THE REPUBLIC OF INDONESIA

REPORT ON URBAN/SUBURBAN RAILWAY TRANSPORTATION IN JAKARTA AREA

MARCH, 1981

JAPAN INTERNATIONAL COOPERATION AGENCY
(JICA)

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PREFACE

In response to the request made by the Government of the Republic of Indonesia, the Government of Japan has decided to cooperate in conducting a master plan study and a feasibility study for a short-term plan on the Urban/Suburban Railway Transportation Development in "JABOTABEK" Area.

For this purpose the Japan International Cooperation Agency (JICA), commissioned by the Japanese Government, dispatched to Indonesia a survey team consisting of fifteen experts, headed by Mr. Mikio Sudo, Executive Vice-President of the Japan Railway Technical Service (JARTS) for a period of four months starting from May 29, 1980, under the guidance of a supervisory committee headed by Dr. Yoshiji Matsumoto, Professor of Tokyo University.

This report has been prepared on the basis of the field survey in Indonesia, further studies made by the team after its return to Japan and its discussions with officials concerned of the Government of Indonesia.

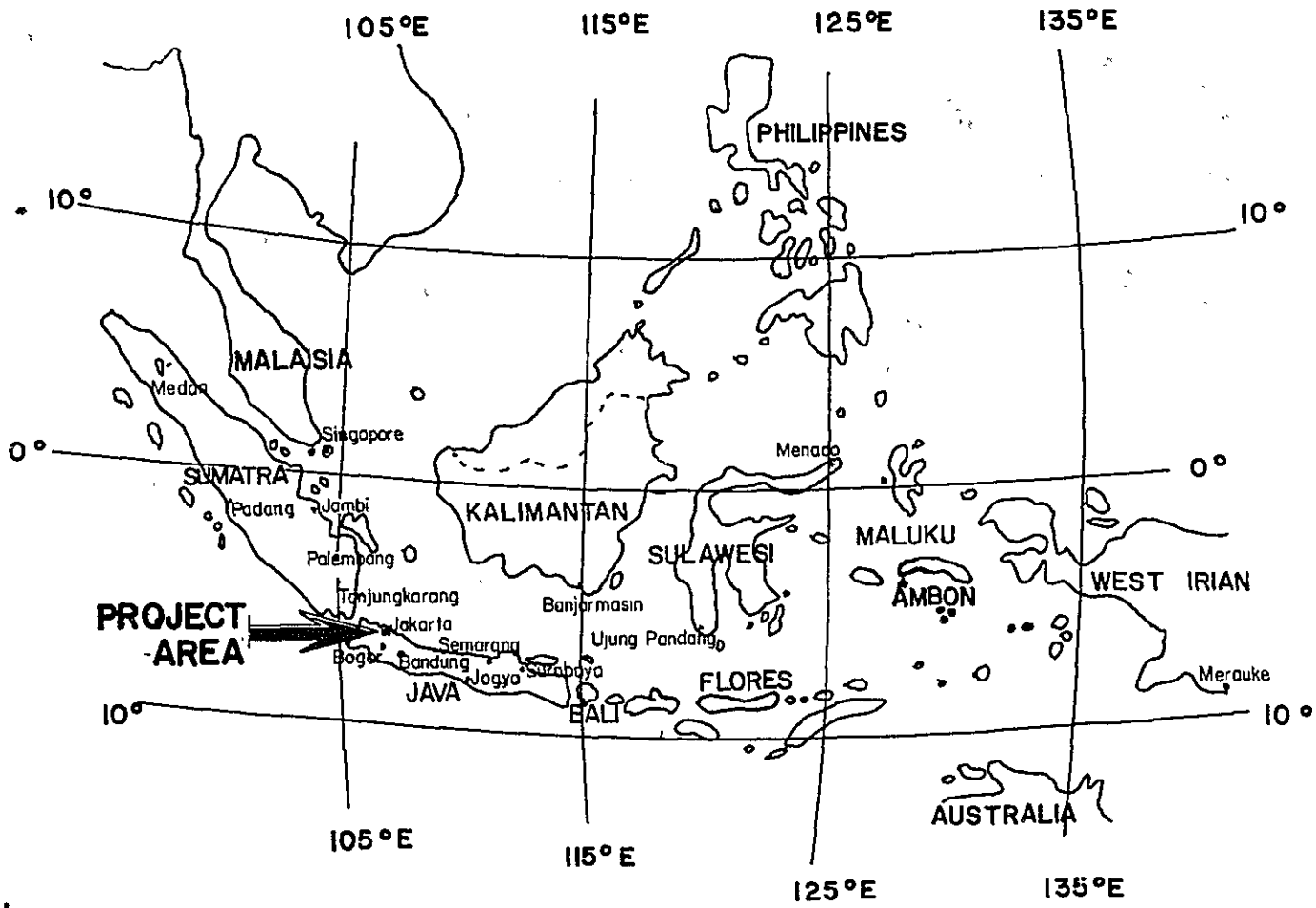
I hope this report will prove to be useful for formulating the railway development plan and will contribute to closer relations between Indonesia and Japan.

I wish to express my deep appreciation to the Government and officials concerned of Indonesia for their cooperation extended to the study team.

March, 1981

Keisuke Arita

Keisuke ARITA
President,
Japan International Cooperation Agency



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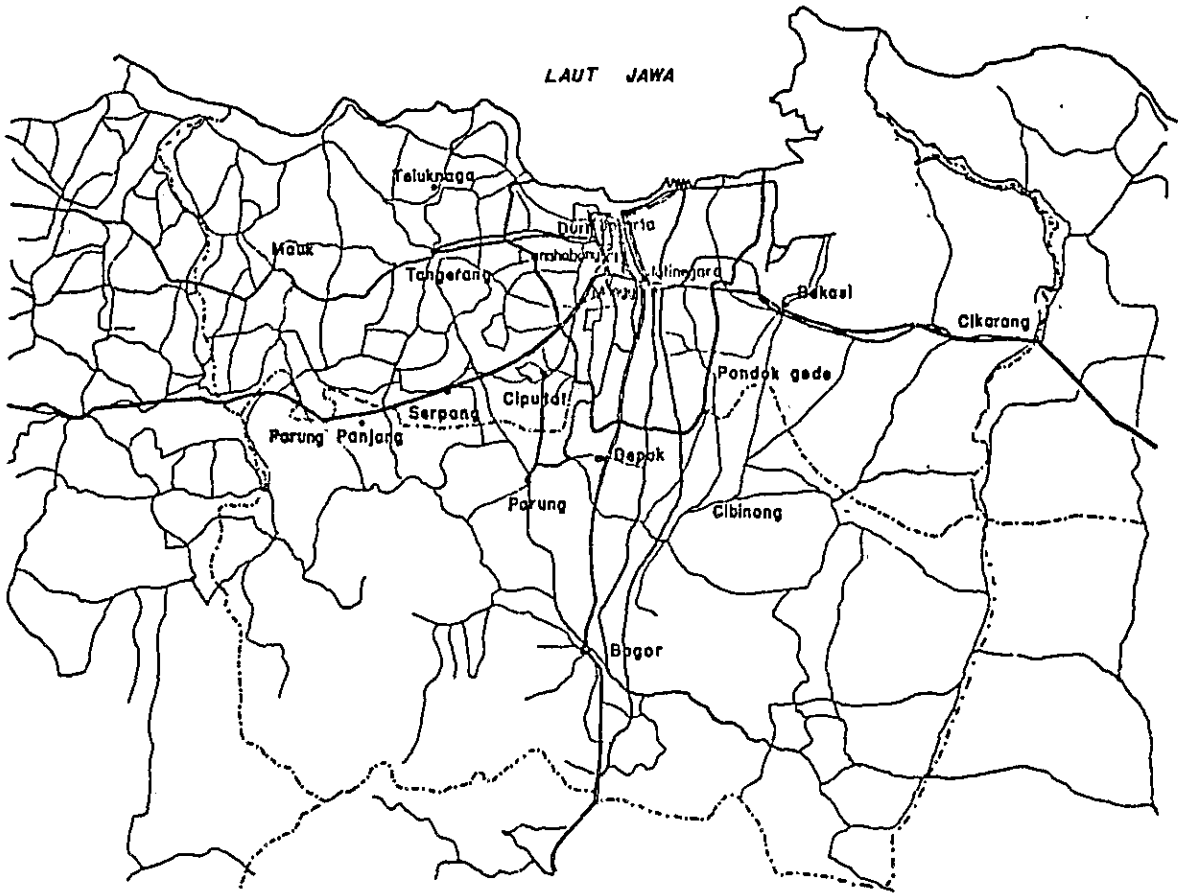
Project Location Map

JABOTABEK Area Railway Transportation Study

Legend



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REPORT

ON

URBAN/SUBURBAN RAILWAY TRANSPORTATION

IN

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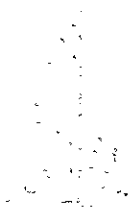

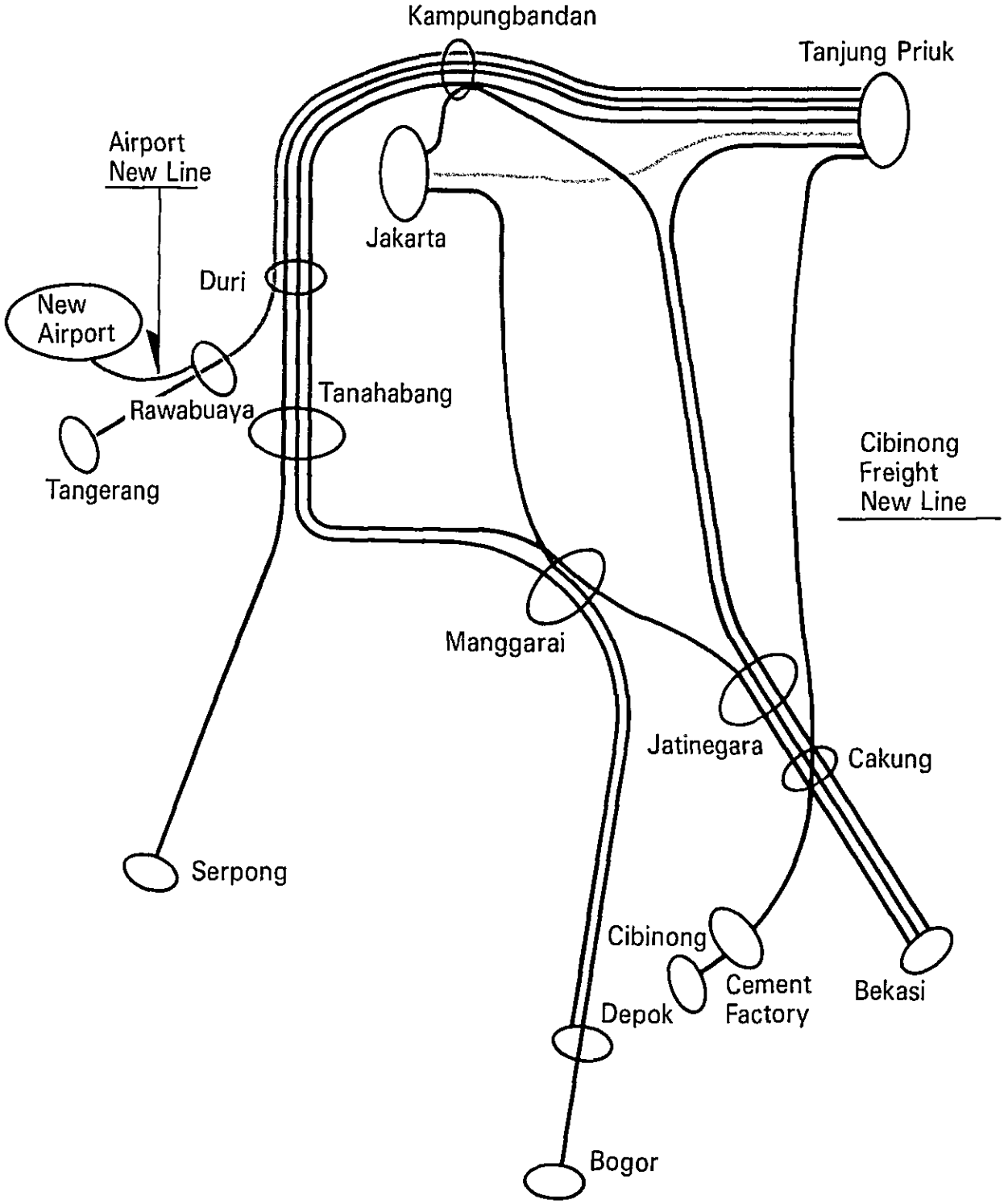

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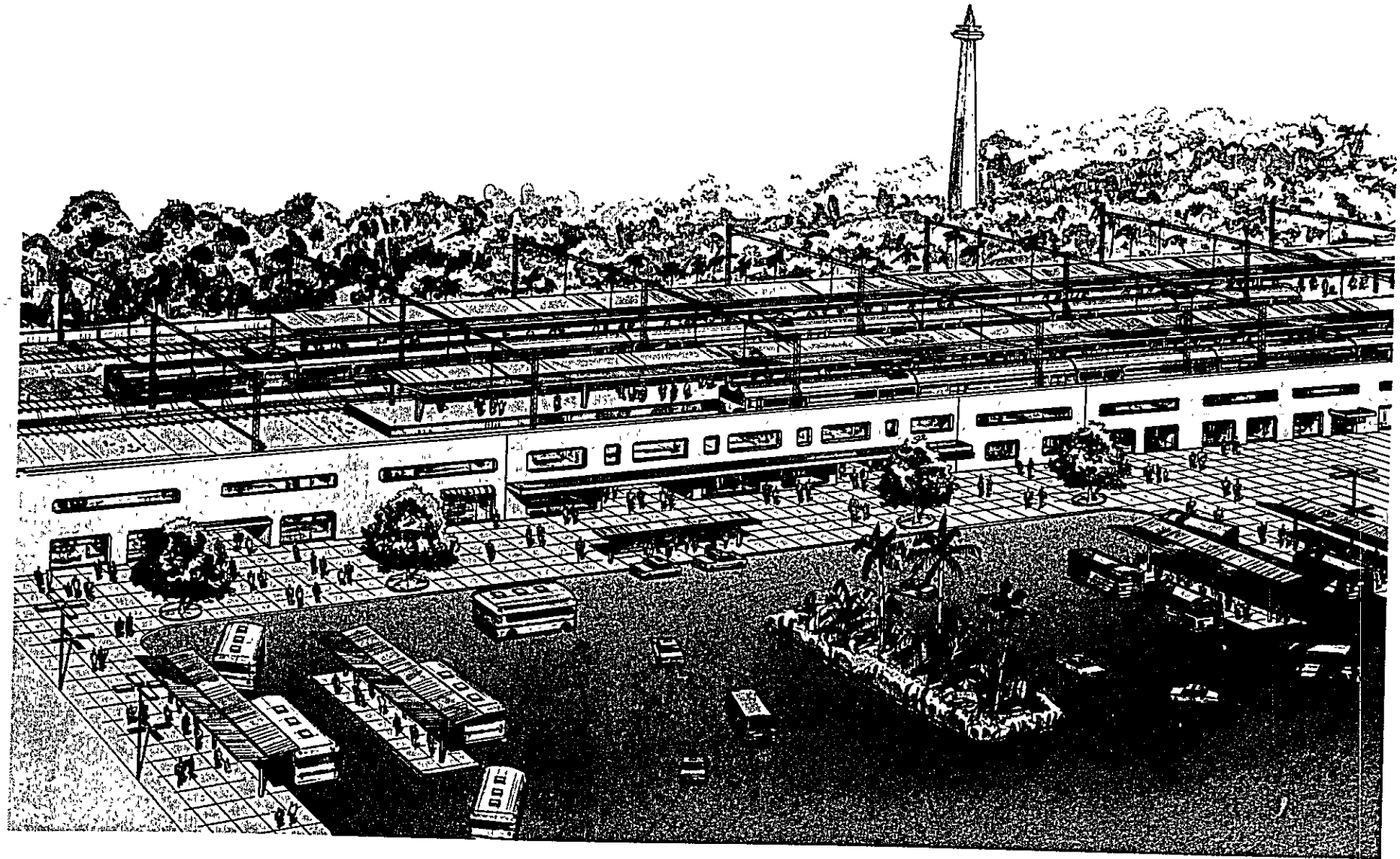

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SUMMARY AND CONCLUSION

1. PRESENT SITUATION OF URBAN / SUBURBAN RAILWAY TRANSPORTATION IN JABOTABEK AREA

1.1 Present Status of Population, Land Use and Development

The JABOTABEK Area covers, as a whole, land expansion of 550,000 ha with population of 10.50 million.

While about three-fourth of the working population are engaged in the service industry within the D.K.I. territory, about two-third of the total in BOTABEK Area are farmers showing a high centrality toward D.K.I.

Housing construction is being stimulated all over the whole area of JABOTABEK, especially developed on a large scale in the southern part of Jakarta City, the north-east of Tangerang, Serpong, Depok and Bekasi. Industrial development tends to be concentrated with selected sites for industrial plants in close vicinities to Jakarta, Tangerang and Bekasi.

1.2 Present Status of Urban and Suburban Traffics

The metropolitan area of Jakarta is developed mainly with vehicle traffic on the road network, in which the bus service takes the overwhelming majority.

The public transport service takes a share of about 60% while the private means is available for the remainder, or about 40%.

The railway utilization factor in all modes of traffic is far down only at 0.09% within the D.K.I. Area as compared with 8.9% in the BOTABEK Area. There are to be considered the following reasons for this low utilization factor of the railway traffic.

1) Because of inadequacy of transport service in aspects of operating frequency and speed of trains
2) Because of insufficiency in the scale of facilities (station and front area) dealing with mass passenger transit at rush hours
3) Because of incompletion of the feeder system connected to the railway

1.3 Present Status of Railway Transport

The greater majority of trains operated in the JABOTABEK Area serves for passenger and freight trains are only a few. Of those passenger trains, urban and suburban lines are operated mostly with electric railcars (or 4-car train set) and diesel railcars (of 2 or 4 cars train set), partially with the locomotive-hauled passenger trains. All long-distance trains are composed of passenger coaches hauled by the diesel locomotive.

Frequency of daily train operation on both direction tracks is numbered at 53 for the electric railcar train, 40 for the diesel railcar train, 56 for the medium or long distance train and 20 for the freight train.

In the aspect of train operation, it poses such problems as insufficient number of trains in operation, low running speed, irregular stoppage at crossing, large delay behind time schedule,

long stoppage time and low operational safety. Especially, there are not a few instances where delay is caused by the long distance train, as a result of which the operation time schedule on the suburban lines is often dislocated. How to assure scheduled operation of the long-distance train will become a big task to be tackled toward the future with possible increase in the number of train operation.

In the manner and behavior of passengers, there remain many points to be improved, for instance, such as free riding, illicit entry into drivers' cab, climbing on coach roof at rush hours, hand-carry of large size baggage and free entry into station yards.

1.4 Future Role of Railway and Prerequisite to Development Plan

The railway is the transport means best suited for mass, high-speed passenger transit and is featured, especially, by its regular time punctuality and higher energy-saving efficiency, in comparison to the road vehicle traffic, with minimum impact to the environment. It is, therefore, recommended that the future urban traffic should be switched over mainly to the railway.

For this conversion, the drastic measures must be taken to improve the existing time-worn railway facilities, along with efforts to establish the well-disciplined organizational system as well as to train professional staff for railway operation and maintenance and other urban development along the railway line areas and the existing feeder system.

2. RAILWAY TRAFFIC DEMAND

2.1 Basic Conception for Demand Forecast

In this study, demand forecast of railway traffic for the year 2000 is made on a sum-up basis. Calculation of future demand is not led out from the strategy of railway share in the total traffic demand, but under following concept; the gross railway demand in the year 2000 is to be the total of non-commuting railway demand plus substantial commuting demand as sum of commuting demand by station which is the main part of railway demand.

2.2 Method of Demand Forecast

As for future demand in the BOTABEK Area, railway passengers in the year 2000 by station was led out with five factors; such as (1) population density in the year 2000 by Kecamatan and by city-rural area, (2) scale of station influence sphere, (3) ratio of economic active population, (4) commuting ratio, and (5) directional commuting ratio for D.K.I. Jakarta.

For the D.K.I. Jakarta area, railway passengers in 2000 by station have been led out from all mode commuting demand within each station influence sphere in 2000, role of railway and commuting ratio.

Then, total generated demand in the whole JABOTABEK Area is obtained from the total sum of two estimated results as above.

As the socio-economic factor to be considered in the JABOTABEK Area., the housing, industrial and other development projects planned for each Kabupaten of Bogor, Tangerang and others have also been incorporated into demand forcast.

2.3 Method of Demand Distribution

Large demand from BOTABEK and D.K.I. into the city center has been distributed into each station by use of the station factor for concentration passengers, that is to say, distributed to each station along the probable train operation routes in proportion of the station factors, for concentration passengers brought about from concentrated demand by all mode in the year 2000 in the specific zone including the station and its adjacent zones.

2.4 Gross Railway Traffic Demand and Cross-Sectional Link Load by Line

As the result of forecast, it is estimated that the total passengers in peak 2 hours by 2000 would reach 299.10 thousand, consisting of 101.6 thousand from BOTABEK into D.K.I. and 197.5 thousand within D.K.I. It is further estimated that those figures would be swelled into 20 % ~ 30 % railway share if any conditional changes should occur on the urban development in future.

In terms of the cross-sectional traffic load at peak 2 hours by 2000 for each line, the striking increase is forecasted on all the existing lines without exception; for instance, 22.89 thousands, or 17.1 times (as compared with demand in 1978. Same in the following cases) between Bogor and Depok, 43.64 thousands, or 23.6 times, between Depok and Manggarai and 19.47 thousands, or 13.9 times, between Managgarai and Gambir on Central Line, and 36.38 thousands, or 134.7 times, between Bekasi and Jatinegara and 18.59 thousands, or 84.5 times, between Jatinegara and Pasarsenen on Eastern Line, 40.05 thousands, or 148.3 times, between Serpong and Tanahabang on Merak Line, 22.57 thousands, or 300.9 times, between Tangerang and Duri on Tangerang Line, and 76.12 thousands, or 281.9 times, between Tanahabang and Duri on Western Line.

2.5 Staging of Cross-Sectional Link Load

The increase of cross-sectional link load, within 20 years, more than 100 times as now. The increase will not be in a linear pattern. The increase of the railway demand in all mode transportation is forecasted with due consideration to increases in the future as well as in the past. From this forecast, it is conceivable that the future load will show rapid increase on each line after 1985.

3. RAILWAY TRANSPORT PLAN

3.1 Future Railway Network after Year 2000

It is anticipated that railway traffic demand will increase significantly with further progress in the reformation of urban structure in the JABOTABEK Area and the progress of urban development alongside the railway line.

The Master Plan includes studies for the railway network by the year 2000, which must be made in close continuity with the future network to be projected after the year 2000 with tremendous increase of traffic demand.

The future network after the year 2000 has been studies on the three alternatives of 50% railway share (1.60 million passengers in rush 2 hours), 30% (0.96 million) and 20% (0.64 million) as envisaged under the D.K.I. Master Plan. In the case of 50% share, it is estimated that supplemental investment would be required in the sum of about 6,320 billion RP, in addition to the investment to be required by the year 2000 under the proposed Master Plan.

3.2 Railway Network by Year 2000

The railway network to be completed by the year 2000 should be fully compatible with the future sectional traffic volume as estimated for each line from demand forecast. To comply with this need, the plan aims at completion of doubling of track, electrification and installation of automatic signal of all the lines and construction of the new Kampungbandan station and the new connection line between Eastern and Western Lines. The plan also includes construction of new railway lines to New Air Port and Cibinong.

3.3 Train Operation Route on Urban and Suburban Lines

Comparative study has been made by advantages or disadvantages on the 5 Alternatives from A thru E as proposed for the future train operation route by the year 2000. After study, Alternative D be recommended because of its advantages that the train operation route requires only a minimum number of electric railcars and that passengers can be assured of their utmost convenience in the transfer from the suburb to the city area.

At estimate of the sectional traffic volume for each line by the year 2000, the section between Duri and Tanahabang shows the most conspicuous rise to 76,000 on a single way in rush 2 hours. To strengthen the transport capacity in this section, Alternative D plans a part of trains to be operated through Central and Bekasi Lines to Western Line. Alternative D aims at, besides the above, a change to the present operation route on the Western Line, where trains are turned back at Kampungbandan to and from the Jakarta Kota Station. In the future, however, this switch-back will be difficult with the increasing number of trains in operation. Therefore, it is planned that the Tanjung priuk Station will serve as the terminal of arrival and departure for all the trains on the Western Line.

The suitable future timing for shifting from the present operation route to the planned route under Alternative D is scheduled for the year 1990 upon completion of the improvement plan for the Kampungbandan Station.

3.4 Long-Distance Train Operation

In the anticipation that in the year 2000 the urban lines will allow passage of long-distance trains even at rush hours, it is planned that all the long-distance trains will be operated, as they are now, to and from the present terminal stations of Jakarata Kota, Pasarsenen and Gambir. It should be noted, however, that full assurance of the scheduled time operation of those long-distance trains must be made as the vital task for implementation of the plan, since any delay in the operation of long-distance trains would affect greatly to the operation of all other suburban trains on the line.

3.5 Train Operation Plan

1) The train operation plan has been drafted under the following prerequisite conditions.
   i) To operate trains to the satisfaction of traffic demand.
   ii) To use 8 cars at maximum for train-set of each electric-railcar train.
   iii) To provide additional number of diesel railcars during the transitional period until final completion of electrification.
   iv) To estimate the car load factor for both electric and diesel railcars in rush hours at 200% at maximum.

   The train headway by the year 2000 under the Alternative D plan allows for 3 minutes on Western Line, 6 minutes on Central Line, 6.5 minutes on Bekasi Line, 6.5 minutes on Merak Line and 12 minutes on Tangerang Line.

   The total number of electric railcars to be additionally required by 2000 under the Master Plan is estimated at 484 cars according to Alternative D. Total number of electric railcars will amount to 584 cars by the year 2000 including 100 cars under the Intermediate Program.

   Another 78 electric railcars will be needed on the new lines to and from the airport and Cibinong.

2) Passenger terminal

   A passenger terminal serves as a point of juncture between railway and road. In this respect, the improvement plan of terminal facilities would contribute toward increase in the number of railway passengers and the terminal would serve as the main core in the urban development.

   The plan, therefore, aims at improvement and expansion of each of those stations, such as Jakarta Kota, Gambir, Manggarai, Pasarsenen, Jatinegara, Tanjung priuk, Duri and Tanahabang, which are proposed for main future terminals by 2000 to serve as the stoppage and/or junction stations of long-distance trains for the estimated number of 25,000 passengers at least per day at each of them. The plan is to contruct business, shopping, amusement and tourist centers around each of those terminal stations to promote urban redevelopment, thus helping to mitigate traffic congestion in the urban area by shortening of the traveling distance to and from the station within the city area. The plan also proposes expansion of the station front area for closer coordination between railway and road traffics.

3) Freight train operation

The operation diagram of freight trains must be well coordinated with that of passenger trains.

They will be operated by way of the Western Line in daytime or night hours by avoidance of operation in rush hours, so that the possible impact to the operating schedule of electric-car trains or long-distance passenger trains can be restrained to most minimum.

It is advisable, in this connection, that all freight trains should be operated through the new Cibinong freight line after its completion.

4) Construction of new railway stations

New stations will be established between the stations which now exist over a long distance with a view to improving convenience for travelers and inviting the increased number of passengers to the railway. Such new stations will be built at 6 sites on the urban lines and at 5 sites on the suburban lines outside the urban line territory but inside the D.K.I. Area toward the target completion by 1997.

3.6 New Line Construction

1) New Airport Line

The new airport is scheduled to open in 1984. For some time after its opening, however, only the bus service will be available through the expressway or to Tangerang Station as the optional means of access to the new airport. In the perspective to the year 2000, it is forecasted that railway traffic demand would be boosted up to 10.4 thousands in rush two hours. It is therefore planned that the new line of single track electrified will be laid over a 10 km distance between the new airport and Rawabuaya Station.

On the new line each train of 8-car train-set will be operated with a headway of 15 minutes in rush hours.

2) New Cibinong freight line

In the future when the new freight line of Tanjung priuk ~ Cakung ~ Cibinong will be constructed as proposed now, a new 14 km line will be laid from the cement factory to the residential area of Cibinong exclusively for passenger transport purpose (at an estimated load of 7.8 thousands in rush 2 hours by 2000). The new line will be electrified with a single track for operation of each 4-car train-set at a headway of 15 minutes during rush hours.

4. PRESENT STATUS AND FUTURE IMPROVEMENT OF EXISTING RAILWAY FACILITIES

4.1 Present Status and Improvement Plan

Survey has been made to establish the improvement plan after comprehensive review of problems on operation and maintenance with regard to track capacity, track structure, station, electrification system, signaling and telecommunication system, rolling stock, workshop and depot.

All those problems are basically related to future improvement of the present railway system and incorporated into the Master Plan as necessary items of improvement. Major problems, together with their improvement measures, are summarized in the Table below.

Problems	Improvement measures
(1) Low track capacity	Doubling of track, electrification and automatic signal control
(2) Level crossing within station yard of Manggarai	Grade separation of crossing
(3) Turn-back operation of Western Line trains at Kampungbandan Station	Alternation of train operation system and new station construction
(4) Incomplete, time-elapsed track structure	Renewal or new installation of track, fence and turnout
(5) Incompleteness of railway crossing	Automatic barrier control and conversion into grade-separated crossing of independent or continuous form
(6) Incompleteness of station facilities	Raising-up of platform elevation, overbridge construction, improvement of track within station yard, station building reconstruction and station front area expansion
(7) Time-elapsed equipment of electrification system	Renewal or replacement
(8) Time-elapsed equipment of signal and telecommunication systems	Installation of automatic signal control and relay interlocking system
(9) Incompleteness of rolling stock maintenance facilities	Improvement of inspection and repair facilities in workshop and car depot
(10) Insufficient of storage capacity in depot	Addition of incoming and outgoing car track lines within depot and construction of new depot

4.2 Trip Survey Over Railway Crossing

Survey was conducted at 17 crossings with heavy traffic load within the city area of Jakarta by surveying every one hour, for 12 hours from 7:00 to 19:00 in a day, the persons' trip and vehicle traffic by categories of pedestrian, bicycle, auto-bicycle, auto-tricycle, motor-car, bus and truck.

1) Surveyed traffic over crossing
   Total of pedestrians and vehicles of various types during surveying for 12 hours over the crossing was counted at maximum 103.6 thousand vehicles/persons (Jl, Veteran and Jl. Juanda) and at minimum 23.2 thousand vehicles/persons (Jl. Pahlawan). Heavy traffic was observed at such crossings as Jl. Veteran & Jl. Juanda, Jl. Perwira, Jl. H. Samanhudi, Jl. K. H. Hasyim Ashari, Jl. Garuda, Jl. Bandengan and Jl. Pramuka, at all of which number of vehicles and persons was exceeding 64 thousand vehicles/persons.
2) Barrier time at crossings
   Barrier time length differs largely at all crossings, since the barrier bar is handled manually by a watchman at each crossing. Average time length from start of shutting to end of lifting of the barrier at each crossing was measured at maximum 232 seconds (Jl. Klender) and minimum 48 seconds (Jl. Gn. Sahari Ancol). Except Jl. Klender and Jl. Kramat Bundar (154 seconds), all other crossings registered less than 100 seconds at each average.
3) Retention of vehicle traffic
   Survey was made by monitoring of retention time of vehicle traffic from its stoppage to recovery into its normal tempo of flow after passage of a train at the crossing and number of vehicles held in retention.
   In case that a train passes over the crossing on only one-way track, the crossing of Jl. Kramat Bundar was monitored at more than 5 minutes and 230 vehicles, the largest in both retention time and number of vehicles affected. Jl. Klender registered relatively a small number of vehicles below 40 though time exceeded 5 minutes 30 seconds. Jl. Pramuka registered large figures in both time and number of vehicles. Longer retention time was recorded at Jl. Mangga Besar, Jl. H. Samanhudi, Jl. Diponegoro and Jl. Bandengan. Needless to mention, there is natural increase in both retention time and number of vehicles, in the event that two trains pass over the crossing on both track lines. Jl. Veteran and Jl. Juanda and Jl. P. Jayakarta registered more than 3 min. 30 seconds in retention time and about 280 vehicles. All other crossings also registered more than 2 min. 30 seconds without any exception.

5. MASTER PLAN

5.1 Basic Conception for Master Plan

The Master Plan has been established with due consideration to various socio-economic factors in the progress of development toward the ultimate aim of shifting the main role of urban traffic to the shoulder of railway traffic.

In the transitional period, the basic aim is to strengthen the transport capacity to be compatible with the maximum future possible demand as forecasted.

In the early half of the planning period, the project aims at completion of the modernized railway system and organization, which may require a time length of 10 years at minimum. It is therefore considered most appropriate that the full time span in the whole planning process in the Master Plan should cover a period of about 20 years.

5.2 Classification of Projects

All necessary projects for assimilation of railway traffic into urban needs by strengthening the transport capacity may be divided largely into the following three categories:

1) Project for expansion of railway transport capacity
2) Project for stimulation of demand
3) Project for improvement of urban amenity

5.3 Implementation of Projects by Phase.

The scheduled time for execution of each project toward the target year 2000 has been divided largely into the following three stages:

1) Phase 1
   Projects at this phase aim at infrastructural development of immediate need and minimum requirement and strengthening of transport capacity to start with at the earliest possible date in order to ensure full performance of the function of the existing railway facilities. Completion is scheduled for the end of fiscal 1987.
2) Phase 2
   Projects at this phase aim at strengthening of transport capacity to ensure full performance of the railway as the urban traffic and to cope with rapid increase of future demand toward the scheduled completion for the end of fiscal 1991.
3) Phase 3
   Projects at this phase aim at construction of new railway stations to induce the preferred choice of railway traffic and new track lines for expansion of the existing railway network to be compatible with traffic demand to be newly generated toward the target completion by the end of fiscal 2000.

5.4 Project Components

Each project outline under the Master Plan is as follows:

1) Track

The whole track structure is generally, except partially otherwise, conspicuous of time-worn change and less maintenance care. In order to cope with increasing speed and frequency of train operation in the future, the track structure must be repaired or replaced. The project also includes new installation of fences along the right-of-way boundary and along the wayside before and after the railway crossing.

2) Station facilities

The existing facilities may well serve the present need of train operation. However, in anticipation of the increasing number of trains to result from future demand increase, it is considered necessary to raise up the platform, construct overbridges and passengers' shelter houses, reconstruct station buildings and improve the station front area in order to meet needs to shorten the headway time, to improve the operational safety and to enhance coordination with vehicle traffic.

3) Crossing facilities

Crossing warnings and barriers are incomplete as a whole. Although they may be improved partially under the Intermediate Program, all the remainders must be improved with continuity under the Master Plan.

4) Track addition

Track addition is planned by conversion into the double-track system the existing single-track section between Manggarai and Bogor on the Central Line, between Tanahabang and Serpong on the Merak Line and between Duri and Tangerang on the Tangerang Line. In parallel with the track addition work, other improvement projects will be executed for electrification and installation of automatic signalling control, together with improvement of station facilities and redevelopment of station front area.

5) Improvement of Kampung Bandan Station

Improvement of the Kampung Bandan Station and new contruction of the connection line of the Eastern Line with the Western should be executed for not only abolishing the present shuttle service of the Western Line trains at Kampung Bandan but also enabling the Eastern Line trains to be operated to the Jakarta Kota Station through the Kampung Bandan Station.

It also includes improvement of the track line between Kampung Bandan and Tanjung priuk so as to extend the operating route of the Western Line trains to Tanjung priuk.

6) Electrification

The project includes improvement of the existing power protection system and new installation of the power dispatching system as well as improvement of the existing substations and new construction of substations for the proposed

section of electrification. Especially, with regard to the power dispatching system, the plan aims at integration of power service operation and control systems within the whole territory of JABOTABEK and improvement of the coordination with the train operation dispatching system and the PLN's dispatching system.
New overhead equipment will be installed on the whole Bekasi Line and the sections improved with track addition. In this case, the existing overhead equipment must be also be improved accordingly.
For introduction of automatic signalling system, the project plans erection of the automatic signal in the middle between the stations, together with the relay-interlocking system for each station. High reliability should be required for the power supply source to the signal and its associated systems. Instead of the individual power receiving system, as convertionally applied, from PLN to each railway station, the exclusive power receiving system is planned by installation of the high-voltage receiving facilities at the substation, from which the outgoing distribution line of exclusive use for electrical operation will be installed for feeding to the signalling system.

7) Signal and the telecommunication systems
The existing signalling system is the semaphore signal with tokenless or block system, which should require considerable volume of manpower for maintenance and handling of equipment. Furthermore, because of a kerosene lamp being used at night, the signal indication is hard to identify by eyes, thus causing the operational problem of trains. The improvement plan includes, therefore, conversion of the existing signal system into the electric color light signal and the automatic block system to be automatically controlled by trains, replacement of the time-worn mechanical interlocking system with the relay interlocking device, and new installaion of the ATS device, so that train operation of high speed and tight schedule can be secured with safety and reliability.
With regard to the telecommunication system, various improvement projects are under way according to the Intermediate Program. Therefore, the Plan aims only at installation of the telecommunication service system for maintenance workers in connection with conversion of the signal into the relay interlocking system.

8) Rolling stock and maintenance workshop
With regard to rolling stocks of additional supply subsequent to the Intermediate Program, it is advisable that they should be standardized for improvement of the operation efficiency and curtailment of the maintenance costs.
In this respect, therefore, the technical specifications of railcar will be basically same as is being used at present, except partial design modifications as may be required from time to time, such as structural change of entrance steps to be modified to meet with the raised level of platform. For introduction of ATS device of each railcars will be taken by remodelling of the conventional type car or by putting into operation the new type car with the ATS device in time for the scheduled commencement of the ATS operation.

The reinforcement project for the Manggari Workshop will be carried out on a step-by-step basis, keeping abreast with additional supplies of railcars on the line, for which the scale and timing of investments have been set up in accordance with the following basic policy.

Stage 1: To complete installation of repair and inspection facilities basically necessary for car maintenance (such as car repair shop, test run track, car body repair and painting shops and electrical parts test apparatus) This reinforcement project will ensure, upon its completion, the increased capability of car repair and inspection for future additional supplies of rolling stock as proposed under the Feasibility Study items.

Stage 2: To complete new installation of various repair and inspection facilities and additional installation of car body repair workshops to prepare for additional supplies of rolling stock after the Feasibility Study period, with the aim to secure full-capability of repair and inspection for proposed additions of rolling stock by the year 1977.

Stage 3: The project at this stage aims mainly at introduction of modernized automatic equipment into the maintenance system for improvement of vehicle quality, with the aim to improve the maintenance facilities to sufficient capability for future additions of rolling stock toward target completion of the Master Plan having the perspective view beyond the year 2000.

9) Rolling stock depot

i) Jakarta Kota car depot

With possible future increase in the number of vehicles, the accommodation capacity of only the Bukitduri Depot on the present scale would not serve such increasing demand. Therefore, the accommodating track for cars, together with the daily inspection shed, must be constructed urgently at a part of the Jakarta Kota depot area.

ii) New construction of Depok car depot

A new car depot will be constructed at Depok, since only the existing two depot, Bukitduri and Jakarta Kota, would not catch up with future demand increase in their present storage capacity. The expansion mark will be divided into three stages, in equal paces with increases in the number of railcars. The work at the first stage is scheduled for completion at the time when the electrification project of Bekasi Line will come to completion. All railcars will undergo monthly and track inspections at the new Depok depot.

iii) New construction of passenger-car depot

To cover possible shortage of accommodation capacity at the Jakarta Kota depot and absorb increasing number of long-distance trains to and from Manggarai Station, a passenger-car depot will be newly constructed within the yard of Cipinang freight station. Monthly inspection of all passenger cars will be made solely and collectively at this new depot.

10) New line construction

The planned passenger service for the New Airport Line and Cibinong Line is as referred to in the preceding Item 3.6.

5.5 Grade Separation Plans of City Line

The road-railway level crossing within the urban area not only impedes the vehicle traffic but also obstructs greatly the free urban mechanism, further affecting safety of the train operation. D.K.I. Jakarta consists of Central, Northern, Eastern, Southern and Western Jakarta and presents itself a typical pattern of metoropolis, in that it has a population density of 9,000 persons per km^2 and has about 75% of the total working population being engaged in the sector of tertiary industry.

In the Central Jakarta, both Central and Eastern Lines are positioned in the south-north direction and Western Line runs on the boundary to Western Jakarta. This prevents the area from being closely linked with the other areas, especially hindering the vehicle traffic flow in the east-west direction. Therefore, as long as the existing level crossing remains as it is, it would give rise to unfavorable effect to the harmoneous growth of the whole metropolitan area.

(1) Traffic volume estimation mation

1) Estimation on crossing traffic volume

The recipient of direct benefit from the conversion of the level crossing into grade separation will be, needless to mention, the vehicle traffic flow on the road which would otherwise be hindered by the crossing barrier. Of all level crossings on the urban lines, the Central Line has the greatest number of crossings, as indicated by comparison in the following Table, at a high rate of one per 520m at average.

Items \ Line	Central Line	Eastern Line	Western Line
	Jakarta Kota ∿ Gambir ∿ Manggarai	Jakarta Kota ∿ Pasar Sene ∿ Jatinegara	Jakarta Kota ∿ Duri ∿ Manggarai
Section length	9km 890m	11km 750m	14km 990m
No. of crossings	19	14	10
Average distance between crossings	520m	839m	1km 499m

When compared by lines as to the estimated traffic volume, the Central Line ranks the top with an estimate of 727,000 wehicles per 12 hours between Jakarta Kota and Manggarai. The following Table compares the estimated crossing traffic volume by lines.

(AM7.00 ~ PM7.00)

Items \ Line	Central Line	Eastern Line	Western Line
	Jakarta Kota ∿ Gambir ∿ Manggarai	Jakarta Kota ∿ Pasar Semen∿ Jatinegara	Jakarta Kota ∿ Duri ∿ Manggarai
Total corssing traffic volume	727,000	293,000	381,000
Average traffic volume per each crossing	38,000	21,000	38,000

2) Forecasted future crossing traffic volume

The future traffic volume at each level crossing has been estimated by use of the forecasted increases of both population and vehicle trips in the Jakarta Metropolitan Area which is based upon estimation in "The Consulting Engineering Service for Jakarta Urban Tollways, September, 1978".

The result reveals that the future increases of population and vehicle trips would rise up to 1.51 and 2.31 respectively by the year 2000 on the basis of 1.00 in 1980. From this result, therefore, it is anticipated that if the present level crossing still continues to survive there would be considerable degree of road congestion, thus impeding future growth of both urban areas being severed by existence of the railway line.

(2) Construction plan

1) Review on grade separation structure

As the method to eliminate the level crossing, there are two alternatives, either the one to separate the road off from the ground surface or the other to separate the railway off the ground, depending upon public priority on either road or railway, topographic restriction in the project section and degree of impact to the land use plan.

The following Table shows structural types in those alternative cases.

Road & Railway	Type	Road Structure	Railway Structure
Grade Separation-Road	Flyover	Bridge or Embankment	Level
	Underground	Underground or Cutting	
Grade Separation-Railway	Elevated	Level	Continuous Bridge or Embankment
	Underground		Underground or Cutting

The grade separation structure may be divided into both underground and elevated types. This study precludes the underground structure because of its higher cost in general.

2) Review on grade separation type by railway lines

This study is to determine here in the applicability of either road elevation or railway elevation to each line with due consideration to the future vehicle traffic flow and the type of road running along the railway wayside.

i) Central Line

The railway elevation type will be adopted. As compared with any other urban lines, the Central Line is featured by its high density with crossings. The fact that there exist a lot of crossings in the limited section signifies that both of the two areas seggregated by the railway line are attached strongly by each other. In view of this fact, therefore, the railway elevation type is preferred over the other type if effective land use toward future is born in mind. Furthermore, on the Central Line the road runs in parallel with the railway line in many railway divisions. Therefore, suppose if the road elevation type is adopted, the road flyover would hange over both road and railway running in parallel, which would affect the aesthetic view of the urban scenery.

ii) Eastern Line

Since the vehicle traffic flow now crossing the Eastern Line tends to be concentrated into the two existing main roads running at Jl. Kramat Bundan and Jl. Pramuka in the future as well as at present, it is advisable that the road flyover type may be adopted when compared solely in respect of construction cost.

However, if consideration is given to such different aspects that the present Pasarsenen Station is planned for future conversion into the terminal station and, besides, that there exist the well-developed flowishing wayside areas such as Jl. Industrial and J.L.G.Sahari, the railway elevation type may also be taken up for selection. Whichever the case may be, the concrete plan for urban redevelopment potential to the proposed section for railway elevation should become the prerequisite to final choise of the type from the two alternatives.

iii) Western Line

The road flyover type is preferrable for the reasons mentioned below.

- There already exist 7 road flyovers with all crossings being distanced relatively far from each other.
- Even though the railway elevation type might be adopted, it would be less effective, because the Banjir Kanal running on the west side of the Western Line would still remain as the splitter of the whole area into eastern and western boundary.

3) Review on timing for implementation of the elevation project

In the interest of future urban growth, it is desirable that the grade separation project should be executed at the earliest possible data. However, since the construction work should require vast amount of investment, any misjudgement on the timing may provoke a great loss of social costs.

In determining the appropriate timing, comprehensive judgement should be required, together with due reference to the economic analysis result. Technical Feasibility must be determined from the viewpoints of cross traffic volume and constructional problems.

i) Central Line

The Central Line proposed for railway elevation is anticipated toward very near future the road congestion at the crossing points, Jl. Veteran, Jl. Juanda and Jl. Perwira, subsequently followed by other crossings. In this forecast, the work is scheduled to start in 1985 for a construction period of 5 years toward the target completion year in 1990, when trains will be operated on the elevated track.

ii) Eastern Line

The Eastern Line seems to be in no urgent need of grade separation, except the crossing Jl. Pasal Senen, Jl. Pramuka now in the growing tendency of traffic congestion. Therefore, if the project aims at immediate dissolution of congestion, the road flyover type should be adopted. However, if it aims at the harmoneous urban growth of Central Jakarta halved by the Eastern Line, the railway elevation type is preferrable over the other.

The following are the major standards of judgement to determine the appropriate timing for grade separation.

- Only in the aspect of cross traffic volume, the grade separation project still has time until it will be commenced. Therefore, implementation of the project should be deferred to the future time when large social benefit will be assured from such conversion.
- The construction work must be carried out in a very close proximity to the existing railway line. The work should require the tentative relocation such as track, passenger facility, aerial wire, signal and telecommunication system. During the period of construction work, therefore, the train operation will be affected by many restrictive factors with resultant decline in the transport capacity.
- Many skilled workers are required for railway elevation and other associated tentative relocation works.
- The railway elevation work requires a vast sum of investment. Therefore, the work must be carried out at different times for diversion of the investment sum.

— All those restrictive factors considered, it is planned under this study that the project work will start in 1991 toward the target completion by 1995 with the elevated track for train operation. In this instance, the crossing path must require extension of width to dissolve traffic congestion at Jl. Krama Bundar.

4) Preliminary evaluation of the economic influence of the continuous grade separation on the Central and the Eastern Lines.

a) Purpose of Evaluation

In accordance with the "Grade Separation Plans of City Lines" of Chapter 5 (5.2.3.), we examined the following points only as a preliminary trial for the economic evaluation.

Therefore, it is necessary to make a more detailed examination before the concrete planning takes place.

i) possible timing for the construction; and

ii) the feasibility of the investment plan

It may be noted, however, that the main purpose of the examination was on item i) above.

b) The Method of Evaluation

The sections to be evaluated:

The Central Line: Jakarta Kota Station – Manggarai Station

The Eastern Line: Jakarta Kota Station – Pasar Senen Station

We set two different periods for the construction of both lines and calculated the Internal Rates of Return for each case.

	Early Construction	Late Construction
Central Line (Construction Period) (Cost in Million Rp.)	1985 – 1989 52,365	1990 – 1994 62,838
Eastern Line (Construction Period) (Cost in Million Rp.)	1986 – 1989 50,723	1991 – 1994 60,868

The maintenance costs of the elevated tracks were estimated. The project life is in every case 30 years between 1984 – 2013.

We conducted our study assuming that the roads will gain more benefit out of this project. The quantified benefits are listed as follows:

a. Time savings

b. Fuel consumption savings

c. Free land creation and use of space under the elevated tracks
d. Accident reduction
e. Maintenance cost savings
f. Sarings on unnercessary construction cost savings in the case of earlier construction

c) The result of the evaluation is given in the table below:

	Early Construction	Late Construction
Central Line EIRR	1985–1989 9.1%	1990–1994 8.1%
Eastern Line EIRR	1986–1989 6.6%	1991–1994 5.3%

Since the construction of both lines at the same period would be difficult, our conclusion is that the construction of the Central Line, which has the highest IRR for the early construction should be started with the first priority.

It is doubtful whether the elevation of the Eastern Line, which has fewer crossings, lower traffic volume and less IRR, is feasible. However, in estimating the IRR above the development plan for the eastern part of Jakarta city was not taken into consideration in our evaluation. If the development plan becomes more definite and is taken into consideration, there is a possibility that the elevation of the Eastern Line at a later period may become feasible. It is, therefore, recomended that the evaluation should be tried again in view of the development planning of the eastern part of Jakarta city.

5.6 Investment Schedule

1) Basic concept for scheduling of investments

Particular emphasis is placed upon the following matters to prepare the investment time schedule.

i) Utomost contribution to the urban traffic is aimed at with minimum investment by maximum utilization of the existing railway network.

ii) Inasmuch as the railway trunsport is a total system, coordination between the system component factors is of vital importance. Without the coordinated balance, the railway could not perform its function to the full extent. With this in mind, transport capacity should be increased on a step-by-step basis by dissolution of various bottleneck problems in an efficient manner.

iii) The Plan must be practically feasible, basically to prepare for formation of the ideal urban railway network in the 21st century.

The project under this Plan covers the period from 1984 as the initial

fiscal year up to the year 2000, since its implementation is schedule subsequent to completion of the Intermediate Program. Items, time schedule and approximate sum of investments are as indicated in the following Table. The investment items and time schedule must be reviewed at a time interval of about 5 years for updating of the plan to cope with any subsequent changes.

2) Investment sums by project phases

As referred to in the preceding item 5.3 "Implementation of Projects by Phase", the whole period of Master Plan is divided into three phases and the investment sum at each phase is as shown in the following Table by foreign and local currency costs.

(Unit: Rpx10^9)

Items		Phase 1 (1984~1987)	Phase 2 (1988~1991)	Phase 3 (1992~2000)	Total
Ground facilities	Foreign currency	65	154	130	349
	Local currency	35	78	71	184
	Total	100	232	201	533
Rolling stock	Foreign currency	56	54	94	204
	Local currency	2	2	3	7
	Total	58	56	97	211
Total	Foreign currency	121	208	224	553
	Local currency	37	80	74	191
	Total	158	288	298	744

The planned increase of rolling stock for each phase is as shown in the following Table (not including 100 electric cars and 56 diesel cars under the Intermediate Program).

Vehicle type	Phase 1 (1984~1987)	Phase 2 (1988~1991)	Phase 3 (1992~2000)	Total
Electric railcar	116	128	240	484
Diesel railcar	36	12	–	48
Total	152	140	240	532

3) Transport capacity increases by phases

The following Table shows future increases of transport capacity by phases and lines as the result of planned improvement and expansion of ground facilities and additional supplies of rolling stock.

(Rush 2 hours)
(Unit: 1,000 passengers)

Lines	(1980)	At end of Intermediate Program (1983)	At end of Phase 1 (1987)	At end of Phase 2 (1991)	At end of Phase 3 (2000)
Central Line	7.9	15.8	22.6	27.2	45.3
Bekasi Line	2.2	4.5	15.4	18.1	38.5
Western Line	1.6	4.5	13.6	27.2	83.8
Merak Line	2.2	2.2	10.9	18.1	40.8
Tangerang Line	0.5	0.5	6.5	10.9	22.6
Total at entrance of urban line	12.8	23.0	55.4	74.3	147.2

Transport capacity projected in rush 2 hours for the year 2000 will be increased, as compared with that at the end (in 1983) of the Intermediate Program, to about 3 times on Central Line, 9 times on Bakasi Line, 18 times on Western Line and Merak Line respectively and 45 times on Tangerang Line. It can be further increased beyond the above estimate only if additional number of vehicles can be provided, since in the perspective toward the year 2000 all the existing lines in the JABOTABEK Area will be converted into double track, electrified operation and automatic signalling system.

5.7 Proposed Items for Feasibility Study

Feasibility Study is proposed for the following projects which are scheduled for completion by 1987, at the end of phase 1, out of all the projects (See the foregoing Table) proposed under the Master Plan.

1) Track renewal on each line
2) Crossing improvement on each line
3) Improvement of Manggarai Workshop (1st stage work)
4) Improvement of Jakarta Kota Depot
5) Doubling of track between Manggarai and Depok on Central Line (including station facilities improvement, station front area establishment and automatic signalling)
6) New construction of Depok Depot (Stage 1)
7) Electrification of Jatinegara and Bekasi Section on Bekasi Line (including station facilities improvement, station front area establishment and auto-

Investment Schedule

		Project Items	Detail	Cost (Rp × 10^9) Total	Foreign	Local	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	2000
Transport Capacity Expansion Program	Rehabilitation Program	1. Renewal of Track between Depok and Bogor	Track, crossing, fence (ex. station yard)	4	2	2																				
		2. Renewal of Bekasi Line	Track, crossing, fence (ex. station yard)	4	3	1																				
		3. Renewal of Merak Line	Track, crossing, fence (ex. station yard)	2	1	1																				
		4. Renewal of Tangerang Line	Track, crossing, fence (ex. station yard)	4	2	2																				
		5. Improvement of Manggarai Workshop	Track, civil work, building, machinery, electrification	8	5	3					Stage 1															
		6. Improvement of Rolling Stock Depot at Jakarta Kota	Track, civil work, structure machinary, electrification	5	4	1																				
		7. Improvement of Railroad Crossings on East and West Lines	Signal, track	0.5	0.4	0.1																				
		8. Additional Supplies of Rolling Stock		33	32	1																				
	Central Line	9. Track Elevation between Kota and Manggarai	Track elevation, track, station facilities, station front area, electrification, automatic signal, ATS	52	32	20																				
		10. Grade Separated Crossing in Manggarai Station	Track elevation, track, station facilities, station front area, electrification, automatic signal, ATS	34	22	12																				
		11. Track Addition (Manggarai – Depok)	Track addition, track, station facilities, station front area, electrification, automatic signal, ATS, new station, rolling stock	57	45	12									ATS					New station						
		12. Track Addition (Depok – Bogor)	Track addition, track, station facilities, station front area, electrification, automatic signal, ATS, rolling stock	37	28	9																				
	Eastern Line	13. Track Elevation of Eastern Line (Kota – Gong Sentiong)	Track elevation, track, station facilities, station front area, electrification, automatic signal, ATS	61	37	24																				
		14. Installation of Automatic Signal of Eastern Line (Gong Sentiong – Jatinegara)	Track, station facilities, station front area, electrification, automatic signal, ATS	4	2	2																				
		15. Improvement of Station Facilities at Kampung Bandan	Track, station facilities, station front area, electrification, automatic signal, ATS	11	7	4																				
	Western Line	16. Installation of Automatic Signal and Station Facility Improvement	Track, station facilities, station front area, electrification, automatic signal, ATS, new station	22	14	8												New station								
		17. Installation of Automatic Signal and Station Facility Improvement between Kampung Bandan and Tanjung Priuk	Track, station facilities, station front area, automatic signal, ATS, new station, electrification	12	7	5												New station								
		18. Flyovers on Western Line	Bridge	13	8	5									Stage 1					Stage 2						
	Other Line	19. Electrification of Bekasi Line (Jatinegara – Bekasi)	Track, station facilities, station front area, electrification, automatic signal, ATS, rolling stock	75	65	10									ATS											
		20. Track Addition and Other Improvements on Merak Line	Track addition, track, station facilities, station front area, electrification, automatic signal, ATS, new station, rolling stock	109	95	14															New station					
		21. Track Addition and Other Improvements on Tangerang Line	Track addition, track, station facilities, station front area, electrification, automatic signal, ATC, new station, rolling stock	63	52	11														New station						
	Car Depot	22. Establishment of New Electric Rail Car Depot at Depok	Track, civil work, building machinery, electrification, signal	18	11	7					Stage 1									Stage 2					Stage 3	
		23. Reinforcement of Manggarai Workshop	Civil work, track, structure, machinery	12	8	4											Stage 2								Stage 3	
		24. Establishment of Rolling Stock Depot for Passenger Coaches	Civil work, track, building, machinery electrification, signal	3	2	1																				
	New Line	25. New Line for New Airport	New line, track, station facilities, station front area, electrification, automatic signal, ATS	36	24	12																				
		26. Cibinong Line for Passenger Traffic Service	New line, electrification, signal, track, station facilities, station front area, electrification, automatic signal, ATS	64	44	20																				
		Total		743.5	552.4	191.1																				

Note: Cost is based on the price as of June, 1980.

Legend: ——— : Project Items of Feasibility Study ——— : Others

matic signalling)

(8) Additional supplies of rolling stock

Aside from above project items, Feasibility Study for the conversion project into continuous track elevation on Central Line is also in urgent need of implementation.

6. EDUCATIONAL TRAINING PROGRAM

6.1 Present Status

The educational training for the PJKA personnel is provided in two different institutions, Railway Engineering College and Training Center, in addition to the on-the-job training within the office or workshop.

1) Railway Engineering College
   This institution is established in Bandung with the aim to cultivate the supervisory technical staff in the fields of train operation, track maintenance, civil work, signalling and telecommunication and mechanical equipment, each course admitting entrance of 30 trainees for a training period of 3 years. Trainees are selected by examination tests from among those high-school graduates with job experience of 2 to 4 years.
2) Training Center
   There exist 2 Centers in Bandung and one more in Yogyakarta as the post-graduate training institutions for staff personnel in the field divisions.
   The Centers in Bandung provide curriculums on train operation, signal and telecommunication, civil work, management and mechanical administration, each course being opened for a period of 3 to 6 months, twice at least to four times a year, for about 30 trainees at one time.
   The other Center in Yogyakarta provides education and training for field workers such as operators for diesel locomotives, car inspectors and workshop mechanics. It admits 25 trainees for a period of 2 to 3 months.

6.2 Expansion and Improvement of Educational Training System

In order to operate the railway most effectively and efficiently with modernized ground facilities and rolling stock, the professional quality of each personnel, such as sense of responsibility and ability of judgement, must be improved with enhancement of knowledge and skill to high level.

It is advisable that the training program as a part of the PJKA Development 5 ~ 10 Year Plan (1979 ~ 1989), for which effort is being exerted by the PJKA should be executed on a gradual basis.

In the viewpoint that the employee training is basically essential to future progress and growth of the PJKA, it is recommended that the following items should be executed under the established training scheme.

1) Effort should be made for wide spreading of the vocational training among all the employees and the correspondence education system should be executed for improvement of ability and qualification of each employee.
2) New curriculums should be introduced aiming emphatically at fostering ability of proper judgement and efficient treatment for operation, inspection and repair of vehicles and facilities. As a method to achieve this aim, teaching of liberal arts and sciences is recommended with the object to enhance the employee's spirit of study and thinking ability.
3) The educational training system must be established, together with expansion of the necessary training facilities, for the employees at all levels and jobs from the top executive personnel to the field workers.

6.3 Immediate Problems related to Employees Training

With improvement of ground facilities and additional increases of rolling stocks and train operation, a greater number of personnel qualified with new knowledge and skill will be required, as shown in Table 7.3.1, to operate and maintain the future railway system. Therefore, to secure and train the necessary number of personnel the staffing and personnel training plans must be established on the long-range projection.

Especially, a large number of operators, maintenance workers and conductors must be cultivated by training. In the unexperienced engineering field as represented by signal and telecommunication, it is necessary that the apparatus as teaching materials should be introduced at an earlier stage and qualified instructors and field work leaders should be cultivated by assignment to the training institution abroad in advance of training for the general personnel. Also it will be necessary to promote education and training for personnel in general by proffesional staffs of well-experienced foreign countries.

Since the project period under the Master Plan covers a long range of work time for completion, it is also recommended that the training program should be formulated so as to enable many personnel to participate in the work operation for track addition, electrification and automatic signalling and acquire new knowledge and skill through performance of the work. In this respect, it is worthwhile to consider new construction of the training facility modernized with sufficient accomodating capacity in the JABOTABEK Area.

7. ADMINISTRATION AND MANAGEMENT

7.1 Organizational System

1) Management pattern
The railway in the Republic of Indonesia is named Indonesian State Railways, which is operated as the Government-owned enterprise under the Law of Indonesian State Enterprises 1927. The State Railways is operated at full responsibility of the President of the Indonesian State Railways, though it is placed under control within the power of authority by the Minister of Transport and Communications.

2) Present administrative system
The Indonesian State Railways, operating some 6,900 km track line and holding employees of 55,500 persons, is organized with four different levels of administration system from Head Office at its top down to Regional Offices, Inspection Offices, and field offices and, aside from that organizational line, with local organs including rolling stock and bridge workshops.
All the existing lines being operated within the JABOTABEK Area are under administration of Inspection 1 within the jurisdiction of West Java Region.

3) Review on organizational system
The railway enterprise is featured by such special characters that the area of business operation covers a very wide expansion, the organization is diversified into various categories of jobs which require sophisticated knowledge and skill, the activity of management is restricted by time limit and the execution needs high speed mass transit at the guarantee of human life (passenger) and property (freight). Therefore, the optimum organizational system for railway administration must be set up with due consideration to those features as mentioned above.
At a look over the present systems of West Java Region and Inspection 1, when viewed from those standpoints, it is considered necessary that the following points should be further studied, though the systems seem to be complete with their organizational frameworks. It is of the opinion that improvement should be made as to the execution system rather than the organizational system.

i) Administrative office location
It is preferrable to have the administrative office generally near the center of its jurisdiction area. In consideration of Manggarai Station being supposed to become the pivot of the transport network within the JABOTABEK Area it is advisable that the main offices of West Java Region and Inspection 1 should be situated, if possible, near Manggarai Station.
Relocation of those main offices is one of the subjects worthy of review in the long-term perspective, although there exist difficulties to be involved in financing and land acquisition, in addition to the traditional

and historical relationship the present offices have with the local community people of D.K.I. and the symbolic status of Jakarta Kota Station.

ii) Administration scale of Inspection 1

The administration scale of Inspection 1 covers at present the operating kilometerage of about 460 km with total workforce of about 6,400 at its 230 field organs. This is a relatively larger scale than any others in the whole PJKA territory or the Java Island. Besides, it is anticipated that Inspection 1 will be expanded with significant increases of both work volume and workforce when the Master Plan will come to its end.

All those conditions considered, the optimum scale of Inspection 1 must be reviewed in the future, from the viewpoints of topography, administrative district and transport pattern, mainly with regard to the administrative boundary including the vertical stratum of local administration between Region and Inspection 1.

iii) Administrative system on electrical service

The administrative system in the electrical engineering sector of Inspection 1 deals with electrical operation on catenary, substation and lighting, at the Electrical Engineering Division of Mechanical Engineering Department.

It is anticipated that the work volume should be increased with expansion of the maintenance territory and increase of the maintenance service upon completion of track addition and electrification projects on each line. Therefore, the administrative system must be strengthened for consolidation of the organization.

To cope with such future reformation, it is most desirable that the Electrical Engineering Division should be established independently. It should be noted, however, that necessary measures should be taken to prevent any possible organizational complexity and increase of staff number which may be provoked by such reformation

iv) Administrative system on signal and telecommunication services

All signal apparatuses, relay interlocking divice and ATS which will be introduced under the Master Plan will be entirely new to everyone and of utmost importance as the security system for train operation. Therefore, precise care and high technology will be required for preservation of their operational functions. To meet the maintenance needs of those new systems, the present administrative system of Inspection 1 must be reviewed from the overall aspect.

v) Dispatching system

In order to secure train operation of high speed and tight time schedule, the complete service system must be established for dispatching services for train operation and passenger transport needed to restore the operation diagram from disturbance upon incidence of accident or to catch up rapidly with undulation of the transport and also for electrical dispatching

service needed to back up train operation.
It is very important to keep the close cooperation among those dispatchers, so as to secure smooth transportation service.

vi) Information transmission service system
In order to ensure officient operation of the modernized railway system, the reliable communication channel must be established as the essential means for transmission of instruction, direction and order from the administration division to field organizations and also for exchange of information closely between offices within the organization. To meet this need, the information service system must be improved and the communication channel must be established.

4) Maintenance service system
To maintain the operating functions of ground facilities, including rolling stocks, track lines, electrical equipment, signal and telecommunication system, in the best condition is most necessary for trouble-free operation of the railway system. In this regard, the present maintenance service system must be reviewed and improved from the viewpoints itemized hereunder:

a. Standardization of equipment, parts and materials and assurance of their reliability
b. Establishment of inspection and test standards
c. Review of maintenance work plan
d. Analysis on cause of failure and determination of countermeasures
e. Review of maintenance work system and improvement of working method by mechanization
f. Efficient business operation for inventory stock control, procurement and supply of maintenance materials

7.2 Financial Situation of PJKA

PJKA is an independent organization with responsibility for the day-to-day management of the railways in Indonesia. However, their status has been as one of the bureaus under the Ministry of Transport and Communication since April 1979.

The procurement of fixed assets, including rolling stock, and the securing of necessary funds for investment, are the responsibility of the Government. The role of PJKA is to manage the transport operations and maintenance of these allotted assets.

PJKA is supposed to be operated in such a way that operating revenue covers operating costs. PJKA is also supposed to pay 3% interest on the assets which have been procured by the Government. However, due to the fact that PJKA is in operational deficit (expenses in general are 1.4 times the revenue in recent years), the Government is providing it with subsidies and the payment of this interest has never been practiced.

With the present Railway fares, the revenue do not actually cover the operating costs. The fares for the JABOTABEK train are maintained at a low level for the last two

years while tariffs of the medium and long distance trains are raised in April 1979 (23% on average) and in May 1980 (17% on average) to cover the cost.

The portion of maintenance cost is, therefore, reduced and the necessary costs for the maintenance need also to be supplied by the Third 5-Year Plan (Pelita III) of the Government.

PJKA is presently concentrating on the reconstruction of railway networks, which have been more or less left untouched for more than 20 years, by implementing PJKA's "Five and Ten Year Development Plan (1979–89)."

Out of operational expenses of PJKA for the years 1977 and 1978, nearly 50% was personnel costs and 25–30% was alloted for maintenance. Since there was a large-scale salary increase in April 1980, the portion allotted to personnel costs is approximately 60%, and that to maintenance is 17% in the budget of 1980/81, which shows the clear tendency that relatively fewer funds for maintenance are becoming available and more subsidies will have to be provided by the Government.

7.3 Subsidiary Enterprises

1) Present status
   PJKA provides management of the subsidiary enterprises including station stalls and refreshment rooms, dining on board the train, land lease and warehousing. The gross earnings from such incidental business lines are estimated at 714 million Rp in 1978 from the whole service territory of PJKA, or 2.3% of total business earnings and 74 million Rp in 1979 within the administrative area of Inspection 1, or 0.6% of total business revenue.
2) Necessity for expansion of subsidiary enterprise activities
   Today, in many countries the railway business is in chronic deficit and granted with large sum of governmental subsidies. Since the railway takes its important part as the principal means of transport, the railway authority uses its best endeavor to increase the revenue by all possible means through management of the subsidiary enterprise, besides those administrative and financial aids from the government and coverage of its deficit account by fare rate increases. Expansion of the subsidiary enterprise is promoted from the following encouraging viewpoints.
   i) The railway possesses a large expansion of land of high utility value. This real estate should be utilized for business purpose most effectively.
   ii) The railway station in a large city attracts many people to gather. It should be, therefore, utilized not merely as the place for train passengers but also as the junction point between town people and railway, so that it may be used for promotional purpose to get more passengers and for prosperity of the local community.
   iii) Any space available under the elevated track line, when completed, should be utilized effectively.

3) Concrete examples of subsidiary enterprise

For reference purpose, the following items are instanced as concrete examples of the JNR's subsidiary and invested business enterprises.

i) Subsidiary enterprise items

a. Sanction on passenger service business within railway premises
Station stall, dining car restaurant and other commercial activities inside station building

b. Sanction on posting of advertisement articles

c. Sanction on use of freight yard
Warehousing and freight yard business

d. Leasing of land

ii) Invested business items

a. Commissioned services to agents
Ticket sales, vehicle maintenance and rapair and data processing

b. Business closely associated with transport
Seaside railway, bus terminal facilities, warehouse terminal, goods distribution terminal and other cargo transport facilities and passenger terminal facilities and rental motorcar

c. High utilization business
Room rent, hotel, rental or installment house, sports and recreational facilities, bus terminal, parking lot, shopping, rest house, advertising media, real estate control under elevated track, motorcar driver training school and new traffic system

d. Utilization promotion of railway line
Hotel, tourism and recreational facilities

8. ECONOMIC EVALUATION

1) Methodology

Based on the "with or without" principle, only incremental benefits and costs due to implementation of the Master Plan were considered in estimating the Economic Internal Rate of Return (EIRR).

2) Estimation of Traffic Volume

The traffic volume in the form of Passenger-Km was estimated at each railway line and at different time periods (peak hour/non-peak hour).

The traffic demand consists of three categories,

a. Normal Traffic : natural increase of railway passengers

b. Diverted " : switching to railway use away from the roads

c. Developed " : influenced by development of new residential areas

3) Factors for Estimating Cost and Benefit

	Cost Estimate		Estimationation of EIRR	
	Investment Items	Operation and Maintenance Costs	Cost	Benfit
With	(1) Railway facility (2) Rolling-Stock	Personnel, maintenance and replacement costs, and fuel expenses	difference in investment	1. cost saving benefit 2. time saving benefit 3. benefit from conditions grade separation
Without	Road and motor vehicles (bus & motor car)	Personnel, maintenance & replacement costs and fuel expenses		

4) Traffic volume and speed of motor vehicles on the roads in the case of "without project"

The investment costs for the construction of needed roads and needed vehicles were calculated from the equation which shows the relation between the increase in traffic volume and decrease of travelling speed. Also, the operation and maintenance costs were calculated by using factor of travel speed of buses and passenger cars.

The shares of passengers using buses and motor cars were used as key parameters for this analysis.

5) Economic Evaluation

The IRR was calculated for 3 different cases set out from the above parameters.

	Case 1	Case 2	Case 3
Bus/Motor Car Passenger Shares	70% : 30%	90% : 10%	100% : 0%
IRR	19.3%	10.8%	5.6%

Case 1 is the ratio obtained from Table 1.2.2. in the Master Plan Report,

Case 2 is based on the assumption that the energy saving policy was pursued by the Government with more emphasis on mass-transport facilities on road.

Case 3 is an extreme case.

Saving benefits of Case 2 expected by comparing with Case 1 is given below:

a. Saving investment costs for road construction amounts to R_p. 45.5 Bil (40%)
b. Saving investment for cars, R_p. 219.5 Bil (38%)
c. Saving operational and maintenance costs, R_p. 535.9 Bil (38%)

Saving benefits expected by comparing with "Without Project":

	(Case 1)	(Case 2)
1. Maintenance & operation costs	4.3 times	2.7 times
2. Fuel	19.5 times	9.1 times

Considering the relatively favorable IRR of 10.8% in even in Case 2, we believe that this Master Plan is economically feasible. The feasibility of the Plan will be further justified by the unquantifiable benefits which are considered equally important.

9. FINANCIAL EVALUATION

1) Methodology and the Purpose of Evaluation

Cash Flow Projection consisting of such items as revenues, operating costs, investment and financing programs were prepared on the incremental principle. The cash flow projection was analysed with a view on the following points:

i) Whether PJKA needs Government subisdies.

ii) How big is the debt service the Government will have to bear against the invested funds and whether the Plan itself can generate funds to pay back its debt from its own cash flow.

We made up cash flow tables for the following three assumed cases.

	Foreign Currency	Local Currency	Notes
Basic Case	6.0% p.a. 27 years, incl. 7 years, grace	Goverment Budget	Assumed the average ODA Loan
Case 1	3.0% p.a. 30 years incl. 10 years grace	Government Budget	Assumed to be the concessional loan on ODA base excluding IBRD/APB loans.
Case 2	6.0% p.a. 27 years incl. 7 years grace	13.5% p.a. 12 years incl. 2 years grace	Assumed to be a case with the biggest debt burden

2) Income Account of PJKA

Since a large traffic demand is forecasted in future, operational profit (revenue) minus operational cost) is expected for the full period of the Plan and the government subsidy will not be needed.

The average operational profit is expected to be as much as Rp 21 Bil per year, and the realization of the Master Plan is expected to contribute to the improvement of PJKA's profit, which is presently in the red.

(3) Analysis of Cash Flow

i) Basic case:

Net cash flow remains in deficit for the whole period, however if the passenger fare is raised by 20% (assuming passenger volume remains unchanged), the net cash flow will turn to a plus, on comulative basis, at the end of the plan period.

ii) Case 1:

The net cash flow is slightly over the boarder line with the prevailing fare, and the repayment of liability will neither result in an increase in government financial burden, nor lead to an increase in burden of passengers (no fare increase necessary).

In the case of decrease of passengers greater than 10% (fare remains unchanged), however, the net cash flow turns into a deficit and the fare may have to be raised.

iii) Case 2:

Debt burden is the biggest and the fare has to be raised by more than 50% in order to meet repayment of the principals and interests.

(4) Evaluation

We came to the conclusion that the Master Plan will be financially viable, provided that, (1) the domestic currency portion of the investment has to be provided by the Government (Pelita); (2) the loans from external sources are concessional enough; and (3) sufficient passenger volume can be expected. However, in case the overseas financial assistance is not soft enough, and/or the passenger volume is not as forecast, or the combination of both, the appropriate fare increase will have to be considered.

INTRODUCTION

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1. Background Situation

The Jabotabek Area consisting of Jakarta City and its environs such as Bogor, Tangerang, Bekasi and Serpong is encountered with rapid growth of population in the face of brisk economic and industrial activities, thus posing a big problem with regard to the commuting transport service in Jakarta and between its satellite cities.

Notwithstanding the fact that the railway line runs on the relatively favorable route in Jakarta and its environs with mass transport demand, the function as a railway system is not fully performed because of a number of problems, such as superannuation of facilities, level crossings with main roads, negligence in maintenance care of railway land and lack of organic interconnection with the feeder traffic system, since there has not been any definite improvement plan oriented toward development of the existing railway as the urban transport means.

As concerns urban development and traffic improvement in the JABOTABEK Area, various surveys were conducted in the past and plans were drafted from those results. They are:

1) D.K.I Jakarta Master Plan as the integrated urban development plan for the D.K.I. Jakarta
2) JABOTABEK Project as the integrated development plan for the JABOTABEK area
3) Jakarta Metropolitan Area Transportation Study (JMATS) as the long-range traffic plan for roads and railways
4) Rapid Transit Study of Eastern Corridor (RTSEC) as the railway improvement plan for the Eastern Line
5) Intermediate Program as the railway improvement plan with target of completion in the near future
6) JABOTABEK Railway Development Project (JARDEP) as the preliminary study for long-term railway improvement projects in the JABOTABEK Area

This sutdy has been made by careful reference to those past study results and is indebted to them as the invaluable data.

It should be pointed out, however, that D.K.I. Master Plan and JMATS are not yet given their functional role as the guideline for determination of the railway facility plan because of the investment estimated for a tremendous sum. That is to say, it seems that they are not as yet taken up as the Master Plan for traffic-policy making.

In the perspective view of future growth in the JABOTABEK Area, it is anticipated that the urban traffic congestion would remain unavoidable unless the railway fulfils its responsibility as the backbone of the urban traffic system. In fact, however, since the present urgency of improvement would not permit any time allowance to wait until final decision of the Master Plan as the guide for railway improvement planning, the Indonesian Government formulated the 'Intermediate Program' as the immediate measures for the transitional period, under which the railway improvement projects started in 1976 toward

target completion scheduled for 1983. This Program is, indeed, worthy of high appraisal as the initial approach toward establishment of the high-speed mass transport system, but is limited to the short-term, immediate measures, leaving the post-Program railway plan yet undecided in a blank.

Therefore, the next problem of transport policy making is how to fill the blank beyond the completion time of the Intermediate Program. As a step in this direction, the JARDEP is proposed as the preliminary study. It should be noted, however, that it is only the result of observation by a short-time preliminary study, but not the result of study on a long-term basis for solution of the traffic problem. In order to fill up the blank, the Government of Indonesia requested the Japanese Government to formulate the overall railway modernization plan with the long-range vision beyond the scheduled end of the Intermediate Program.

In accordance with this request, the Japanese Government decided implementation of the proposed survey as a part of its overseas technical cooperation scheme and, in line with this decision, the Japan International Cooperation Agency (JICA) as the executing organization dispatched the preparatory study mission headed by Mr. Fumikatsu Tachibana to Indonesia in February 1980.

The study mission after round calls to the governmental agencies concerned in Indonesia, entered into agreement with those officials involved with regard to the Scope of Work and the tentative period of survey by due reference to all necessary data and information available.

The survey was thus conducted under the agreement.

2. Objective of Survey

The purpose of survey is to draft a Master Plan for establishment of the overall railway modernization plan toward the target year 2000, with due consideration to further growth of economy, industry, people's living and culture in the JABOTABEK Area.

Priorities will be determined on each individual project and feasibility study will be made on those projects scheduled to start toward the target completion generally by 1985.

3. Survey Outline and Schedule

The time schedule for the survey is divided largely into three stages as shown hereunder.

1) 1st Stage: Domestic preparatory works
   Review of collected data available and general outline of policy for execution of the survey
2) 2nd Stage: Site works
   Site works in Indonesia continued for about four (4) months starting from May 29 and ending on September 25, 1980 by execution of major work items as listed hereunder.

i) Presentation, briefing and discussion on the Inception Report
ii) Discussion and hearing meetings with officials of Governmental agencies concerned
iii) Collection of relevant data and information
iv) Review and updating of published data relevant to traffic volume, demand analysis and forecast
v) Present status survey and analysis on facilities, organization, management and administration of the existing railway system
vi) Supplemental traffic survey (for clarification of number of passengers by stations and traffic congestion at each crossing)
vii) Review on prerequisite conditions to railway transport expansion and facility improvement plans
viii) Establishment of basic concepts for railway development Master Plan (including object, scope, items, construction period and priority)
ix) Basic survey on economy and finance
x) Selection of proposed projects for Feasibility Study and determination of rough plan on the study method
xi) Preparation and briefing of the Progress/Interim Report

During the period of site survey period, the joint supervisory committee meetings between Indonesian and Japanese representatives were held three times (in June, August and September, 1980), and Progress/Interim Report was submitted in September.

3) 3rd Stage: Domestic Works

Domestic works are performed for the period from October 1980 to March 1981 principally on the following items:

i) Review on the basic conception for the Master Plan
ii) Orientation of short-term railway improvement planning
iii) Review of collected data and information and study of detailes thereof
iv) Preliminary design and cost estimation
v) Economic analysis and financial evaluation
vi) Plan of short-term railway improvement projects and their implementation program
vii) Preparation of the Draft Final Report and site briefing therewith
viii) Final Report preparation

4. Basic Policy on Survey Activities

The Master Plan as the concrete guideline for the railway traffic system projected toward the year 2000 should serve as the practically feasible scheme to fill up the blank period after termination of the Intermediate Program and, besides, should have a reasonable relationship with the urban development and urban traffic plans. In other words, a solution must be answered to the question as to how the railway transport will be able to contribute toward solution of the traffic problem in the JABOTABEK Area within the limited scope of investment scale, work period and operating capability.

In formulating the plan, consideration was given to the coordinated balance with the future railway traffic demand forecast, aiming mainly at maximum possible expansion and improvement of the existing railway facilities. Further study was made as to the necessity of new line construction from the aspect of inducement of passengers, together with Study for development of new stations, station front area and feeder system.

Full consideration was also given to such factors as operational organization, operation control, maintenance capability and personnel education and training, which are essential to operation of the mass, high speed and density urban railway transit system.

The Master Plan should require review of the implementation plan for all the subsequent projects, at termination of the short-range program, with reconsideration to the up-to-date changes in the city-side condition and new information available.

5. Organization

Listed hereunder are the organizational system involved in this feasibility study which consists of the Supervisory Committee, Survey Team and their respective counterparts on the part of Indonesia.

5-1 JICA Supervisory Committee

Dr. Y. Matsumoto (Chairman)	-	Professor Civil Engineering Department, Tokyo University
Mr. Y. Fukuda (Deputy Chairman)	-	Director Rolling Stock & Operation Division Railway Supervision Bureau Ministry of Transportation (MOT)
Mr. N. Kodera	-	Deputy Director Civil Engineering & Electricity Division Railway Supervision Bureau, MOT
Mr. S.Onoyama	-	International Cooperation Officer Rolling Stock Industry Division Railway Supervision Bureau, MOT

Mr. T. Kuroda	- Deputy Director Division of Safety Operation Railway Supervision Bureau, MOT
Mr. A. Otake	- Deputy Director International Secretariat, MOT
Mr. T. Oguni	- Deputy Director, Planning Division, Shinkansen Construction Department, Japanese National Railways (JNR)
Coordinator:	
Mr. H.Kawaguchi Mr. K. Mima	- Social Development Cooperation Department, Japan Internationl Cooperation Agency (JICA)

5-2 Indonesian Government Steering Committee

Ir. Giri S. Hadihardjono (Chairman)	- Directorate General of Land Transport and Inland Waterways (PHBD)
Mr. Gatot Soedjantoko	- Directorate General of Land Transport and Inland Waterways (PHBD)
Drs. Mochtarudin Siregar	- National Planning and Development Board (BAPPENAS)
Ir. Abdulrachman	- Ministry of Transpot, Communications and Tourism
Ir. Wijoto Wijono	- Directorate General of Hidhways (BM)
Mr. Sugiarto Sumobrote	- Directorate General of Budget
Ir. Ruslan Diwirjo	- Directorate General of Cipta Karya
Ir. F. Soewarto MSc.	- Highways and Traffic Agency, Jakarta Capital City Government (DLLAJR—D.K.I.)
Ir. Soetijanto Ir. Sriwiranto	- Indonesian State Railways Headquaters (PJKA)
Ir. Soetarno	- Western Regional Office of PJKA
Drs. R. Soekotjo	- Directorate General of Land Transport and Inland Waterways (PHBD)
Drs. Tb. M. Rais	- City Planning Bureau of D.K.I. Jakarta
Mr. Kandar S	- City Planning Bureau of D.K.I. Jakarta
Mr. Moch Slamet	- Directrate General of Land Transport and Inland Waterways (PHBD)

5-3 JICA Study Team

Mr. Mikio Sudo	- Team Leader Executive Vice-President, Japan Railway Technical Service (JARTS)
Mr. Nobuwaka Yamakawa	- Member (Transport Demand Forecasting) Adviser to JARTS
Mr. Naoshi Kawabata	- Member (Transport demand forecasting) Adviser to JARTS
Mr. Yoshikazu Itoh	- Member (City and Regional Planning) Adviser to JARTS
Mr. Masaki Tamura	- Member (Transport Economy) Adviser to JARTS
Mr. Takamatsu Sakai	- Member (Railway Management) Assistant to the Director Corporate Planning Dept., Japan National Railways (JNR)
Mr. Masao Taniwaki	- Member (Train-Operation Planning) Assistant to the Director, International Dept., JNR
Mr. Ikujiro Kikuta	- Member (Line and Structures Planning) Senior Engineer, JARTS
Mr. Kenji Maeda	- Member (Track and Crossing Planning) Adviser to JARTS
Mr. Toshiki Miyuki	- Member (Station and Yard Planning) Assistant to the Director, Research & Planning Section, Tokyo 3rd Construction Div., JNR
Mr. Ichiro Nomura	- Member (Rolling Stock and Workshop Planning) Senior Engineer, JARTS
Mr. Masanobu Niwa	- Member (Electrification Planning) Adviser to JARTS
Mr. Kazuei Asada	- Member (Signal and Telecommnication Planning) Assistant to the Director, International Dept., JNR
Mr. Tomohiro Ishiguro	- Member (Financial and Economic Analysis) Adviser to JARTS

5-4 Indonesian Counterpart Experts

Project Officer	Ir. Ajeh Karyana	Chief of Sub Directorate of Development, PJKA
Deputy Project Officer/Mechanical	Mr. Hardi	Staff Chief of Sub Directorate of Rolling Stock, PJKA
Administrator	Drs. Hatmadji P	Chief of Sub Division of Planning & Programing (PHBD)
Electrification	Mr. Tugiman	Supervisor of Rolling Stock, PJKA
Signal & Telecommunication	Mr. Suradji	Chief of Division of Signal & Telecommunication West Regional Office, PJKA
Civil Engineer	Ir. Satriyo K	Staff of Directorate Way and Work, PJKA
Railway Planner	Mr. Tohir Kartabrata	Vice of Manager of Traffic and Comerce West Regional Office, PJKA
Transport Planner	Ir. Udji Atmono	Staff of Planning Division (PHBD)
Economist	Mr. Wahjuhardjo	Staff Chief of Sub Directorate of Marketing, PJKA
Ass. Administrator	Mr. Yunus	Staff of Planning Division (PHBD)