City;
- To analyze the existing land use and the development to be implemented in the near future; and
- To provide planning parameters for the transport planning.

The residential population of Medan City in 1978 is around 1.2 million and is forecasted to grow up to 2.3 millions by the year 2000 A.D. The average growth rate in the last 5 years was 3.6%/hr. of which about 2.0%/hr. has been attributable to the natural growth and the rest to the migration. The present total area of Medan City is about 265 km<sup>2</sup> and consequently, the present average gross population density in the city area is about 45 inhabitants/ha.

In view of the evolution of the urbanized area, it can be observed that the urban development had started in the beginning around the present Medan Station towards the direction of the Medan-Belawan corridor, and since then the development has been continuing along five major radial corridors until the present. Medan had been characterized many years ago by its railway station and yard, port facilities, warehouses and trading firms. But after the city's population exceeded 1.0 million the city has been gradually changing from its former face of a port town exporting local agricultural products into a metropolitan city of North Sumatra as centers of politics, administration, economy and culture. Presently the central four Kecamatan (a sort of administrative unit and the whole Medan City

is divided into 11 Kecamatan) accommodate more than 50% of the total population with a very high density, and its population growth rate has become very low in recent years. The area around Belawan Port has also a very high population density, losing its population in recent years due to its flowing out.

There exist presently several housing projects and the Kampung Improvement Project implemented by Perumnas, which aims at the low income people within the central downtown area, is one of them. At present, about 250 ha of high density areas, are planned to be improved. Besides those in the private sector, there are several small and medium sized housing projects by public organizations. Also, there are large scale housing projects to be implemented by Perumnas. One of them in the western side of the city along the Medan-Binjel corridor has been completed already, and the second project is now under implementation in the east side of the City. At present, the third one is in the stage of its site selection and is likely to be located in the southwest part along the Medan-Pancur Batu corridor.

As for industrial developments, Medan Industrial Estate Project is now in progress along with Belawan Port/Industrial Area Project which were originally proposed by 'Master Plan of Medan City', which was authorized in 1974.

The Belawan-Medan - T. Morawa Highway, a tollway by-pass connecting the Belawan Port and the Trans-Sumatra Highway at T. Morawa to serve inter-regional traffic, is scheduled to be completed by 1985, the target year of the 'Short-Term Improvement Plan'. By the completion of Outer Ring Road, which is partially under construction, and by organizing its feeder system, the accessibility to the City's peripheral area will be increased, raising the City's development potential.

Planning parameters provided for the Transport Planning are:

- Residential Population;
- Numbers of Jobs<sup>1)</sup>;
- Employed Populations<sup>2)</sup> and;
- Numbers of Traffic-Relevant Students<sup>3)</sup>.

Notes: 1) Numbers of Jobs: The numbers of workers, namely, the day-time working population who actually work within an area including those who commute from the outside of the said zone.

2) Employed Population: The employed portion of residential population in an area including those who commute to the outside of the said zone.

3) Numbers of Traffic-Relevant Students: In this study students of senior highschools, universities and academies which provide rather vocational education are taken into account.



In the 'Long-Term Improvement Plans' two alternatives are adopted in allocating planning parameters: "CURRENT TREND MODEL" assumes that the present trend of population increase in the central area by the same rate as that of the natural growth will continue even in the future; and "CBD RE-DEVELOPMENT MODEL" assumes that a rather drastic conversion of the central densely inhabited area into a Central Business District.

In general, the allocation of planning parameters for the 'Short-Term Improvement Plans' is based on the interpolated mid-term value in the "CURRENT TREND MODEL".

### 3.2 Transportation Facilities

#### (1) Road Network

The basic road network of Medan City consists of five corridor roads radiating from the central part of the city, and the street network in the urbanized area has developed in a regular grid form in the eastern half, while an irregular street network has developed in the western half which is cut at many locations by winding streams. In such a wide road network of the city of this urban size the greatest traffic problem is the passing through the CBD by the through traffic because of lack of appropriate bypass route; accordingly, this is the main reason causing the present traffic congestion daily in the CBD.

The second problem of the road network is the absolute shortage of road area as a city of this urban size, which road rates in the central three Kecamatan of Medan Kota, Medan Timur and Medan Baru are presently as low as 6 to 8%. On the other hand, there exist numerous road portions of unfavorable surface conditions because of insufficient road maintenance despite of its high percentage of paved area in the public record.

#### (2) Road Public Transport Facilities

Medan City has presently four types of transport mode, namely bus, Bemo, Becak and taxicab, among which taxicab is a mode of the smallest existence, being utilized almost by foreigners mainly for sightseeing purpose. Becak is a mode which is conveniently utilized by citizens for short trips but forms a hindrance in the general traffic because of its low operating speed; but Becak's drivers are all of low income groups who constitute actually a noticeable group of employments in the city. Bus and Bemo constitute the backbone of the present road public transport system, which lacks a balance between traffic demand and transport supply, particularly in peak hours every day. From such a fact a pressing shortage in the bus service is presently felt strongly by citizens.

As for the mutual relation between the intra-city bus and Bemo, bus shares the longer trips, while Bemo shares the shorter trips, which relation is clearly seen from the trip

length characteristics of users, from which it is evident that both modes of transport not compete but supplement one another performing their characteristics in their own domains. As for the bus route network which concentrates in the central part of the CBD at present, called Pasar Sambu Bus Terminal, and radiates from there; there exist such areas between radial routes of unsatisfactorily served by bus. As for the inter-city bus system its terminal problem has to be considered rather than its bus route problem, and accordingly it is described in the next paragraph.

### (3) Bus Terminals

There exist three bus terminals in Medan City, the most important problem of those is taking place at Pasar Sambu Bus Terminal which uses a road space for the terminal purpose and handles the major part of all bus passengers of intra-city trips, where most of the intra-city bus and Bemo routes concentrate and bus passengers by route mingle with those of Bemo, the reasons of congestion are insufficient numbers of berths for bus and Bemo and the carriageway is not clearly separated from sidewalks.

The inter-city bus terminals of Teladan and Sei Wampur have their own land spaces with their own terminal facilities, and any congestion is not presently observed, but an inconvenience in transferring between bus and Bemo is actually observed.

### (4) Railway

In Medan City a four legged railway network exists presently, namely main lines stretching out from Medan towards Belawan, Binjai, Pancur Batu and Batu, and also Tebing Tinggi, of which the lines for Pancur Batu and Batu have not been in use for about ten years. Those all lines are of single line but a wide right-of-way is secured on all of those main lines. Not an electrified operating portion presently exists and such a situation will continue to remain unless the power situation of Medan Area turns better. From the point of view of railway passenger service the present service has problems of inconvenient time band of operation, insufficient operating frequency, and long station intervals, all are not suitable for urban passenger service. The present operating conditions and facilities of railway aims only at freight transportation and passengers of longer trips; and accordingly, there exists no commuting of workers nor students is handled by railway at present. There exist small intermediate stations along main lines even in the city area where they had once handled some number of passengers before but they are now simple stations of passing sidings or have been closed for long time.

In addition to this, attention should be paid to the problem of railway warehouses existing in and around Medan Station, which are the properties of the State Railway but substantially

no railway freight is handled there at present but those are operated as warehouse for rent utilized by private warehousing enterprises or trading firms; consequently, certain improvements have to be done to improve such a situation.

(5) Marine Port and Airport

Polonia Airport does not presently much affect on the urban traffic directly. Port of Belawan, through which majority of imports and exports of Province of North Sumatra is performed, has the problem relating to the urban transport of Medan City in the viewpoint of how to receive the commodities imported through Port of Belawan and to distribute them into the hinterland. Consequently, in both Polonia Airport and Port of Belawan the problems are presently not of their facilities but rather how to handle those traffic to be generated there.

3.3 Traffic Conditions

3.3.1 Urban Traffic in Medan City

(1) Trip End Analysis

Through analyzing the traffic survey data trip ends by mode of transport at present are shown in the following table.

Table 1 Trip-Ends by Type of Road Vehicle, Medan City (1979)

Type of Vehicle	Numbers of Trip Ends per day	Composition Rate (%)
Sedan	169,702	14
Motor-cycle	523,970	44
Becak machine	159,706	13
Bicycle	237,440	20
Truck	65,430	5
Bus	4,594	1
Bemo	32,822	3
Total:	1,193,664	100

It is clear from this table that motor-cycle occupies presently 44% of the total trip ends daily, which fact shows that Medan City is experiencing presently a transient period to the so-called motorization era, in which it is evident that the burden of urban road traffic will be noticeable when motor-cycle transfers to sedan as citizens' income increases. The following table shows the trip end composition by trip purpose and by transport mode.

Table 2 Trip-End Composition by Trip Purpose and by Transport Mode, Medan City (1979)

(Unit: 1,000 Trip Ends/day)

Trip Purpose	Sedan	Bus	Bemo	Motor Cycle	Becak	Bicycle	Railway	Total
Commuting	133.2	93.1	87.9	200.5	101.7	75.0	0.6	692.0
Shopping	28.1	26.8	25.3	57.6	35.8	23.5	0.02	197.2
Return Home	162.0	180.1	170.0	307.0	160.7	110.2	1.5	1,091.4
Others	150.7	66.8	63.0	215.4	124.1	74.0	1.8	695.7
<b>Total</b>	<b>473.8</b>	<b>366.8</b>	<b>346.2</b>	<b>780.6</b>	<b>422.3</b>	<b>282.7</b>	<b>4.0</b>	<b>2,676.4</b>

It is evident from this table that the railway has not presently shared of the urban passenger transport service and that bus and Bemo, which occupy small percentages in trip ends by type of road vehicle, shares 27% of total urban passenger transport and that the commuting trip by workers and students occupies 26% of all in figures by trip purpose.

(2) Desire-Lines

According to desire-line patterns compiled by type of road vehicle, both sedan and Becak are similar in type of concentration to the center of the CBD; and both motor-cycle and bicycle are similar to somewhat dispersing type; truck is characteristic in its direct relation between Port of Belawan and warehouses existing in the CBD. Thus, every type of road vehicles is different one another in the type of desire-line pattern.

(3) Trip Length by Transport Mode

Trip lengths by type of vehicle based on trip ends are shown in the following table, which indicates the character of the urban transport of Medan City evidently. Sedan, motor-cycle and bicycle are in the similar range of 5.6 to 6.3 km in trip length which are considered to be due to the distribution of population in the city area. In the case of bus the trip length is as high as 11 km, while in the case of Bemo it is as short as 3.9 km, those figures show the clear separation of their sharing range of service in the urban transport system.

Average Trip Length by Mode of Transport  
Medan City (1979)

Mode	Average Trip Length (km)
Sedan	6.3
Bus	11.1
Bemo	3.9
Motor cycle	5.6
Becak	3.6
Bicycle	5.8
Railway	25.5
<b>Average</b>	<b>6.6</b>

(4) Modal Split

The present sharing rates by transport mode in terms of trip distance are shown in the following figure from which it is apparent that shares by sedan, motor-cycle, and bicycle are different one another but their shares become stable as the trip distance increases, indicating their characteristics as private road vehicles. In the case of bus and Bemo they show the similar trend within the trip distance of 10 km, but the share by bus increases rapidly and that of Bemo decreases rapidly when the trip distance exceeds 10 km.

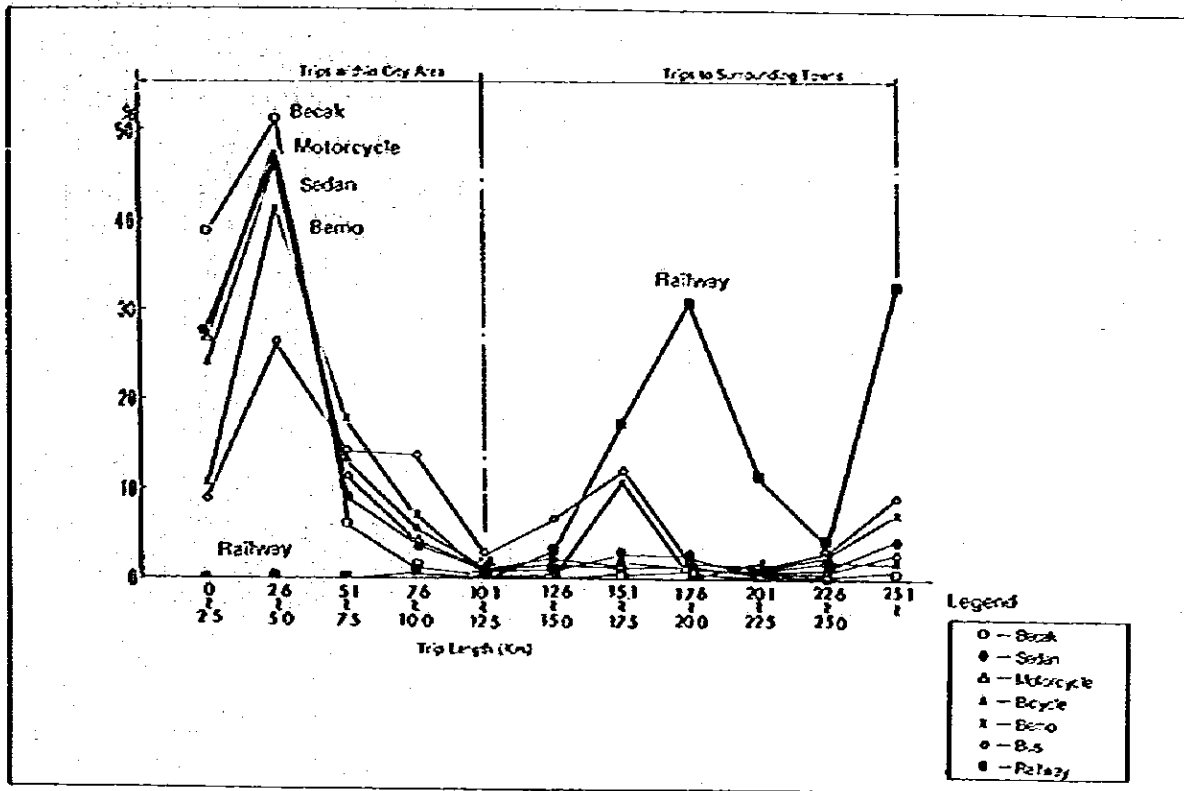
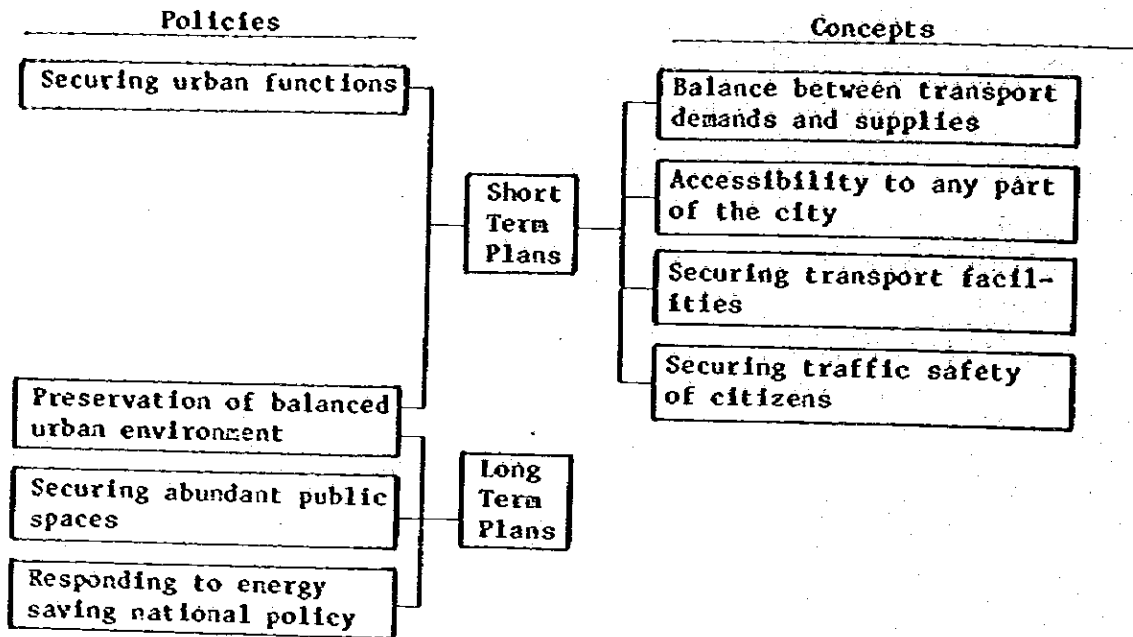


Fig. 1 Distribution of Trip Length by Transport Mode Medan City (1979)

#### 4. Planning Policy for Short-Term Solutions

The following policies and concepts are taken into account for formulating Short-Term Improvement Plans in relation with long-term:



In other words, the emphasis is placed on securing urban functions in Short-Term Plans with the least additional public investments; the improvement concepts are substantially classified into the following four categories:

- i) Balance between transport demands and supplies;
- ii) Accessibility to any part of the City;
- iii) Securing public transport facilities; and
- iv) Securing traffic safety of citizens.

The following table shows the itemized alternative improvements.

**Table 3 Concepts and Itemized Improvements**

<b>Concepts</b>	<b>Itemized Improvements</b>
<b>Balance between Transport Demand and Supply</b>	- Road Betterment & New Construction; - Improvement of Parking System.
<b>Accessibility to Any Part of the City</b>	- Improvement of Road Intersections; - Strengthening of Traffic Signal Control; - Improvement of One-Way Traffic System; - Improvement of Pedestrian Bridge at Medan Station; - Improvement of Railway Crossings; - Opening of the Eastside Gate at Medan Station
<b>Securing Public Transport Facilities and Services</b>	- Improvement of Bus Terminal; - Improvement of Bus Service; - Re-opening of Railway Passenger Service between Belawan and Medan

## **5. Alternative Plans of Improvement**

### **5.1 Road Affiliated Facilities & Traffic Control Devices**

#### **(1) Road Affiliated Facilities**

Although there exist a wide variety of items in this category but in this paragraph only those items affiliated directly to the improvement of roads themselves for the purpose to present their possible problems. Actually those items are included in categories such as improvement of roads, and improvement of road intersections etc.

The following items are to be taken into account from the viewpoint of present situation of Medan City:

- |                            |  |
|----------------------------|--|
| <b>i) Drainage</b>         | - There exist numerous locations on roads where drainage water over-flows on the road surface.                       |
| <b>ii) Street Lighting</b> | - This is necessary for the safety of traffic at night time.<br>The present street lighting is not sufficient.       |
| <b>iii) Planting</b>       | - The priority of this item is not so urgent, but there exists almost no plant nor vegetation in the CBD at present. |

It is proposed to establish some planting program to provide a model of green stripes in the road spaces.

- iv) Road Reflector - The present situation of many road intersections reveals lack of appropriate sight distance due to insufficient corner cutting, where traffic reflectors are very effective to be installed for the safety of traffic.

## (2) Traffic Control Devices

### i) Road Markings

Road markings are for the purpose to stabilize the traffic flows, for which keeping the road surface in good condition by road maintenance is pre-requisite condition. Typical road markings are such as lane marks, stop lines, pedestrians' crossing marks, auxiliary lane marks, zebra zoning marks, etc.

### ii) Traffic Signals

As it is mentioned in later paragraph 'Traffic Control System' the installation of many additional traffic signals are indispensable. Those to be needed in Medan City are those which become necessary due to the partial improvement of the one-way traffic system into the two-way traffic system and also those which become necessary due to installation of the route coordinated traffic signal system.

### iii) Traffic Signs

Those traffic signs are to be installed according to the traffic regulations in order to regulate the traffic flows. Presently in Medan City number of locations of existing traffic signs is not sufficient, particularly such types as symbol arrows, guide signs, regulating signs and warning signs are badly needed.

## 5.2 Railway Improvement Plans

Generally, the improvement of railway facilities needs larger amount of cost of improvement compared to those of road facilities because the management and operation of railway are more systematic and sophisticated affiliated facilities than those of roads. Those improvements necessary for the purpose of train operation are now under study separately in North Sumatra Transportation Study Project at present for the Long-Term Solutions which have not been finalized yet. Accordingly, the Short-Term Solutions to be proposed herewith may be somewhat coordinated later when the Long-Term Solutions are finalized in order to keep a smooth transferring from the Short-Term implementation programme to the Long-Term implementation programme.



Within the Short-Term Solutions the following categories are considered:

**(i) Improvement of Crossings:**

- Installation of devices to warn gate-men as well as road users on approaching trains at ten locations is considered to reduce the closing time of railway crossings and to prevent traffic accidents at railway crossings.
- Improvement of Crossing Barriers is indispensable to increase traffic safety because the existing barriers are not long enough to close crossings;
- Installation of cabins for gate-men at crossings which are lacking at certain crossings. This type of cabins is the least necessary facility for gate-men.
- Improvement of Pavement at Crossings is necessary to make the traffic flows across the crossings more smooth.

**(ii) Re-Opening of Railway Passenger Service between Belawan and Medan**

This is one of the prospective plan to be studied because the trip length between Belawan and Medan is approximately 20 km which will justify for urban transport service by railway in terms of average trip length and also the State Railway decided to open such a passenger service by using diesel railcar trains.

**(iii) Opening of the Eastside Gate of Medan Station is studied due to the fact that about half of the present railway passengers using Medan Station live on the eastside of Station and the present Station lacks the gate on its eastside. Opening of the eastside gate is for the convenience of passengers.**

**(iv) Improvement of a pedestrian over-bridge at Medan Station**

This is a mere repair of the existing deck of a pedestrian over-bridge existing at Medan Station in order to increase the convenience of pedestrians as well as bicycle riders.

### **5.3 Road Traffic Control System**

In this category of improvement the following items are studied;

**(i) Partial Improvement of One-Way Traffic Control System**

For the purpose of improving accessibility the improvement of the present one-way traffic control system, which is widely applied in the central part of the CBD, under the condition that traffic signals are to be introduced in its improvement. One is the partial improvement of

one-way traffic system, namely the new installation of signals at 26 locations, and the other is the improvement of one-way traffic system on wide roads into two-way traffic system.

(ii) Traffic Signal Control

In the present situation of the CBD the introduction of the wide-area coordinated traffic control system is considered still premature, but the introduction of route coordinated traffic signal control system is studied in this report, which involves the installation of traffic signals at 15 locations.

(iii) Vehicle Parking

In the improvement of one-way traffic system which presently permits roadside parking on specified roads in the CBD, into the two-way traffic system prohibiting the roadside parking, becomes necessary in order to increase the traffic capacity of those roads and make traffic flows more smooth. On this occasion it becomes necessary to study how to provide with convenient public vehicle parking spaces of appropriate capacity within the CBD.

5.4 Road Betterments and Construction (Refer to Fig. 2)

In this paragraph the improvement of the following five streets are studied, which are those locations to be relieved from their present congestion, those locations to be improved relating to the improvements of traffic signal control, those roads to be improved in order to keep consistency with other relevant development projects and also those roads which are already scheduled to be implemented in the Third 5-Year Plan period.

Access Roads to Belawan-Medan-T. Morawa Tollway

(i) Improvement of Jl. Pembalagian (Route-1: 4,000m long, 4-lanes)

This is the improvement of a road which is scheduled to become an access to an interchange to be constructed along Belawan-Medan-Tanjung Morawa Tollway which is scheduled to be completed within the Pelita III period.

(ii) Improvement of Jl. Prof. Yasin (Route-2: 3,900m long, 4-lanes)

This is also the similar improvement of the road as in Case (i).

Road Improvement Affiliated with Partial Improvement of One-Way Traffic Control

(i) Improvement of Jl. Gajah Madah (Route-3: 600m long, widening up to 4-lanes)

(ii) Improvement of Jl. Pemuda & Jl. Yani (Route-4: 400m long)

The improvement of those two roads are related to the improvement of One-Way Traffic Control System and also to widening of the bottle neck portion where the road width is not sufficient at present.

Road Construction Scheduled in Peita III Program

(i) Improvement of Jl. Gang Warni (Route-5: 950m, 2-lanes)

This improvement is included in the Third 5-Year Plan and also is reviewed in this study.

5.5 Improvement of Intersections (Refer to Fig. 2)

Improvement of road intersections is not effective enough unless the road section between said intersections is simultaneously improved. In case of improvement of single intersection will result in levying additional traffic burden to its adjoining intersections unless the said intersection to be improved is forming a traffic bottle neck presently. From such a point of view and in the light of the maximum utilization of existing facilities it is recommended to improve intersections simultaneously with the improvement of related road sections.

But on the other hand, there exist many rotary typed intersections in Medan City; accordingly, the improvement of the following two typical rotary-typed intersections are selected to be improved as model cases of similar intersections to be improved later. Their locations are as follows:

- (i) Improvement of Intersection at Jl. Gatot and Jl. Gelugur Bypass;
- (ii) Improvement of Intersection at Jl. Jati and Jl. Yamin.

5.6 Bus Terminals

The traffic congestion at Pasar Sambu Bus Station is presently noticeable among others, which is studied in its following categories:

- (i) Improvement of pavement;
- (ii) Separation of bus from Bemo;
- (iii) Improvement of Bus berths;
- (iv) Separation of passengers from bus.

5.7 Opening a Loop Route Service by Bus (Refer to Fig. 2)

There exist such areas particularly in the western portion of the city where is served only by Bemo due to the fact that the related roads are

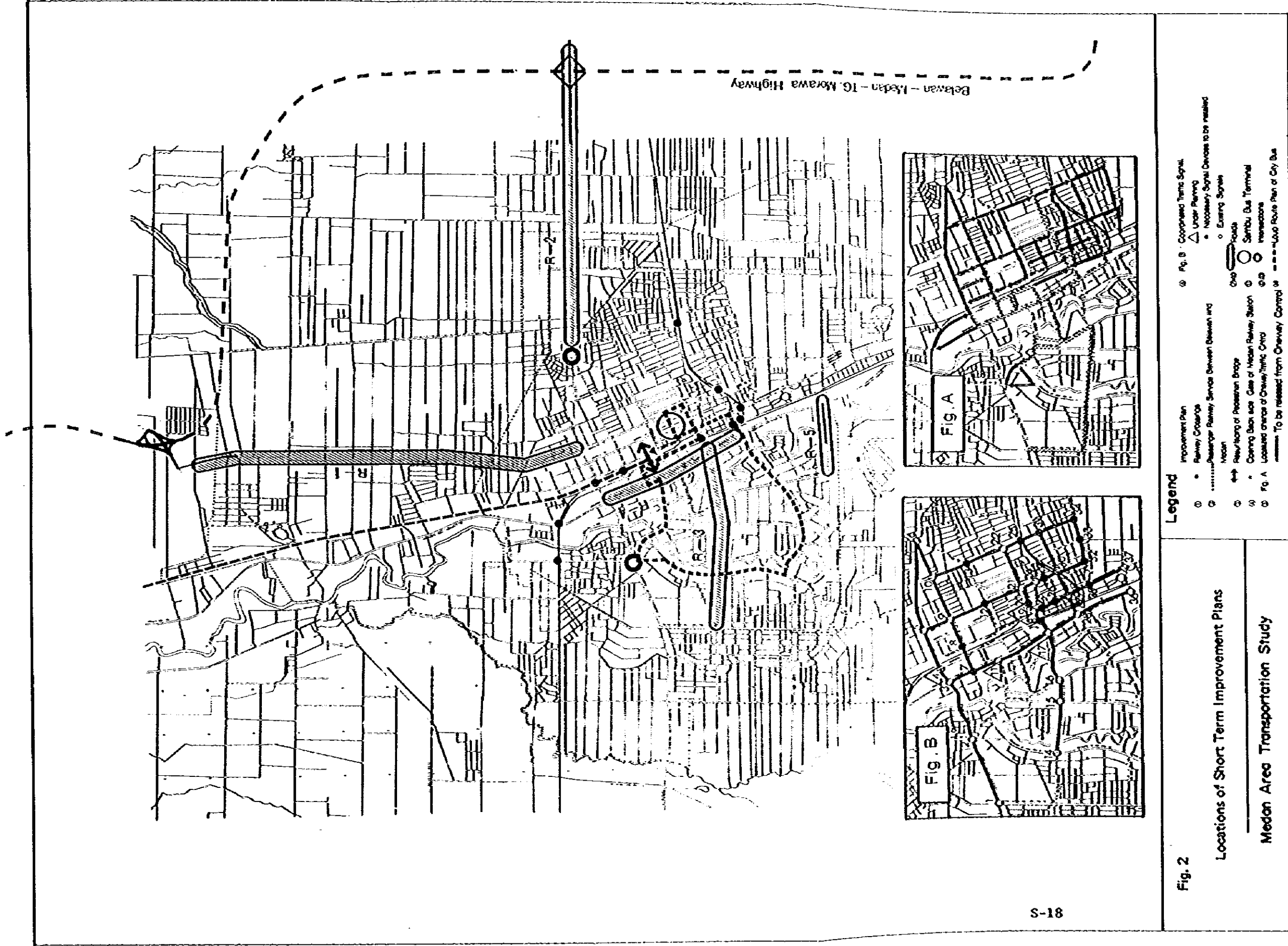


Fig. 2

Locations of Short Term Improvement Plans

Medon Area Transportation Study

Legend

- Improvement Plan
- Railway Crossing
- ⊙ Passenger Railway Service Between Belawan and Medan
- ⊕ Rebuilding of Pedestrian Bridge
- ⊗ Closing Back side Gate of Medan Railway Station
- ⊙ Fig. A Located change of Cheong/THHC Cntrl
- ⊙ Fig. B Coordinated Traffic Signal
- △ Under Planning
- Necessary Signal Devices to be Installed
- Existing Signal
- Road
- Sertibu Bus Terminal
- Intersections
- Bus Route Plan of City Bus
- ⊖ To be released from Cheongway Control



partially narrow for the operation of bus. A loop Route Service Intra-City bus is studied in such inconvenient areas existing between radial bus routes.

### 5.8 Counter-Measures for Pedestrians

Counter-measures for the safety and the convenience of pedestrians are considered in every phase of road improvement in this study.

## 6. Economic and Financial Analysis and Evaluation

### 6.1 Economic Analyses

In conducting economic analyses on short-term improvement plans, vehicle operating benefits and time saving benefits versus the cost of improvements and their maintenance costs are taken into account. Although the span of project life affects on the analyses in the case of short-term solutions it is not reasonable to consider a long project life under the premise of effective utilization of the existing facilities. Therefore, the period of comparison is set for the period up to 1990 because on the other hand, the long-term solutions are under study presently.

In the operation of a loop bus route service it is presently difficult to calculate benefits; therefore, a simple financial analysis is made on this matter in this study.

### 6.2 Financial Analyses

The financial analyses on the short-term solutions include that for a loop bus route service and that for public works. As for the urban railway passenger service between Belawan and Medan its financial analysis has not been conducted in the short-term study because its potential transport demand is still not enough and also for the purpose to keep consistency with Long-Term Master Plan.

#### 6.2.1 Public Works

As for the improvements related to public works a comparison is made with the financial situation of Medan Municipal Government. Although it is difficult to estimate how much amount of fund can be prepared for such public investments, it is estimated that such investments will be limited considerably under the anticipated financial situation.

#### 6.2.2 Loop Bus Route Service

In opening a loop bus route service about 8,500 potential passengers per day can be assumed in 1985, and the estimated balance between the revenues and expenditures is anticipated.

### 6.3 Evaluation

Viewing on the results of economic and financial analyses the following general evaluation can be made on each improvement plan.

(1) Installation of Device to Inform Approaching of Trains at Railway Crossings

There exists even at present approximately a total of 200,000 P.C.U. of road traffic daily at 4 crossings in the central part of the CBD. The result of its economic analysis shows a high internal rate of return, which means that this improvement plan is an effective measure of high priority.

(2) Improvement of Barriers at Crossings

The benefit/Cost ratio is not calculated in this plan, but this is considered to be the least condition for the safety of road vehicles and pedestrians considering the graveness of railway accidents if any take places at crossings.

(3) Installation of Cabins for Gate-Men at Crossings

This plan is also considered to be one of the least conditions for railway crossing facilities.

(4) Improvement of Pavement at Crossings

This is also to be an objective not suitable for economic analysis, but it is of course to be one of the least condition for railway crossing facilities.

(5) Railway Passenger Service between Belawan and Medan

The necessity of re-opening of passenger service between Belawan and Medan is presently felt but the cost of diesel railcars is not small; and the present grade of service is much affected by its necessity in 2000 A.D. And also due to the present small demand this plan is proposed to be studied when its potential demands has reached a certain level. Consequently, its economic and financial study is proposed to be performed in the Long-Term solution. But the State Railway decided to open this service in the fiscal year 1980/81.

(6) Opening the Eastside Gate of Medan Station

Opening the eastside gate of Medan Station is proposed to consider simultaneously when the railway passenger service between Belawan and Medan is re-opened.

(7) Improvement of Over-Bridge at Medan Station

This plan is not an objective for economic analysis. The improvement is nothing but the repair of bridge deck which has deteriorated for the purpose to secure the safety of pedestrians. The cost necessary for it is not large, and its priority is high.

**Table 4 Economic Benefit/Cost Ratios and Internal Rates of Return of Short-Term Improvement Plans**

Item	Benefit/Cost Ratio			Internal Rate of Return (%)
	10%	12%	15%	
Improvement of Railway Crossings	18.3	17.0	15.4	259.7
Re-opening of Railway Passenger Service betw. Belawan & Medan	0.061	0.057	0.052	(A)
Opening of East Gate Station Building of Medan	0.034	0.032	0.028	(A)
Localized Change of One-Way Traffic Control	30.4	29.2	27.4	17,477.5
Installation of Co-ordinated Traffic Signals	14.6	13.9	12.9	312.6
Improvement of Route 1 (Jl. Pembagian)	3.9	3.6	3.2	59.4
Improvement of Route 2 (Jl. Prof. Yamin)	2.8	2.7	2.4	42.0
Improvement of Route 3 (Jl. Gajah Madah)	7.1	6.5	5.8	83.5
Improvement of Route 4 (Jl. Remuda, Jl. Yari)	7.2	6.7	6.0	107.3
Improvement of Route 5 (Jl. Gang Warni)	3.2	3.0	2.7	50.8
Improvement of Pasar Sambu Bus Terminal	0.68	0.63	0.58	1.1
Improvement of Intersection at Jl. Gatot Subroto & Jl. Gelugur Bypass	0.75	0.70	0.63	3.4
Improvement of Intersection at Jl. Jati & Jl. Yamin.	1.8	1.6	1.5	25.8

Note: (A) shows that evaluated benefit total is less than the value of evaluated financial total cost.



(8) Improvement of One-Way Traffic Control

This plan is not complete abolishing of the present one-way traffic control system widely applied in the CBD but to improve partially on 9 routes where the noticeable improvement of the current traffic situation can be expected, by which the ratio of congestion in the CBD can be bettered. In this plan all wide roads are to be changed into two-way system basically, for this purpose considerable traffic regulations is necessary to be enforced to cope with forbidding road-side vehicle parking. Considering such related conditions the drastic change of one-way system into two-way system on all wide roads is considered premature to be taken up as a solution in the short-term improvements. Consequently, the improvement is proposed to be localized as the necessary minimum.

(9) Coordinated Traffic Signal Control

The effect of establishing the route coordinated traffic signal control system is expected on such arterial roads in Medan City where they are considerably straight and conspicuous, by which the users' convenience will be surely enhanced. This system is the first step to proceed to the area-coordinated traffic signal control system. It will be necessary, in the intermediate term, to proceed to the system which can be altered into area-coordinated traffic signal control system with small additional cost. The route coordinated traffic signal control system under consideration is proposed to cope with such change later easily.

(10) Vehicle Parking Spaces

Presently in the CBD of Medan City no public land space suitable for vehicle parking purpose is found. From such a viewpoint the introduction of parking charge variable according to parking time length as one of the short-term solutions, by which the efficient rotation of roadside parking space will become feasible at such locations where the roadside parking is still permissible.

(11) Betterments and Construction of Roads

i) Improvement of Jl. Pembalagian (Route-1)

This improvement is the construction and betterment of the said road as an access to an interchange to be constructed along Belawan-Medan-Tanjung Korawa Highway. This plan is proposed to be completed timely in the same phase when the highway and its interchanges are completed. But it is proposed that its construction cost to be subsidized by Bina Marga.

**ii) Improvement of Jl. Prof. H.M. Yamin SM (Route-2)**

This plan is the similar case as of (i) because this road extends out of the city boundary, the portion of which the Municipal Government is not authorized to bear the cost. It is proposed to be subsidized by Bina Marga for such an access road of the said nature.

**iii) Improvement of Jl. Gajah Mada (Route-3)**

This plan is to widen a bridge width on this road which forms a bottle neck of the road, an access road from Binjai to Medan. If the financial situation of the Municipal Government cannot afford to implement such a plan due to its financial reason, its implementation can be delayed without causing any serious bad effect on the traffic on this road.

**iv) Improvement of Jl. Pemuda & Jl. A. Yani (Route-4)**

It is proposed to implement this plan urgently because a large volume of traffic is flowing on these roads being retarded as the bottle neck where the road is not wide enough.

**v) Improvement of Jl. Gang Warni (Route 5)**

This plan is expected to give an efficient bypass effect on the traffic between the western area and the southern area of Medan, which is not small in quantity. It is proposed to implement early if the financial situation of the Municipal Government can afford.

**(12) Improvement of Intersections**

In this category the main feature is the improvement of existing two rotary typed intersections as model cases to be followed later. Improvement of other intersections is proposed to be carried out when the related roads are improved.

**(13) Improvement of Bus Terminals**

Although those improvements except for Pasar Sambu Terminal do not show high internal rate of return in their economic evaluation but the problems which do not appear in the economic analysis should be kept in mind. But the improvement of Pasar Sambu Bus Station is evaluated with high priority from the viewpoint of serious present traffic congestion, which needs to be implemented urgently.

**(14) Loop Bus Route Service**

In this plan it is intended as a means to strengthen the existing bus transport service for the convenience of users. The plan seems economically feasible but it is proposed to postpone until the improvement of the related roads is

implemented because its related road has some narrow portions to be improved.

(15) Counter-Measures for Pedestrians

Counter-measures necessary for the convenience and safety of pedestrians are proposed to be considered as the road improvement program is progressed.

## 7. Expected Effects of Proposed Improvement Plans

From the proposed short-term improvement plans already mentioned the following effects can be expected:

- (i) In the railway passenger service on Belawan-Medan Line it will be difficult to balance between its revenues and expenditures in the short-term. However, it will be for its railway personnels to accumulate many valuable experiences to perform the urban railway passenger service by operating diesel railcar trains which are expected to grow up into a powerful mass transit system of Medan City in the long-term.
- (ii) It can be expected that the strengthening of safety device of railway crossings can reduce the closing time of crossing per train and can prevent serious traffic accidents at crossings which occasionally took place before.
- (iii) Applying road markings drastically on the existing roads and the improvement of traffic signals and, the installation of traffic signs will enhance the safety of vehicle drivers as well as pedestrians.
- (iv) The improvement in traffic signals into the route coordinated signal system in combination of the partial improvement of the present one-way traffic control system will reduce the volume of sectional traffic of roads in the CBD including railway crossing traffic, and also enables road users to save their time in reaching their destinations.
- (v) Improvements and the new construction of roads will bring about the reduction of rate of congestion of roads in the CBD. The completion of two access roads from the CBD to interchanges of Belawan-Medan-T. Morawa Tollway will relieve the traffic congestion in the CBD noticeably.
- (vi) The improvement of Pasar Sumbu Bus Terminal will reduce the rate of congestion around there and will enhance the accessibility to buses and Beros and vehicular flows in the terminal will be much improved.
- (vii) Opening a loop route service by the intra-city bus system will increase the efficiency of bus service and users' convenience, for which an improvement of the bottle-neck portion of the proposed route is necessary.

## 8. Conclusion

The implementation progress will be affected by financial scale of public fund annually available, but the followings can be said as its conclusions:

As for railway facilities the following improvements are proposed to be included in the implementations program to be completed by the fiscal year 1985/86:

- (i) Installation of devices to warn the approaches of trains;
- (ii) Repair of deck of the over-bridge at Medan Station;
- (iii) Light repairs or improvements related to railway crossings;  
and
- (iv) Improvements necessary for re-opening the passenger service  
on Belawan-Medan Line.

Particularly, the category (i) and (iv) keep the first priority to be urgently implemented.

As for road facilities it is proposed to implement the improvement of one-way traffic control and traffic signals with higher priority compared to improvement of roads themselves. In improving traffic signals the selection of such types, which enables to alter them later into the area-coordinated traffic control system, should be considered.

In the improvements of Jl. Pemuda & Jl. Yani Route-4 the elimination of traffic bottle necks is of the first priority, by which the improvement of one-way traffic control system will bring about better results of smooth traffic flowing. On the other hand, the improvement of Jl. Gang Wani, which is scheduled to be implemented in the Third 5-Year Plan period, will bring about a favorable by-pass effect, consequently this program is reasonable and is proposed to be carried out as it is scheduled if the financial situation of the Municipal Government can afford.

As for the improvement of Pasar Sambu Bus Terminal, the bus system is pressed with the urgent strengthening of its bus fleet; on the other hand, levelling-up of its service level including bus terminal facilities is considered imminent.

Improvements afore-mentioned in the conclusion are those of high priority, and the rest of those are of the second priority. In implementing those short-term solutions the important problem is its financing which seems to be a considerable heavy burden to the Municipal Government of Medan and is expected probably to cause a kind of financial difficulty. As the problem to be considered hereafter the reasonable sharing of such fund for public investments is proposed to be discussed seriously among government agencies concerned because favorable internal rate of return are expected from those short-term solutions, which proves that they are effective and economically feasible. The cooperation among the related government agencies will enable the efficient and smooth implementation of those solutions which will make Medan City more comfortable and convenient to residents.

As mentioned in Sec. 7.4. Administration and Others, implementation of those solutions accompanied with appropriate legislative measures is expected to result in the realization of the policy to utilized facilities with the least additional public investment.

Table 5 Implementation Programme of All Proposed Improvement Plans

Category	Project No.	Improvement Plans	Capital Investment cost in the value of January, 1980 Rp.x10 <sup>6</sup>	Quantity	Priority	Implementation (Unit Rp.x10 <sup>6</sup> )						TOTAL
						1980/81	1981/82	1982/83	1983/84	1984/85	1985/86	
Railway	1	Improvement Railway Crossing Facilities	358.5	10 locations	First priority		394.4	-	-	-	-	394.4
	2	Reopening Passenger Service between Bolawan and Medan.	3,226.4	20 km, 12 diesel Cars	Scheduled to reopen in 1980/81	3,226.4	-	-	-	-	-	3,226.4
	3	Reconstruction of Deck of Pedestrian Bridge in Medan Station	13.7	240 sq. m	Second priority	-	-	16.6	-	-	-	16.6
	4	Opening Back Side Gate of Medan Station	860.3	-	To be considered in long term	-	-	-	-	-	-	-
Traffic Control Device	5	Partial improvement of One way Traffic Control	293.1	26 places	First priority	-	322.4	-	-	-	-	322.4
	6	Installation of Route coordinated signal system	132.6*	15 places	First priority	-	145.9	-	-	-	-	145.9
Road	7	Improvement Jl. Palembang	2,209.0	3.8 km	Second priority	-	534.6	1,176.1	1,293.7	-	-	3,004.4
	8	" Jl. Prof. Yamin SH	2,636.4	3.7 km	Second priority	-	-	638.0	1,403.5	1,543.9	-	3,585.4
	9	" Jl. Gajah Madah	1,512.5	0.6 km	Second priority	-	-	-	664.4	1,705.0	-	2,369.4
	10	" Jl. Pemuda, Jl. J. A. Yani	1,025.6	1.7 km	First priority	-	564.1	620.5	-	-	-	1,184.6
	15	" Jl. Wairi	911.6	0.9 km	Second priority	-	-	330.9	849.3	-	-	1,180.2
Inter-Section	12	Improvement of Inter-section	371.9	1 location	Third priority	-	-	-	-	-	598.9	598.9
	13	" "	239.2	1 location	Third priority	-	-	-	-	-	385.2	385.2
Bus Facilities	11	Improvement of Pasar Sambu Bus Terminal	1,180.5	1 location	First priority	-	649.3	714.3	-	-	-	1,363.6
	14	Bus Loop Route Service	140.0	7 buses	Second priority	-	-	169.4	-	-	-	169.4
Administration and Others	-	-	-	-	-	-	-	-	-	-	-	-
TOTAL:			15,111.3			3,226.4	2,076.1	3,024.3	3,428.9	3,502.0	2,689.1	17,946.8

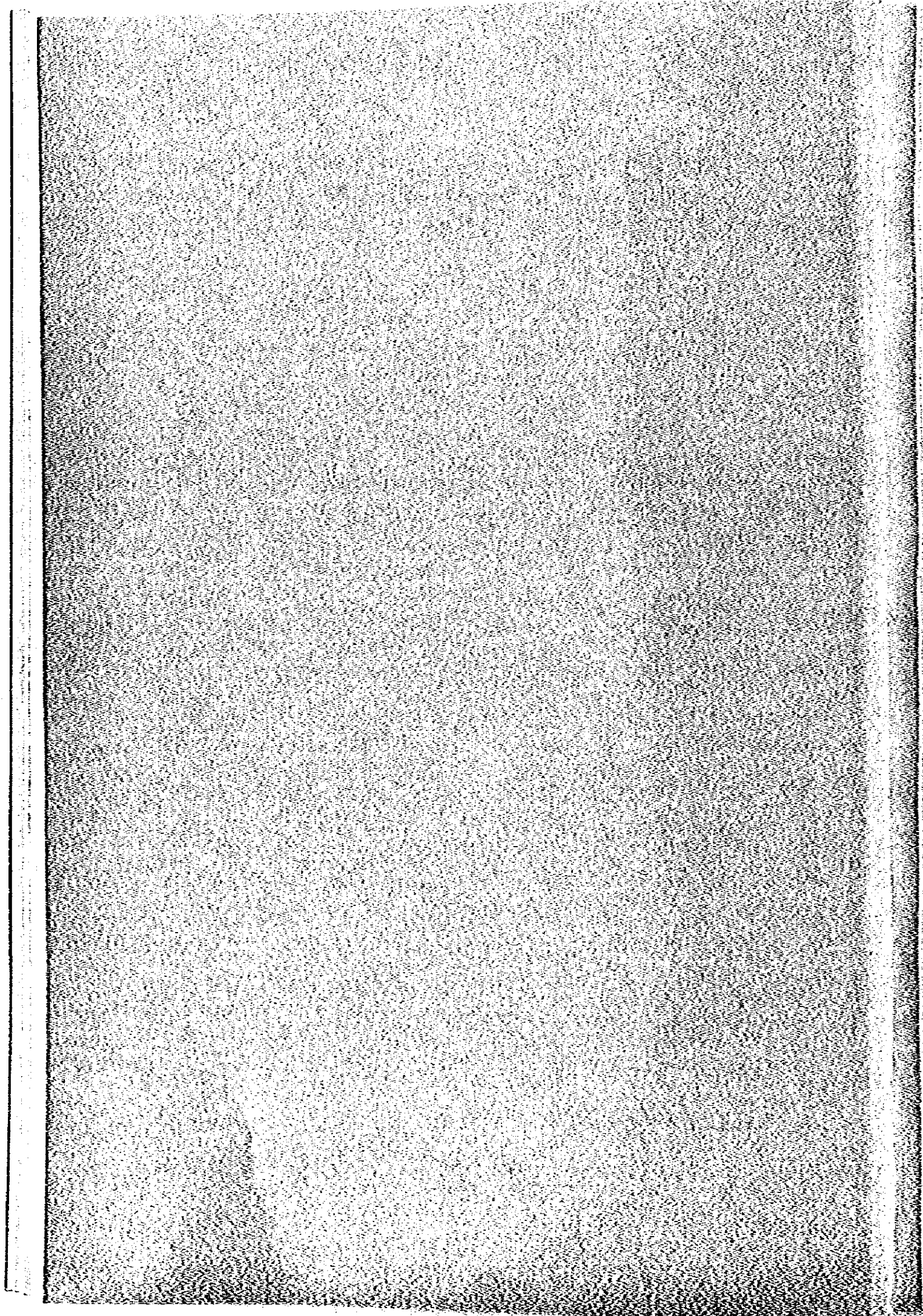
Notes (1) \* Marked figure means an additional cost for project No. 5

(2) The escalation allowance of 10 percent per annum are applied to distributed costs according to their fiscal years.



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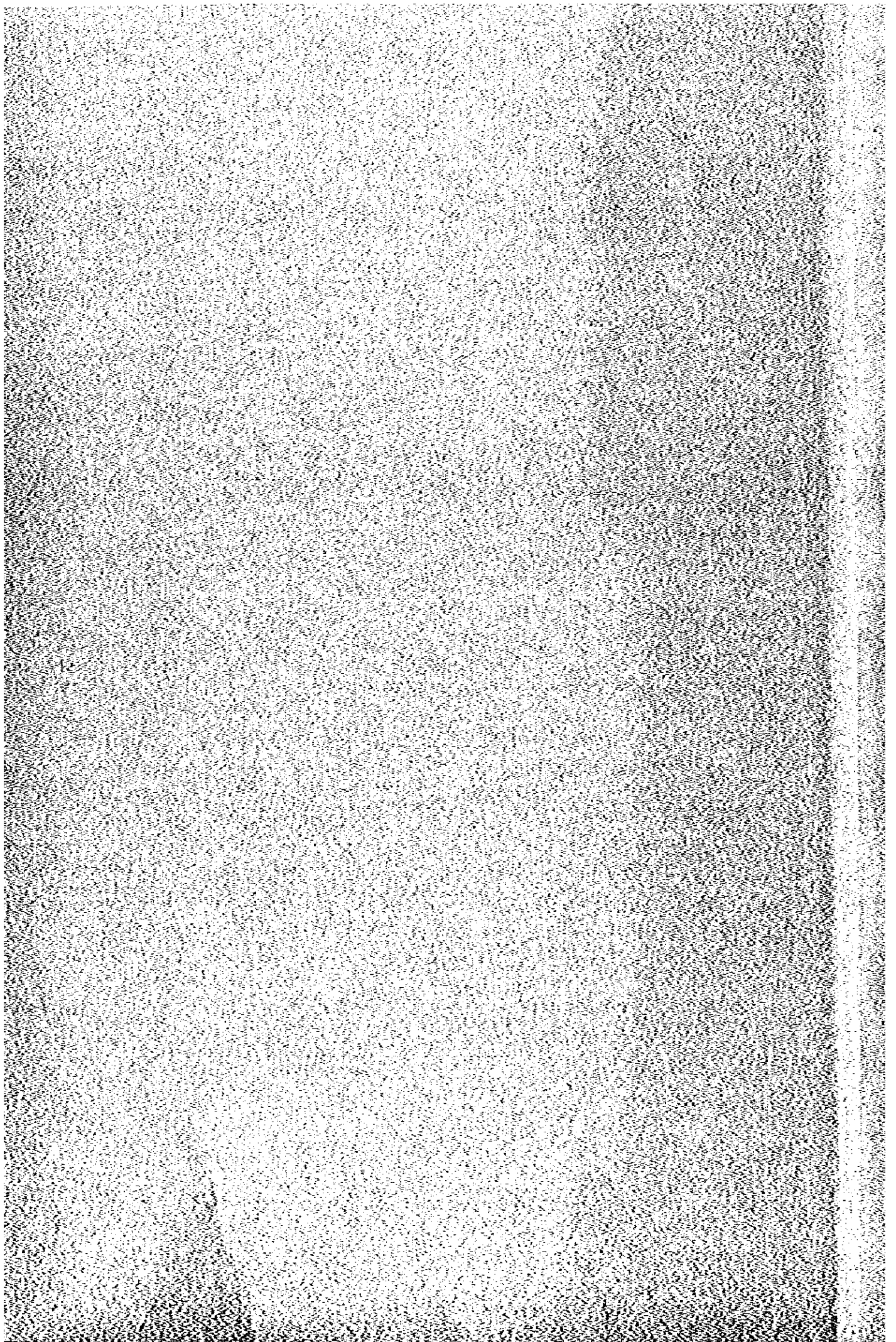
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