# THE REPUBLIC OF INDONESIA

# THE STUDY ON INTEGRATED TRANSPORTATION SYSTEM IMPROVEMENT BY RAILWAY AND FEEDER SERVICE IN JABOTABEK AREA

## FINAL REPORT

## SUMMARY

AUGUST 1990

JAPAN INTERNATIONAL COOPERATION AGENCY
(JICA)

THE REPUBLIC OF INDONESIA

# THE STUDY
# ON
# INTEGRATED TRANSPORTATION SYSTEM IMPROVEMENT
# BY RAILWAY AND FEEDER SERVICE
# IN
# JABOTABEK AREA

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# PREFACE

In response to a request from the Government of the Republic of Indonesia, the Japanese Government decided to conduct a study on the Integrated Transportation System Improvement by Railway and Feeder Service in Jabotabek Area and entrusted the study to the Japan International Cooperation Agency (JICA).

JICA sent to Indonesia a study team headed by Misao Sugawara, Japan Railway Technical Service (JARTS) , composed of members from the Pacific Consultants International (PCI) four times, from November 1988 to March 1989, from September to November 1989, from January to February 1990 and June 1990.

The team held discussions with concerned officials of the Government of Indonesia, and conducted field surveys. After the team returned to Japan, further studies were made and the present report was prepared.

I hope that this report will contribute to the promotion of the project and to the enhancement of friendly relations between our two countries.

I wish to express my sincere appreciation to the officials concerned of the Government of the Republic of Indonesia for their close cooperation extended to the team.

August, 1990

Kensuke Yanagiya

Kensuke Yanagiya

President

Japan International Cooperation Agency

August 1990

Mr. Kensuke YANAGIYA
President
Japan International Cooperation Agency
Tokyo, Japan

Dear Sir,

LETTER OF TRANSMITTAL

We have the pleasure of submitting herewith the final report of the Study on Integrated Transportation System Improvement by Railway and Feeder Service in JABOTABEK Area in the Republic of Indonesia.

The Study was conducted from November 1988 to August 1990 by a team of experts from Japan Railway Technical Service and Pacific Consultants International.

Based on the Scope of Work agreed upon in February 1988 by the Japan International Cooperation Agency and the Indonesian Government, the study team sought for appropriate measures for establishing an integrated transportation system in the JABOTABEK Area. The Study includes drawing up a master plan which would be fully harmonized with related development projects and related transportation projects in the area, as well as the feasibility studies conducted for urgent projects, with cooperation of the Indonesian counterparts.

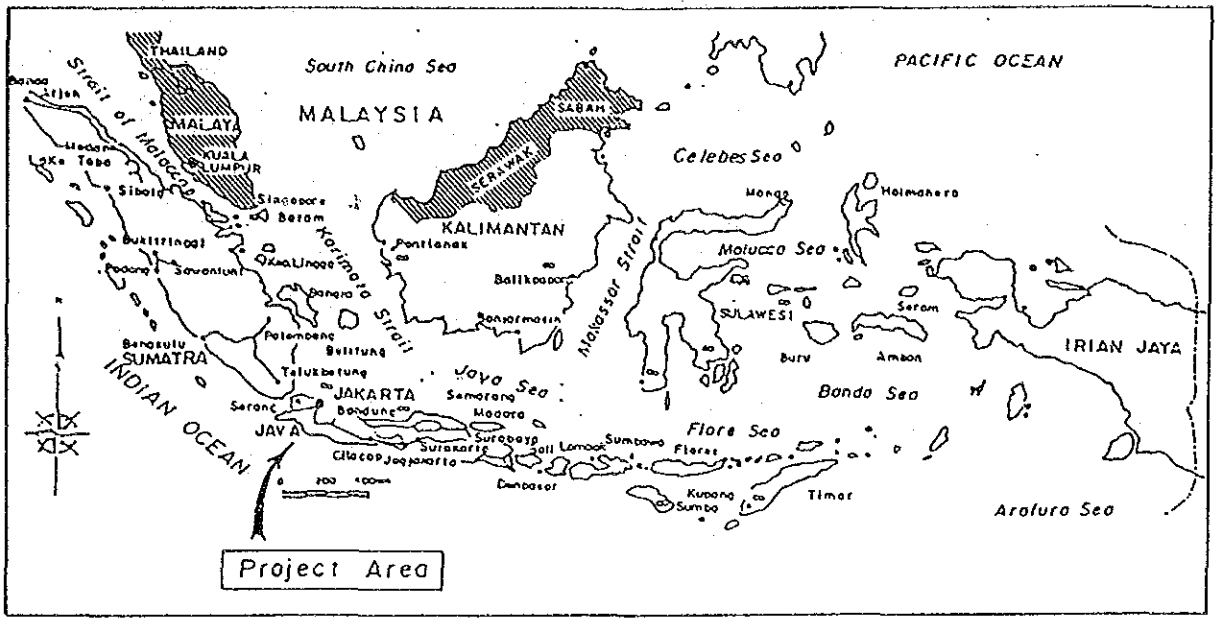
We hope that the Study will greatly contribute to the implementation of this project and to the transportation system improvement in the JABOTABEK Area.

We wish to express our sincere gratitude to the officials of your Agency, the Advisory Committee, the Embassy of Japan in Indonesia, as well as to those concerned of the Government of the Republic of Indonesia, for the kind assistance and cooperation they extended to the study team.

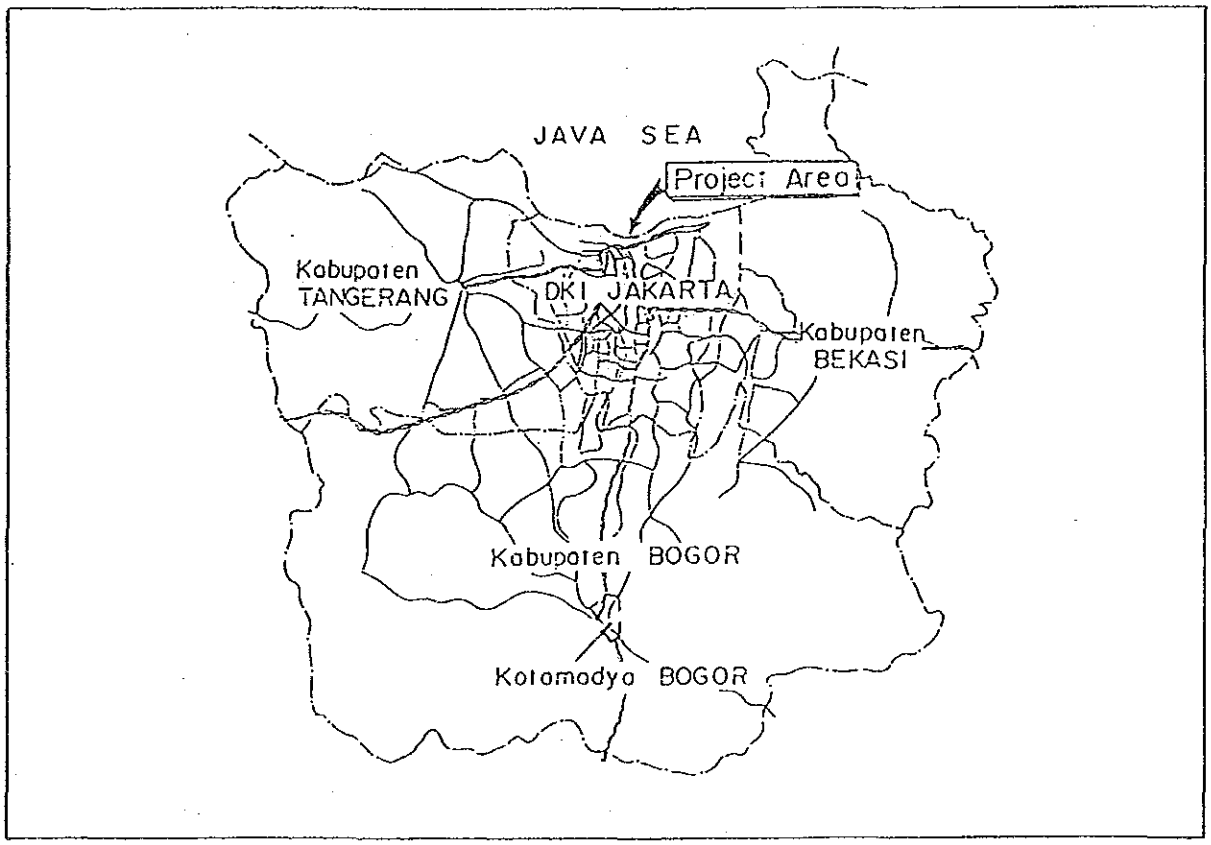
Very truly yours,

M. Sugawara

Misao Sugawara, Dr. Eng.
Study Team Leader
Integrated Transportation System
Improvement by Railway and Feeder
Service in JABOTABEK Area,
Indonesia




INDONESIA




JABOTABEK

# Conclusion and Recommendation

## 1. Conclusion

### (1) Significance of this project

With the progress of population concentration in urban districts and development of economic activities, traffic in the Jabotabek area is increasing year by year, and owing to the advancement of motorization, the transportation capacity of roads within Jakarta and those connecting the city center with the suburbs is reaching their limit. This has caused not only chronic traffic congestion but also transport-related public nuisances such as air pollution.

The railway in the Jabotabek area runs radially in four directions from Jakarta to peripheral cities. Within the Jakarta city, the railway forms a quasi-loop line, and it also has a very favorable route. However, the railway is hardly functioning in commuter transportation due to superannuation of facilities and defects and shortage of facilities and rolling stock.

Concerning the existing railway, reinforcement is progressing under the Master Program to modernize the existing network and facilities. However, the progress of improvement has not fully satisfied the original expectations due to changes in economic conditions in Indonesia.

As for road planning, reinforcement is under way in the Indonesia side based on the Jabotabek Area Development Plan 2005 and the Jakarta City Development Plan 2005. Furthermore, the Arterial Road System Development Study (ARSDS) by JICA was proposed in 1987. However, both plans lack in the vision of sufficiently utilizing the railway for establishing a integrated urban transportation network in the Jakarta metropolitan area.

This study aims at organic harmonization of railway and road plans in line with development plans for the Jakarta metropolitan area so as to contribute to the improvement of transportation in the Jakarta metropolitan area. For this purpose, it was scheduled in this study to implement the following work and draw up a plan that would allow the railway and roads to fully display their inherent characteristics.

1) Drawing up of a master plan up to 2005 for the Jakarta metropolitan area
2) Ascertaining the feasibility of urgent reinforcement projects

(2) Drawing up of a master plan

To obtain an optimum integrated transportation system for 2005, 6 alternative pair patterns were set up by combining 3 railway cases and 2 road cases of different improvement levels. From among these alternatives, a selection was made of an optimum pattern with small generalized cost in 2005, and further by evaluating such aspects as urban development, land utilization, environmental problems, and amounts of investment. Based on the result, a master plan for 2005 was drawn up.

Note 1 : The term "Generalized Cost" does not only indicate monetary cost such as investment, and operation and maintenance cost but total cost including the consumed time converted into cost.

According to the optimum alternative thus selected, the amounts of investment up to 2005 were determined to be 2,017,680 million rupiah for railway improvement and 7,740,800 million rupiah for road improvement.

In the Jabotabek area, reinforcement of the existing railway is taking place under the Rationalized Execution Plan based on the Master Program and the projects to be completed by 1992 have been decided.

Together with this Study, evaluations were conducted of the following two options in order to ascertain the effects of the above projects.

Option a : Make investments only for projects already in progress or in those whose implementation has already been decided. (Refer to Note 2.)

Option b : Make investments specified in the Rationalized Execution Plan. (Refer to Note 3 )

Note 2 : In this option, investments will be made by 1992 only for such projects in progress or those to be implemented as track elevation and signal automation of the Central Line, and signal automation of the Eastern and Western Lines.

Note 3 : In addition to Option a, investments will be made for such projects as grade separation at Manggarai, signal automation of the Tangerang Line, and establishment of the Depok Depot. This will enable train operation at intervals of 8 minutes 30 seconds on the Central Line and at 10-minute intervals on the Loop Line during peak hours.

According to the evaluations, in comparison with Option a, the economic internal rate of return and the financial internal rate of return by implementing Option b would be 22.8% and 5.07% respectively. Therefore, Option b is effective from both economic and financial standpoints when utilization of low-interest inter-government loans and the standard discount rate (about 15%) in Indonesia are considered.

(3) Ascertaining the feasibility of Urgent Projects

1) General

From among the urgent projects selected from the Master Plan, the following three were selected as worthy of feasibility study.

a) Improvement of feeder services (Refer to Note 4.)
b) Improvement of station facilities (Refer to Note 5.)

Note 4 : This includes investments for easier access of passengers to the railway through improvement of transfer facilities between the railway and other modes of urban transportation such as buses by improvement of station plazas, bus bays, pedestrian bridges, etc.

Note 5 : This includes investments for easier access of passengers to the railway and also for adequate job performance in stations such as by improvement of concourses, passages, ticket offices, ticket gates, information offices, and other station offices and facilities.

As for the items a) and b), same stations were taken up in the feasibility study since both items are closely related.

2) Improvement of feeder services and station facilities

At first, 19 stations were selected in view of the number of passengers getting on and off trains, number of trains, relationship with bus routes, etc. Of these, feasibility studies were conducted for 3 typical stations and simple feasibility studies for the remaining 16 stations. The study results are as shown in Table 1.

Table 1 Evaluation of Investments for Improving Feeder Services and Stations

| Stations | Amounts of investments ($10^6$ Rupiah) | Economic internal rate of return (%) | Financial internal rate of return * (%) |
|---|---|---|---|
| Jatinegara Pasarsenen Kemayoran | 65,190 | 34.8 | 6.3 |
| Remaining 16 stations | 71,462 | 55.9 | 22.9 |
| Total | 136,652 | - | - |

* The figures show financial internal rates of return for the railway side in the case where sectors other than the railway bear 80% of the investments and operation and maintenance costs of the feeder service facilities and also bear 80% of the investments for station facilities.

As shown in the table, the economic internal rates of return are fairly high in the typical 3 stations and also in the remaining 16 stations. It is considered therefore that these projects should be urgently taken up by the Indonesian government. However, appropriate financial internal rates of return for the railway side can not be obtained unless sectors other than the railway bear reasonable shares of the investments and operation and maintenance costs. This shows that the improvement of feeder services brings about large benefits to the city and road sectors in such respects as space utilization and transportation time saving.

3) Grade separation of the Eastern Line

Concerning the level crossings on the Eastern Line, traffic volume in the future was estimated and alternative plans for the grade separation were drawn up, based on the available data and results of new investigations. Regarding these alternative plans, economic internal rates of return were calculated and comprehensive judgement was made from such aspects as city planning, land utilization, aesthetic viewpoint and preservation of environment. The amounts of investments and internal rates of return are as shown in Table 2.

Table 2 Amounts of Investments for Grade Separation of the Eastern Line and Internal Rates of Return

(in the case of completion in fiscal 2001)

| Alternative plans | Investments ($10^6$ Rupiah) | Economic internal rates of return (%) |
|---|---|---|
| Single grade separation | 283,282 | 14.5 |
| Track elevation plan I (Track elevation extending 6 km and single grade separation of the remaining tracks) | 448,121 | 15.2 |
| Track elevation plan II (Track elevation extending 9 km) | 601,921 | 14.3 |
| Underground construction | 1,510,350 | - |

The underground construction plan is optimum from the viewpoint of city planning, land utilization, aesthetics and preservation of environment. However, this alternative can not be adopted because the amount of investment is extremely large and there are some difficulties in respect of train operation.

When calculated assuming the project to be completed in fiscal 2001, the economic internal rates of return of the other three plans are between 14% and 15%, and generally satisfy the Indonesian standards for adoption. Among the three, however the track elevation plan I is most highly evaluated from the economic standpoint. In this connection, railway track elevation is more recommendable than single flyover from such aspects as city planning, land utilization, aesthetics and preservation of environment.

## 2. Recommendation

### (1) Master plan for integrated transportation

In the past, master plan formation and feasibility studies for transportation system improvement in the Jabotabek area were conducted separately by the railway and road sectors. This caused transportation demand forecasts under different preconditions, and the Indonesian side also recognized the need of unifying the preconditions. Accordingly, the following procedure was applied in this Study: (i) At first, set up 6 pairs of options concerning improvement levels of the railway and roads. (ii) From among the options,

select the most effective investment system. (iii) Based on the selection, finally draw up a master plan.

In view of the above, the results of this Study should be used as a long-term guideline for planning an integrated transportation system in the Jabotabek area. It is reasonable, therefore, to basically follow the principles of the master plan drawn up in this Study, and implement the individual projects for railway and road improvement in accordance with the order of priority.

(2) Implementation of the On-Going Rationalized Execution Plan

This Study mainly aimed at formation of master plan for 2005 and implementation of a feasibility study for urgent projects to be taken up in the future. In the course of the study, however, it became necessary to reconfirm the feasibility of the railway projects having their completion targets in 1992. Through the feasibility study conducted for this purpose, it was confirmed that the implementation by 1992 of the railway improvement investments based on the Rationalized Execution Plan would show an economic internal rate of return of 22.8%. Since the progress of these projects is now behind schedule mainly due to economic conditions in Indonesia, it is strongly recommended that these investments be completed as much as possible by the targeted year. The completion of these projects will enable train operation during peak hours at intervals of 6 minutes on the Central Line and 10 minutes on the Loop Line. This will allow the existing Jabotabek railway to sufficiently display its role as a means of urban transportation.

(3) Joint development by the railway and city and road sectors

According to the feasibility study on improvement of stations and feeder services, economic internal rates of return are fairly high, ranging from 35% to 56%, and this has attested to the magnitude of the effects of the projects. However, this also shows that the projects can be financially feasible for the railway sector only when the sectors other than the railway bear their reasonable shares of burden. This is because the railway stations and feeder services act as links between the railway and urban road transportation, and improvement of these facilities would bring large social and economic benefits to the city and road sectors as well as to the railway sector. The same can be said of railway track elevation.

To cite an example in Japan, the principle that the causer should bear the cost was applied in the past to such kinds of projects. This caused

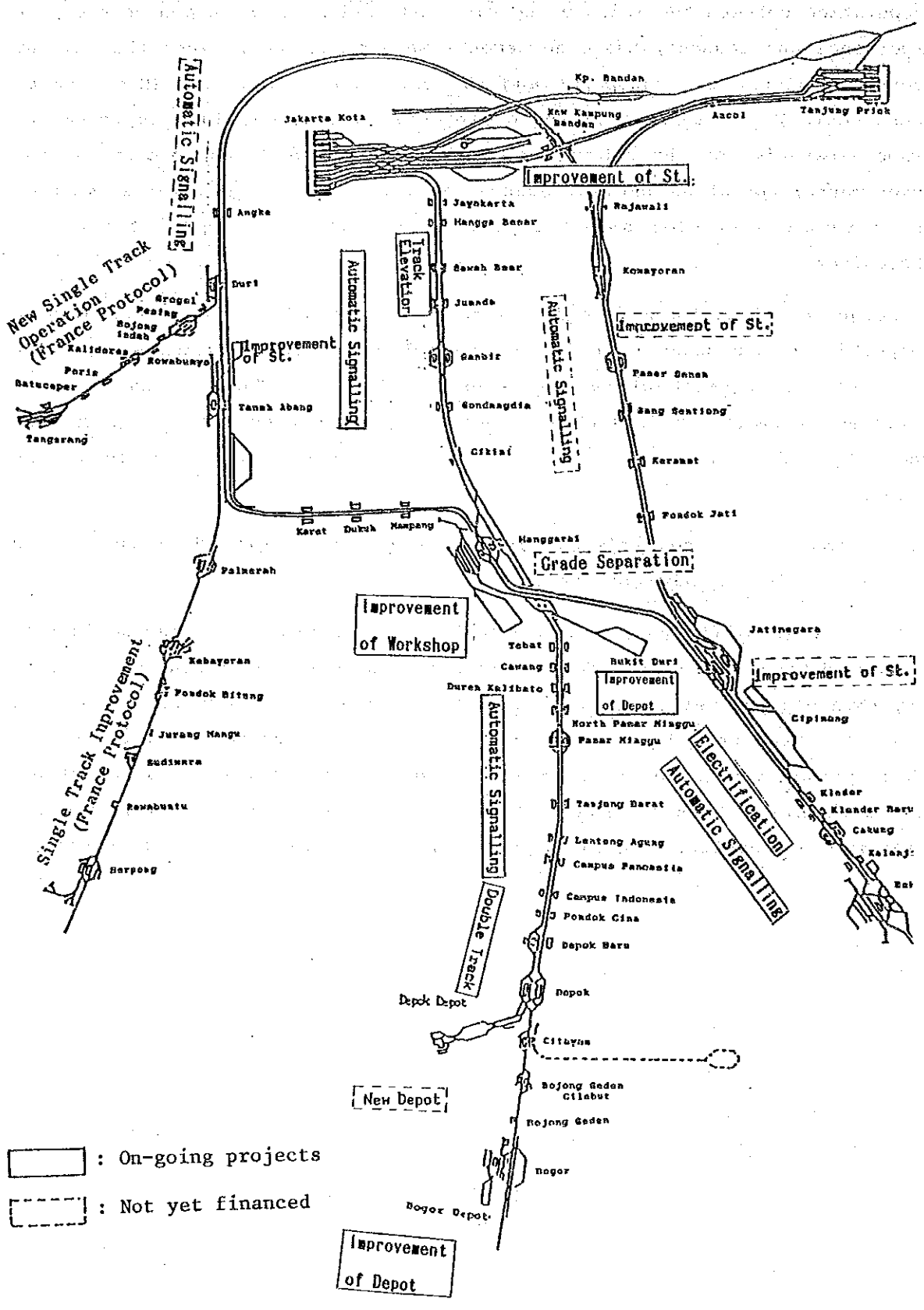
difficulties in project implementation, and pointed to the need of cooperation between the railway and city and road sectors. Based on the past experience and lessons, basic agreements were concluded between the railway sector (Ministry of Transport) and the city and road sector (Ministry of Construction) in implementing such projects as station plaza improvement, grade separation of the railway and roads, and railway track elevation, and investments, operation and maintenance costs are shared. The establishment of the agreements enabled smooth implementation of these types of projects thereafter.

Although the situation may be different from country to country according to respective circumstances, it is recommended that a system which would allow reasonable assignment of burden be established in Indonesia, in order to efficiently implement investments that bring about benefits to the railway and city and road sectors. In this case, the experience in Japan may be helpful.

(4) Promotion of the projects for improving the integrated transportation system in the Jabotabek area

Lastly, it is strongly recommended again that the projects taken up in this recommendation, beginning with the on-going Rationalized Execution Plan, be vigorously promoted in order to meet the transportation demand in the Jabotabek area that is bounded to increase in the future. This is because these projects will not only solve the aggravating transportation problems but also bring about enormous long-term and comprehensive benefits for improving and amplifying city functions and development of national economy.

CONCEPTUAL RAILWAY LAYOUT IN TARGET YEAR OF 1992



Investment Schedule for Railway and Road under the Proposed Master Plan

| | Project Item | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Double Tracking Electrification and Automatic Signalling on C/L (Dp - Boo) | | | | | | | | | | | ..... | ..... | | | | |
| 2 | Improvement of Feeder Service | ..... | ..... | ..... | | | | | | | | | | | | | |
| 3 | Relocation of Kota-Station | | | | | | ..... | ..... | ..... | | | | | | | | |
| 4 | Construction of Car-depot in Relation to Kota-Station | | | | ..... | ..... | ..... | | | | | | | | | | |
| 5 | Track Elevation of E/L | ..... | ..... | ..... | | | | | | | | | | | | | |
| 6 | Flyover on W/L | ..... | ..... | ..... | | | | | | | | | | | | | |
| 7 | Improvement of Station Facilities | ..... | ..... | ..... | | | | | | | | | | | | | |
| 8 | Construction of New Station | | | | | ..... | | | | | | | | | | | |
| 9 | Electrification on Tangerang Line | | | | | | | | | | | ..... | ..... | | | | |
| 10 | Double Tracking of Serpong Line | | | | | | | | | | ..... | ..... | | | | | |
| 11 | Rolling Stock (EC : 376 Cars) | | | | | | | | | | | | | | | | |
| 12 | Road Construction | ..... | ..... | | | | | | | | | | | | | | |
| 13 | Mass Transit | ..... | ..... | ..... | ..... | ..... | | | | | | | | | | | |

Note: The dotted lines mean preliminary works.

CONTENTS

MASTER PLAN

FEASIBILITY

LIST OF ABBREVIATION

| ABBREVIATION | FULL NAME | LOCATION |
|---|---|---|
| Ac | Ancol Station | Tangjungpriok Line |
| Ak | Angke Station | Western Line |
| Bid | Bojonggede Station | Central Line |
| Bin | Bintaro | Serpong Line |
| Bks | Bekasi Station | Bekasi Line |
| Boo | Bogor Station | Central Line |
| Cit | Cilebut Station | Central Line |
| Cki | Cikini Station | Central Line |
| Cpn | Cipinang Staton | Bekasi Line |
| Cta | Citayam Station | Central line |
| Cuk | Cakung Station | Bekasi Line |
| Dp | Depok Station | Central Line |
| Dpb | Depok baru Station | Central Line |
| Drn | Duren kalibata Station | Central Line |
| Du | Duri Station | Western Line |
| Dkh | Dukuh Station | Western station |
| Gdd | Gondangdia Station | Central Line |
| Gmr | Gambir Station | Central Line |
| Gsi | Gang Sentiong Station | Eastern Line |
| Jng | Jatinegara Station | Western Line |
| Jak | Jakarta Kota Station | Central Line |
| Kat | Karet Station | Western Line |
| Kby | Kebayoran Station | Serpong Line |
| Kds | Kalideres Station | Tangerang Line |
| Kld | Klender Station | Bekasi Line |

| ABBREVIATION | FULL NAME | LOCATION |
|---|---|---|
| Kldb | Klender baru Station | Bekasi Line |
| Kmo | Kemayoran Station | Eastern Line |
| Kmt | Kramat Station | Eastern Line |
| Kpb | Kampungbandan Station | East of Jakg Station |
| Kri | Kranji Station | Bekasi Line |
| Lna | Lenteng Agung Station | Central Line |
| Mam | Mampang Station | Western Line |
| Mri | Manggarai Station | Western Line |
| N-Jak | New Jakartakota Station | Central Line |
| N-Kpb | New Kampungbandan Station | Eastern Line |
| Plm | Palmerah Station | Serpong Line |
| Pnd | Pondok bitung Station | Serpong Line |
| Poc | Pondok Station | Central Line |
| Pok | Pondok Jati Station | Eastern Line |
| Pse | Paser Senen Station | Eastern Line |
| Psg | Pesing Station | Tangerang Line |
| Psm | Pasarminggu Station | Central Line |
| Rjw | Rajawari Station | Eastern Line |
| Rk | Rangkrsbetung | Serpong Line |
| Ru | Rawabuntu Station | Serpong Line |
| Rw | Rawabuaya Station | Tangerang Line |
| Sdm | Sudimara Station | Serpong Line |
| Srp | Serpong Station | Serpong Line |
| Sw | Sawahbesar Station | Central Line |
| Teb | Tebet Station | Central Line |
| Thb | Tanah Abang Station | Western Line |
| Tng | Tangerang Station | Tangerang Line |

| ABBREVIATION | FULL NAME | LOCATION |
|---|---|---|
| Tpk | Tanjungpriok Station | Tanjungpriok Line |
| Ui | Uni. Pancasila Station | Central Line |
| Up | Uni. Indonesia Station | Central Line |
| C/L | Central Line | Jak-Boo |
| E/L | Eastern Line | Jak-Pse-Jng<br>Tpk-Kmo |
| W/L | Western Line | Jak-Thb-Jng |
| Bks/L | Bekasi Line | Jng-Bks |
| Tpk/L | Tanjungpriok Line | Jak-Tpk |
| Tng/L | Tangerang Line | Du-Tng |
| Srp/L | Serpong Line | Thb-Srp |

## ABBREVIATIONS AND ACRONYMS FOR JABOTABEK STUDY

| | |
|---|---|
| ARSDS | - Arterial Road Systems Development Study |
| BAPPENDA, DKI | - DKI Jakarta Region Development Planning Board |
| BAPPENAS | - National Development Planning Agency |
| Bina Marga | - Directorate General Bina Marga (Highways), MPW |
| BKSP | - Jabotabek Level I Planning Coordination Unit |
| DAMRI | - State-owned Bus Company Serving Regional Cities |
| Dinas LLAJR | - Traffic and Highway Transportation Department, DKI-Jakarta |
| Dinas PU | - Public Works Department, DKI Jakarta |
| Dinas Tatakota | - Urban Planning Department, DKI Jakarta |
| DKI Jakarta | - Jakarta Special Capital Province |
| GOI | - Government of Indonesia |
| INPRES | - Central Government Grant to Local Governments |
| JABOTABEK | - Region comprising Jakarta, Bogor, Tangerang and Bekasi local government administrative areas |
| JASA Marga | - Public Corporation responsible for constructing expressways |
| JICA | - Japan International Cooperation Agency |
| JUDP | - Jabotabek Urban Development Project |
| JUPCO | - Project Coordination Unit in DKI-Jakarta BAPPEDA |
| JUPT | - Jakarta Urban Transport Project |
| KIP | - Kampung(Village) Improvement Program |
| LLAJR | - Directorate of Highway Transport, PHBD |
| LLAK | - Directorate of Urban Traffic and Transport, PHBD |
| MHA | - Ministry of Home Affairs |
| MOC | - Ministry of Communication |
| MOF | - Ministry of Finance |
| MPW | - Ministry of Public Works |

| | |
|---|---|
| PHBD | - Directorate General Perhubungan Darat (Land Transport), MOC |
| PJKA | - State Railway |
| PPD | - State-Owned bus company serving Jakarta |
| REPELITA | - National Five-year Development Plan (Repelita IV, 1984-89; Repelita V, 1989-94) |
| TKPP | - Tim Koordinasi Pembangunan Perkotaan (Interagency Coordinating Team for Urban Development |

# MASTER PLAN

# MASTER PLAN

## CHAPTER 1. Introduction

This is a summary of the Volume I, the Master Plan of the Study on Integrated Transportation System Improvement by Railway and Feeder Service in Jabotabek area.

The aims of the Volume I are to propose a master plan of Integrated Transportation System of Jabotabek area in 2005, and to select and propose Urgent Projects for Feasibility Study from many projects composing the Master Plan. In addition, this includes the evaluation of the a, b Option for the railway service level at 1992 which determines a premise of the study.

## CHAPTER 2. Present Socio-economic Conditions and Future Development Perspective of Jabotabek

### 1. Present Socio-economic Conditions

#### (1) Population

1) National population

Average annual population growth rate: 2.15% (1980-85). The growth rate has slowed down from its peak period.

2) DKI Jakarta

Average annual population growth rate higher than the national average: 3.93% (1980 - 85)

3) The rate of population growth has decreased within DKI itself, but has increased in the surrounding areas.

4) Botabek region

The population growth rate in the Botabek region, in particular Tangerang and Bogor, is larger than that of DKI.

(2) Employment situation

1) Employment

National: average annual growth rate of 3.91% (1980 - 85)
DKI : average annual growth rate of 4.63% (1980 - 85)

2) The creation of employment opportunities has become the most important issue of the national development plan.

(3) Economic conditions

1) National economy

Slowing down of GRDP growth:
8.1% (1970s); 5.0% (first half of 1980s)

2) DKI

National high growth:
10.4% (1970s); 10.2% (first half of 1980s)
Jakarta's economic structure is centered on finance, trade and manufacturing.

3) Per capita GRDP

Jakarta's per capita GRDP is 2.3 times the national average.

## 2. Review of Related Development Plans

### (1) Fifth Five-year National Development Plan

Repelita V: April 1989 - March 1994

1) Average annual economic growth rate of 5%

2) Important items regarding DKI

Controlling of population growth and the spread of population, enhancing economic activity, and expansion of employment opportunities.

### (2) Jabotabek Metropolitan Development Plan (JMDP 2003)

1) Dispersion of the population and the city's functions; change to a multi-core urban structure.

2) Promotion of expansion to the east and west.

### (3) Jabotabek Development Plan 2005 (drawn up in 1985)

1) Population goals in 2005:

| | | |
|---|---|---|
| DKI | : | 12 million |
| Botabek: | | 11.4 million |
| | | 23.4 million |

2) Proposed land use plan

### (4) DKI Jakarta Master Plan 2005 (drawn up in 1984)

1) Dispersion of the population and the city's functions.

2) Detailed plans for thirty districts

Land use, road network, designation of location of public facilities, etc.

3. Policy to Establish the Future Development Frame for this Study

(1) The forecast Indonesian population in 2005 is based on long-range estimates by the Government Statistics Bureau.

(2) The Jabotabek regional frame is based on regional and city plans of the municipalities.

(3) Socio-economic indeces by traffic zones

The indeces adopted by ARSDS will be amended based on city planning targets in DKI Jakarta and Botabek.

# CHAPTER 3. Present Situation of Transportation System

## 1. Railway Transportation in Jabotabek Area

### (1) Present conditions

1) General

. Seven lines, Route length - 160 km

. Number of Railway Stations - 53

Table 3.1 Stations in the JABOTABEK Area

| Name of Line | Station to Station | km | Number of Station |
|---|---|---|---|
| Central/L | Jak – Boo | 54.7 | 19 |
| Eastern/L | Jak –(Pse)– Jng | 12.4 | 7 |
| | Tpk – Kmo | 8.6 | 2 |
| | Total | 21.0 | 9 |
| Western/L | Jak –(Thb)– Jng | 19.0 | 6 |
| Bekasi/L | Jng – Bks | 14.7 | 5 |
| Tanjungpriok/L | Jak – Tpk | 8.1 | – |
| Serpong/L | Thb – Srp | 23.3 | 7 |
| Tangerang/L | Du – Tng | 19.3 | 7 |
| Total | | 160.1 | 53 |

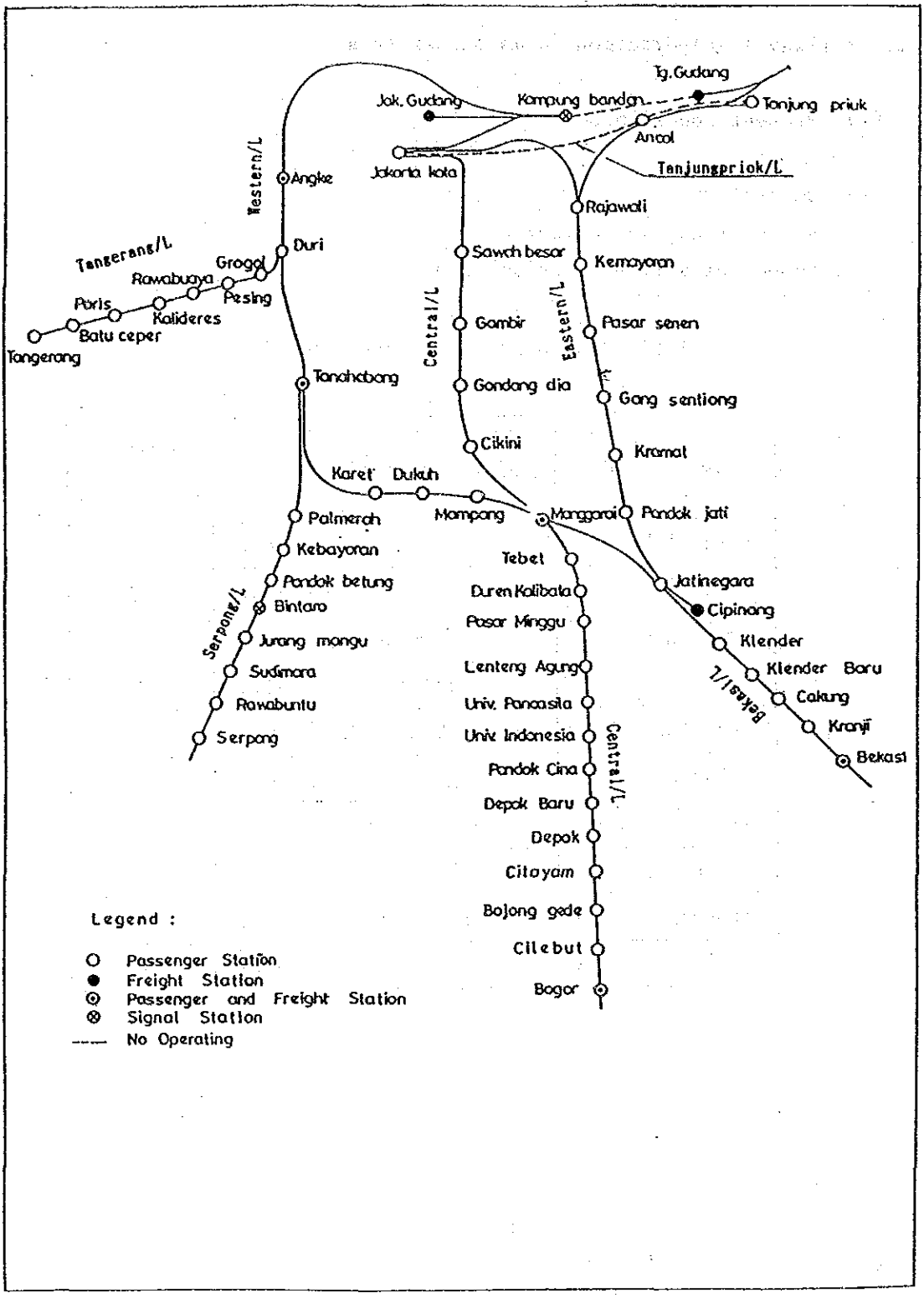



Fig. 3.1 Situation of Existing Stations

2) Railway traffic share

The railway traffic share is 0.3% in DKI and 8% for the traffic between Botabek and DKI; the bus traffic share is more than 50%.

Table 3.2 Transportation Mode Shares of Jakarta-Related Person Trips, 1985 (trips/day)

| Mode | Jakarta[2] Residents | | To/From[3] Botabek (Cordon Line Survey) | |
|---|---|---|---|---|
| Railway | 21,237 | 0.3% | 53,960 | 8.0% |
| Bus | 3,428,139 | 52.6% | 392,901 | 57.9% |
| Taxi | 67,833 | 1.0% | 676 | 0.1% |
| Private Vehicles 1) | 2,819,768 | 43.3% | 208,794 | 30.8% |
| Trucks | 175,695 | 2.7% | 22,391 | 3.3% |
| Total | 6,512,672 | 100.0% | 678,722 | 100.0% |

Source: ARSDS, 1985

Note: 1) Private vehicles include motorcycles.

2) ARSDS Home Interview Survey

3) ARSDS Cordon Line Survey

3) Railway traffic volume

The Central Line has the largest railway traffic volume, followed by the Eastern Line and the Western Lone.

The number of trains is the same as the traffic volume.

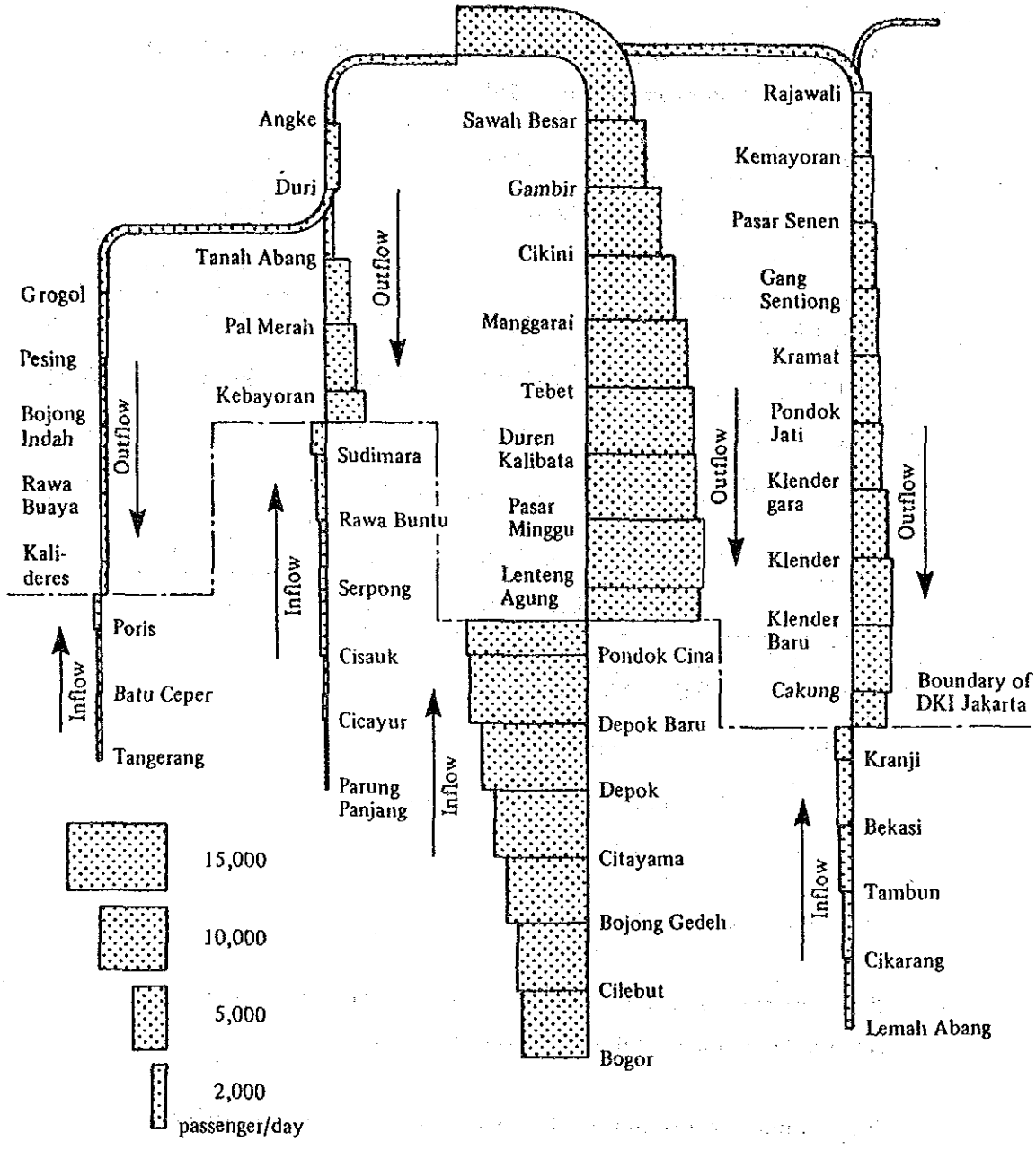



Fig. 3.2 Number of JABOTABEK Train Passengers by Section

Source: ARSDS Railway Survey, 1986

4) Operation head

The shortest operation head is that in the morning commutation time zone of the Central Line, and yet it is 23 minutes.

(2) Railway Transportation Problems

1) Train operation

- Numerous operating accidents
- Lengthy delays
- Slow scheduled speeds of trains
- Unsatisfactory train dispatching
- Most of the DCs are out of service due to engine trouble.

2) Railway facilities

- Track layout is unsuitable.
- Low platforms are unsuitable for commuting.
- Connecting passages cross the railway track at grade.
- Station buildings and arrangements of facilities are unsuitable for passenger flow.
- Station plazas are unsuitable for access.
- There are numerous level crossings and the volume of road traffic is high.
- Signalling and telecommunications equipment have become superannuated.

(3) Railway management

- The total length of PJKA - 6,458 km, total employee - 48,244 (as of 1987)

- The total revenue covers only about 60% of total expenses.

- The revenue in Jabotabek area accounts for 3 to 3.5% of the total revenue of PJKA, and yet its expenses account for 4 to 4.5% of the total expenses of PJKA.

- As for loss and profit before depreciation, the loss in Jabotabek area accounts for 7 to 11 % of the total loss of PJKA.

- In spite of the staff reductions and fare revisions, the balance of accounts is worsening.

2. Road and Bus Transportation in Jabotabek Area

(1) Present conditions

- DKI Road length - 3,038 km
- Bus network - 373 routes
- The only state enterprise of 8 bus operating units is projected loss.
- Bus types are large, medium and small. The numbers of registered bus fleets are about 11,000.
- Number of bus passengers - 3.4 million per day
- Major bus terminals in DKI - 14
- Number of passengers using the major terminals - 630,000

(2) Bus transportation problems

- Bus rides are very unreliable because bus operates without schedule and road traffic congestion is increasing.

- Buses are unsafe because of ruthless driving and loading/unloading of passengers without stopping.

- There is a need to allocate appropriate bus routes because of the overlapping routes with railway.

- The average peak hour running speed of buses declines.

3. Feeder Transportation in Jabotabek Area

. Road access to stations is poor.

. Station plazas are small, transfer facilities are inadequate, and safety is not maintained.

. Next to walking, small and medium buses are most commonly used to travel to and from railway stations.

. Access to railway station takes 20 - 30 minutes by bus.

. Majority of transit users do not possess private vehicles, thus railway users require feeder services.

## CHAPTER 4. Approach to Forming a Master Plan

### 1. Characteristics of the Guided MRT Systems

(1) Greater transportation capability than buses.

(2) Construction and running costs per user compares favourably with buses.

(3) More benefit to the national economy than motor vehicles

1) Substantial time-saving effect
2) Substantial energy-saving effect
3) Greater safety
4) Less air pollution

(4) Development finance

The introduction of a guided transportation system in a metropolitan area should be planned not only from a financial view point but in due consideration of the national economic benefits, with the financial support of the central or local government, when required .

### 2. Solving the Urban Traffic Problem in Jabotabek Area

The problem of urban traffic in Jabotabek area should be solved by the following matters.

(1) When investing in urban transportation in Jabotabek area, both the railway and the road system should be considered, and in each system, realistic levels of investment should be provided. After deciding the most efficient balance of investment for railway and road, improvement of the railway and other guided transportation means should be examined.

(2) Based on the forecasted demand, the existing railway facilities should be improved and modernized so that they will be fully

utilized, and when required, expansions in function should be examined.

(3) The railway feeder services should be improved so that there is satisfactory linkage with road transportation. Thus an integrated transportation system which utilizes both the railway and the road system should be established.

(4) For the main corridors not covered by the railway network, introduction of mass rapid guided transit system should be planned, when required.

## 3. Basic Methodology

### (1) Setting up of the alternative patterns

There are to be six alternative patterns formed by combinations of various railway improvement levels and road improvement levels for the integrated transportation system in 2005: three cases of railway improvement level and two cases of road improvement level.

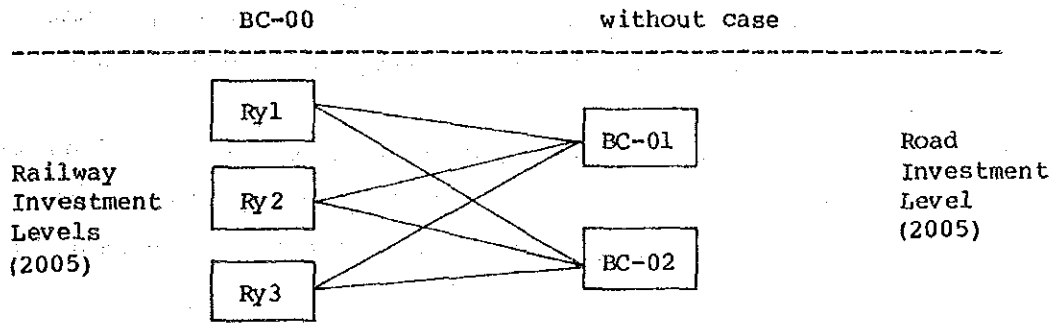



Fig. 4.1 Alternative Pattern Formed by Combination

Ry1 represents a minimum level of investment in the railway, Ry2, a medium investment level and Ry3, a high investment level. BC01 represents medium road investment levels and BC02, high investment levels. BC00 signifies the without cases.

Ry1: Minimum Development Case

Complete the minimum facilities necessary for achieving a 6-minutes interval on the C/L, 10-minutes interval on the Extended Loop Line, 15 minutes on the Serpong Line and 20 minutes on the Tangerang Line including following option "a" and "b" (completion aimed at 1992).

(a) On-going and committed projects

(b) Projects for Rationalized Excution Plan

Ry2: Medium Development Case

In addition to the facilities for Ry1, complete the necessary facilities for achieving the following intervals; 3-minutes on the C/L, 6-minutes on the Extended Loop Line, 10-minutes on the Serpong Line, and 15-minutes on the Tangerang Line.

Ry3: High Development Case

Maintain the same levels of service as Ry2 for an increased passenger. In addition to the facilities for Ry2, complete the Cibinong Line, and provide the necessary rolling stock.

BC-00 contains without cases and includes Ry0 projects that will be completed in 1992. A new mass transit system is also being considered for the mass transit corridor between Sudirman, Thamrin, and Kota.

BC-00: Without case (1992)

1. Ry0; a or b Option selected.
2. Completion of the traffic management program and parking policy implementation project, as well as an improved level of service in the bus transportation system
3. Completion of the on-going and committed road construction project within the JABOTABEK Region (JUTP, JUDP-1 and Toll roads), and the development of a mass transit system on the Blok M - Sudirman - Thamrin - Kota corridor.

BC-01: Medium Development Case (2005)

BC-00 with the following additional improvements:

1. Completion of the urban free-way network, i.e. the Inner Ring Road, Outer Ring Road and Horbour Road.
2. Further traffic management improvements within the Outer Ring Road, including the extension of the licensing scheme.
3. Construction of East/West Mass Transit Corridor from Kebon Jeruk, via Tanah Abang. Gambir, Pasar Senen and Pulo Gadung to new interchange with railway between Klender Baru and Cakung.
4. Upgrading of Blok M - Sudirman - Thamrin - Kota Mass Transit Corridor, and extension from Blok M to Pasar Minggu.
5. *Development of street system within East/West Jakarta and within* the Tangerang/Bekasi Core-Cities.

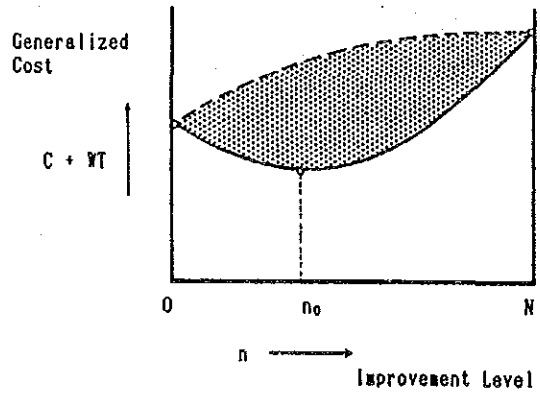
BC-02: High Development Case

BC-01 with the additional improvements:

1. Extension of Mass Transit Corridor from Kebon Jeruk to North Serpong from new station near Cakung to Pondok Gede.
2. Provision of the road/street system within the southeast/ southwest suburbs.

(2) Selection of the optimum alternative pattern

Calculate the generalized cost in 2005 for each alternative pattern, and select the alternative pattern having the lowest cost. A final decision will be made after seeking the overall judgement of Indonesian Government. (Fig. 4.2)




Where,

C: Construction cost + operation cost

W: Time value

T: Trip time

C + WT = generalized cost

Fig. 4.2 Improvement Level and Generalized Cost

## 4. Feeder Service

### (1) Main purpose

The object of feeder service planning will be mainly focus on bus transportation as for public transportation service, due to the efficiency transportation volume in serving a wide service area for each railway station.

- To realize integration of railway transport and bus transport by improving the feeder service

### (2) Major approach for improving the feeder services

- Improvement of access road, station plaza and parking area, bus bay
- Improvement of various facilities (pedestrian bridge, installing bus stops etc.) in order to reduce the transfer time
- Shifting of bus terminal to the railway stations or providing shuttle services between bus terminals and railway station

## Table 4.1 Railway Improvement Cases

| Improvement case | | | Project Item | Remarks |
|---|---|---|---|---|
| Ry0 (to be included in BC-00) | | | (a) or (b) items to be taken up from the below | |
| Ry1<br><br>Complete the minimum facilities necessary for achieving the service of 6 minutes interval on C/L, 10 minutes interval on Extended Loop Line, 15 minutes on Serpong Line and 20 minutes on Tangerang Line. | (b) | (a) | 1. Track elevation and Automatic signalling of C/L (Kota-Mri)<br>2. Automatic signalling on E/L.<br>3. Automatic signalling on W/L.<br>4. Electrification and Automatic signalling on Serpong Line. (including Srp.Sub-Depot)<br>5. Electrification and Automatic signalling on Bekasi Line. (including Bks.Sub-Depot)<br>6. Double tracking. Electrification and Automatic Signalling on C/L. (Mri-Dp)<br>7. Automatic signalling for single track on C/L (Mri-Boo)<br>8. Improvement of Kampung Bandan Station.<br>9. Improvement of feeder service (Station plaza included in no. 1.5.6)<br>10. Establishment of Train operating system.<br>11. Rolling stock (EC, 44 cars) | (a)<br>On-going and committed projects |
| | | | 12. Grade separation at Manggarai Station.<br>13. Automatic signalling on Tangerang Line. (including Tng.Sub-Depot)<br>14. Improvement of passenger handling facilities, such as platform elevation and widening. (Jng, Pse, Tnb)<br>15. Investment of on Manggarai workshop. (2nd step)<br>16. Construction of Depok Depot.<br>17. Increase of necessary number of rolling stock. | (b)<br>Projects for Rationalized<br><br>Execution Plan |
| | | | 18. Double tracking. Electrification and Automatic Signalling on C/L (Dp-Boo)<br>19. Improvement of feeder service (station plaza, bus bay, approach roads, etc.)<br>20. Increase of necessary number of rolling stock. | |
| Ry2<br><br>Complete the necessary facilities for achieving the service level of 3 minutes interval on C/L, 6 minutes on Extended Loop Line, 10 minutes on Serpong Lone, 15 minutes on Tangerang Line. | | | In addition to the completion of the facilities of Ry1, the following facilities will be completed.<br><br>1. Relocation of Kota-Station.<br>2. Construction of car-depot in relation to Kota-Station.<br>3. Track elevation of E/L (Kota-Gangsentiong)<br>4. Flyover on W/L.<br>5. Improvement of passenger handling facilities.<br>6. Construction of new station.<br>7. Improvement of feeder service (station plaza, bus bay, approach road, etc.)<br>8. Electrification on Tangerang Line.<br>9. Double Tracking of Serpong Line.<br>10. Increase of necessary number of rolling stock. | |
| Ry3<br><br>Maintain the same levels of service as Ry2 for increased Passenger. | | | In addition to the completion of the facilities of Ry2, the following will be completed.<br><br>1. Improvement of other facilities such as small stations.<br>2. Construction of Cibinong Line.<br>3. Increase of necessary number of rolling stock. | |

## CHAPTER 5. Details of Alternative Patterns

### 1. Evaluation of the a, b Option (completion aimed at 1992)

After taking into account the operating plan, facility plan and feeder service of the a, b, Option, economic and financial evaluation were carried out using "a" as the "without" case in order to determine the alternative case which should be completed at 1992.

(1) Economic evaluation

"Economic Internal Rate of Return (EIRR)" was adopted as the evaluation criteria.

1) Preconditions of the analysis

a) Project life
Twenty years from the completion of Option "b"

b) Pricing date
Prices of April 1989

c) Foreign exchange rate
1 US dollar = 1758 Indonesian Rupiahs

d) Result of the economic analysis

Table 5.1 Result of the Analysis on the a, b Option

| | | EIRR (%) |
|---|---|---|
| 1) Base Case | | 22.8 |
| 2) Investment | 10% up | 21.2 |
| 3) Benefit | 10% down | 21.0 |
| 4) 2) + 3) | | 19.5 |

(2) Financial evaluation

"Financial Internal Rate of Return(FIRR)" was adopted as the evaluation criteria.

1) Preconditions of the analysis

Same as the economic evaluation

2) Result of the financial analysis

Table 5.2 Result of the Financial Analysis on the a, b, Option

| FIRR (%) | | |
|---|---|---|
| 1) Base Case | | 5.07 |
| 2) Investment | 10% up | 4.30 |
| 3) Revenue | 10% down | 3.81 |
| 4) 2) + 3) | | 3.11 |

(3) Conclusion

With the effective use of low interest funds through inter governmental cooperation, and a standard test discount ratio in Indonesia of about 15%, "b" Option is feasible both from economical and financial point of view.

2. Railway Alternative Case (Ry1, Ry2, Ry3)

Costs were calculated by determining an operating plan, facilities plan and feeder service for Ry1, Ry2, and Ry3. Train head by each line is as following Table 5.3:

Table 5.3 Train Head During Peak Hour (2005)

Unit: minutes

| Line | Case | Ry1 | Ry2 | Ry3 |
|---|---|---|---|---|
| Central Line Jak - Dp | | 4 | 3.5 | 3.5 |
| Western, Eastern Line | | 8 | 8 | 8 |
| Bekasi Line | | 4 | 4 | 4 |
| Serpong Line | | 16* | 25** | 25** |
| Tangerang Line | | 20 | 17 | 17 |
| Tanjungpriok Line | | 20 | 15 | 12 |

* Single track ** Double track

3. Road Alternative Case (BC-00, BC-01, BC-02)

BC-01 and BC-02 of road alternative case as mentioned in Chapter 4 include construction of East/West and North/South Mass Transit Corridor.

(1) BC-01

In addition to road improvement,

. Construction of East/West Mass Transit Corridor
From Kebon Jeruk, via Tanah Abang, Gambir, Pasar Senen and Pulo Gadung to new interchange with railway between Klender and Cakung.

. Construction of North/South Mass Transit Corridor
From Blok M - Sudirman - Thamrin - Kota and extension from Blok M to Passar Minggu

(2) BC-02

In Addition to road improvement,

. Extension of Mass Transit Corridor from Kebon-Jeruk to North Serpong from new station near Cakung to Pondok Gede.

(3) The routes for MRT were chosen based on the agreement between JICA Study Team and the counterpart.

4. Selection of MRT Mode

For the main corridors (North-South and East-West) for which a MRT system is to be planed, an appropriate system has been chosen in consideration of the demand forecast.

(1) Demand forecast for MRT

*Table 5.4 Demand Forecast of Mass Transit*

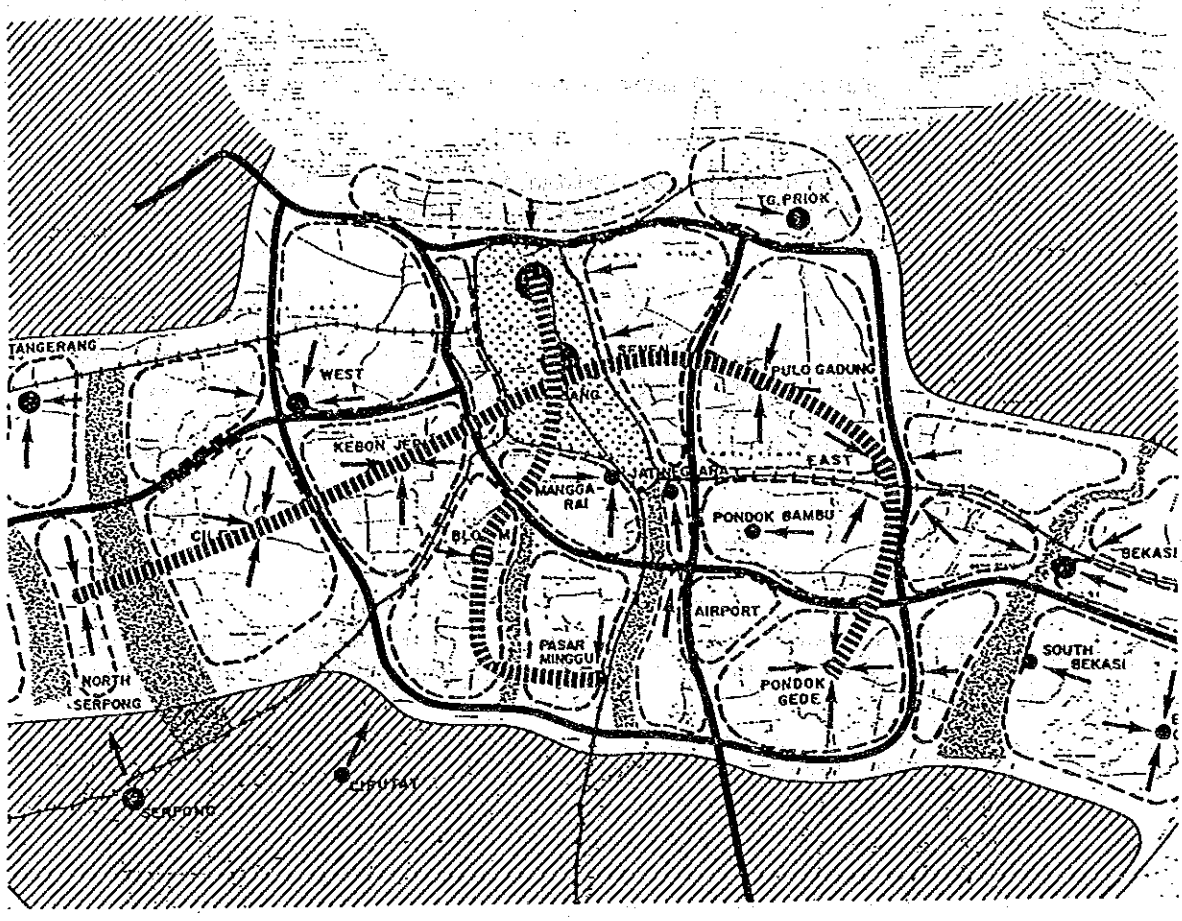
A. Maximum Transportation Volume in Both Directions in One Day (Thousand persons/day) (Section Traffic Volume)

| Case | BC-01 | | | BC-02 | | |
|---|---|---|---|---|---|---|
| | Ry1 | Ry2 | Ry3 | Ry1 | Ry2 | Ry3 |
| N-S Line | 442.1 | 425.5 | 424.3 | 419.5 | 409.6 | 408.3 |
| E-W Line | 411.8 | 383.9 | 373.0 | 433.7 | 412.0 | 410.7 |

B. Maximum Transportation Volume in One Direction During Morning Peak Hours (Thousand persons/hour) (Sectional Traffic Volume)

| Case | BC-01 | | | BC-02 | | |
|---|---|---|---|---|---|---|
| | Ry1 | Ry2 | Ry3 | Ry1 | Ry2 | Ry3 |
| N-S Line | 21.0 | 20.2 | 20.2 | 19.9 | 19.5 | 18.4 |
| E-W Line | 19.6 | 18.2 | 17.7 | 20.6 | 19.6 | 19.5 |

The average during 3 peak hours in the morning are given in B. (A x 0.0475)




LEGEND

- Metropolitan Center
- Sub Center
- Secondary Center
- Green Preservation/ Recreation Zone
- Central Area
- Traffic Regulation Zone
- Limited Development Zone
- Freeway
- Railway
- Mass Transit Corridor

(A) Kota - Thamrin - Dukuh - Sudirman - Block M - Passar Minggu.

(B) North Serpong - Ciledug - Kebon Jeruk - Tanah Abang - Passar Senen - Pulo Gadung - East Metropolitan Center - New Railway Station - Pondok Gede.

Fig. 5.1 Routes of Mass Transit Corridor

(2) Comparison of modes

Bus and various guided transport system (mono-rail, linear motor car, LRT, AGT, conventional railway system) were compared from technical, economical and social points of view, and LRT was selected in this survey after the overall evaluation.

5. Cost Estimation

Estimation of Construction Cost

Estimation of the construction cost was made according to the following.

(1) The engineering work cost was estimated as of 1989, and the subsequent rise of prices was not taken into account.

(2) The engineering work cost was estimated upon the existing investigation data and the data furnished by Indonesia.

(3) The imported machines and materials were assumed to be free from tax.

(4) The engineering work cost was classified into the foreign and local currencies.

(5) The engineering work cost includes the investigation, design and work management cost and reserve expense.

(6) The exchange rate was assumed to be RP 13.4 = ¥ 1 (April 1989).

Result of Estimation of Construction Cost

The construction cost is as shown in Table 5.5.

Table 5.5 Cost Estimation for Each Case

(1) Railway Case (Rp.Million)

| IMPROVEMENT CASE | FOREIGN | LOCAL | Total |
|---|---|---|---|
| a | 823,800 | 256,700 | 1,080,500 |
| b | 1,393,100 | 340,300 | 1,740,400 |
| R y - 1 | 2,093,450 | 389,900 | 2,483,350 |
| R y - 2 | 2,940,660 | 817,400 | 3,758,060 |
| R y - 3 | 3,840,130 | 933,200 | 4,773,330 |

(2) Base Case (Rp.Million)

| IMPROVEMENT CASE | | FOREIGN | LOCAL | Total |
|---|---|---|---|---|
| BC00 | Road | 438,800 | 421,600 | 860,400 |
| | Total | 438,800 | 421,600 | 860,400 |
| BC01 | Road | 1,496,200 | 1,437,400 | 2,933,600 |
| | Mass Transit | 3,003,400 | 1,803,800 | 4,807,200 |
| | Total | 4,499,600 | 3,241,200 | 7,740,800 |
| BC02 | Road | 1,496,200 | 1,437,400 | 2,933,600 |
| | Mass Transit | 3,748,600 | 2,165,200 | 5,913,800 |
| | Total | 5,244,800 | 3,602,600 | 8,847,400 |

# CHAPTER 6. Transportation Demand Forecast

## 1. Estimation Process

Future transportation demand was estimated as follows.

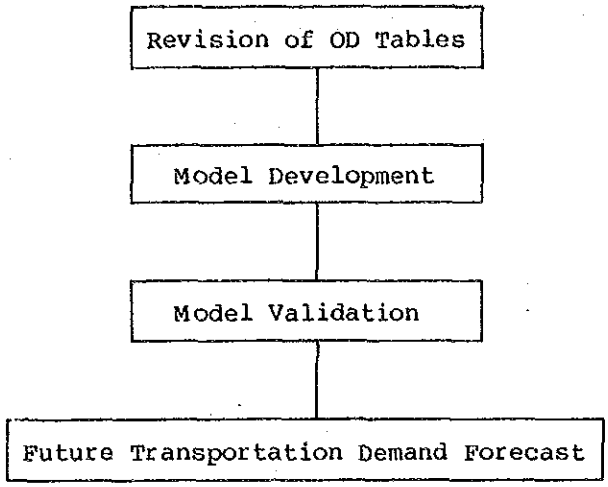



Fig. 6.1 Procedure of Demand Forecast

A survey on railway and bus passengers was conducted to revise OD tables.

## 2. Forecast Cases

The demand forecasts are for 1992 and 2005. The forecast cases for 1992 were forecast, as b Option-"with", and a Option-"without". For 2005, three railway network cases and two road network cases, giving a total of six cases, were forecast as "with", taking the 1992 network as "without". Eleven cases in total were prepared considering network combinations and the forecast year.

*Combination of six cases are as follows.*

| | | | |
|---|---|---|---|
| 051: | Ry1 + BC01 | 054: | Ry1 + BC02 |
| 052: | Ry2 + BC01 | 055: | Ry2 + BC02 |
| 053: | Ry3 + BC01 | 056: | Ry3 + BC02 |

Table 6.1 Demand Forecast Cases

| Case | Year | Railway | | | | | | Road | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1988 | RY a | RY b | RY 1 | RY 2 | RY 3 | 1988 | BC 00 | BC 01 | BC 02 |
| Analysis | 1988 | x | | | | | | x | | | |
| 92a | 1992 | | x | | | | | | x | | |
| 92b | 1992 | | | x | | | | | x | | |
| 05a | 2005 | | x | | | | | | x | | |
| 05b | 2005 | | | x | | | | | x | | |
| 051 | 2005 | | | | x | | | | | x | |
| 052 | 2005 | | | | | x | | | | x | |
| 053 | 2005 | | | | | | x | | | x | |
| 054 | 2005 | | | | x | | | | | | x |
| 055 | 2005 | | | | | x | | | | | x |
| 056 | 2005 | | | | | | x | | | | x |

3. Result of Forecast

As the results of the forecast, the total number of trips was forecast to increase from an estimated 7.09 million trips in 1988 to 8.53 million trips in 1992, and 13.46 million trips in 2005. The total number of railway trips differs according to the case, and for 2005 it is estimated at a low of 1.63 million trips and a high of 2.02 million trips, which accounts for 12 - 15% of the total number of trips. Furthermore, this accounts for 21 - 26% of the number of trips on public transport, which itself accounts for 58% of the total number of trips.

Table 6.2 Transportation Demand Forecast Results

| | - Number of Passengers - | | | | | (1000 passengers) | |
|---|---|---|---|---|---|---|---|
| Case | Total | Public | Railway | Bus | Private | M-cycle | Sedan |
| ARSDS | 5516 | 3099 | 115 | 2984 | 2417 | 930 | 1487 |
| 1988 | 7089 | 3432 | 217 | 3215 | 3657 | 1038 | 2619 |
| 1992a | 8530 | 4243 | 815 | 3428 | 4287 | 1322 | 2965 |
| 1992a' | 8530 | 4243 | 421 | 3822 | 4287 | 1322 | 2965 |
| 1992b | 8531 | 4244 | 868 | 3376 | 4287 | 1322 | 2965 |
| 05a | 13462 | 7745 | 1492 | 6253 | 5717 | 2207 | 3510 |
| 05a' | 13461 | 7744 | 421 | 7323 | 5717 | 2207 | 3510 |
| 05b | 13461 | 7744 | 1629 | 6115 | 5717 | 2207 | 3510 |
| 051 | 13461 | 7744 | 1741 | 6003 | 5717 | 2207 | 3510 |
| 052 | 13462 | 7745 | 1995 | 5750 | 5717 | 2207 | 3510 |
| 053 | 13462 | 7745 | 2016 | 5729 | 5717 | 2207 | 3510 |
| 054 | 13462 | 7745 | 1709 | 6036 | 5717 | 2207 | 3510 |
| 055 | 13462 | 7745 | 1968 | 5777 | 5717 | 2207 | 3510 |
| 056 | 13462 | 7745 | 1991 | 5754 | 5717 | 2207 | 3510 |

Note 1:The 1992a' and 05a' figures show capacity constrained demand on railway.
Note 2:The 1988 figures show the result of model validation.

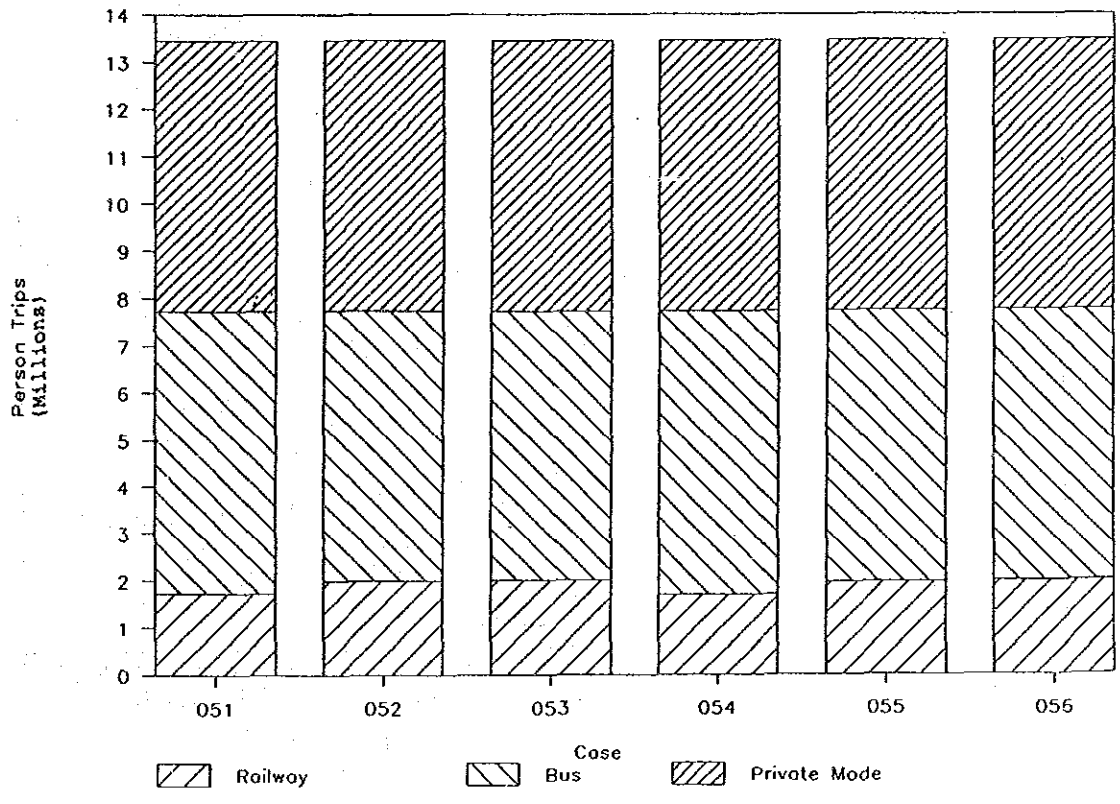



Fig. 6.2 Future Demand by Mode and by Case

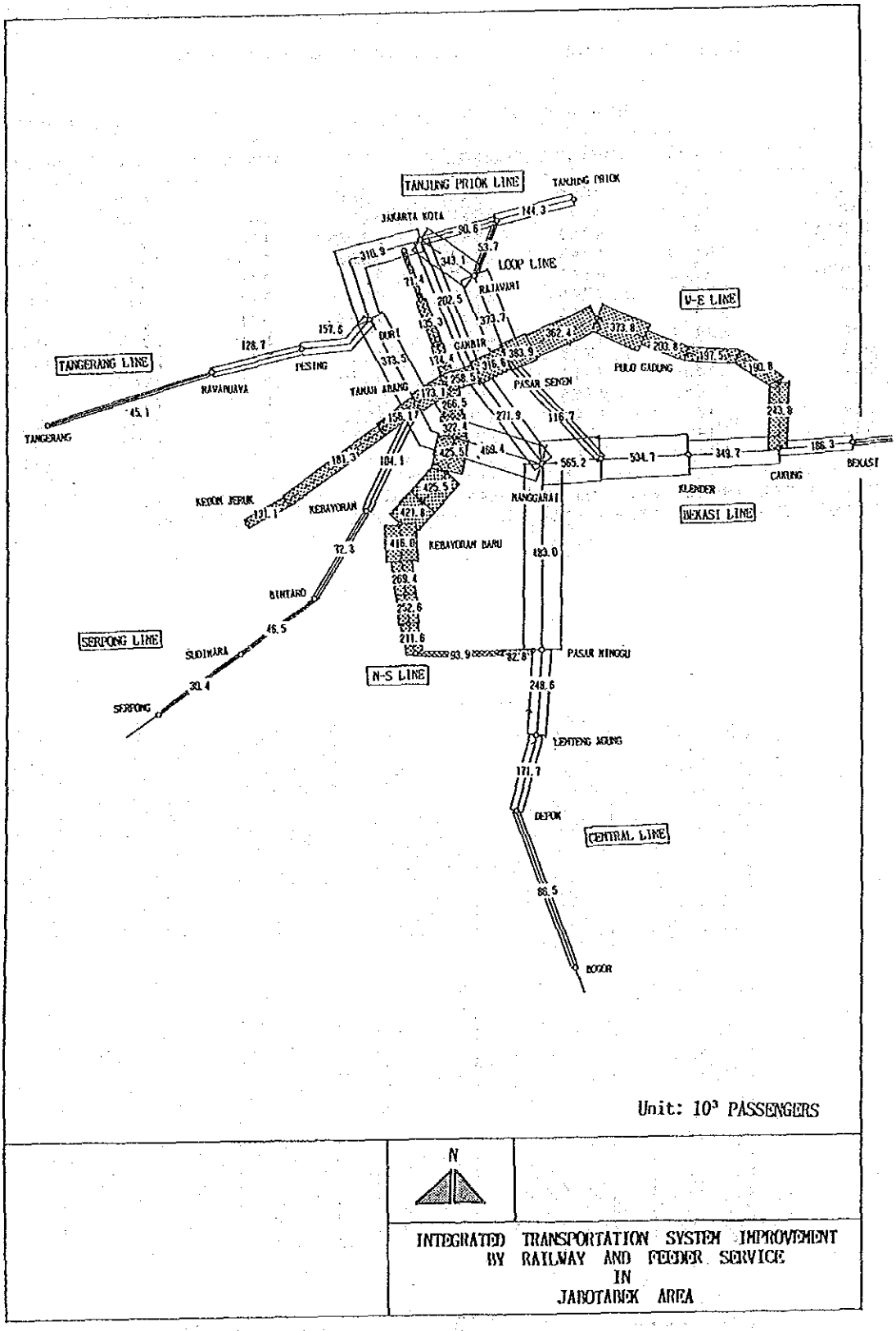



Fig. 6.3 No. of Railway Passengers

(Case 052: Ry2, BC01) (2005)

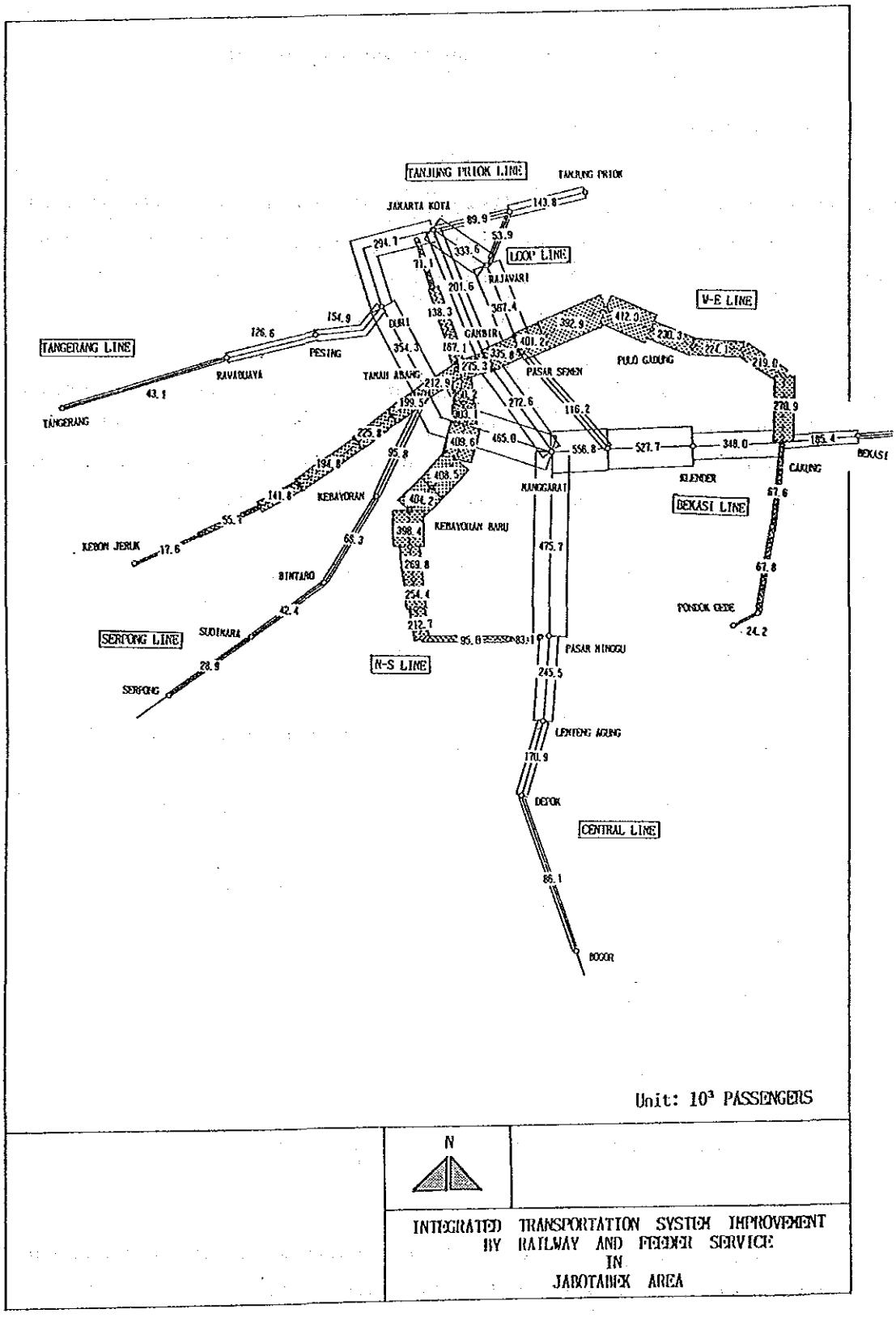



Fig. 6.4 No. of Railway Passengers
(Case 055: Ry2, BC02) (2005)

# CHAPTER 7. Selection of Optimal Patterns

## 1. Generalized Cost Approach

In order to selest the optimum alternative pattern among 6 alternatives for Master Plan, a generalized cost will be calculated for each alternative pattern at 2005. A generalized cost will be used as an evaluation index for comparison of alternative patterns.

The outline of calculation method of generalized cost will be described in the following paragraphs. BC00 will be considered as "without" case and other 6 alternative patterns will be considered as "with" cases. Generalized cost will be calculated as the difference between "with" and "without" cases.

Generalized cost is given by the following equation:

$$GC_i = IC_i + OC_i + VT_i - B_i$$

where, $GC_i$ = annualized generalized cost of alternative i (in 2005)

$IC_i$ = annual investment cost of alternative i (in 2005)

$OC_i$ = annual operation and maintenance cost of alternative i (in 2005)

$T_i$ = annual total travel time of alternative i (in 2005)

V = time value per passenger

$B_i$ = other benefits of alternative i (in 2005)

$GC_i$, $IC_i$, $OC_i$, $T_i$, $B_i$ above will be calculated as the difference from the corresponding values for BC00 "without" case.

2. *Generalized Cost Comparison*

Fig. 7.1 is a comparison of the annual average investment cost and annualized generalized cost saving of the six alternative patterns.

Comparisons were also made with respect to the other economy, promotion of urban development, and traffic integration of each alternative pattern.

Pattern 052 or 055 is generally superior, but 052 (Ry2 + BC01) is selected to hold down the scale of investment.

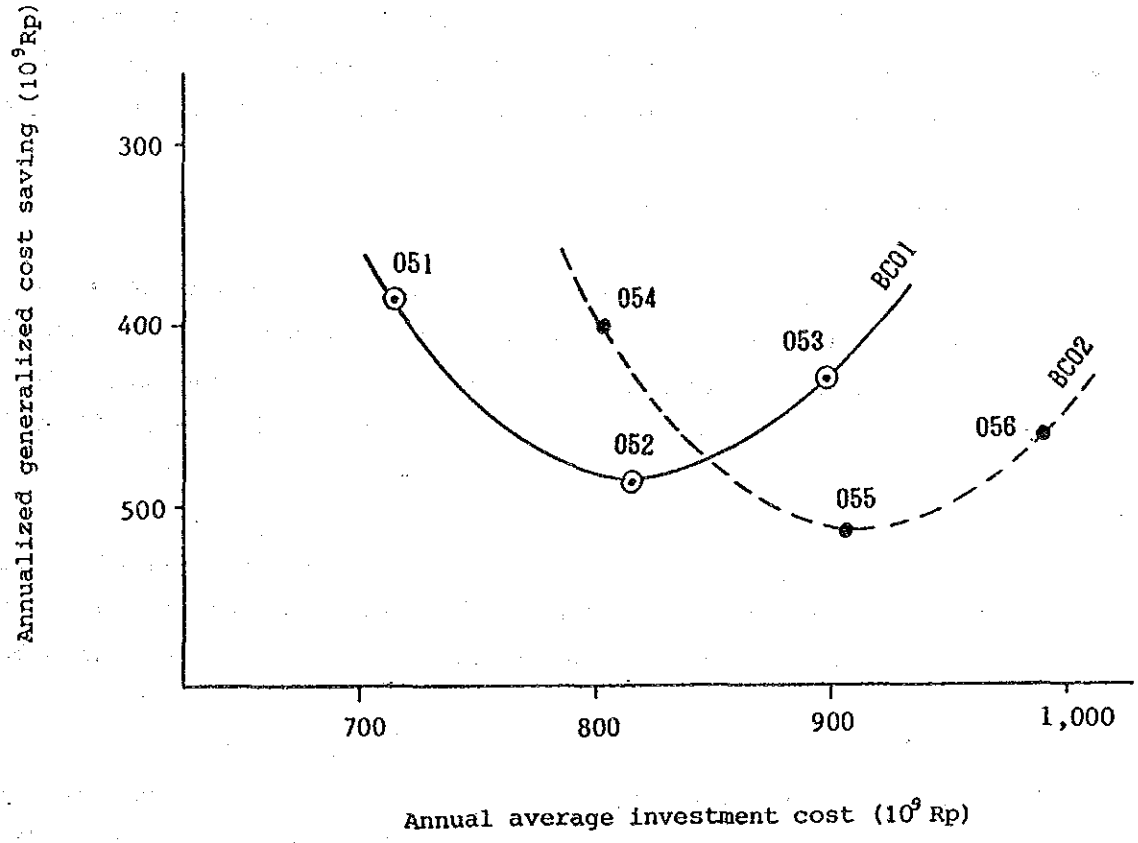



Fig. 7.1 Annualized generalized cost saving vs. annual average investment cost for each alternative pattern

# CHAPTER 8. Drawing-up of the Master Plan

## 1. Implementation Schedule of the Master Plan

The investment schedule has been drawn up taking into account the urgency of the respective projects, the smoothing of annual investment, and the results of the demand forecast.

## 2. Selection of Urgent Projects

The improvement of feeder services, improvement of station facilities and track elevation of the Eastern Line were selected as projects requiring urgent development. The Western Line flyover, although it is urgent, is a road improvement project, so it was decided not include it in the F/S.

(1) Improvement of feeder services

1) According to the results of the forecast, the number of railway trips under BC01 + Ry2 will increase by 7.5 times in 1992 (868,000 trips/day), and by 17.3 times in 2005 (1,995 million trips/day), respectively when compared with the number in 1985 (115,000 trips/day).

Station plazas and access roads linking railway stations with city areas or trunk roads are under-developed, and unless they are improved urgently, railways cannot fulfill their functions as urban transport.

2) Improvement priority is determined by considering railway improvement program, the number of passengers that each railway station is expected to serve in future, the number of passengers served at present by each station and the volume of rail traffic between zones.

(2) Improvement of Station Facilities

Station facilities for improvement are chosen in generally the same way as the feeder service facilities.

(3) Track Elevation of Eastern Line

An extremely large volume of road traffic crosses the Eastern and Western Lines, and the slowness of the trains affects punctuality of railway operation. In 2005 the volume of road traffic crossing these two lines will increase two-fold, and if the interval between trains is reduced to six minutes, road traffic congestion caused by vehicles being held up at railway crossings will severely affect the city's functions.

It is estimated that in 1997, the average road traffic volume per one level crossing at sections where track elevation is to be carried out along the Eastern Line will reach the same level as the average traffic volume per one crossing at the sections of track elevation along the Central Line in 1993 when it will be completed.

Consequently, track elevation of the Eastern Line is required urgently from the aspect of overall urban development.

Through discussion with the counterpart team, it was decided to consider not only the continuous track elevation of the Eastern Line but to consider the posibility of subway and flyover.

Investment schedules for railway and road improvement are shown in Table 8.1 and 8.2.

Table 8.1 Investment Schedule for Railway Improvement (Ry2)

(Unit: $10^6$ Rp, $10^9$ Rp)

| | Project Item | Investment Cost ($10^6$Rp) | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Double tracking Electrification and Automatic Signalling on C/L (Dp -Boo) | 96,900 | | | | | | | | | | | ..... | ..... | ═══ | ═══ | ═══ | |
| 2 | Improvement of Feeder Service | (65,390) 19,970 | ..... | ..... | ..... | ═══ | ═══ | ═══ | ═══ | ═══ | ═══ | ═══ | ═══ | ═══ | ═══ | ═══ | ═══ | |
| 3 | Relocation of Kota -Station | (339,730) 37,710 | | | | | | ..... | ..... | ..... | ═══ | ═══ | ═══ | ═══ | ═══ | | | |
| 4 | Construction of Car-depot in relation to Kota -Station | (32,280) 36,160 | | | | ..... | ..... | ..... | ═══ | ═══ | ═══ | | | | | | | |
| 5 | Track elevation of E/L | (325,600) 42,600 | ..... | ..... | ..... | ═══ | ═══ | ═══ | ═══ | ═══ | | | | | | | | |
| 6 | Flyover on N/L | (76,410) 38,030 | ..... | ..... | ..... | ═══ | ═══ | ═══ | ═══ | ═══ | | | | | | | | |
| 7 | Improvement of Station Facilities | 62,580 | ..... | ..... | ..... | ═══ | ═══ | ═══ | ═══ | ═══ | ═══ | ═══ | ═══ | ═══ | ═══ | ═══ | ═══ | |
| 8 | Construction of new Station | 4,200 | | | | | ..... | ═══ | ═══ | | | | | | | | | |
| 9 | Electrification on Tangerang Line | 37,620 | | | | | | | | | | | ..... | ..... | ═══ | ═══ | | |
| 10 | Double Tracking of Serpong Line | 99,380 | | | | | | | | | | ..... | ..... | ═══ | ═══ | ═══ | ═══ | |
| 11 | Rolling stock ( EC : 376 Cars) | 702,440 | | | | ═══ | ═══ | ═══ | ═══ | ═══ | ═══ | ═══ | ═══ | ═══ | ═══ | ═══ | ═══ | |
| | Total | (840,010) 1,177,670 | | | | (58) 88 | (108) 100 | (108) 102 | (115) 88 | (70) 81 | (47) 75 | (64) 64 | (94) 73 | (94) 89 | (74) 140 | (4) 139 | (4) 141 | |

Note: The doted lines mean preliminary works.
Figures in parenthese are borne by city side, others are borne by railway side.

Table 8.2 Investment Schedule for Road Improvement (BC01)

(Unit: $10^6$ Rp, $10^9$ Rp)

| Project Item | Investment Cost ($10^6$Rp) | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Road Construction | 2,933,600 | ..... | ..... | | | | | | | | | | | | | | |
| Mass Transit | 4,807,200 | ..... | ..... | ..... | ..... | ..... | | | | | | | | | | | |
| Total | 7,740,800 | | | 204 | 210 | 210 | 890 | 890 | 890 | 900 | 900 | 900 | 900 | 280 | 280 | 280 | |

Note; The doted lines mean preliminary works.

# FEASIBILITY STUDY

# FEASIBILITY STUDY

## CHAPTER 1. Introduction

This is a summary of the Volume II, which contains the major results of the Feasibility Study (F/S) of Urgent Projects selected from the Master Plan.

The following three urgent Projects for the F/S were selected for F/S through agreements of Indonesian Side.

- Feeder Service improvement
- Station facilities improvement
- Grade separation of the Eastern Line

Feeder service improvement and station facilities improvement involve the same stations, and can be combined into one project. As a result there are two projects taken up in the Feasibility Study.

(1) Feeder service improvement

Through consultation with the counterpart team, 21 urgent stations were chosen from the 53 total existing stations of the Jabotabek railway and the 10 proposed new stations. Of these 21 stations, 3 stations were chosen as the most important stations for which the F/S should be carried out. It was also agreed that a Pre F/S should be conducted for the remaining 18 stations. These 21 stations are listed below.

Angke, Bekasi, Cikini, Depok Baru, Dukuh, Duren Kalibata, Gambir, Jakarta Kota, Jatinegara, Kebon Pedes, Kemayoran, Klender, Manggarai, New Kampung Bandan, Pasar Minggu, Pasar Senen, Sawah Besar, Tanah Abang, Tanjung Priok, Palmerah, Kebayoran

Of these, Pasar Senen, Jatinegara and Kemayoran were chosen as the three stations to be taken up in the F/S.

(2) Station facilities improvement

Station facilities to be improved are closely related to feeder services, therefore it would be effective to make the improvements of station facilities simultaneously with the improvements in feeder services. Thus, the same 21 stations for feeder service improvement were chosen as urgent for station facilities improvement, and the same three stations, namely Pasar Senen, Jatinegara and Kemayoran as the objectives of the F/S and the same remaining 18 stations as the objectives of Pre F/S. (Two stations out of those 18 stations will be improved by another plan.)

(3) Grade separation of the Eastern Line

Through discussion with the counterpart team, it was decided to consider not only the continuous track elevation of the Eastern Line but to consider the possibility of subway and flyover. Further it was decided that with respect to continuous track elevation plan, the continuous track elevation southward over Gangsentiong Station to about Jatinegara should be added. That is, a comparative examination would be made of:

- Subway
- Flyover
- Continuous track elevation
  near Kota - near Gangsentiong
  near Kota - near Jatinegara

# CHAPTER 2. Transportation Demand Forecast

## 1. General

Transportation demand forecasts were conducted for the two feasibility studies and one preliminary feasibility study. They are the "Eastern Line Grade Separation Project", "Feeder Service and Station Facilities Improvement Project for High Priority Stations" and the "Feeder Service and Station Facilities Improvement Project for 16 Other High Priority Stations", respectively.

The methodology and models used in these studies are almost as common as the master plan formation study presented in the Master Plan.

A socio-economic framework of the Jabotabek area in the year of 2005 is common to the master plan formation study. The frameworks for intermediate target years were not estimated, because trip tables for the target years were forecasted by direct interpolation of the estimated 2005 and 1992 trip tables.

## 2. Feeder Service and Station Facilities Improvement for High Priority Stations

### (1) General

This project aims to improve the existing service level of feeder services and station facilities. Three stations were selected to measure the viability of the improvement project: Pasar Senen, Jatinegara and Kemayoran Stations. The difference from the third project is the accuracy of the cost estimation and the reduced time estimation.

### (2) Premises

Target years of the demand forecast were 1995 and 2005. Table 2.1 shows the forecast cases for the assumed railway, bus and road networks and target years.

Table 2.1 Demand Forecast Cases for Feeder Service and Station Facilities Improvement

| Case | Year | Transportation Network | | |
|---|---|---|---|---|
| | | Rail | Bus | Road |
| F950 | 1995 | 92B | 1992 | BC00 |
| F050 | 2005 | 92B | 1992 | BC00 |
| F95W | 1995 | 92F | 1992 | BC00 |
| F05W | 2005 | 92F | 1992 | BC00 |

Note: Railway network 92B represents the service level of Option "b", while 92F represents completion of feeder improvement in addition to the 92B service level.

(3) Forecast results

Table 2.2 shows the results of forecasts by the cases.

Table 2.2 Forecast Results by Case (000 trips)

| Case | Year | Public | Railway | Bus | Private | M-cycle | Seden |
|---|---|---|---|---|---|---|---|
| F950 | 1995 | 5052 | 1089 | 3963 | 4701 | 1531 | 3170 |
| F050 | 2005 | 7745 | 1810 | 5934 | 5716 | 2207 | 3510 |
| F95W | 1995 | 5052 | 1122 | 3929 | 4701 | 1531 | 3170 |
| F05W | 2005 | 7745 | 1864 | 5880 | 5716 | 2207 | 3510 |

With completion of this project, the number of railway passengers would increase by 33,000 and 54,000 by 1995 and 2005 respectively.

3. Eastern Line Grade Separation

(1) Traffic count survey

1) General

Regarding the road vehicle traffic demand forecast, a traffic count survey at the railway level crossings between Jakarta Kota and Jatinegara Station was carried out to obtain information on the existing traffic volume at the crossings.

The survey was conducted on Oct. 3, 4 and 5 in 1989 over 16hours from 6 a.m. to 10 p.m.

The names of the roads of the level crossings are given below.

1 Jl. Manggadua
2 Jl. Gunung Sahari
3 Jl. Industri
4 Jl. Angkasa
5 Gang Spoor
6 Jl. Garuda
7 Jl. Kepu Selatan
8 Jl. Jend. Suprapto
9 Jl. Tanah Tinggi
10 Jl. Kramat Sentiong
11 Jl. Percetakan Negara
12 Jl. Salemba Tengah
13 Jl. Pramuka
14 Jl. Tegalan
15 Jl. Achmad Dahlan

2) Survey results

Fig. 2.1 shows daily traffic volume (16 hours) in passenger car units (PCU) by crossing. Most crossings have daily traffic volume of more than 10 thousand PCU except Gang Spoor and Jl. Tegalan. They serve mainly pedestrians and non-motorized vehicles such as bicycles and becak. Five if the fifteen crossings have more than 50 thousand PCU daily.

Fig. 2.2 shows vehicle type by crossing. Gang Spoor (No. 5) and Jl. Tegalan (No. 14) indicate a greater proportion of pedestrians, including non-motorized traffic, while Jl. Pramuka (No. 13), Jl. Percetakan Negara (No. 11). Jl. Gunung Sahari (No. 2), Jl. Angkasa (No. 4), Jl. Kepu Selatan (No. 7) and Jl. Jend. Suprapto show a greater proportion of motorized traffic.

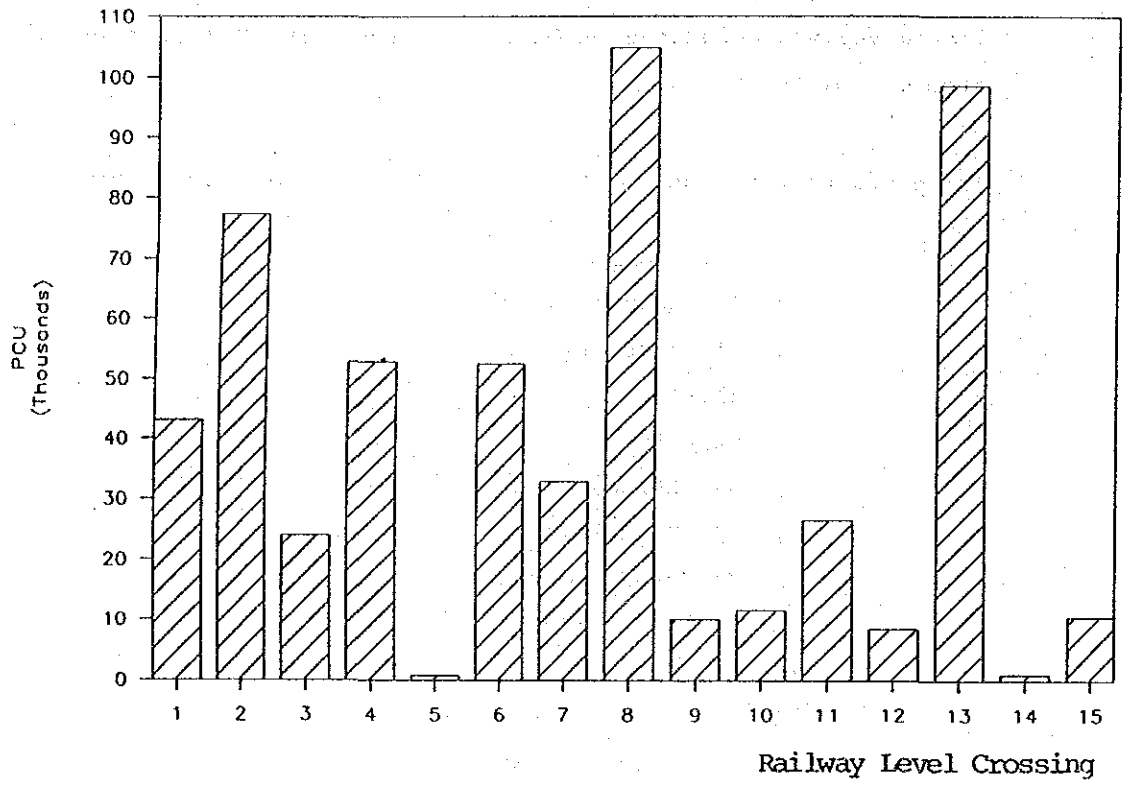



Fig. 2.1 Traffic Volume at Railway Level Crossings

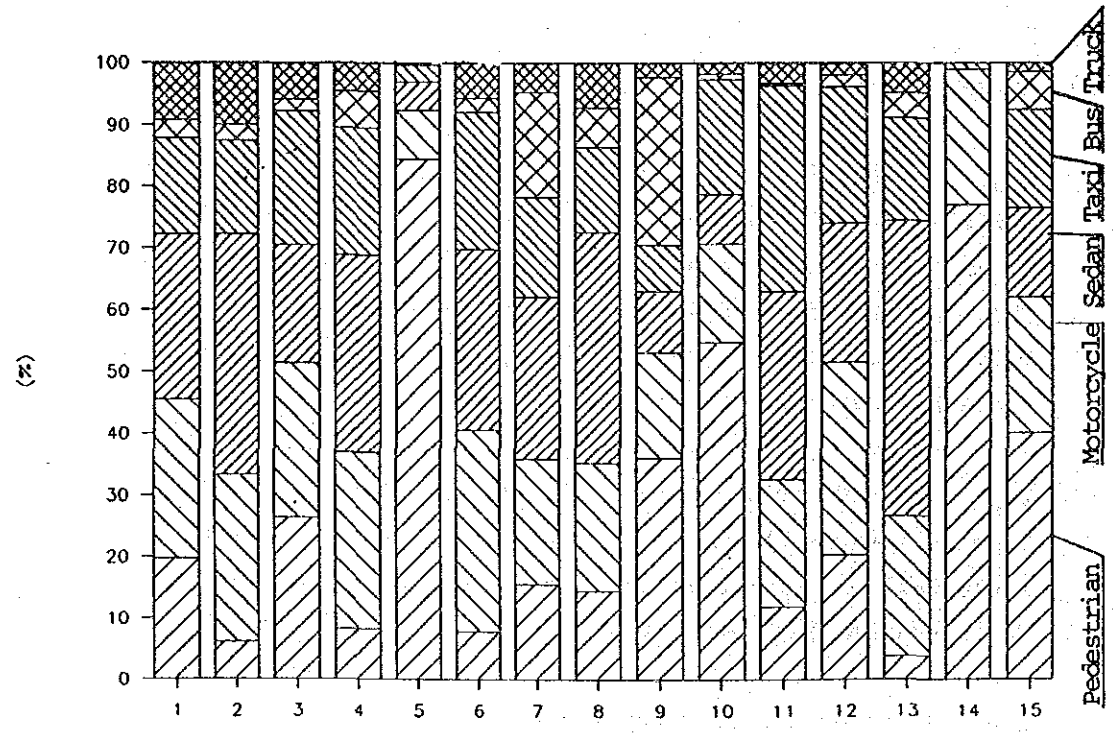



Fig. 2.2 Vehicle Type

(2) Premises

Target years of the demand forecast were 1998 and 2005. Table 2.3 shows the forecast cases.

Table 2.3 Demand Forecast Cases for Eastern Line Grade Separation

| Case | Year | Transportation Network | | |
|---|---|---|---|---|
| | | Rail | Bus | Road |
| E98 | 1998 | 92B' | 1992 | BC00 |
| E05 | 2005 | 92B' | 1992 | BC00 |

Note: Railway network 92B' includes the Option "b" projects and the feeder service and station facilities improvement project up to 1997.

(3) Forecast results

Table 2.4 shows the results of the forecast cases.

Table 2.4 Forecast Results by Case (000 trips)

| Case | Year | Public | Railway | Bus | Private | M-cycle | Seden |
|---|---|---|---|---|---|---|---|
| F98 | 1998 | 5860 | 1464 | 4395 | 5064 | 1737 | 3326 |
| E05 | 2005 | 7745 | 2065 | 5679 | 5716 | 2207 | 3510 |

Furthermore the future road vehicle traffic volumes in the target years are estimated for each level crossings.

Table 2.5 Traffic Volume at Railway Crossings in 1988

(Both Directions/day)

| | Name of Road | Pede-strian | Motor-cycle | Sedan | Bus | Truck |
|---|---|---|---|---|---|---|
| 1 | Jl. Manggadua | 16894 | 16006 | 33347 | 2478 | 12954 |
| 2 | Jl. Gunung Sahari | 6359 | 28156 | 57044 | 2832 | 13097 |
| 3 | Jl. Industri | 11566 | 11814 | 17419 | 915 | 2544 |
| 4 | Jl. Angkasa | 5970 | 19666 | 35506 | 5110 | 3842 |
| 5 | Gang Spoor | 8775 | 789 | 748 | 0 | 37 |
| 6 | Jl. Garuda | 7533 | 31075 | 50569 | 1943 | 5418 |
| 7 | Jl. Kepu Selatan | 8682 | 11390 | 23855 | 9195 | 2581 |
| 8 | Jl. Jend.Suprapto | 24115 | 34552 | 85271 | 10595 | 11799 |
| 9 | Jl. Tanah Tinggi | 8163 | 3891 | 3932 | 6120 | 523 |
| 10 | Jl. Kramat Sentiong | 23155 | 6881 | 11122 | 326 | 933 |
| 11 | Jl. Percetakan Negara | 5808 | 12026 | 29837 | 163 | 1889 |
| 12 | Jl. Salemba Tengah | 4109 | 7080 | 7980 | 371 | 650 |
| 13 | Jl. Pramuka | 6123 | 40694 | 90581 | 6004 | 14579 |
| 14 | Jl. Tegalan | 15090 | 4669 | 184 | 0 | 0 |
| 15 | Jl. Achmad Dahlan | 13067 | 7791 | 9270 | 1721 | 799 |

Table 2.6 Traffic Volume at Railway Crossings in 2005

(Both Directions/day)

| | Name of Road | Pede-strian | Motor-cycle | Sedan | Bus | Truck |
|---|---|---|---|---|---|---|
| 1 | Jl. Manggadua | 21435 | 17200 | 40787 | 3144 | 19023 |
| 2 | Jl. Gunung Sahari | 7905 | 32147 | 65792 | 3310 | 16753 |
| 3 | Jl. Industri | 13123 | 13960 | 19476 | 1085 | 2891 |
| 4 | Jl. Angkasa | 6553 | 20815 | 37207 | 6159 | 4636 |
| 5 | Gang Spoor | 10396 | 924 | 878 | 0 | 46 |
| 6 | Jl. Garuda | 9444 | 38591 | 63829 | 2277 | 6794 |
| 7 | Jl. Kepu Selatan | 10625 | 13980 | 29394 | 11105 | 3166 |
| 8 | Jl. Jend.Suprapto | 29285 | 41958 | 103550 | 12866 | 14328 |
| 9 | Jl. Tanah Tinggi | 9896 | 4732 | 4770 | 7416 | 639 |
| 10 | Jl. Kramat Sentiong | 28016 | 8427 | 13383 | 367 | 1242 |
| 11 | Jl. Percetakan Negara | 7266 | 16032 | 36675 | 206 | 2514 |
| 12 | Jl. Salemba Tengah | 5179 | 9322 | 9548 | 452 | 966 |
| 13 | Jl. Pramuka | 7771 | 53381 | 107404 | 7305 | 21972 |
| 14 | Jl. Tegalan | 19153 | 6128 | 227 | 0 | 0 |
| 15 | Jl. Achmad Dahlan | 16585 | 10226 | 11425 | 2054 | 1186 |

## 4. Feeder Service and Station Facilities Improvement for 16 Others High Priority Stations

### (1) Premises

Target years for the demand forecast were 1995 and 2005 as same as the project of the three stations. Regarding the forecast cases, two forecast cases were prepared for each target year as well as the Three Stations improvement.

The "without" cases represent the situation in which the Three Stations project has been completed, while the "with" cases represent the situation in which the 16 station improvements were completed.

Table 2.7 Demand Forecast Cases for Feeder Service and Station Facility Improvement for 16 Other High Priority Stations

| | | Transportation Network | | |
|---|---|---|---|---|
| Case | Year | Rail | Bus | Road |
| 95FW | 1995 | 92F | 1992 | BC00 |
| 05FW | 2005 | 92F | 1992 | BC00 |
| 95PW | 1995 | 92P | 1992 | BC00 |
| 05PW | 2005 | 92P | 1992 | BC00 |

Note: Railway network 92F represents the service level of completion of "Three Stations" improvement in addition to the 92B service level, while 92P represents the completion of 16 other High Priority Stations improvement in addition to the "Three Stations".
FW: "without" case PW: "with" case

### (2) Forecast results

Table 2.8 shows the result of demand forecast for the "16 Other High Priority Stations."

Table 2.8 Forecast Result by Case

(000 trips)

| Case | Year | Public | Railway | Bus | Private | M-cycle | Sedan |
|---|---|---|---|---|---|---|---|
| F95F | 1995 | 5052 | 1122 | 3929 | 4701 | 1531 | 3170 |
| F05F | 2005 | 7745 | 1864 | 5880 | 5716 | 2207 | 3510 |
| F95P | 1995 | 5052 | 1197 | 3854 | 4701 | 1531 | 3170 |
| F05P | 2005 | 7745 | 2008 | 5736 | 5716 | 2207 | 3510 |

With completion of this project, railway passengers would increase by 75,000 and 144,000 by 1995 and 2005 respectively. When compare the effect of this project with the " Three Stations" improvement, the increase of railway passengers in 2.2 and 2.7 times in 1995 and 2005 respectively.

# CHAPTER 3. Train Operation

## 1. Existing Situations

Number of trains are shown in following table.

Table 3.1 No. of Trains by Lines (1989, per day, in both ways)

| Year | Line | Section | EC Train | Middle- and Long-Distance Passenger Train | Middle-Distance DC Train | Freight Train | Total |
|---|---|---|---|---|---|---|---|
| 1989 | Central Line | Jak-Mri-Dp | 57 | 34 | 9 | | 100 |
| | Western, Bekasi Line | Du-Jng-Bks | 31 | 2 | 2 | 36 | 71 |
| | Eastern Line | Jak-Pse-Jng | 26 | 20 | 16 | 2 | 64 |

Source ; PJKA Inspection 1

## 2. Train Operation Plan

### (1) Train Operation under Construction

Construction for track elevation of the Eastern Line is scheduled to begin in fiscal year 1993 and last through the end of fiscal year 1997. The number of trains in 1993 and 1998 are forecasted as follows.

Table 3.2 No. of Trains by Lines (per day, in both ways)

| Year | Line | Section | EC Train | Middle- and Long-Distance Passenger Train | Middle-Distance DC Train | Freight Train | Total |
|---|---|---|---|---|---|---|---|
| 1993 | Central Line | JaK-Mri-Dp | 138 | (38) | | | 176 |
| | Western, BeKasi Line | Du-Jng-BKs | 140 | 2 | 34 | 23 | 199 |
| | Eastern Line | Jak-Pse-Jng | 114 | 34 | 34 | 3 | 185 |
| 1998 | Central Line | Jak-Mri-Dp | 188 | (46) | | | 234 |
| | Western, BeKasi Line | Du-Jng-BKs | 226 | 4 | 34 | 31 | 295 |
| | Eastern Line | Jak-Pse-Jng | 148 | 38 | 34 | 3 | 223 |

Note: Middle-distance passenger trains on the Central Line stop and start at Manggarai Station.

Double track train operation of Eastern Line as at present is continued during the construction period.

(2) Train operation after completion of grade separation

Train operation after track elevation is as follows.

. EC trains

Table 3.3 EC Train Operation (Eastern Line)

| Year | Operation head way (min.) | Train make up (cars) | No. of trains (per day, in both ways) |
|---|---|---|---|
| 1998 | 10 | 8 | 148 |
| 2005 | 8 | 8 | 184 |

. Middle-Distance DC Trains

Table 3.4 DC Train Operation (Eastern Line)

| Year | Operation head way (min.) | Train make up (cars) | No. of trains (per day, in both ways) |
|---|---|---|---|
| 1998 | 43 | 4 | 34 |
| 2005 | 43 | 5 | 34 |

. Terminal stations for middle- and long-distance passenger trains in Jabotabek area after grade separation are the following:

Eastern Line: Jakarta, Pasar Senen, Jatinegara, (New Jakarta)
Central Line: Gambir, Manggarai, (New Jakarta)
Wester Line : Tanah Abang

Operation routes will not be changed after completion of grade separation.

# CHAPTER 4. Feeder Service and Station Improvement

## 1. Feeder Development Policies

The improvement of feeder services should be classified in accordance with the following phased program:

Phase I : Initial Provision of Intermodal Facilities and Services
Phase II : Provision of New Zonal and Shuttle Services
Phase III: Creation of a Railway Transport Corridor

Although this study has developed the improved program for phase I above, the ultimate program of phase III should be completed in the future.

## 2. Investment Priorities and the Selection of Urgent Projects

Twenty one stations to be improved by 1995 have been selected using the following Criteria 1 to 4.

Criteria 1: Peak Hour Service Level: should be more than 30 trains/2 hours

Criteria 2: Present Passenger Level: should be more than 1,000 Passengers/ day
Future Passenger (1992) Level: should be more than 15,000 Passengers/day

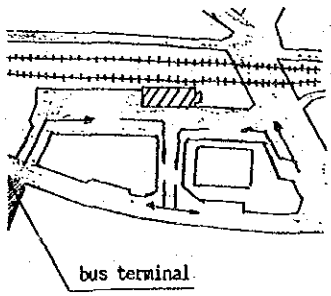
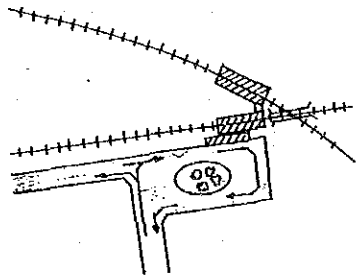
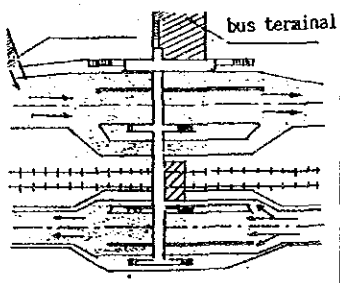
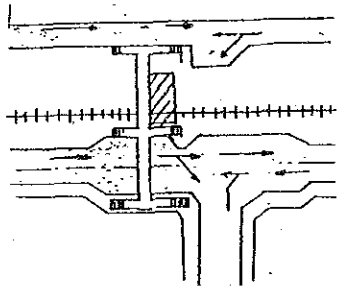
Criteria 3: There should be at least one bus route passing within 350 m from a railway station

Criteria 4: Whether or not there are specific reasons to attach higher priorities, or to postpone the improvement

## 3. Improvement Plans for Representative Stations

Four typical patterns of transfer between bus and rail were set up from the view point of connection with bus service and provision of station front plaza.

The 21 stations urgently requiring improvement were classified into these four patterns as follows:

| Typology of Traffic Interchange | Connection with Bus Terminal | Connection with Bus Route |
|---|---|---|
| Provision of Station Front Plaza | Type A   | Type C  |
| Insufficient Space for Station Front Plaza | Type B   | Type D  |

| Type A | Type B | Type C | Type D |
|---|---|---|---|
| - Pasar Senen | - Pasar Minggu | - Bekasi | - Jakarta Kota |
| - Manggarai | - Tanjung Priok | - Kemayoran | - Gambir |
| - Depok Baru | | - New Kampung Bandan | - Jatinegara |
| - Kebon Pedes | | | - Klender |
| | | | - Cikini |
| | | | - Duren Kalibata |
| | | | - Sawah Besar |
| | | | - Tanah Abang |
| | | | - Angke |
| | | | - Dukuh |
| | | | - Palmerah |
| | | | - Kebayoran |

Fig. 4.1 Classification of Transfer Patterns

Of these 21 stations, three stations having high passenger demand were selected for detailed feasibility study, so as to ensure that they belong to different types of transfer patterns and that their improvement plans have not yet been established by any other projects.

Three stations are namely Pasar Senen, Kemayoran, and Jatinegara.

Details of improvement of feeder facilities and station facilities for each station are presented in the report.

The pre-feasibility study of improvement of feeder and station facilities for the other stations are also presented in the report.

Construction cost for the three stations amounts to 38,161.7 Mil Rp for Stage 1, and 27028.0 Mil Rp for Stage 2.

Improvements for Stage 1 is carried out by the end of fiscal 1994, and those for Stage 2, by the end of fiscal 2003.

Construction cost for the 16 stations amounts to 71462 Mil Rp and are to be completed by the end of fiscal 1994.

Table 4.1 Construction Cost for Improvement of Feeder and Station Facilities

(Million Rupiah)

| Name of Stations | | Construction Cost | | | Remarks |
|---|---|---|---|---|---|
| | | Foreign | Local | Total | |
| Jatinegara<br>Pasar Senen<br>Kemayoran | 1st. stage | 20,070 | 18,092 | 38,162 | Number of railway passengers increase<br>33,000 by 1995<br>54,000 by 2005 |
| | 2nd. stage | 13,672 | 13,356 | 27,028 | |
| | Subtotal | 33,742 | 31,448 | 65,190 | |
| Other 16 Stations | | 44,735 | 26,727 | 71,462 | 75,000 by 1995<br>144,000 by 2005 |
| Total | | 78,477 | 58,175 | 136,652 | |

# CHAPTER 5. Grade Separation on E/L

## 1. Necessity of Grade Separation

There are 15 level crossings along the Eastern Line. Present and future (1998, 2005) vehicular traffic volumes on each level crossing were counted and estimated.

The total traffic volume across all of the level crossings on the Eastern Line is presently approximately 720,000 vehicles (100) (PCU), and it will be 1,016,000 (141) in 1998 and 1,246,000 (173) in 2005.

To cope with these future increases in traffic volume, grade separation of Eastern Line will be required.

Alternatives for grade separation were established as follows;

- Subway
- Flyover
- Continuous track elevation
  near Kota - near Gangsentiong
  near Kota - near Jatinegara

## 2. Grade Separation Alternative Plans

### (1) *Subway alternative plan*

With the consideration on the various unfavourable situations associated with train operation and the very high construction cost, the subway alternative was judged as inappropriate alternative plan and was accordingly eliminated.

### (2) Flyover plan

#### 1) *Selection of flyover sites*

Flyover is planned according to the traffic volume, and the number of lanes is derived from the traffic volume of level crossings in

2005 using 13,000 PCU per lane. The flyovers of less than two lanes are estimated due to unefficiency.

As the result, 9 sites were chosen , viz.

(1) Jl. Manggadua, (2) Jl. Gunung Sahari, (3) Jl. Industri, (4) Jl. Angkasa, (6) Jl. Garuda, (7) Jl. Kepu Selatan, (8) Jl. Jend Suprapto, (11) Jl. Percetakan Negara, (13) Jl. Pramuka

Six Sites were not chosen, viz.

(5) Gang Spoor and (14) Jl. Tegalan where the traffic is mainly comprised of pedestrians; and (9) Jl. Tanah Tinggi, (10) Jl. Kramat Sentiong, (12) Jl. Salemba, and (15) Jl. Achmad Dahlan

2) Determination of the number of lanes

The number of lanes are shown in Table 5.1

However in the following cases , method above mentioned was not used. (2) Jl. Gunung Sahari: Extends from south to north and has 8 lanes. Therefore, it makes no sense to increase the number of lanes only at places where there is a flyover. (8) Jl. Jend Suprapto and (13) Jl. Pramuka require respectively 18 lanes according to calculations. However, such a wide road impedes the sound development of the city and thus the 10 lane maximum was chosen.

Table 5.1 Traffic Volume of Level Crossings and Number of Lane of Flyover (Both Directions) - PCU -

| Name of Road | 1989 | 1998 | 2005 | 13,000/lane | Number of lane |
|---|---|---|---|---|---|
| 1. Jl. Manggadua | 55,994 | 89,173 | 114,978 | 8.8 | 8 |
| 2. Jl. Gunung Sahari | 96,464 | 126,438 | 149,751 | 11.5 | 8 |
| 3. Jl. Industri | 31,160 | 38,337 | 43,919 | 3.4 | 4 |
| 4. Jl. Angkasa | 69,842 | 80,106 | 88,089 | 6.8 | 6 |
| 5. Gang Spoor | 1,262 | 1,631 | 1,917 | - | - |
| 6. Jl. Garuda | 68,589 | 101,016 | 126,237 | 9.7 | 10 |
| 7. Jl. Kepu Selatan | 49,578 | 69,278 | 84,605 | 6.5 | 6 |
| 8. Jl. Jend. Suprapto | 131,192 | 181,105 | 219,926 | 16.9 | 10 |
| 9. Jl. Tanah Tinggi | 19,960 | 27,490 | 33,347 | 2.6 | - |
| 10. Jl. Kramat Sentiong | 15,270 | 21,313 | 26,014 | 2.0 | - |
| 11. Jl. Percetakan Negara | 30,965 | 47,076 | 59,607 | 4.6 | 4 |
| 12. Jl. Salemba Tengah | 11,571 | 17,797 | 22,639 | 1.7 | - |
| 13. Jl. Pramuka | 119,012 | 185,734 | 237,629 | 18.2 | 10 |
| 14. Jl. Tegalan | 2,922 | 4,853 | 6,355 | - | - |
| 15. Jl. Achmad Dahlan | 15,795 | 24,222 | 30,777 | 2.4 | - |

Note: The PCU by vehicle type used in this table is derived from Bina Marga Standards.

3) Flyover plan

For the railway, the flyover will have a clearance of H = 6.1 m including an allowance for the construction work. In cases where the flyover crosses over a road, the clearances will be H = 5.3 m. The standard grade will be 6 %.

a) Flyover passing over the railway only

Jl. Gunung Sahari, Jl. Industri and Jl. Pramuka

b) Flyover passing over the railway and road but not requiring an interchange

Jl. Garuda and Jl. Percetakan Negara

c) Flyover passing over the railway and road and requiring an interchange

Jl. Manggadua and Jl. Kepu Selatan

d) Flyover which creates a hazard for another road and thus requires the construction of a detour.

Jl. Jend Suprapto

e) Underground required

Jl. Angkasa

(3) Track Elevation Plan

The following two alternatives were established with consideration of the traffic volumes on the crossing roads.

| | | |
|---|---|---|
| Track Elevation 1: | Kota - Gangsentiong | About 6.0 km (Fig. 5.1) |
| Track Elevation 2: | Kota - Jatinegara | About 9.6 km (Fig. 5.2) |

The horizontal alignment was planned on the eastern side along the existing Eastern Line so that double-track operation can be continued during construction. With completion of track elevation, surplus land is produced on the western side of the Eastern Line.

Jl. Manggadua is located close to New Kampung Bandan St., and it is difficult to put an elevated bridge over the road. Thus, flyover of the road was taken. The grade at the starting point was set at 12‰ in order to clear Jl. Gunung Sahari.

In Track Elevation 1, Jl. Percetakan Negara and Jl. Pramuka will be of flyover.

(4) Construction costs

1) Total cost for Flyover

283,282 Million Rp

2) Total cost for Track Elevation 1,

448,121 Million Rp

3) Total cost for Track Elevation 2

601,921 Million Rp

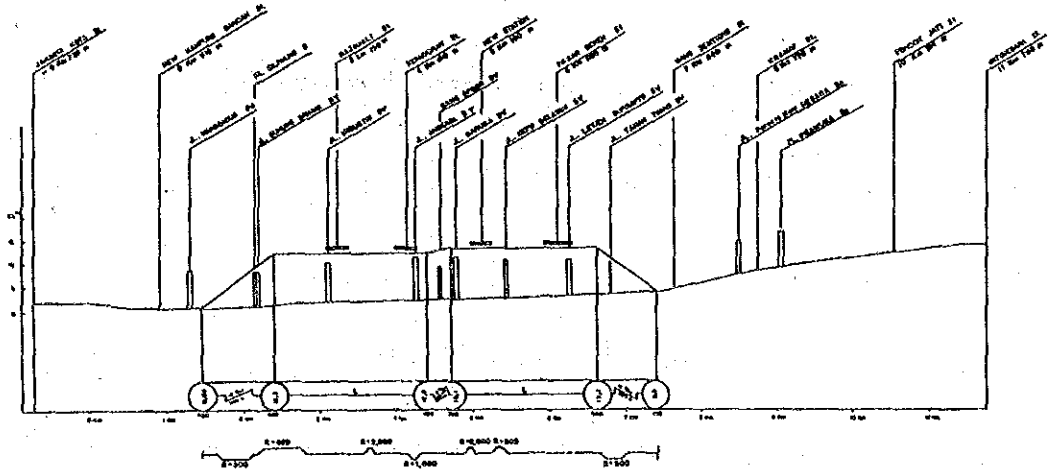


Fig. 5.1 Vertical Alignment Alternative 1

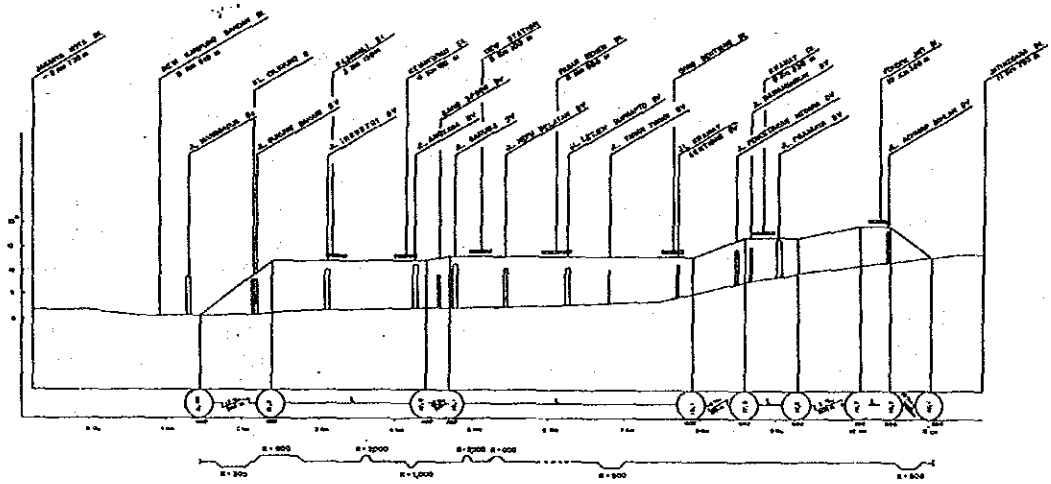


Fig. 5.2 Vertical Alignment Alternative 2

Table 5.2 Investment Cost for Grade Separation

(Million Rupiah)

| Alternatives | | Investment Cost | | | Remarks |
|---|---|---|---|---|---|
| | | Foreign | Local | Total | |
| Flyover | Flyover | 112,769 | 136,180 | 248,949 | |
| | Railway | 20,695 | 13,638 | 34,333 | |
| | Total | 133,464 | 149,818 | 283,282 | |
| Track elevation Alternative 1 | Flyover | 40,911 | 46,381 | 87,292 | |
| | Railway | 238,608 | 122,221 | 360,829 | |
| | Total | 279,519 | 168,602 | 448,121 | |
| Track elevation Alternative 2 | Flyover | 17,284 | 18,685 | 35,969 | |
| | Railway | 365,411 | 200,541 | 565,952 | |
| | Total | 382,695 | 219,226 | 601,921 | |
| Subway | Flyover | | | 35,970 | |
| | Subway | | | 1,474,380 | |
| | Total | | | 1,510,350 | |

# CHAPTER 6. Economic and Financial Analysis

## 1. Feeder Service and Station Improvement

### (1) Economic analysis

#### 1) The results of three high priority stations

Table 6.1 shows the results of the economic analysis for the three high priority stations. The EIRR of the project is very high, and shows a high effectiveness of the project.

Table 6.1 Economic Analysis Results of Three Stations

| Case | EIRR(%) | B/C | NPV |
|---|---|---|---|
| Base Case | 34.78 | 2.39 | 114736 |
| Benefit 10% down | 31.76 | 2.15 | 95033 |
| Cost 10% up | 32.04 | 2.18 | 106506 |
| Benefit 10 down & Cost 10% up | 29.19 | 1.96 | 86804 |

Note:NPV(Rp.000000)

#### 2) The results of 16 high priority stations

Table 6.2 shows the result of the analysis on 16 high priority stations. The EIRR of the most pessimistic case is 47.68%. The viability of this project can be said very sufficient from an economic point of view.

Table 6.2 Economic Analysis Results of 16 Stations

| Case | EIRR(%) | B/C | NPV |
|---|---|---|---|
| Base case | 55.87 | 4.47 | 421383 |
| Benefit 10% down | 51.44 | 4.03 | 367111 |
| Cost 10% up | 51.85 | 4.07 | 409249 |
| Benefit 10% down & cost 10% up | 47.68 | 3.66 | 354977 |

Note: NPV (Rp. 000000)

(2) Financial analysis

1) The results of three high priority stations

The FIRR of the thee stations is -2.92%. This figure means that the project is not financially feasible at all. The further examination how to make the project feasible from the railway enterprise point of view was carried out under the assumption of cost sharing.

The table 6.3 shows the change of FIRR according to cost sharing on railway side.

Table 6.3 Change of FIRR According to Cost Sharing on Railway Side

| | Investment Cost | | Maintenance Cost | | Operation Cost | | FIRR (%) |
|---|---|---|---|---|---|---|---|
| | Feeder | Station | Feeder | Station | Feeder | Station | |
| Cost Sharing on Railway Side (%) | 100 | 100 | 100 | 100 | 100 | 100 | -2.92 |
| | 50 | 100 | 50 | 100 | 50 | 100 | -2.82 |
| | 20 | 100 | 20 | 100 | 20 | 100 | -2.76 |
| | 90 | 90 | 90 | 100 | 90 | 100 | -2.68 |
| | 50 | 50 | 50 | 100 | 50 | 100 | -0.71 |
| | 20 | 20 | 20 | 100 | 20 | 100 | 6.32 |

The project becomes financially feasible (with a positive FIRR) for the railway under the condition that the railway's share of capital investment and of operational and maintenance cost of the feeder section are reduced to 20%.

2) The results of 16 high priority stations

The FIRR of the 16 stations is 2.37%. This figure can not be said to be a sufficient level for financial viability of PJKA. In order to make the project financially feasible from PJKA's point of view,

the further examination how to improve the results were carried out under the assumptions of cost sharing. The Table 6.4 shows the change of the FIRR for the various cost sharing conditions on railway side.

Table 6.4 Change of FIRR According to Cost Sharing on Railway Side

| | | Investment Cost | | Maintenance Cost | | Operation Cost | | FIRR (%) |
|---|---|---|---|---|---|---|---|---|
| | | Feeder | Station | Feeder | Station | Feeder | Station | |
| Cost Sharing on Railway Side (%) | I | 100 | 100 | 100 | 100 | 100 | 100 | 2.37 |
| | II | 50 | 100 | 50 | 100 | 50 | 100 | 3.10 |
| | III | 20 | 100 | 20 | 100 | 20 | 100 | 3.62 |
| | IV | 90 | 90 | 90 | 100 | 90 | 100 | 3.13 |
| | V | 50 | 50 | 50 | 100 | 50 | 100 | 8.57 |
| | VI | 20 | 20 | 20 | 100 | 20 | 100 | 22.91 |

The project may become financially feasible for PJKA under the Case II to IV. However, the debt of commercial base may make management unfeasible under the FIRRs of the Case II to V, and it would be necessary to obtain loans at low interest as possible and, above all, government grants which need not be repaid.

2. Grade Seperation of the Eastern Line

With respect to this project, only economic analysis was carried out, because financial analysis is not so meaningful due to the characteristics of the project. Grade seperation was originally scheduled to be completed by the end of fiscal year of 1997. In this case, the EIRRs of the Track Elevation 1, 2, and Flyover were 12.87%, 11.26% and 13.28% respectively. These values are not sufficient enough to satisfy the necessary economical feasibility of the project.

Therefore, a further examination on the results were carried out in relation to the construction and completion year of the project. When the completion of the project is delayed, the benefit of the project

increases as the demand increases year by year. In this regard, the economical feasibility of the project, in case the completion of the project will be delayed by the end of the fiscal 2001, was examined.

Table 6.5 shows the results of the economic analysis in this delayed case. The EIRR of the Track Elevation 1 reached to the standard discount rate of 15%, showing the Track Elevation 1 as the most feasible alternative among the three.

Table 6.5 Economic Analysis Results of Grade Seperation

- Track Elevation 1 -

| Case | EIRR(%) | B/C | NPV |
|---|---|---|---|
| Base Case | 15.22 | 1.02 | 8943 |
| Benefit -10% | 14.27 | 0.92 | -28445 |
| Cost +10% | 14.36 | 0.93 | -27551 |
| Benefit -10% & Cost + 10% | 13.43 | 0.84 | -64939 |

- Track Elevation 2 -

| Case | EIRR(%) | B/C | NPV |
|---|---|---|---|
| Base Case | 14.27 | 0.93 | -33784 |
| Benefit -10% | 13.82 | 0.84 | -80309 |
| Cost +10% | 13.31 | 0.85 | -83687 |
| Benefit -10% & Cost + 10% | 12.29 | 0.76 | -130211 |

- Flyover -

| Case | EIRR(%) | B/C | NPV |
|---|---|---|---|
| Base Case | 14.52 | 0.93 | -14449 |
| Benefit -10% | 13.82 | 0.84 | -33577 |
| Cost +10% | 13.89 | 0.85 | -35022 |
| Benefit -10% & Cost + 10% | 13.18 | 0.76 | -54150 |

# CHAPTER 7. Comprehensive Evaluation

## 1. Feeder Service and Station Improvement

The feeder service and station improvement of the three stations receiving urgent consideration and of the 16 stations to be taken up in the prefeasibility study are sufficiently feasible from an economic standpoint. Also, in order to insure the financial self-sufficiency of the railway side, it is necessary to contemplate an appropriate burden to be borne by the city side in respect to investment, maintenance, and operating costs.

## 2. Grade Separation of the Eastern Line

In the Track Elevation 2, the investment amount is the largest and the EIRR the smallest. Accordingly, this alternative should be excluded from the subjects for selection. The Track Elevation 1 and the Flyover are almost the same in terms of EIRR, but the track elevation is far superior against to the flyover in respect to city planning. In view of these considerations, the Track Elevation 1 is recommended as the optimum among the alternatives for the grade separation of the Eastern Line. In this connection, it is considered desirable to set a target year for completion at the end of fiscal 2001 in view of economic feasibility.