CHAPTER 5. IMPROVEMENT PROGRAM CLASSIFIED BY LINE

CHAPTER 5 IMPROVEMENT PROGRAM CLASSIFIED BY LINE

5.1 Purpose of Improvement Program

The purpose of the JABOTABEK Area Railway Transport Development Program can be generally divided into the following three itms:

1) Improvement of foundation of existing lines
   Improvement of ground facilities in the Intermediate Program is such that emphasis is laid on the section in the urban area, and it does not cover the entire JABOTABEK Area. Consequently, a part of the purpose of the JABOTABEK Area Railway Transport Improvement Program is to improve the railways in the entire JABOTABEK Area up to an equal level by executing reinforcement of sections in suburban area (tracks, crossings and fences) as the Stage that is subsequent to the Intermediate Program.
2) Expansion of transport capacity
   Because of the fact that reinforcement of foundation aims to enable exhibition of functions of railways on the existing facilities level, efforts should be made to expansion the transport capacity by making improvement in quality to cope with the increase of the traffic demand. Therefore, track addition in the section between Manggarai and Depok of Central Line and electrification in the section between Jatinegara and Bekasi of Bekasi Line will be made as the Project that is most urgently required. In combination with these works, efforts will be made to improve passenger services by improving station facilities and by establishing station front areas, and in addition, expansion of transport capacity and improvement of security will be made by automatic signalling system.
   Improvement of tracks of existing lines will also be executed simulateneously.
3) Improvement of back-up facilities
   Improvement of inspection and repair facilities of workshops and railcar depots will be made for maintaining railcars in good conditions. This Project should be urgently executed because it is not included in the Intermediate Program. Furthermore, improvement of Jakarta Kota Depot will be made as a base for storage of railcars, and an electric railcar depot will be constructed in Depok.

5.2 Contents of Reinforcement of Ground Facilities

5.2.1. Steps of improvements

For execution of improvement program, it is necessary to consider matching of various lines and sections and also to make planning so that duplicate efforts in construction works will be avoided. Table 5.2.1. indicates the time of completion of each item of improvement classified by line and section.

Table 5.2.1 The Time of Completion

Line	Section	Improvement of Foundation of Existing Lines		Expansion of Transport Capacity						
		Track	Cros-sing	Track Addition	Electrifi-cation	Track	Cros-sing	Station Facilities	Station Front Area	Auto-matic-Signalling
Central Line	Jakarta ~ Manggarai	(1983)	(1983)	–	–	–	–	–	–	–
	Manggarai ~ Depok	–	–	1987	1987	1987	1987	1987	1987	1987
	Depok ~ Bogar	1985	1985	–	–	–	–	–	–	–
Eastern Line	Jakarta ~ Jatinegara	(1983)	1985	–	–	–	–	–	–	–
	Tanjungpriuk ~Kemayoran	(1983)	1985	–	–	–	–	–	–	–
Bekasi Line	Jatinegara ~ Bekasi	–	–	–	1987	1987	1987	1987	1987	1987
Western Line	Jakarta ~ Jatinegara	(1983)	1985	–	(1983)	–	–	–	–	–
Merak Line	Tanahabang~ Serpong	1986	1986	–	–	–	–	–	–	–
Tangerang Line	Duri ~ Tangerang	1985	1985	–	–	–	–	–	–	–

Note: What are indicated in parentheses are included in the Intermediate Program.

In order to avoid duplicate efforts in construction works, improvement of station facilities and station front areas, automatic signalling and so forth will be executed in parallel with the works of electrification and grade separation of crossings. Reinforcement of tracks planned on the improvement of foundation of existing lines does not include station yard areas. As changes to station yard track become necessary at the occasion of improvement of station facilities such as elevation of platforms, renewal of tracks and replacement of turnouts in station yards will be made at the occasion of improvement of station facilities. Improvement of crossings and fences will be partly made for urban lines in the Intermediate Program. Therefore, improvement of crossings and installation of fences in the remaining sections of urban lines as well as of suburban lines will be made in this Project.

For the purpose of backing up expansion of the transport capacity, improvement of Manggarai Workshop will be completed in 1986, improvement of Jakarta Kota Depot will be completed in 1985 and construction of a new electric railcar depot in Depok will be completed in 1987. It is planned that Manggarai Workshop and the electric railcar depot in Depok will be sequentially reinforced in accordance with increase of number of railcars, and the work mentioned above is of Phase I.

5.2.2 Contents of improvement classified by line and section

The matters specific to lines and sections are described in this section, as the common contents of improvement are described in detail in Chapter 4.

(1) Central Line

The track addition work in the section of 22.8 km between Manggarai and Depok of Central Line will be commenced in 1984 and will be completed in 1987. Eelctrification of added tracks, strengthening of tracks, improvements of crossings and station facilities as well as installation of automatic signal of existing sections will be executed at the same time. Renewal of tracks, reconditioning of crossings and installation of fences between Depok and Bogor will be completed in 1985. The contents of improvement classfiied by item are indicated in Table 5.2.2.

Table 5.2.2 Improvement of Central Line

Item \ Section	Jakarta ~ Manggarai	Manggarai ~ Depok	Depok ~ Bogor
Track addition	–	Double tracking will be made by track addition of 22.8km.	–
Electrification	–	The section of track addition will be electrified.	–
Track and fences	(Executed in the Intermediate Program)	Existing lines will be reinforced in parallel with track addition work.	Consolidation will be finished by 1985.
Crossings	(Executed in the Intermediate Program)	To be executed at the time of track addition work. o Automation: 8 crossings o Improvement to double track automation: 9 crossings	Consolidation of 5 crossing will be finished by 1985.
Station facilities	–	Tebet Duren Kalibata Pasarminggu Tanjungbarat Lentengagung Pondokcina Depokbaru Depok Improvement will be made at above stations.	–
Station front area	–	Same as above.	–
Automatic signalling		To be executed in parallel with track addition work. Relay interlocking devices will be provided at Pasarminggu Station and Depok Station.	

1) Tracks

Renewal of tracks will be made with the target of increasing the maximum train running speed to 60 km/h in urban lines and 100 km/h in suburban lines. Renewal will be made for the suburban lines because urban sections of Central Line are scheduled to be reinforced in the Intermediate Program. Together with reinforcement of the existing line in parallel with track addition between Manggarai and Depok, change of track layout and replacement of turnouts in station yards will be made. Renewal of tracks between Depok and Bogor will be made excluding station yards with future double tracking taken into account. In addition, Installation of fences will be made in all sections.

2) Crossings

It is scheduled that crossings in the urban sections will be reconditioned in the Intermediate Program.

In this Project, therefore, barriers of eight crossings will be automated at the occasion of track addition work and barriers of nine crossings will be changed to double track automatic barriers from single track automatic barriers in the section between Manggarai and Depok.

3) Station facilities

Platforms, platform sheds, overbridges and station buildings will be improved between Manggarai and Depok in parallel with track addition work.

This improvement work will be applicable to eight stations shown in Table 5.2.2.

The station buildings of Pasarminggu Station and Depok Station were planned to be of the scale of 1,000 m^2 each and the station buildings of other stations were planned to be of the scale of 500 m^2 each with future increase of number of passengers taken into consideration. (See Fig. 4.2.1.)

It is desirable that improvement of station facilities is executed in parallel with other projects for the purpose of eliminating duplicate efforts in works. Improvement of station facilities between Jakarta and Manggarai will be made, therefore, in parallel with track elevation of Central Line, that between Depok and Bogor will be made in parallel with track addition work, and that of Manggarai Station will be made in parallel with grade separation work in yard.

4) Station front areas

The thought on the time of expansion and improvement of station front areas is same as that of station facilities described in paragraph 3) above. That is, expansion and improvement station front areas will be made at eight stations only in the section between Manggarai and Depok.

5) Electrification

Addition of overhead equipment in the section of track addition and addition of silicon rectifiers at substations will be made accompanying the work of track addition between Manggarai and Depok. Furthermore, new feeders will be added because the feeder capacity for existing overhead equipment will become insufficient, and provision of new lightening arresters and improvement of grounding facilities will be made.

Remote supervisory control facilities will be installed at substations to cope with added equipment, and efforts will be made to eliminate attendance of men by the introduction of new dispatch system.

As the yard of Manggarai Station is of complicated feeding system, rearrangement will be made to it, and security will be improved by providing relay interlocking protection between related high speed DC circuit breakers for feeders.

6) Automatic signalling

Automatic signalling will be made in parallel with track addition work between Manggarai and Depok. Relay interlocking devices will be provided at two stations, that is, Pasarminggu and Depok Stations. In addition, automatic block signals will be provided between interlocked stations for providing block section lengths which are capable of coping with the train operation diagram.

The time of execution of signal automation work is also of the thought identical to that of station facilities and of station front areas.

(2) Eastern & Bekasi Line

The work of electrification of 14.802 km between Jatinegra and Bekasi will be commenced in 1985 and will be completed in 1987. Improvement of station facilities and station front areas as well as signal automation work will be executed in parallel with electrification work. (Table 5.2.3)

Table 5.2.3 Improvement of Eastern & Bekasi Line

Section / Item	Eastern Line	Bekasi Line
	Jakarta,Tanjung priuk ~ Jatinegara	Jatinegara ~ Bekasi
Electrification	–	The section of 14.8 km will be electrified and a substation will be newly constructed near Bekasi.
Track and fence	(Executed in the Intermediate Program)	To be improved by 1985.
Crossing	8 crossings will be improved by 1985.	Same as Eastern Line.
Station facilities	–	Improvement will be made at following 6 stations in parallel with electrification work. Jatinegara Klender New Klender Cakung Kranji Bekasi
Station front area	–	Improvement will be made at above stated 6 stations.
Automatic signalling	–	To be executed in parallel with electrification work. Relay interlocking devices will be provided at Jatinegara, Cipinang and Bekasi Stations.

From the standpoints of commuter transportation and inter-city transportation it is desirable that the electrified section is extended to Krawang, Cikampek, Purwakarta or Bandung in the future. Electrification to Bekasi is the first stage of this electrification work.

1) Electrification
   A substation will be newly constructed near Bekasi Station. However, it may become necessary to review the location of the substation in connection with electrification of the section beyond Bekasi in the near future.
2) Tracks and fences
   It is scheduled that Eastern Line (Jakarta Kota or Tanjung priuk ~ Jatinegara) will be reconditioned in the Intermediate Program. As the track between Jatinegara and Bekasi has already been doubled, its reinforcement will be completed by 1985 because duplicate efforts in works will not occur even if reinforcement is made apart from electrification work and its completion will be delayed if it is executed in parallel with electrification work.
3) Crossings
   Eight crossings of Eastern & Bekasi Line will be respectively improved by 1985. As improvement of crossings of Bekasi Line is of the time that is overlapped with automatic signalling accompanying electrification, it is necessary to provide relations between them in the setting of alarming distance, composition of track circuits and so forth.
4) Station facilities
   Station facilities of six stations between Jatinegara and Bekasi, that is, Jatinegara, Klender, New Klender, Cakung, Kranji and Bekasi Stations, will be improved in parallel with electrification work.
   The scale of the station main building will be 1,000 m^2 at Jatinegara and Bekasi Stations, and it will be 500 m^2 at other stations. (See Fig. 4.2.2.)
5) Station front areas
   Station front areas of six stations shown in Table 5.2.3 between Jatinegara and Bekasi will be expanded and improved in parallel with electrification work. The scale of the station front area will be about 10,000 m^2 at Jatinegara and Bekasi Stations, and it will be about 5,000 m^2 at other stations.
6) Automatic signalling
   Automatic signalling will be made in parallel with electrification work between Jatinegara and Bekasi.
   The stations to be equipped with relay interlocking devices will be Jatinegara, Cipinang and Bekasi Stations, and automatic block signals are installed in the sections between these three stations. Block section lengths are selected so as to be capable of matching with the train operation diagram. As the time of work is overlapped in this section with improvement of crossings, it is necessary to execute the work with relations provided so that the conditions necessary for crossings can be provided from relay interlocking devices.

(3) Western Line

It is scheduled that electrification, renewal of tracks and installation of fences will be executed in the Intermediate Program. As four crossings will be improved in the Intermediate Program, remaining six crossings will be improved in this Project. (Table 5.2.4) Reinforcement of tracks in station yards, station facilities and station front areas as well as automatic signalling will be executed in 1988 and subsequent.

Table 5.2.4 Improvement of Western Line

Item \ Section	Jakarta ~ Jatinegara
Electrification	(Executed in the Intermediate Program.)
Track & fence	(Executed in the Intermediate Program.)
Crossing	6 crossings will be improved by 1985

(4) Merak Line

Reinforcement of tracks, fences and crossings (14 places) of Merak Line will be executed by 1986. (Table 5.2.5) Renewal of tracks in station yards, station facilities and so forth will be executed in parallel with track addition and electrification works by 1987 and subsequent.

Table 5.2.5 Improvement of Merak Line

Item \ Section	Tanahabang ~ Serpong
Track & fence	To be improved by 1986.
Crossing	14 crossings will be improved by 1986.

(5) Tangerang Line

Renewal of tracks, installation of fences and improvement of crossings (11 places) will be executed by 1985. (Table 5.2.6) Renewal of tracks in station yards, station facilities and so forth will be executed in parallel with track addition and electrification works by 1988 and subsequent.

Table 5.2.6 Improvement of Tangerang Line

Item \ Section	Duri ~ Tangerang
Track & fence	To be improved by 1985.
Crossing	11 crossings will be improved by 1985.

5.3 Precautions until Commencement of Work

The investment schedule of the items which are the object of this Feasibility Study is shown in Table 6.2.12. The work will be commenced in fiscal 1984 subsequent to the Intermediate Program.

It is usual that a period of at least three to four years is required including the period of engineering service before commencement of the work after termination of Feasibility Study, although the length of this period varies by the scale of the work. It is extremely important to make the maximum efforts and to make the maximum schedule control so that the work will be commenced at a suitable time and will be completed by the required time by carrying out surveys and examinations as well as clerical processing in concrete made as early as possible with above mentioned period of time used as a measure.

For improvement of foundation of existing lines listed in Table 5.3.1 of the Master Plan, the following items are of the characters which are entirely identical to those of the Intermediate Program currently under execution. When the present situation of railway facilities and future increase of railway traffic demand in JABOTABEK Area are taken into account, it is desirable that these works are materialized as early as possible.

Consequently, it is positively requested that measures for promoting the Program with commencement of work around 1982 as a criterion are established.

i) Renewal of tracks and improvement of crossings between Depok and Bogor
ii) Renewal of tracks and improvement of crossings of Bekasi Line.
iii) Renewal of tracks and improvement of crossings of Merak Line
iv) Renewal of tracks and improvement of crossings of Tangerang Line
v) Improvement of equipment of Manggarai Workshop
vi) Improvement of equipment of Jakarta Jakarta Kota Depat
vii) Improvement of some crossings of Eastern and Western Lines
viii) Additional supply of electric and diesel railcars

CHAPTER 6. SCALE AND PROCESS OF INVESTMENT

CHAPTER 6 SCALE AND PROCESS OF INVESTMENT

6.1 Basic Concept

The JABOTABEK Area Railway Transportion Development Program, which is the object of this Feasibility Study, is scheduled to be executed consequent to the Intermediate Program which is under execution.

Improvement of the minimum required foundation as urban railways will be first made in this Development Program with focus on unconsolidated existing lines requiring urgent reinforcement. Improvement measures for expansion of transport capacity required to cope with the traffic demand for some time will then be made.

In concrete, the following works to be completed by the end of fiscal 1987 will be executed as shown in Table 6.2.12.

i) Renewal of tracks of each line
ii) Improvement of crossings of each line
iii) Improvement of Manggarai Workshop (Stage 1)
iv) Improvement of Jakarta Kota Depot
v) Double tracking between Manggarai and Depok of Central Line
vi) Construction of new depot in Depok (Stage 1)
vii) Electrification between Jatinegara and Bekasi of Bekasi Line
viii) Additional supply of railcars

6.2 Estimation of Construction Expenses

6.2.1 Conditions for estimation of construction expenses

Estimation of consturction expenses is made using the materials collected during the field survey as principal references. Some of the items which affect the construction expenses are estimated based on the data obtained in Japan.

The following conditions are used in addition for calculation.

1) The unit prices are as of June, 1980.
2) Increase of prices after June, 1980 is not taken into account.
3) Foreign currency exchange rates are as follows:
   Rp 625 = US$1.00 = ¥220
4) The physical contingency is in the range of 5 ~ 15%, as it varies by the category of business.
5) The design and construction administration costs are in the range of 15 ~ 25%, as it varies by the category of business.
6) The construction expenses are composed of the following items;
   i) Civil engineering work expenses
   ii) Track work expenses
   iii) Structure construction work expenses
   iv) Electrification work expenses

v) Signal and telecommunication work expenses
vi) Machinery work expenses
vii) Rolling stock expenses
viii) Land purchase expenses and house compensation expenses.

Expenses for machinery and equipment required for execution of works, machinery, equipment and material transportation expenses, indirect expenses and so forth are included in the related items.

7) The consturction expenses are classified into those of foreign currency and those of local currency. They include the following items;

i) Expenses of foreign currency:
   a. Imported machinery and equipment expenses
   b. Rolling stock expenses
   c. Personnel expenses for foreign engineers
   d. Indirect expenses of foreign corporations
   e. Transportation expenses up to Indonesia of imported machinery, equipment and materials

ii) Expenses of local currency:
   a. Domestic machinery, equipment and material expenses;
   b. Domestic personnel expenses
   c. Indirect expenses of domestic corporations
   d. Domestic transportation expenses for machinery, equipment and materials
   e. Land purchase expenses and house compensation expenses

The unit expenses costs for major materials and labor used for calculation of construction expenses were determined with those of Government or private construction works in Jakarta, uased as references.

Units Costs of Major Materials

Material	Unit	Cost
Fuel Gasoline	Rp/Lit	150
Light Oil	"	53
Sand	Rp/m^3	6,000
Cement	Rp/ton	48,750
Ready Mixed Concrete (628,275 kg/cm^2)	Rp/m^3	41,740
Timber (Hard wood)	Rp/m^3	180,000
(Soft wood)	"	90,000
Round Bar Steel	Rp/ton	300,000
Steel (Angle, channel)	"	250,000
Ballast	Rp/m^3	6,500
Sleeper	Rp/pcs	8,000
Rail (R14A)	m	36,200
Fastening (F type)	sets/m	26,990

Units Costs of Labors

Class	Daily Cost
Earth Worker	1,400 Rp./day
Carpenter	2,100 "
Steel Worker	1,900 "
Stone Worker	1,900 "
Rigger	3,000 "
Driver	3,000 "

6.2.2 Construction expenses and process

The scale of investment of the object items of the Development Program is shown in Tables 6.2.1 through 6.2.11. The total amount is approximately Rp 155.6 x10^9.

Table 6.2.1 Improvement between Depok and Bogor of Central Line

(Unit: Rp x 10^6)

Item	Unit	Quantity	Unit Cost	Total	Foreign Currency	Local Currency
1. Track facilities						
(1) Track renewal	km	21.2	174.2	3,693	2,093	1,600
(2) Others	set	1	284.0	284	209	75
2. Crossing facilities						
(1) Pavement	places	5	2.2	11	4	7
(2) Alarm equipment	places	5	35.0	175	145	30
(3) Others	set	1	15.0	15	12	3
Total				4,178	2,463	1,715

Table 6.2.2 Improvement of Eastern & Bekasi Line

(Unit: Rp x 10^6)

Item	Unit	Quantity	Unit Cost	Total	Foreign Currency	Local Currency
1. Track facilities						
(1) Track renewal	km	20.1	171.6	3,450	2,093	1,357
(2) Others	set	1	214.0	214	150	64
2. Crossing facilities						
(1) Pavement	place	8	6.5	52	19	33
(2) Alarm equipment	place	8	35.0	280	232	48
(3) Others	set	1	4.0	4	1	3
Total				4,000	2,495	1,505

Table 6.2.3 Improvement of Merak Line

(Unit: Rp x 10^6)

Item	Unit	Quantity	Unit Cost	Total	Foreign Currency	Local Currency
1. Track facilities						
(1) Track renewal	km	14.0	92.1	1,290	741	549
(2) Others	set	1	97.0	97	67	30
2. Crossing facilities						
(1) Pavement	place	14.0	2.4	33	11	22
(2) Alarm equipment	place	14.0	35.0	490	406	84
(3) Others	set	1	6.0	6	6	0
Total				1,916	1,231	685

Table 6.2.4 Improvement of Tangerang Line

(Unit: Rp x 10^6)

Item	Unit	Quantity	Unit Cost	Total	Foreign Currency	Local Currency
1. Track facilities						
(1) Track renewal	km	18.1	175.1	3,170	1,792	1,378
(2) Others	set	1	239.0	239	179	60
2. Crossing facilities						
(1) Pavement	place	11	2.6	29	10	19
(2) Alarm equipment	place	11	35.0	385	319	66
(3) Others	set	1	17.0	17	14	3
Total				3,840	2,314	1,526

Table 6.2.5 Improvement of Maggarai Workshop (Stage 1)

(Unit: Rp x 10^6)

Item	Unit	Quantity	Unit Cost	Total	Foreign Currency	Local Currency
1. Civil engineering						
(1) Inspection and repair pit	m	240	1.23	295	127	168
(2) Rehabilitation of track	m	1,000	0.157	157	96	61
2. Structure						
(1) New construction	m^2	8,550	0.447	3,821	1,616	2,205
(2) Withdrawal of hindering portion	set	1	48	48	0	48
3. Machinery	set	1	2,735	2,735	2,355	380
4. Electrification	set	1	728.0	754	688	66
Total				7,810	4,882	2,928

Table 6.2.6 Improvement of Jakarta Kota Depot

(Unit: Rp x 10^6)

Item	Unit	Quanti-ty	Unit Cost	Total	Foreign Currency	Local Currency
1. Track facilities						
(1) Construction of new tracks	km	5.5	153.0	842	597	245
(2) Installation of new turnouts	set	1	195.0	195	138	57
(3) Withdrawal of existing tracks	km	4	3.0	12	0	12
(4) Withdrawal of existing turnouts	set	1	5.0	5	0	5
(5) Others	set	1	272.0	272	194	78
2. Structure machinery and equipment						
(1) Construction of new inspection and repair shed	set	1	839.0	839	460	379
(2) Others	set	1	303.0	303	215	88
3. Electrification						
(1) Installation of new overhead equipments	set	1	1,332.0	1,332	954	378
(2) Improvement of existing substations	set	1	627.0	627	494	133
(3) Installation of new power distributing equipment	set	1	439.0	439	335	104
(4) Others	set	1	4.0	4	1	3
Total				4,870	3,388	1,482

Table 6.2.7 Improvement of Crossings of Eastern and Western Lines

(Unit: Rp x 10^6)

Item	Unit	Quantity	Unit Cost	Total	Foreign Currency	Local Currency
(1) Pavement	place	14	5.3	74	27	47
(2) Alarm equipment	place	14	35.0	490	406	84
(3) Others	set	1	6.0	6	3	3
Total				570	436	134

Table 6.2.8 Additional Supply of Railcars

Item	Unit	Quantity	Unit Cost	Total	Foreign Currency	Local Currency
(1) Electric railcar	car	52	387.0	20,103	19,500	603
(2) Diesel railcar	car	36	363.2	13,074	12,682	392
Total				33,177	32,182	995

Table 6.2.9 Track Addition between Manggarai and Depok

(Unit: Rp x 10^6)

Item	Unit	Quantity	Unit Cost	Total	Foreign Currency	Local Currency
1. Track facilities						
(1) Civil engineering	10^3xm^3	99	6.0	594	340	254
(2) Construction of new tracks	km	45	153.0	6,885	4,878	2,007
(3) Withdrawal of existing tracks	km	24	3.0	72	0	72
(4) Installation of new turnouts	set	1	171.0	171	121	50
(5) Withdrawal of existing turnouts	set	1	5.0	5	0	5
(6) Others	set	1	1,531.0	1,531	1,081	450
2. Station facilities						
(1) Construction of new platforms	10^3xm^2	14	79.0	1,106	671	435
(2) Construction of new overbridges	10^3xm^2	1.5	438.0	657	481	176
(3) Construction of new passenger sheds	10^3xm^2	7	95.0	665	364	301
(4) Construction of new station buildings	10^3xm^2	5.5	486.0	2,673	1,464	1,209
(5) Station front areas	10^3xm^2	45	33.0	1,485	867	618
(6) Others	set	1	1,234.0	1,234	898	336
3. Crossing facilities						
(1) New pavement work	place	8	4.1	33	12	21
(2) Improvement of existing pavement	place	9	4.1	37	13	24
(3) Installation of new alarm equipment	place	8	35.0	280	232	48
(4) Improvement of existing alarm equipment	place	9	26.0	234	189	45
(5) Others	set	1	13.0	13	5	8
4. Electrification						
(1) Installation of new overhead equipment	km	23	129.0	2,967	2,208	759
(2) Improvement of existing substations	place	2	1,989.0	3,978	3,150	828
(3) Installation of new power distributing equipment	set	1	3,104.0	3,104	2,437	667
(4) Others	set	1	48.0	48	15	33
5. Signal and telecommunication equipment						
(1) Relay interlocking devices	stations	2	355.0	710	590	120
(2) Automatic signals	km	23	18.0	414	345	69
(3) Telecommunication equipment	set	1	195.0	195	159	36
(4) Others	set	1	19.0	19	14	5
6. Land	10^3 xm^2	17.2	12.0	206	0	206
7. Railcars	car	12	387.0	4,639	4,500	139
Total				33,955	25,034	8,921

Table 6.2.10 Electrification of Bekasi Line

(Unit: Rp x 10^6)

Item	Unit	Quantity	Unit Cost	Total	Foreign Currency	Local Currency
1. Track facilities						
(1) Construction of new tracks	km	10	153.0	1,530	1,084	446
(2) Withdrawal of existing tracks	km	11	3.0	33	0	33
(3) Installation of new turnouts	set	1	666.0	666	472	194
(4) Withdrawal of existing turnouts	set	1	15.0	15	0	15
(5) Others	set	1	290.0	290	178	112
2. Station facilities						
(1) Construction of new platforms	10^3xm^2	12	79.0	948	575	373
(2) Construction of new overbridges	10^3xm^2	2.5	438.0	1,095	802	293
(3) Construction of new passenger sheds	10^3xm^2	7	95.0	665	364	301
(4) Construction of new station buildings	10^3xm^2	4	486.0	1,944	1,065	879
(5) Station front areas	10^3xm^2	41	33.0	1,353	790	563
(6) Others	set	1	748.0	748	451	297
3. Crossing facilities						
(1) Improvement of existing alarm equipment	place	8	11.0	88	72	16
(2) Others	set	1	3.0	3	2	1
4. Electrification						
(1) Installation of new overhead equipments	km	15	264.0	3,960	2,940	1,020
(2) Construction of new substations	place	1	4,283.0	4,283	3,539	744
(3) Installation of new power distributing equipment	set	1	1,679.0	1,679	1,301	378
(4) Others	set	1	14.0	14	1	13
5. Signal and telecommunication equipment						
(1) Relay interlocking devices	stations	3	788.0	2,364	1.956	408
(2) Automatic signals	km	15	18.0	270	225	45
(3) Telecommunication equipment	set	1	197.0	197	156	41
(4) Others	set	1	5.0	5	3	2
6. Land	10^3xm^2	22.6	60.0	1,356	0	1,356
7. Railcars	cars	48	387.0	18,568	18,011	557
Total				42,074	33,987	8,087

Table 6.2.11 Construction of New Depot in Depok

(Unit: Rp x 10^6)

Item	Unit	Quantity	Unit Cost	Total	Foreign Currency	Local Currency
1. Track facilities						
(1) Civil engineering	$10^3 xm^3$	352	3.0	1,056	604	452
(2) Construction of new tracks	km	18	153.0	2,754	1,951	803
(3) Installation of new turnouts	set	1	684.0	684	485	199
(4) Others	set	1	883.0	883	723	160
2. Structure machinery and equipment						
(1) Inspection and repair sheds	set	1	2,723.0	2,723	1,492	1,231
(2) Offices	set	1	1,856.0	1,856	1,017	839
(3) Others	set	1	899.0	899	735	164
3. Electrification						
(1) Installation of new overhead equipment	set	1	2,703.0	2,703	1,968	735
(2) Improvement of existing substations	set	1	554.0	554	437	117
(3) Installation of new power distributing equipment	set	1	1,495.0	1,495	1,133	362
(4) Others	set	1	6.0	6	2	4
4. Signal and telecommunication equipment						
(1) Relay interlocking devices	set	1	275.0	275	222	53
(2) Telecommunication equipment	set	1	80.0	80	62	18
5. Land	$10^3 xm^2$	269	12.0	3,228	0	3,228
Total				19,196	10,831	8,365

The process of construction works is shown in Table 6.2.12

Table 6.2.12 Short Term Investment Schedule

Project Item	81	82	83	84	85	86	87
Improvement of foundation of existing lines							
Improvement between Depok and Bogor							
Improvement of Bekasi Line							
Improvement of Merak Line							
Improvement of Tangerang Line							
Improvement of Manggarai Workshop (Stage 1)							
Improvement of Jakarta Kota Depot							
Improvement of crossings of Eastern Line and Western Line							
Additional supply of railcars							
Expansion of transport capacity							
Track addition between Manggarai and Depok							
Electrification of Bekasi Line							
Construction of new depot in Depok (Stage 1)							

CHAPTER 7. PERSONNEL PROGRAM

CHAPTER 7 PERSONNEL PROGRAM

7.1 Designing of Personnel Program

The Railway Transport Development Program for JABOTABEK Area should not be such that is considered sufficient when simply hardware alone such as facilities, equipment and railcars are provided. It is most important for enabling railways to truely exhibit functions as means of urban transportation to a hundred per cent, to make contribution to the development of JABOTABEK Area and to reward the expectation of regional residents to steadily secure and upbring capable personnel required for smoothly operating the railways. Unless security and upbringing of personnel can be made, it will not be possible to operate extra trains and works such as operation and maintenance of facilities, equipment and so forth and inspection and repair of railcars cannot be performed, and new facilities, railcars and so forth constructed and purchased with a great pain will become idle assets and all what can be done with them is to let them stand wastefully.

Therefore, it is necessary to secure required personnel and to wrestle with new training and switching-over training with the period of time required for education and training for new personnel taken into account with the time of completion of equipment and facility works, time of carry-in of newly built railcars and other factors as preconditions. Consequently, it is also necessary to design a long-term program classified by year regarding demand and supply of personnel and to establish an education and training program which meets the personnel demand and supply program.

7.2 Number of Required Personnel Classified by Work System

It is estimated that the number of personnel required in each fiscal year classified by work system concerning this Railway Transport Development Program is shown in Table 7.2.1. For the extra personnel required in each fiscal year, therefore, employment should be completed at least by the end of the previous fiscal year, and it is also required that necessary education and training of these newly employed extra personnel is completed by the end of the previous fiscal year.

The number of personnel indicated in Table 7.2.1 does not take reduction due to retirement or long-term absence into account. Therefore, it is necessary to take the number of these people into account, and the personnel program should be designed based on the relationship with the number of personnel to be educated and trained, education and training period, capacity of training facilities and so forth.

Table 7.2.1 Estimated Number of Required Personnel Classified by Work System (at beginning of each fiscal year)

(Unit: person)

Work system \ Fiscal year			1980 (as of July)		1984		1985		1986		1987		1988		Remarks
			Present No.	JABOTA-BEK Area only	No. of personnel	Increase	No. of personnel	Increse	No. of personnel	Increase	No. of personnel	Increase	No. of personnel	Increase	
Track Facilities	Track maintenance		1,180	612	612	0	612	0	685	73	701	16	794	93	Excluding personnel related architectural construction
	Crossing			265	265	0	265	0	265	0	265	0	265	0	
Service	Station		1,694	948	948	0	948	0	980	32	1,023	43	1,023	0	
	Conductor		258	116	190	74	198	8	214	16	230	16	220	Δ10	Based on precondition of two crews per train
Operation	Operator		1,698	116	190	74	198	8	214	16	226	12	218	Δ8	
	Inspection and repair			83	131	48	154	23	182	28	207	25	222	15	
	Other			25	40	15	43	3	46	3	50	4	67	17	Including personnel for depot management clerical work operation and switching in yard, etc.
Electrification			95	91	102	11	102	0	104	2	104	0	127	23	
Signalling and telecommunication			245	143	171	28	183	12	189	6	200	11	226	26	Wireless and telegram personnel (fixed throughout the indicated period 28 persons)
Total			5,170	2,374	2,649	275	2,703	54	2,879	176	3,006	127	3,162	156	
Inspection main office	Inspection 1 main office		317		334	17	337	3	348	11	356	8	365	9	Present management personnel ratio $\frac{317}{5170} = 0.0613$
	dispatcher	Passenger	–		–	–	–	–	–	–	–	–	6	6	Dispatching system will be established in 1988 and subsequent.
		Operation	–		–	–	–	–	–	–	–	–	13	13	
		Electrical	–		–	–	–	–	–	–	–	–	13	13	
Inspection 1 Total			5,487		5,779	292	5,836	57	6,023	187	6,158	135	6,355	197	Including work site personnel for local offices than JABOTA-BEK Area (fixed throughout the indicated period, 2,796 persons).
Workshop (Manggarai)			1,008		1,600	592	1,632	32	1,728	96	1,660	Δ68	1,556	Δ104	

Remarks: 1. Number of personnel related to signalling and telecommunication was calculated particularly based on the assumption that they participate in the work. beginning in the construction stage.
2. Figures with Δ marks indicate decrease.

Railway transportation work is said to be a labor intensive type industry because work-site organs are locally scattered over a broad range and also because works are divided into diversified craft departments. Consequently, it is expected that increase of the number of work-site organs or increase of work volume immediately causes increase of the number of personnel, and it is considered that increase of number of personnel should be limited to the most possible extent by positively promoting modernization and rationalization of work operation structure in the future.

In order to accomplish this objective, it is necessary to make a full renovation of work structure through mechanization of maintenance work, reorganization of maintenance work structure, improvement of station equipment, mechanization of ticketing work and so forth, rational crewwork operation and review of crew work standard of train crewmen (operators and conductors) and also through development of carious measures such as promotion of use of season tickets.

In order to operate the railways in JABOTABEK Area rationally and efficiently, it is necessary to positively promote modernization and rationalization of work structure in the future.

7.3 Promotion of Education and Training of Personnel

For execution of education and training of the personnel based on the personnel program, education and training should be started with judgement made based on the capacity of training facilities, period of education and training and number of persons requiring upbringing. When the facts that no training facilities are located in the vicinity of JABOTABEK Area three training centers located in Bandung and Yogyakarta are not provided with training courses for upbringing electric train operators and electric railcar inspection and repair personnel and number of class rooms, equipment and lectures are insufficient at these training centers are taken into account, it is necessary to secure temporary class rooms in the buildings of Manggarai Workshop and Inspection 1 main office in West Java Region and to start education and training of the personnel as early as possible with measures such as early purchase of training equipment and upbringing of lecturers by dispatching them to overseas training centers suitably taken.

According to the result of a survey, the education and training period classified by work system is as shown in the next table. But it is probably necessary to take the following matters into account for upbringing electric railcar operators, conductors and personnel related to signalling and telecommunication.

1) With electric railcar operators and conductors, it is necessary to train electric railcar operators through practical operation and to train conductors through track learning for the purpose of causing them to become fully acquainted with changes to track locations in station yards and so forth and places of installation of automatic signals and so forth.

2) New equipment and devices such as automatic signals, relay interlocking devices, electric switching machines, track circuits and ATS devices will be introduced. And therefore, the personnel related to signal and telecommunications should be

caused to master how to operate and how to maintain these new equipment and devices, through education and training.
This training is not what is required to newly employed personnel, but switch-over training and new education and training should be made to all the personnel related to signal and telecommunication, and the period of education and training should be determined based on this precondition. (Table 7.3.1)

Table 7.3.1 Period for Personnel Training Classified by Work System

	Apprentice	Trained
Guard	6 m – 1 y	3 m – 6 m
Engineer of steam loco & diesel electric-loco	2 y – 3 y	6 m – 1 y
Electric railcar operator	2 – 3 y	6 m – 1 y
Diesel motor operator	2 – 3 y	6 m – 1 y
Inspection personnel and repair personnel in engine depot, diesel railcar depot and electric railcar depot	1 – 2 y	6 m – 1 y
Inspection personnel and repair personnel in work-shop	1 – 3 y	6 m – 1 y
Technical personnel and rail inspection personnel in depot for maintenance of truck		6 m – 1 y
Technical personnel and inspection personnel in signal-telecommunication maintenance depot.		6 m – 1 y course of operator radio signalling telecommunication.
Technical personnel and inspection personnel in electric power depot	On the job training 1 year, and 1 year later again 6 months ~ 1 year training	

Note: The figures indicated in the above table are based on the replies made against the question "What is required length of training period (if practical training period is required, such a period should also be included) for educating and upbringing personnel?"

CHAPTER 8 STRUCTURE FOR PROMOTION OF RAILWAY TRANSPORTATION DEVELOPMENT PROJECTS

CHAPTER 8 STRUCTURE FOR PROMOTION OF RAILWAY TRANSPORTATION DEVELOPMENT PROJECTS

8.1 Necessity of Structure for Promotion of Projects

In order to allow efficient execution of the Railway Transportation Development Program for JABOTABEK Area, it is necessary to establish an organization having the authority and capacity sufficient for managing and operating the Project from an all-round standpoint and to promote execution of the program with measures against the following problems energetically taken and with efforts made to make adjustment of opinions with concerned organs and to solve problems.

First of all, this program is a long-term program of a large scale that involves an investment of a huge amount and a period of as long as seventeen years, and exceptional consideration by the Government of the Republic of Indonesia is required regarding financing, special budgetary measures, procurement of materials and so forth.

Secondly, positive guidance and cooperation of the Government of the Republic of Indonesia and related local administrative organs as well as understanding and cooperation of the residents living along the railways are required in the aspect of security of right of way for execution of the program.

Thirdly, it is necessary to smoothen accounting works such as execution of budget and accounting as well as procurement of materials and so forth, and it is also necessary to clarify responsibility with classified accounting through provision of special accounts and special accounting audit system introduced, for execution of the Project.

Fourthly, besides establishment of the structure for execution of the program regarding draw-up of work execution plan, selection of constructors, supervision and auditing of construction works, it is necessary to make close deliberation, adjustment and communication thorough with concerned organs regarding work processes, working hours, security of safety in train operation and security of safety in works. This is because of the fact that construction works of this program require execution with the limited train intervals and work intervals utilized to the maximum while continuing operation of the existing railways, unlike construction of a new line.

Fifthly, the contents of the program are composed of security of right of way, reinforcement of tracks, addition of tracks, electrification, automation of signals, introduction of ATS devices, improvement of station facilities, improvement of crossings, reinforcement of railcar terminal and workshop, additional supply of railcars, security of personnel and execution of education and training of personnel. All of these components of the program are closely related to each other, and delay in the work of one component will exert major influence over other component such as delay in the start of works of other components. Such a delay tends to affect the time of completion of the entire project. A strong all-round adjusting function is essential for execution of a project of this kind as scheduled, because it is considered that advancement of works while maintaining harmony and coordination of all the components is most important.

8.2 Provision of Organization for Promotion of Program

It will not be possible to smoothly promote the Railway Transportation Development Program for JABOTABEK Area only by consolidating the structure in the Indonesian State Railways alone. It is needless to say that full guidance, cooperation, assistance and so forth from the related Government agencies of the Republic of Indonesia and related local administrative organs in the aspects of the problem of financing, problem of security of right of way, problem of procurement of materials, problem with local residents and so forth are essential as already described. In order to obtain such guidance, cooperation, assistance and so forth, it is considered desirable that a structure for guidance and cooperation for accomplishment of the Program is established in such a manner that JABOTABEK Area Railway Transportation Development Program Promotion Committee" (tentative name) composed of representatives of related organs stated earlier and representatives of Indonesian State Railways with the Minister of Transport, Communications and Tourism as the chairman, for example, is organized and this committee makes all-round adjustment and advice regarding required matters.

8.3 Provision of Organization for Execution of Program

The place of provision of the organization for execution and promotion in concrete of the Program can be the Directorate General of Landtransport and Inland Waterways, head offfice of Indonesian State Railways or West Java Region of Indonesian State Railways, but it is considered that it is most suitable to provide it in West Java Region of Indonesian State Railways because of the following reasons.

i) This Program is a railway transport development program.
ii) The Intermediate Program is currently executed, and this railway transportation improvement program is what will be executed subsequent to the Intermediate Program.
iii) The facilities constructed and installed in accordance with this program will be managed and operated by West Java Region and Inspection 1 after their completion.
iv) The construction works should be executed while operating the existing railways.
v) It is desirable that the organization for execution is located as close as possible to the place of execution of works because it is necessary to seize advancement of works at all times and to make all-round adjustment regarding problems in concrete regarding accomplishment of the Program.

In this case, transfer of authorities within the range that causes no obstruction to accomplishment of the Program regarding execution of budget and so forth as well as clarification of responsibility structure will be required as already described in Item 8.1 of this Chapter.

As for the contents of the organization in concrete, it is suggested that JABOTABEK Area Railway Transportation Development Department" (tentative name) be established under the control of Chief of West Java Region and be constituted by several competent personnel of each of work systems, that is, general affairs (including the work related to education and training of personnel and accounting work), business, operation and railcars, track maintenance, electrical and signalling and telecommunication.

In this case, it is considered desirable that one of personnel of each one of these work systems at the same time holds the post as one of supervisors of Inspection 1 so that he can make adjustment and communication with the existing daily operation work.

CHAPTER 9. ECONOMIC EVALUATION

CHAPTER 9 ECONOMIC EVALUATION

9.1 General

The basic approach, methodology and assumptions used in assessing the economic costs and benefits of the proposed Phase I Program (the Program) are essentially the same as those used in the Report on the Master Plan (the Plan), and details of which can be found in the report. However, the basic differences are that the priority projects in the Plan which are recommended for early implementation are selected for the Feasibility Study and that more accurate data are used for the examination.

9.2 Basic Approach for Economic Evaluation

Economic evaluation is carried out in terms of cost-benefit analysis, which compares – from the point of view of the country as a whole – the benefits of a project with the costs corresponding to it. The identification of economic benefits and costs has been based on the "With and Without principle," which compares what costs and benefits would be with the Project investment and what they would be without it over the life of the Project.

In this evaluation, based on the "With and Without principle," only incremental benefits and costs due to implementation of the Program are considered in estimating the economic internal rate of return (EIRR). As details of the factors for estimating costs and benefits are given in the Master Plan Report, they are summarised in Table 9.2.1 below.

Tabel 9.2.1 Factors for Cost-Benefit Analysis

	Cost Estimate		Estimate of EIRR	
	Investment Items	Operation/Maintenance Costs	Costs	Benefits
With	(1) Railway facilities (2) Rolling stock (EC, DC)	Maint./replacement, personnel and energy costs	Difference in investment	(1) Cost saving benefit (2) Time saving benefit
Without	(1) Road construction (2) Road vehicles (Buses, cars)	Maint./replacement, personnel and fuel costs		

9.3 Assumptions and Methodology

9.3.1. Traffic demand

The assumed passenger volume expected to be carried by the proposed Program is measured on an incremental basis and is forecast for the period of 1984–2000. This passenger

volume is estimated in passenger-km on each railway line and during different time periods (peak hours/non-peak hours) and comprises three categories of demand.

i) Normal traffic demand: the demand that will exist even if the Program is not implemented.
ii) Diverted traffic demand: the demand which is switched to railway use away from roads as the Plan is implemented.
iii) Developed traffic demand: an entirely new demand generated by the economic and social development in the Project Area that is induced as the Program is implemented.

The growth of the normal traffic demand is estimated on the basis of population increase in each district where the demand is generated. The developed traffic demand is estimated by taking into account the development of residential areas along the railway lines.

The shares of these categories of demand in the total passenger volume were assumed and are shown in Table 9.3.1.

Table 9.3.1 Daily Passenger Volume by Section in 2000
(Incremental volume after 1984)

(Unit: 1,000 passenger-km)

	Normal Demand	Developed Demand	Diverted Demand	Total
Central Line (Depok-Managgarai)	952(18.9%)	2,011(40.0%)	2,063(41.1%)	5,026(100.0%)
Bekasi Line (Jatinegara-Bekasi)	765(15.5%)	1,470(29.8%)	2,699(54.7%)	4,934(100.0%)
City Lines	616(13.2%)	519(11.2%)	3,515(75.6%)	4,650(100.0%)
Total	2,333(16.0%)	4,000(27.4%)	8,277(56.6%)	14,610(100.0%)
Master Plan: Total	4,690	11,505	14,339	30,534
Phase I/Master Plan (%)	49.7%	34.8%	57.7%	47.8%

Because the Program consists of priority projects, the passenger volume accounts for almost 50% of the total demand estimated for the Master Plan.

9.3.2 Scope of the Program

The Program broadly consists of rehabilitation of tracks for the JABOTABEK trains in suburban areas and of the Manggarai workshop, and expansion of railway capacity by double tracking the Central Line (Manggarai – Depok), electrifying the Bekasi Line (Jatinegara-Bekasi) and constructing a new depot in Depok to accommodate more ECs and DCs. The detailed scope of the Program can be found in Chapters 3 to 6.

9.3.3 The "Without" situation

1) Passenger Volume
Only the normal and diverted demands are taken into account due to the fact that the developed demand does not exist in the "Without" situation. Further, the portion of normal demand which can be carried by the transport capacity as at the end of 1983 is deducted from the demand.

2) Parallel Road Construction
The passenger volume which is supposed to be carried by railways will be carried by road transport in case the Program is not implemented. In this study, a road (two-lanes, 7m wide) with a length of 1.3 times the railway is assumed to be constructed along each railway line where necessary. A two-lane road is required to accommodate traffic during morning and evening peak hours going in opposite directions.

3) Traffic volume and running speed of road vehicles
The following equation indicating the amount that the running speed of road vehicles will decrease as traffic volume increases, is used in the study.

$V = Vo - aq$*

V = the average running speed (miles per hour) of a motor vehicle

Vo = the average mileage per hour with the condition that there is very little traffic on roads as well as taking into account the characteristics of the road (i.e., number of intersections, traffic signals etc.)

a = the coefficient of speed reduction due to road specifications, capacity, etc.

q = the traffic volume

*from "Traffic System Analysis" for engineers and planners, by M. Wohl and B.V. Martin

The following values were applied in this Study:

	Suburban areas	City area
Vo (miles/hour)	24.86*	18.65*
a	0.017	0.021

* 24.86 miles = 40 km
18.65 miles = 30 km

Based on the estimated average running speed per hour of passenger cars, the average speed of buses is calculated with the conditions given below:

	Suburban area	City area
Average distance between bus stops	1000 m	500 m
Average stoppage time	20 sec.	10 sec.

*The stoppage time includes deceleration and acceleration time of bus at each stop

4) Road traffic congestion and road widening
The running speed of vehicles will be considerably reduced, if the traffic volume exceeds road capacity. In this analysis, the minimum average speed is set at 10 km/hour within the city area and 15 km/hour in suburban areas. We presumed that construction of an additional road will be required if the speed of passenger cars falls below the minimum speed during the morning and evening peak hours.

5) Investment in road vehicles
As against the mass transport system of railways, buses with 45-seat capacity and 2000 c.c. medium size passenger cars (excluding short range transport means such as oplet,bemo, helicak, bajaj, becak, etc.) were considered as the road transport fleet. The investment amount for road vehicles is determined by calculating the number of vehicles required to carry passengers during the peak hours.
The proportionate share of passengers using buses and motor cars needs to be determined in estimating the number of vehicles. This share will be the key parameter in the study.

9.3.4 Assumptions

The basic assumptions are outlined below.

1) Life of the Program is projected for the 30-year period of 1984–2013.
2) Inflation is not taken into account due to the same reasoning as indicated in the Master Plan Report. However, two cases of cost overrun assumed at 10% and 20% are considered in the sensitivity analysis in Table 9.6.3.
3) Life of physical assets is determined on the basis of PJKA's depreciation rates. The assumption was also made that after reaching the end of the life of a physical assets, a new investment of the same amount takes place to replace the assets.
   - 40 years: bridges, buildings, tracks
   - 25 years: ECs, DCs
   - 20 years: telecommunications, signals, electrification facilities, crossings.

Seven-year and ten-year lives were assumed for buses and motor cars, respectively, in accordance with information from PPD.

4) In estimating IRR, the salvage value of fixed investment is computed and deducted (i.e., considered as a benefit) from the cost of the last year of the Program life.

5) The foreign exchange rate of US$1 = Rp. 625 = Yen 220 is used in this report. A shadow exchange rate (SER) was not used because the simple method of estimating SER by using a weighted average of custom duties in Indonesia proved that there was no significant difference from the current exchange rate.

6) Costs in the nature of transfer payments such as taxes are excluded and subsidies are included in order to reflect the cost to the country as a whole. However, since the sales tax on essential commodities, which presently ranges between 0% – 2.5% due to the revision that took place in March 1979, can be considered very small and negligible, this tax was not adjusted.
Economic prices, which are obtained by adjusting transfer payment items, are applied to the commodities mainly concerning the "Without" situation. These commodities and the relative economic prices are shown together with market prices in Table 9.3.2.

Table 9.3.2 Relevant Economic Prices (Unit: Rp.)

	Market Prices	Economic Prices
Gasoline (per litre)	150	108.15
Diesel Oil (per litre)	52.5	99.65
Engine Oil		
Motor Vehicle (per litre)	1,350	1,080
Bus (per litre)	650	520
Motor Vehicle (per vehicle)	11,725,000	5,003,640
Bus (per vehicle)	28,806,000	27,024,516
Tyre for Motor Vehicle (per tyre)	28,000	22,568
Tyre for Bus (per tyre)	102,000	82,212

Source: (1) Gasoline & Diesel Oil – Directorate Revenue, Ministry of Finance
(2) Others: Interviews with dealers

Economic prices for imported materials and equipment are valued at CIF prices. Personnel costs, wherever necessary, are adjusted with income tax ranging from 6% – 10%.

9.4 Investment Plan

9.4.1 Investment Plan for the Program

The investment schedule contemplated for the economic evaluation is summarized in Table 9.4.1.

Table 9.4.1 Investment Schedule of the Program

(Unit: Rp. million)

	1984–1987	1988–2000	2001–2013	Total
Civil works	57,011	4,560	–	61,571
Signals/Telecom.	7,388	721	3,440	11,549
Electrification	25,640	1,882	9,250	36,772
Manggari Workshop	3,741	–	–	3,741
Rolling Stock	56,371	38,390	56,371	151,132
Total	150,151	45,553	69,061	264, 765

Of the total amount invested for the Program 58% accounts for rolling stock which need to be supplied proportionately with the increase of passenger volume.

This investment schedule differs from that indicated in Chapter 6 this Feasibility Study Report due to the following reasons:

(1) While the investment for the Program is scheduled to be completed by 1987 in Chapter 6, the life of the Program lasts until 2013 and the traffic demand is forecasted until 2000. In the economic analysis, ECs and DCs are supposed to be supplied in accordance with traffic increase, and the expansion of the Depok depot in Phase II (1994 - 95) and Phase III (1999 - 2000), in addition to its Phase I construction, will be required in order to accommodate the increase EC/DC fleet. These additional investments for such items as civil works, electrification and rolling stock are included among the investments in the period of 1988 - 2000.

(2) The additional investments in the Table during 2001 - 2013 for signals/telecommunications, electrification and rolling stock are for replacement of physical assets at the end of their lives.

(3) DCs which can be transferred to other lines outside the project area as the electrification of the JABOTABEK railway progresses are considered as negative (minus) investment in the table. Transfer values of DCs correspond to their salvage values at the time of transfer.

(4) The Manggarai Workshop is designed to accommodate not only JABOTABEK trains but also other medium and long haul trains. In view of this, in this economic evaluation, costs incurred for this investment were assigned proportionally according to the number of rolling stock handled at the workshop. Only the portion of the JABOTABEK train is taken into consideration in estimating the cost.

(5) Installation of ATS in 1989 is also taken into consideration as the trains with ATS device will be introduced after 1990.

9.4.2 Investment relating to the "Without" situation

Road construction and purchase of road vehicles such as buses and motor cars required to carry the designated passenger traffic are contemplated as items for investment.

As referred to in Item 9.3.3 (5), one of the key factors in examining the feasibility of this Program is the proportionate shares between the passengers using buses and the passengers using motor cars (hereinafter referred to as "bus/motor car passenger shares"). The amount of investment varies depending on the relative shares: the greater the share of passenger cars, the greater the investment amount for the "Without" situation and vice versa.

1) Investment in road construction
   The construction cost of a two-lane (7m wide) road is estimated at Rp.225 million/km.
2) Investment in buses and motor cars
   The number of vehicles required depends on the volume of passengers to be carried as well as the bus/motor car passenger shares. For instance, the average annual purchase of buses and motor cars in Base Case (refer to Chapter 9.6.1) amounts to Rp. 4,492 million (about 170 buses) and Rp.1,518 million (about 300 passenger cars).
   The assumption of passenger accommodation of a bus and a motor car is given below:

	Model	Peak Hours	Non-peak Hours
Bus	45 passengers	170%	100%
Motor Car	2000 c.c.	1.8 passengers	1.8 passengers

9.5 Economic Benefits

9.5.1 Cost saving benefits

The difference of the operating and maintenance expenses of "With" (the Program) and "Without" is regarded as the cost saving benefit.

1) Expenses under the Program
   i) Maintenance Cost
   The cost comprises those relating to installed facilities and rolling stock:
   a. Installed facilities: A certain maintenance rate and replacement rate set for each facility is applied to the invested amount in calculating the cost.
   b. Rolling stock: Routinely required material costs of the workshop and the depot are regarded as maintenance costs relating to rolling stock.

   The average annual maintenance costs of (a) and (b) together are estimated at Rp. 3,295 million.

ii) Personnel Cost

Personnel costs of staff at stations and for track maintenance, drivers and assistants of ECs and DCs and staff at depot and workshop are estimated.

iii) Energy Cost

The cost comprises expenses for electric power consumed for EC operation and diesel oil consumed for DC. Factors determining expenses for electric power are the number of substations and the EC vehicle-km operated, and that of diesel oil is calculated according to the DC vehicle-km operated.

2) Cost estimation for the "Without" situation

i) Road maintenance cost

The cost estimated by applying a unit price of Rp. 200 million per 100 km per year.

ii) Operating cost of road vehicles

The cost consists of three expense items referred to below, each estimated by applying equations used in the report entitled "The Consulting Engineering Services for Jakarta Intra Urban Tollway" (by Pacific Consultants International, September 1978).

a. Fuel cost: Quantities of gasoline, diesel oil and engine oil consumed were estimated and the economic price of each respective fuel is used to estimate the cost.

b. Maintenance cost: Costs of such items as tyres, spare parts, maintenance labor and insurance are contemplated.

c. Personnel cost: While one driver and 1.7 assistants are considered necessary personnel for a bus, no driver was assumed for the 2000 c.c. class motor car.

9.5.2 Time saving benefit

The commuting time in the Project area will be reduced due to the rehabilitation of tracks, double tracking and electrification, etc., under the Program. On the other hand, a longer commuting time is assumed to be required should there be no Program. By comparing these two commuting times, we can estimate the time saved. The time saving benefit is measured by multiplying the time difference and the average time value of commuters, which is indicated below.

(Unit : Rp. per hour)

Commuter's average income	300
Average income of commuter using motor vehicle	1,040

2080 working hours per yar (40 hours/week, 6 hours–day) was used to compute the income per hour indicated above. Income tax was adjusted to have an economic value.

9.5.3 Other benefits

Among other secondary benefits which were not quantified in the study are:

1) The benefits that will also be enjoyed by the long distance passenger trains and freight trains, such as cost and time savings as well as increased train frequency due to the enormous increase in transport capacity.
2) Inprovement of station front areas will activate the feeder transport service.
3) The effects of development and transfer of technology by introduction of various new systems and generation of effective demand due to the investment and expansion of the railway system.

9.6 Economic Evaluation

9.6.1 Internal rate of return

The projects which deserve high priority and urgency among those included in the Master Plan were selected as the Phase I Program for implementation in the four-year period of 1983–1987.

According to the data in Table 1.2.2of Chapter 1, the proportionates shares between the passengers using bus services and the passengers using motor cars is 70% and 30%. However, considering the general tendency of the Government authorities to pursue energy saving policies in various manners, it may not be inappropriate to assume, even in the "Without" situation, that more emphasis will eventually be placed on mass transport media on roads, i.e., the but service.

Two cases were assumed in the study and their internal rates of return were estimated as indicated below:

	Base Case	Case I
Passenger shares between bus and motor car	90% : 10%	100% : 0%
EIRR	28.9%	14.7%
Reference to Appendix	Table G	Table H

In either case a favorable EIRR was obtained. This is a manifestation that the projects involved in the Program are accorded high priority and urgency, that is to say, a relatively large portion of traffic demand is assigned to the Program out of the total demand forecast in the Master Plan.

We also supposed a case for the "Without" situation which does not include road construction as an investment item. The EIRRs estimated on this assumption are:

Base Case 17.9%
Case 1 9.4%

Savings expected from the Base Case in comparison with the "Without" situation during the Project period are:

Operation/maintenance costs:	5.3 times
Energy/fuel costs:	16.2 times

9.6.2 Sensitivity analysis

A sensitivity analysis was carried out in a relatively simple manner with assumptions less favourable than what is expected in the previous Chapters: i.e., reduced passenger volume and increased investment amount. This is because these two aspects are considered as among the key factors in determining the feasibility of the Program and there is always an element of uncertainty in the estimation and forecast:

1) the investment of the Program commences only in 1984 and extends for another four years thereafter, and
2) the demand forecast is made for 17 years as from 1984.

Three cases are examined for the Base Case and the results are summarized below.

Factors \ Cases	1	2	3
Passenger Volume	−20%	−30%	−
Investment Amount	+10%	−	+20%
EIRR	17.5%	16.8%	21.1%

9.6.3 Conclusion

The Program is considered economically feasible taking into account the following points:

1) The internal rate of return of the Base Case is estimated at 28.9% and even in the extreme case (the ratio of 100% : 0%) the IRR of 14.7% is obtained.
2) The cost saving effects, particular, that of fuel, are estimated to be considerable.
3) Even considering less favourable circumatances assumed for the Program, the results indicate that in any of the cases the Program can be regarded as feasible.

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