3.2 Preconditions

3.2.1 Zoning

The socio-economic development framework is based mostly upon the DKI Jakarta Master Plan 2005 and the JABOTABEK Metropolitan Development Plan.

For the sake of convenience, the study area of the traffic demand forecast is divided into a number of zones, and takes into account the following factors:

1) The Kecamatan districts, the admistrative units in the JABOTABEK Area, should be adopted as a basis for zoning to facilitate data collection.
2) The coordination of zoning should be made with other studies such as the JIUT study.
3) The Provision of one zone for one railway station is desirable in estimating traffic flows between two stations. However, the level of accuracy of available statistical data does not allow the division of the area into such small zones.

Consequently, the zones for the demand forecast are defined as follows:

DKI Jakarta	50 zones	No. 1 - 50
BOTABEK	23 zones	No.51 - 73
Outside JABOTABEK	7 zones	No.74 - 80
Total	80 zones	

The zone code list and zoning maps are shown in Appendices 3.1 through 3.3 (see Appendix 3.4 for details of the zone code).

3.2.2 Zonal Parameters

Each zone will make a different contribution to the traffic generation/attraction of the area as a whole. In Step-1 (see 3.1), the contribution of each zone must be quantitatively grasped. It is affected by the following three "zonal parameters":

1) Estimated residential population by zone (see Appendix 3.5)
2) Estimated residential population by income group in DKI Jakarta (see Appendix 3.6)
3) Estimated land use by zone in DKI Jakarta (see Appendix 3.7)

The zonal parameters in DKI Jakarta are based on the preparatory study for the DKI Jakarta Master Plan 2005 conducted by the Strategic Development Planning Group, and those in the BOTABEK Area on the JABOTABEK Metropolitan Development Plan.

3.3 Traffic Demand Forecast

3.3.1 Future Person Trips Generated = Step-1

(1) Future Person Trips Generated in JABOTABEK Area

The results of JIUT estimates were used for the future generation of person trips in the JABOTABEK Area (see Table 3.1).

Table 3.1 Estimated Number of Future Person Trips Generated

(Unit: 1000 person trip ends / day)

Region	Year	Trip Ends
DKI Jakarta	1984	10,955.6
	1995	16,519.2
	2005	22,410.4
BOTABEK	1984	1,108.6
	1995	1,694.4
	2005	2,660.6
Outside JABOTABEK	1984	174.5
	1995	226.8
	2005	270.7
Total	1984	12,238.7
	1995	18,440.4
	2005	25,341.7

Source: JIUT

(2) Share of Mass Transit (Control Total)

Person trips are divided into two categories: individual trips using motorcycles and sedans; and mass transit trips using trains and buses.

The figures worked out in the JIUT study are considered the framework within which estimates are controlled, and are defined as "a Control Total". The JIUT results are shown in Table 3.2.

Table 3.2 Estimated Future Share of Transportation Mode

(Unit: person trip ends x 1000, (%))

Mode of Transportation	1984	1995	2005
Mass transit	5,710 (46.7)	11,160 (60.5)	14,170 (55.9)
Individual	6,530 (53.3)	7,280 (39.5)	11,172 (44.1)
All modes	12,240 (100.0)	18,440 (100.0)	25,342 (100.0)

Note: "Individual" consists of Motorcycles and Sedans

Source: JIUT

(3) Generation of Person Trips by Mass Transit in Each Zone

The relationship was examined between the generation of mass transit person trips in each zone and the zonal parameters (population, population by income group, and land use) in 1984. The parameter population by income group and the parameter land use (commercial/administrative area) denote the close relationship with the mass transit person trips in zones of DKI Jakarta, and the parameter population, in zones of BOTABEK Area. Accordingly, the regression equation is formed with the above-mentioned parameters.

Applying the regression equation, the future mass transit person trips for each zone were estimated, adopting future zonal parameters and adjusting to the total mass transit person trips calculated by JIUT.

The estimated future person trips generated by mass transit are shown in Table 3.3 (see Appendix 3.8 for each zone).

Table 3.3 Estimated Future Person Trips by Mass Transit

(Unit: 1000 person trip ends/day)

	1984	1990	1995	2005
DKI Jakarta Total	5,122	7,739	9,898	12,333
BOTABEK Total	492	808	1,074	1,610
Outside of JABOTABEK	98	147	188	227
Total	5,712	8,694	11,160	14,170

3.3.2 Distribution of Mass Transit Person Trips = Step-2

The future mass transit person trips obtained are distributed to each zone, and are based on an updated mass transit origin and destination table (O/D table). The major traffic movement patterns are shown in Figs. 3.2 through 3.5 (see Appendix 3.9 for integrating the previously mentioned 80 zones into 20 zones).

To compile this updated mass transit O/D table, the following data was used:

1) The O/D table for railway passengers in the "Feasibility Study of Grade Separated Crossing in Manggarai Station, Track Addition and Other Improvement on Merak Line and Tangerang Line, JICA 1984" (hereinafter referred to as the "F/S of Manggarai")
2) The O/D table for bus transportation in JIUT

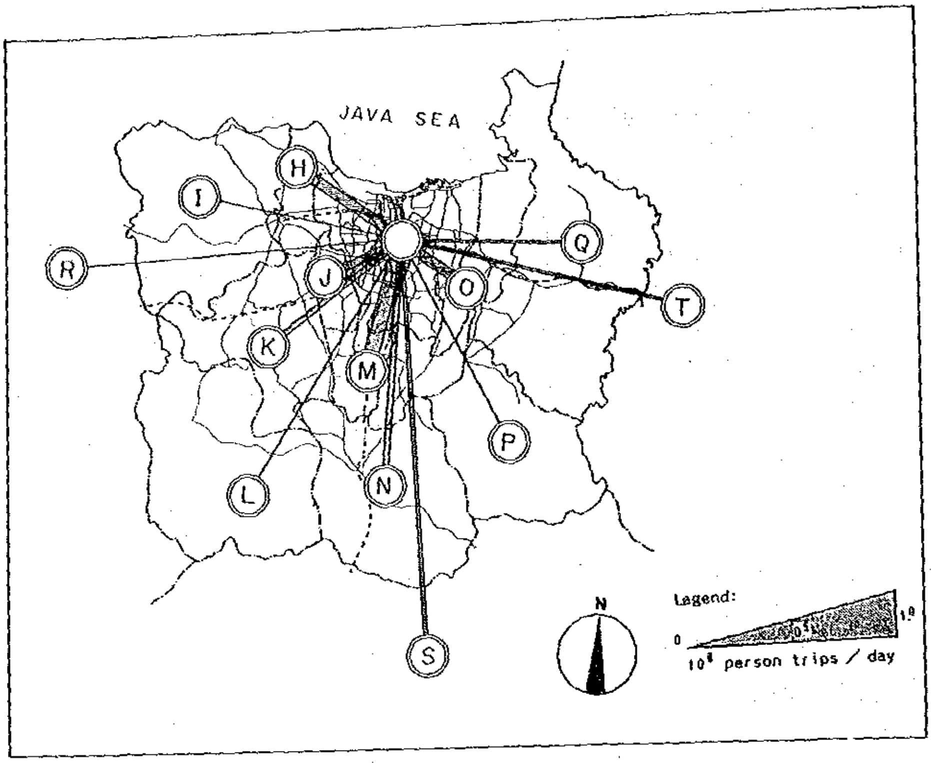


Fig. 3.2 Desire Traffic Lines of Person Trips by mass Transit between DKI Jakarta and Other Zones, 1995

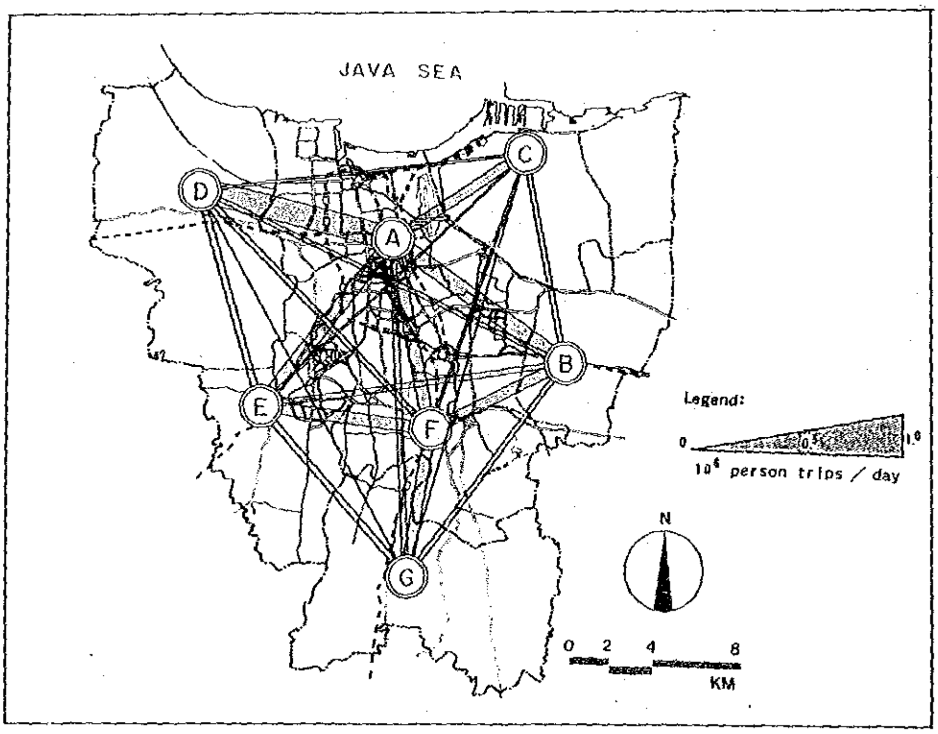


Fig. 3.3 Desire Traffic Lines of Person Trips by Mass Transit inside DKI Jakarta, 1995

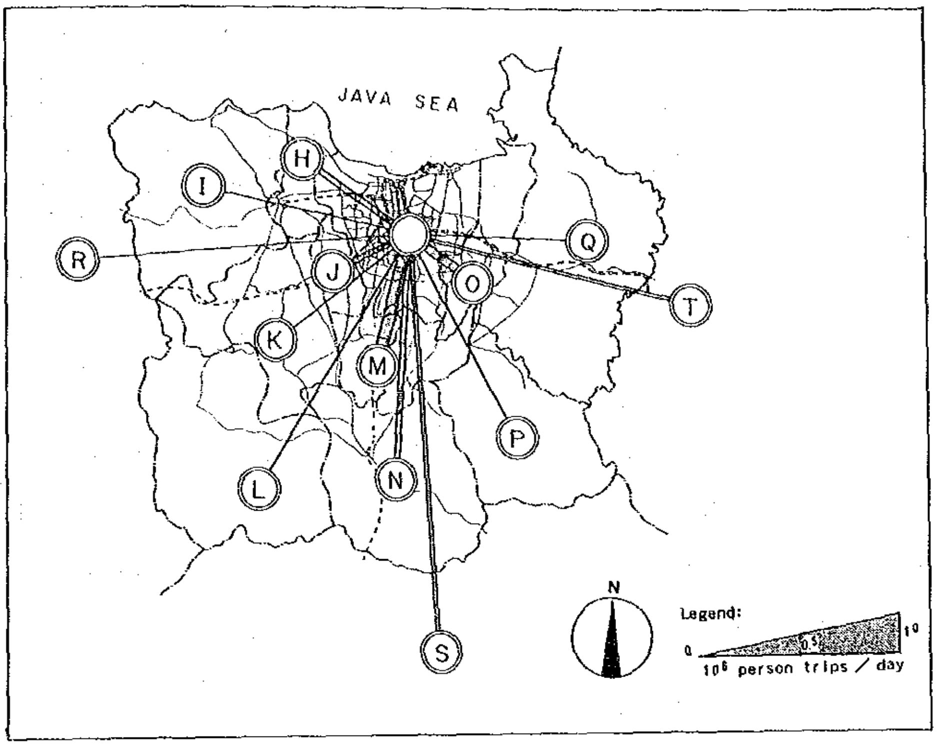


Fig. 3.4 Desire Traffic Lines of Person Trips by Mass Transit between DKI Jakarta and Other Zones, 2005

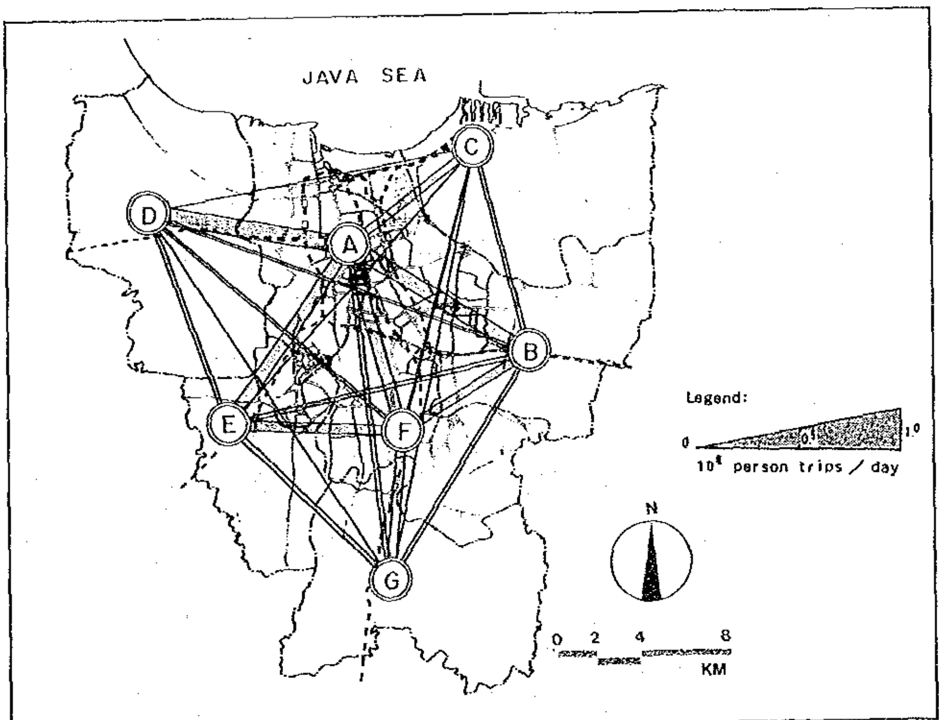


Fig. 3.5 Desire Traffic Lines of Person Trips by Mass Transit inside DKI Jakarta, 2005

3.3.3 Modal Split between Railway and Bus = Step-3

The traffic volume of each flow thus obtained is divided into railway and bus traffic.

(1) Modal Split Curve between Railway and Bus

The railway traffic volume is obtained by multiplying the mass transit person trips by a railway traffic share ratio. The railway traffic share ratio can be determined by applying a travel time ratio to the modal split curve between railway and bus (see Fig. 3.6). The travel time ratio is arrived at by dividing railway travel time by bus travel time.

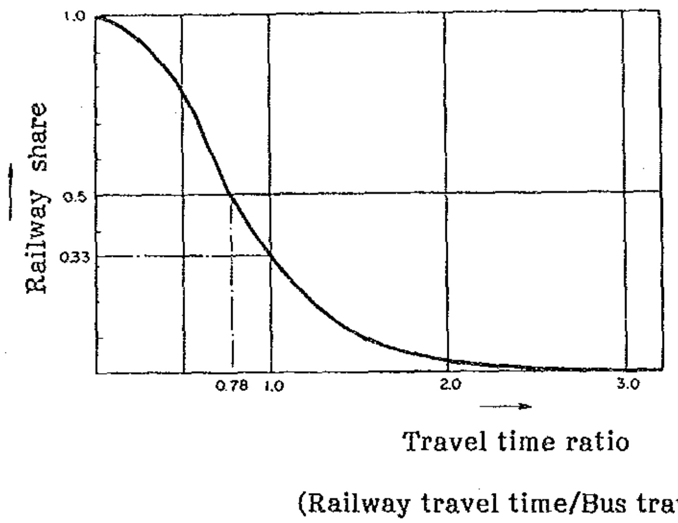


Fig. 3.6 Modal Split Curve between Railway and Bus

(2) Estimation of Future Travel Time

Future railway travel time is an aggregate of the following:

1) future link distance (km) between stations divided by future train speeds (km/h);

2) future access/egress time to/from railway stations; and

3) future waiting time at railway stations;

Future bus travel time is an aggregate of the following:

1') future link distance (km) between bus-stops divided by future bus speeds (km/h);

2') future access/egress time to/from bus-stops; and

3') future waiting time at bus-stops;

The above-mentioned factors of future travel time are based on the following assumptions:

(a) Link Distance and Speed (Factors 1,1')

Future railway link distances between stations were set based on the railway network conceived in the F/S of Manggarai and the Review of F/S. The future bus link distances were set based on the road network conceived in the JIUT and Review of F/S.

The future scheduled train and bus speeds are based on the Review of F/S. Scheduled train speed in 1984 was assumed to be 30 km/h on radial lines (the Tangerang, Merak, Bekasi, Bogor, and Tanjung Priok Lines) and 23 km/h on loop lines (the Central, Eastern, and Western Lines), and will be followed by speed increases of approximately 10 km/h in 2005, for both kinds of lines, respectively. Scheduled bus speeds inside DKI Jakarta in 1984 were assumed to be 15 km/h and 20 km/h on non-arterial and arterial roads, respectively and 20 km/h for both kinds of roads outside DKI Jakarta. It was assumed that scheduled bus speeds will not change by 2005.

(b) Access/Egress Time (Factors 2,2')

Access/egress time to/from either a railway station or a bus stop was assumed to accord with bus speed.

(c) Waiting Time (Factors 3,3')

At railway stations, waiting time is based on the frequency of train operation for each railway line. Future train frequency is also taken into account. At bus-stops, waiting time is considered negligible.

(3) Estimated Future Person Trips by Transportation Mode

(a) Railway and Bus Person Trips

Based on this modal split analysis, the future distributions of railway and bus person trips are obtained. The railway and bus person trip estimations by zone are shown in Appendices 3.10 and 3.11, respectively.

(b) Railway Traffic Share (Total)

The results show that the railway traffic share of the total person trips will be 6.2% in 1990, 10.1% in 1995, and 15.0% in 2005 (see Fig. 3.7).

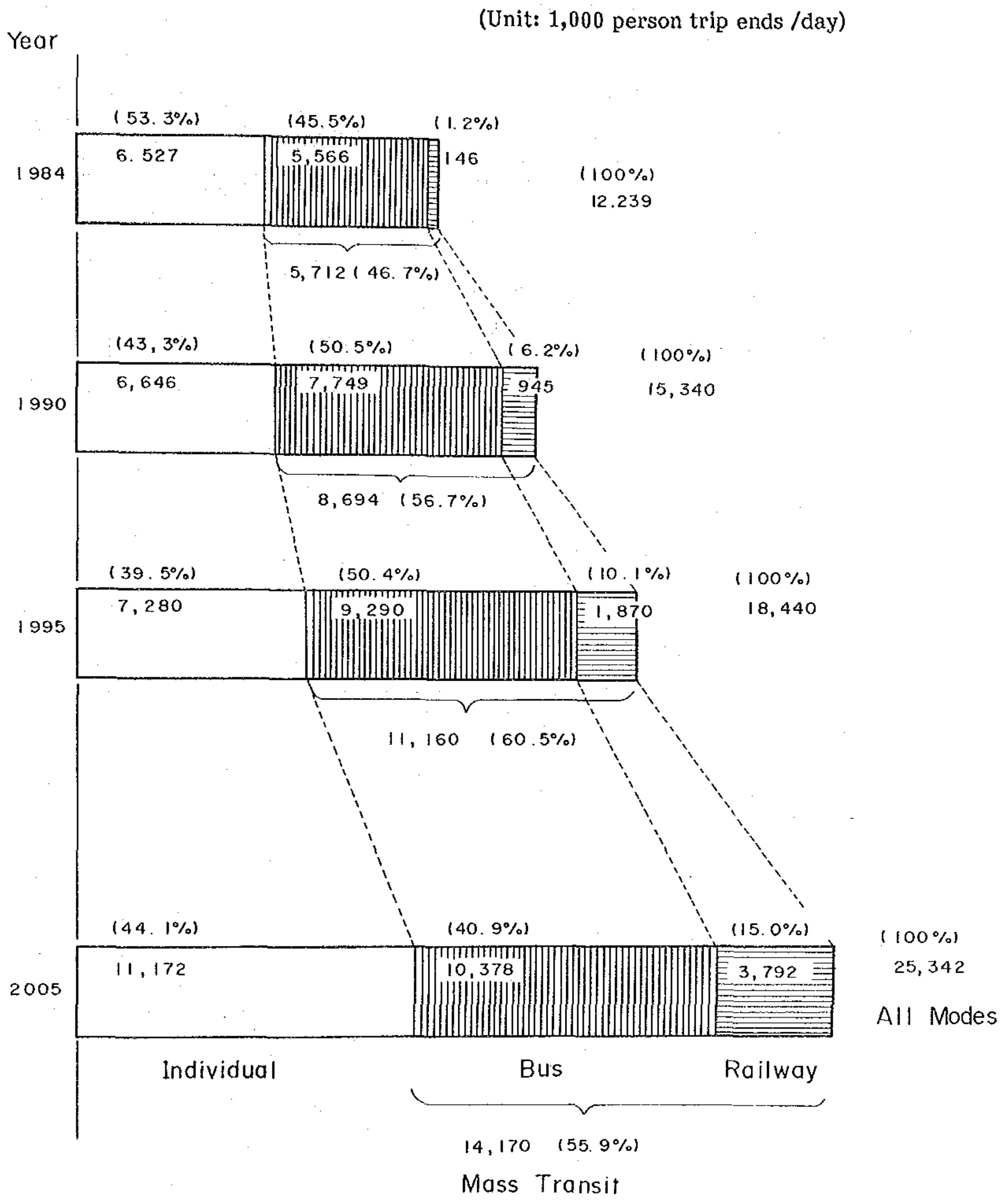


Fig 3.7 Estimated Future Person Trips by Transportation Mode

3.3.4 Future Railway Traffic Demand = Step-4

(1) Desire Traffic Lines of Railway Passengers

The future distribution patterns of railway passenger movements are shown in Figs. 3.8 - 3.9. These figures focus on passenger movements among station groups for each railway line.

The railway stations were integrated into 10 groups (see below).

Station group ⓐ: Loop lines (Central, Eastern, and Western Lines)

Station group ⓑ: Bekasi Line inside DKI Jakarta

Station group ⓒ: Tanjung Priok Line

Station group ⓓ: Tangerang Line inside DKI Jakarta

Station group ⓔ: Merak Line inside DKI Jakarta

Station group ⓕ: Bogor Line inside DKI Jakarta

Station group ⓖ: Bekasi Line outside DKI Jakarta

Station group ⓗ: Tangerang Line outside DKI Jakarta

Station group ⓘ: Merak Line outside DKI Jakarta

Station group ⓙ: Bogor Line outside DKI Jakarta

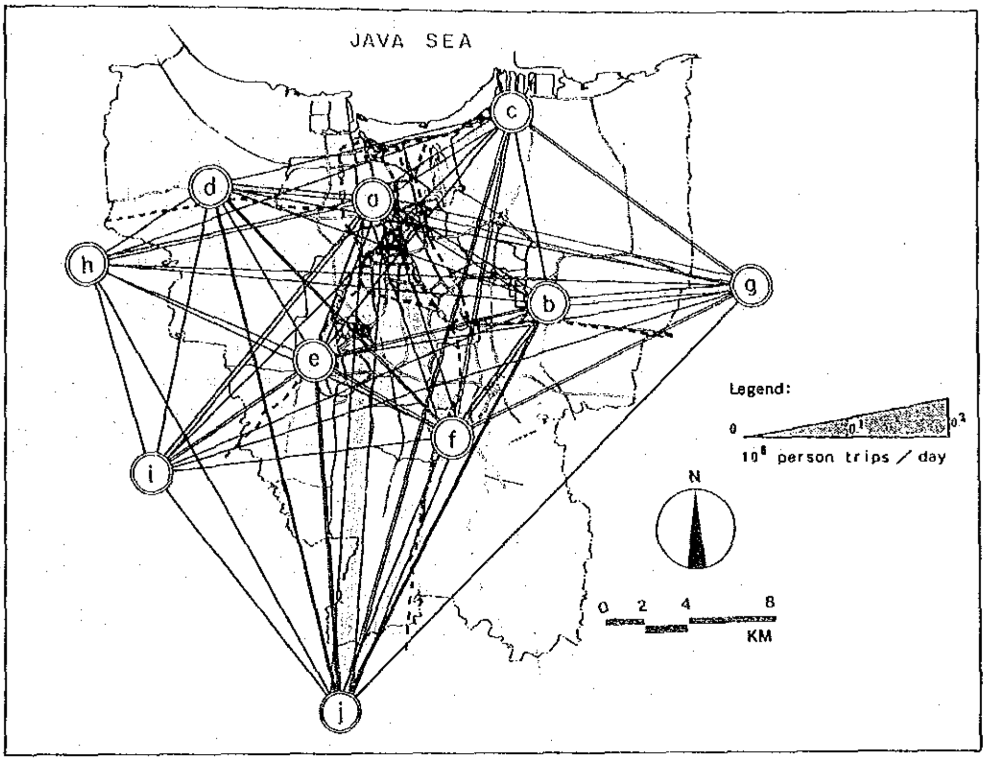


Fig. 3.8 Desire Traffic Lines of Railway Passengers, 1995

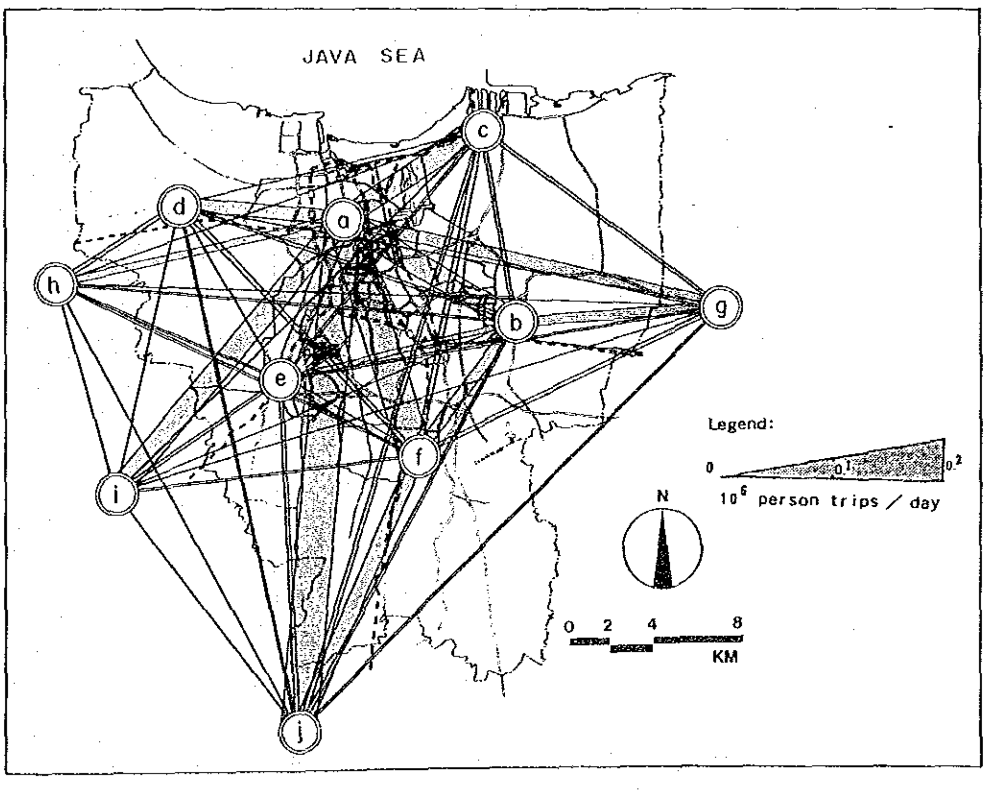


Fig. 3.9 Desire Traffic Lines of Railway Passengers, 2005

(2) Cross-sectional Passenger Traffic Volume

The estimated interzonal volume of railway passengers is assigned to a railway network by route choice based on minimum travel time.

The above method for route choice was applied in two different cases: first, in the situation where the network has a connection between the Eastern and Western Line at Kampung Bandan (hereinafter referred to as "With Project"); second, in the situation where no such connection exists (hereinafter referred to as "Without Project"). The results of the latter will be dealt with in the subsequent section 3.3.5. The results of the former are as follows.

The forecasted passenger volumes (all day) of the major railway links in 1990, 1995, and 2005 are shown in Fig. 3.10.

Incidentally, Appendix 3.12 illustrates the said passenger volumes in the form of O/D table for the major railway stations.

In addition, the forecast for passenger volumes (all day and peak 2 hours) of major railway links in 1990, 1995, 2005, and 2015 are shown in Table 3.4 and Appendix 3.13.

Taking into account the study results of the Review of F/S, the peak ratio for the peak 2 hours is assumed to be approximately 20%.

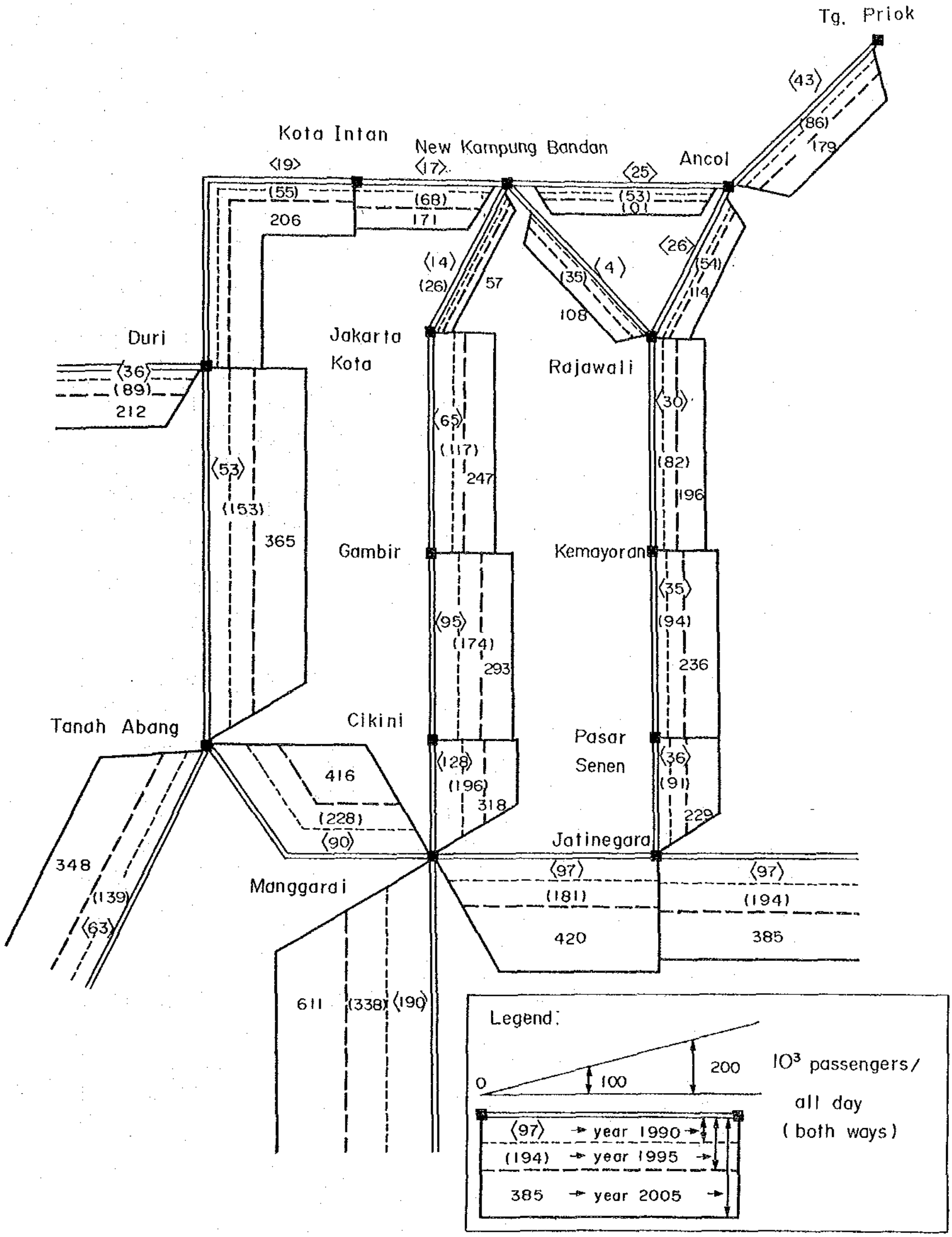


Fig. 3.10 Estimated Railway Passenger Volume (With)

Table 3. 4 Railway Passenger Volume of Major Railway Links by Stage (All day and peak 2 hours)

(Unit: ×1,000 Pass.)

Line	Station - Station	Period	1990	1995	2005	2015
Tangerang Line	Grogol - Duri	All day	36	89	212	233
		Peak 2 hr.	7	18	42	47
Merak Line	Palmerah - Tanah Abang	All day	63	139	348	383
		Peak 2 hr.	13	28	70	77
Bogor Line	Durenkalibata - Manggarai	All day	190	338	611	672
		Peak 2 hr.	38	68	122	134
Bekasi Line	Klendar - Jatinegara	All day	97	194	385	424
		Peak 2 hr.	19	39	77	85
Tg. Priok Line	Tg. Priok - Ancol	All day	43	86	179	197
		Peak 2 hr.	9	17	36	39
Western Line	Manggarai - Tanah Abang	All day	90	228	416	458
		Peak 2 hr.	18	46	83	92
Western Line	Duri - Kota Intan	All day	19	55	206	228
		Peak 2 hr.	4	11	41	46
Central Line	Manggarai - Cikini	All day	128	196	318	350
		Peak 2 hr.	26	39	64	70
Eastern Line	Jatinegara - Pasar Senen	All day	36	91	229	252
		Peak 2 hr.	7	18	46	50

(3) Passenger Flow around the Kampung Bandan Station Area

Fig. 3.11 shows the forecasted breakdown of railway passenger flow according to direction around the Kampung Bandan Station Area in 1995 and 2005. It focuses on the movement of railway passengers at the Jakarta Kota and New Kampung Bandan Stations.

For example, it is estimated that at the New Kampung Bandan Station in 2005, 170,600 passengers will move from/in the direction of Kota [illegible] Station; of these passengers, 63,500, 93,300, and 10,200 will move from/in the directions of Tanjung Priok, Rajawali, and Jakarta Kota Stations, respectively; and, finally, 3,600 passengers will get on/off at the New Kampung Bandan Station.

It is estimated that the traffic volume between Kota Intan Station and Rajawali Station, which runs through the Western - Eastern Line via the New Kampung Bandan Station, will amount to 31,600 passengers in 1995 and 93,300 in 2005.

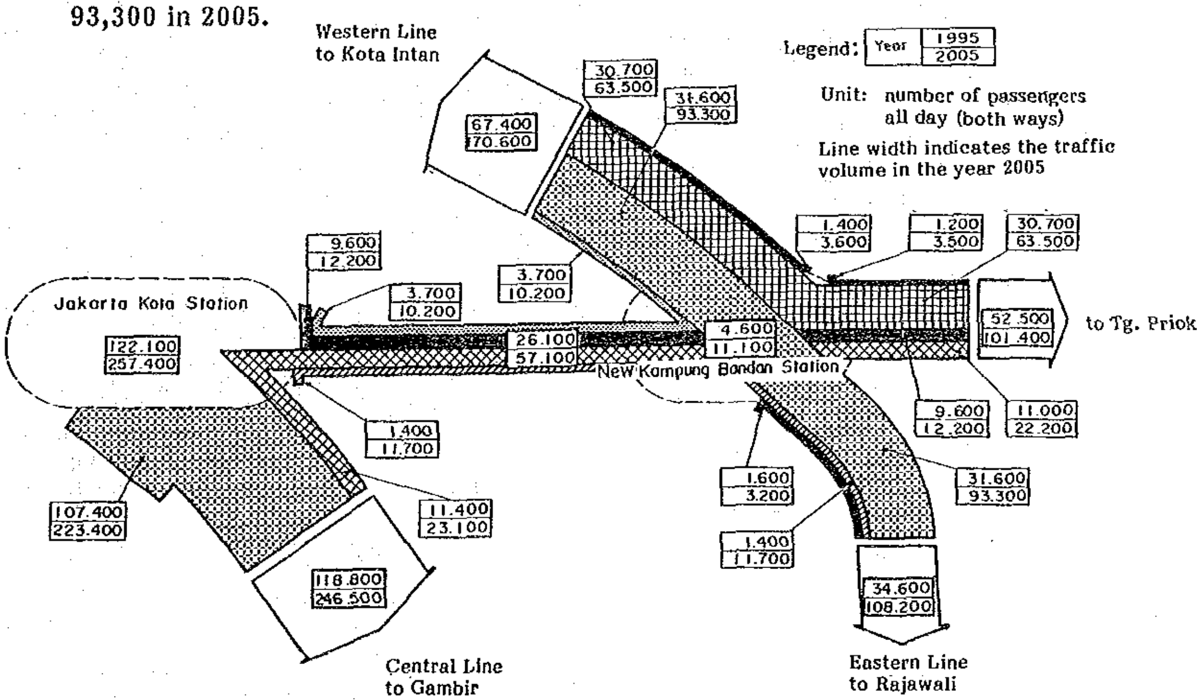


Fig. 3.11 Passenger Flow around Kampung Bandan Station Area (With)

3.3.5 Traffic Volume "Without Project"

(1) Cross-sectional Passenger Traffic Volume ("Without Project")

The passenger volumes of the major railway links for "Without Project" are shown in Fig. 3.12.

(2) Passenger Flow around the Kampung Bandan Station Area ("Without Project")

The movement of railway passengers around the Kampung Bandan Station Area in the case of "Without Project" is shown in Fig. 3.13.

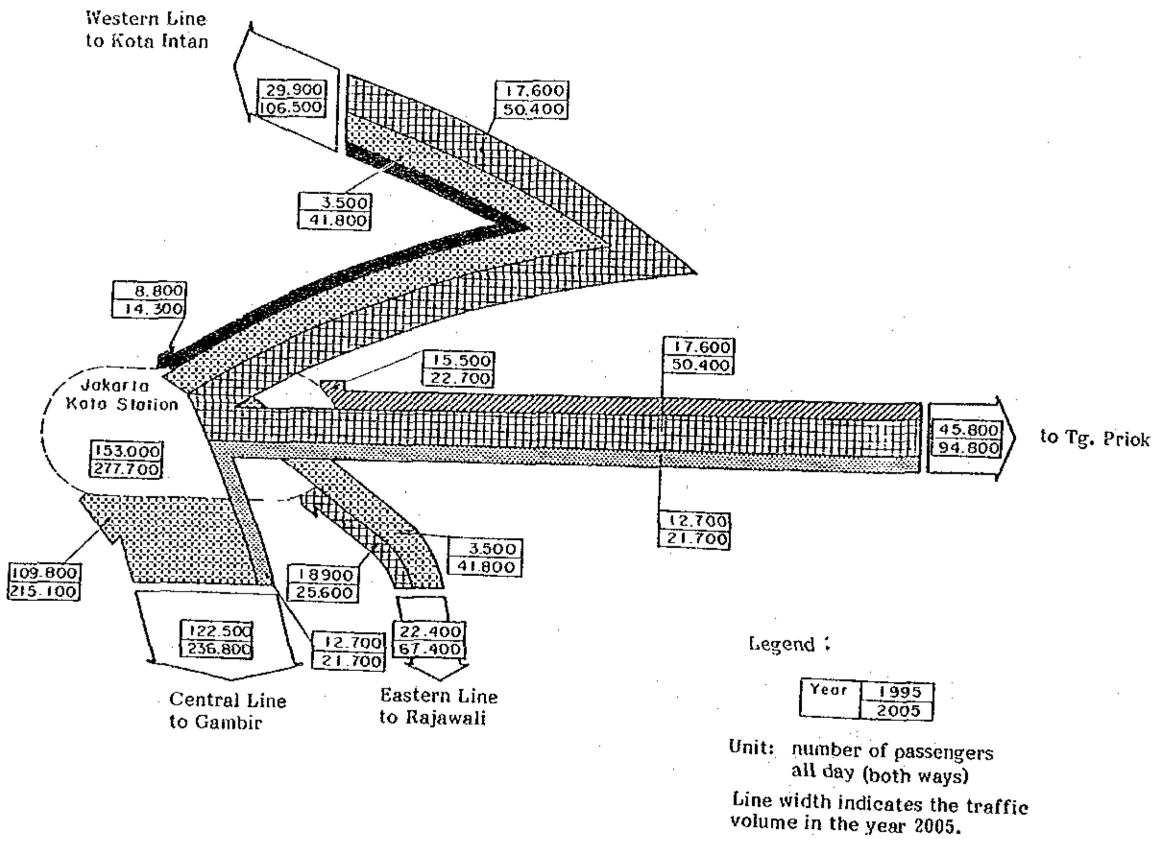


Fig. 3.13 Passenger Flow around Kampung Bandan Station Area (Without)

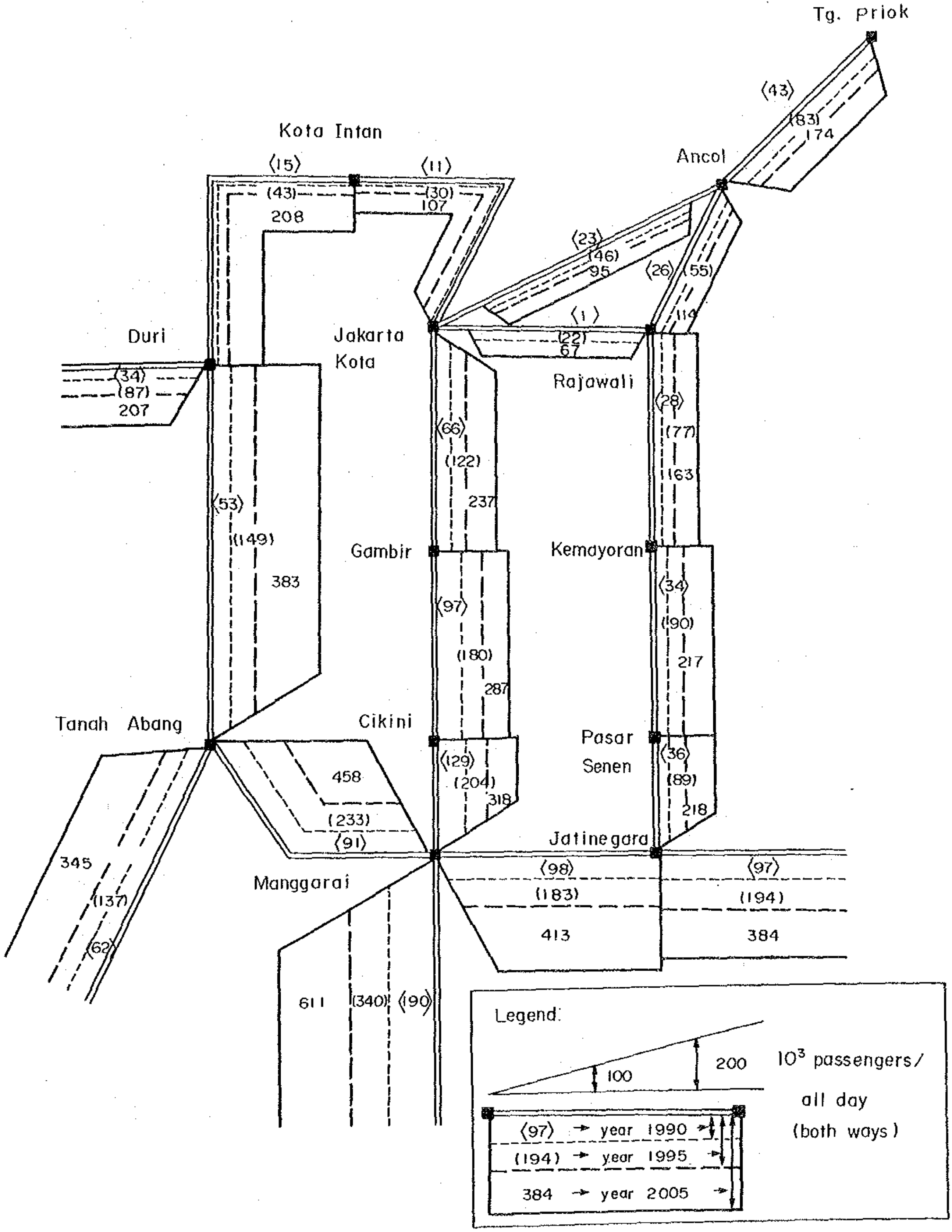


Fig. 3.12 Estimated Railway Passenger Volume (Without)

3.3.6 Comparison of "With Project" and "Without Project"

The comparison of "With Project" and "Without Project" is shown in Table 3.5.

The railway traffic volume of "With Project" always surpasses that of "Without Project". This is due to the reduction in railway travel time that accompanies the implementation of the Project. A part of the traffic would be shifted from bus to railway in the case of "With Project", with savings in both passenger-kms and passenger-hours being realized.

However, the increase in total railway traffic volume due to the Project is quite small (around 1% for the whole JABOTABEK Railway Network). Therefore, the Project aims at securing advantages different from that of traffic volume increase (see 4.1.3 and 4.2.5).

Table 3.5 Comparison of Railway and Bus Traffic Volumes of "With Project" and "Without Project"

(Per day)

	Mode	Item	1990	1995	2005
"With Project"	Railway	Passengers	472,000	935,000	1,896,000
		Pass.-km	20,280,600	34,951,000	61,371,400
		Pass.-hr	618,100	1,081,700	1,904,900
	Bus	Passsengers	3,875,000	4,645,000	5,189,000
		Pass.-km	48,955,900	62,730,000	74,350,900
		Pass.-hr	2,813,600	3,595,200	4,579,400
	(Total)	Passengers	4,347,000	5,580,000	7,085,000
		Pass.-km	69,236,500	97,681,000	135,722,300
		Pass.-hr	3,431,700	4,676,900	6,484,300
"Without Project"	Railway	Passengers	468,000	928,000	1,870,000
		Pass.-km	20,268,600	34,901,400	61,242,000
		Pass.-hr	617,600	1,080,500	1,897,000
	Bus	Passengers	3,879,000	4,652,000	5,215,000
		Pass.-km	48,991,300	62,856,100	74,674,600
		Pass.-hr	2,815,700	3,602,600	4,600,600
	(Total)	Passengers	4,347,000	5,580,000	7,085,000
		Pass.-km	69,259,900	97,757,500	135,916,600
		Pass.-hr	3,433,300	4,683,100	6,497,600
"With Project" minus "Without Project"	Railway	Passengers	4,000	7,000	26,000
		Pass.-km	12,000	49,600	129,400
		Pass.-hr	500	1,200	7,900
	Bus	Passengers	△ 4,000	△ 7,000	△ 26,000
		Pass.-km	△ 35,400	△ 126,100	△ 323,700
		Pass.-hr	△ 2,100	△ 7,400	△ 21,200
	(Total)	Passengers	-	-	-
		Pass.-km	△ 23,400	△ 76,500	△ 194,300
		Pass.-hr	△ 1,600	△ 6,200	△ 13,300

CHAPTER 4 TRANSPORTATION PLAN (Connection of the Western and Eastern Lines)

CONTENTS

CHAPTER 4 TRANSPORTATION PLAN

(Connection of the Western and Eastern Line)

4.1 Present Train Operation around Kampung Bandan Signal Station

4.1.1 General

Kampung Bandan Signal Station is located in the northern part of Jakarta City near the Jakarta Kota and Jakarta Gudang Stations and Jakarta Kota Passenger Car Depot.

Tracks branch out from this station to the Jakarta Kota, Angke, Jakarta Gudang, and Tanjung Priok Gudang Stations. Accordingly, this signal station is considered as one of the key stations of the Jakarta City urban transportation system from the viewpoint of train operation.

1) Passenger trains of the Western Line are switchbacked here as they proceed to the the Jakarta Kota Station.
2) Freight trains of the Western Line are switchbacked at the station in order to proceed to the Jakarta Gudang Station, and also pass here when going to the Tanjung Priok Gudang Station. In addition, freight trains of the Eastern line are switchbacked here after stopping at the Jakarta Kota Station on their way to the Jakarta Gudang Station.

At present, a total of 36 trains are switchbacked here daily, while four trains pass it when going to the Tanjung Priok Gudang Station.

The schematic layout of the Kampung Bandan Signal Station is on the following page.

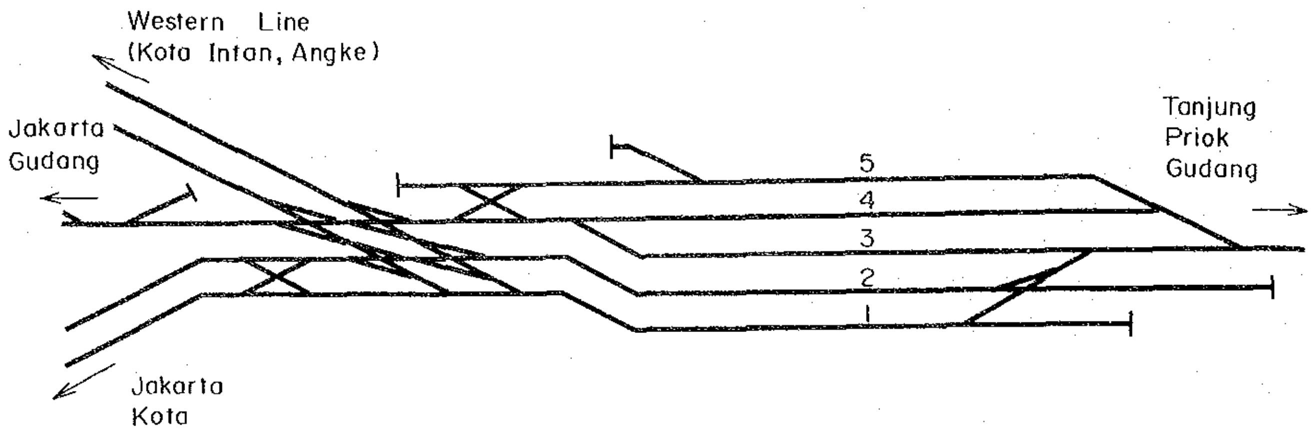


Fig. 4.1 Schematic Layout of Kampung Bandan Signal Station

4.1.2 Switchback Operation

A switchback operation is to be avoided since it interrupts smooth train operation and increases the probability, however minor, of accidents.

(1) Multiple unit (electric or diesel railcar) trains

To minimize the time required for a switchback operation, an additional driver is necessary for driving in the reverse direction.

Without an additional driver, more time will be required for the station stop, since the driver must change driving cabs in order to operate the train in the reverse direction.

Failure to change operating cabs at the switchback station will expose the train operation to hazards. This is due to the driver being at the rearmost part of the train formation when driving the train in the reverse direction. In such cases, restrictions on train operation speed are inevitable.

(2) Trains hauled by locomotive

To minimize the time required for a station stop, an additional locomotive is required for driving the train in the reverse direction.

The absence of an additional locomotive requires shunting the present locomotive, which hauled the train up to the station, to be newly re-coupled to the head of the train. This method requires a much longer station stop.

Without an additional locomotive or a change in the position of the locomotive to the opposite end of the train, the driver's visibility will be extremely poor and will pose a serious safety hazard. Inevitable restrictions on train speed and visibility problems associated with this kind of operation are serious problems posed by the switchback operations described above.

4.1.3 Connection of Lines for Eliminating Switchback Operation

(1) The switchback operation whose demerits are outlined above can be eliminated by adopting a new train operating route that would modify a combination of existing lines by means of new connecting links.

(2) Four new combinations of existing lines are significant.*1 (see Fig. 4.2).

(3) On studying the possible combination of lines in the Kampung Bandan Station Area, the following items are to be compared and evaluated.

1) Effective passenger service
2) Simplicity of train operation
3) Construction simplicity and investment amount

In Item 1, the future traffic volume and directions of the Western Line passenger flow are compared; and, in Item 2, the complication caused by the bifurcation of train operations at stations is checked. In Item 3, construction simplicity is evaluated for each of the new links.*2

The conclusions are noted below.

Notes *1 : 1) The "E-T Connection" is not viable, because both lines approach this area from the same direction.

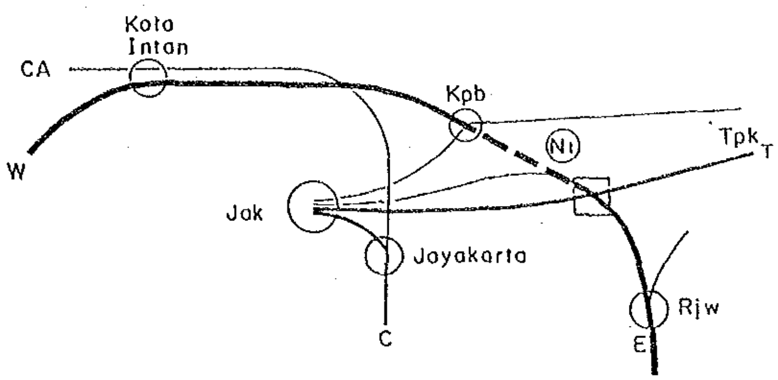
2) The "C-E Connection" is not considered effective, since these lines are nearly parallel and too close to each other.

*2 : The following matters were also checked.

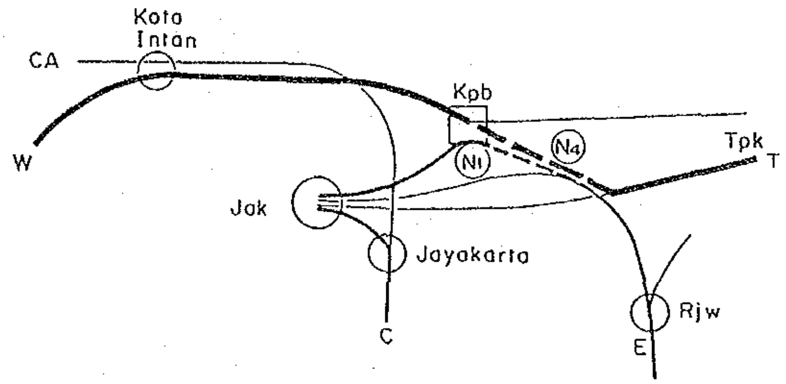
1) "Y-shaped" track connections must be avoided, because the total capacity of two tracks when directly connected with a third track will be cut to less than half. Furthermore, a failure of the third track will have a negative influence on both of the two other tracks.

2) A conceivable exception to the above rule is, for example, the Y-shaped track layout formed by the intersection of track of the Cengkareng Airport Line (used for airport passenger service), and Jakarta Kota-Jayakarta and Jayakarta-Gambir sections. The track on the Cengkareng Airport Line does not share peak-hour traffic with the two other tracks. Therefore, the Y-shaped track connection is allowed at Jayakarta Station.

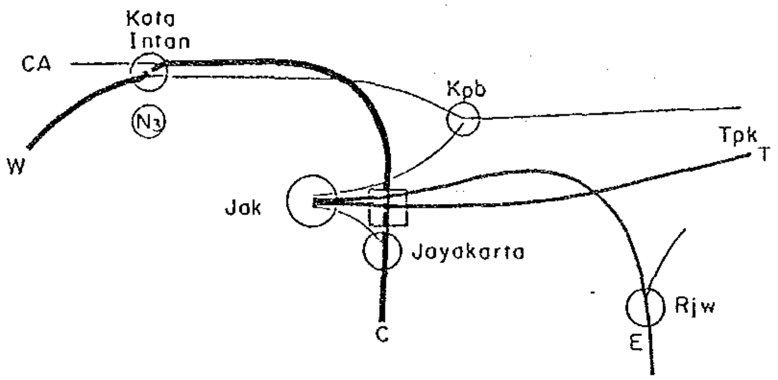
W - E combination



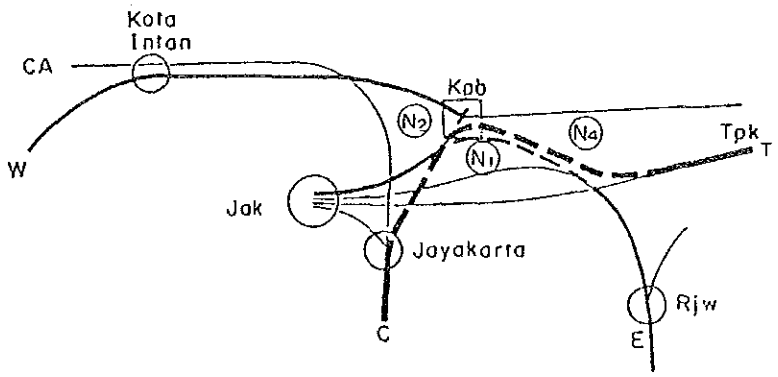
W - T combination



W - C combination



C - T combination



Remark

☐ : New passenger station

Ni-N4 : New links required to be constructed

Fig 4.2 Combination of Lines

The above abbreviations will be used in the tables and figures of this chapter.

Table 4.1 Comparison and Evaluation of Line Combinations

Combination / Criteria	W-E	W-T	W-C	C-T
Effective passenger service	o		x	x
Simplicity of Train operation	o	o		o
Simplicity of Construction	o		x	x

Notes: o : "no problems"

△ : "with some problems"

x : "with serious problems"

In eliminating the switchback operation at the Kampung Bandan Signal Station, the W-E connection is preferable not only from the viewpoint of passenger convenience and simplicity of train operation, but also from the viewpoint of construction cost.

4.2 Improvement of Train Operation Route

4.2.1 Basic Concepts of Train Operation Planning

Three basic concepts should be adhered to in commuter train operation planning:

1) Meeting peak-hour demand
2) Maintaining simplicity of train operation
   Simplicity eases and secures wholesome decision-making when train operation is behind schedule, thereby, ensuring the reliable functioning of the railway during peak hours. (Switchback operations, bifurcation of trains at a station, etc. will only complicate efforts to normalize a schedule.)
3) Minimizing the scale of the fleet required

4.2.2 Assumptions

Assumptions for the train operation plan are as follows:

(1) The cross-sectional transportation demand for all day (both ways), and that for the 2-hour peak (one way) with a peak factor of 20% are indicated Fig. 4.3.

(2) Transportation capacity of a train with 4 railcars is 560 persons. The load factor of a train during peak hours is supposed to be 200%. Accordingly, the transportation capacity of a 4 railcar train during peak hour is 1120 persons; an 8 railcar train, 2240; and a 12 railcar train, 3360.

(3) The train formations are 4, 8, and 12 railcars.

(4) The characteristics of any multiple unit train are the same as those now use by PJKA.

(5) The minimum train frequency required during peak hours is four services per hour.

(6) The train operation routes of long-distance passenger trains and freight trains are the same as they are now, except for a few minor schedule improvements.

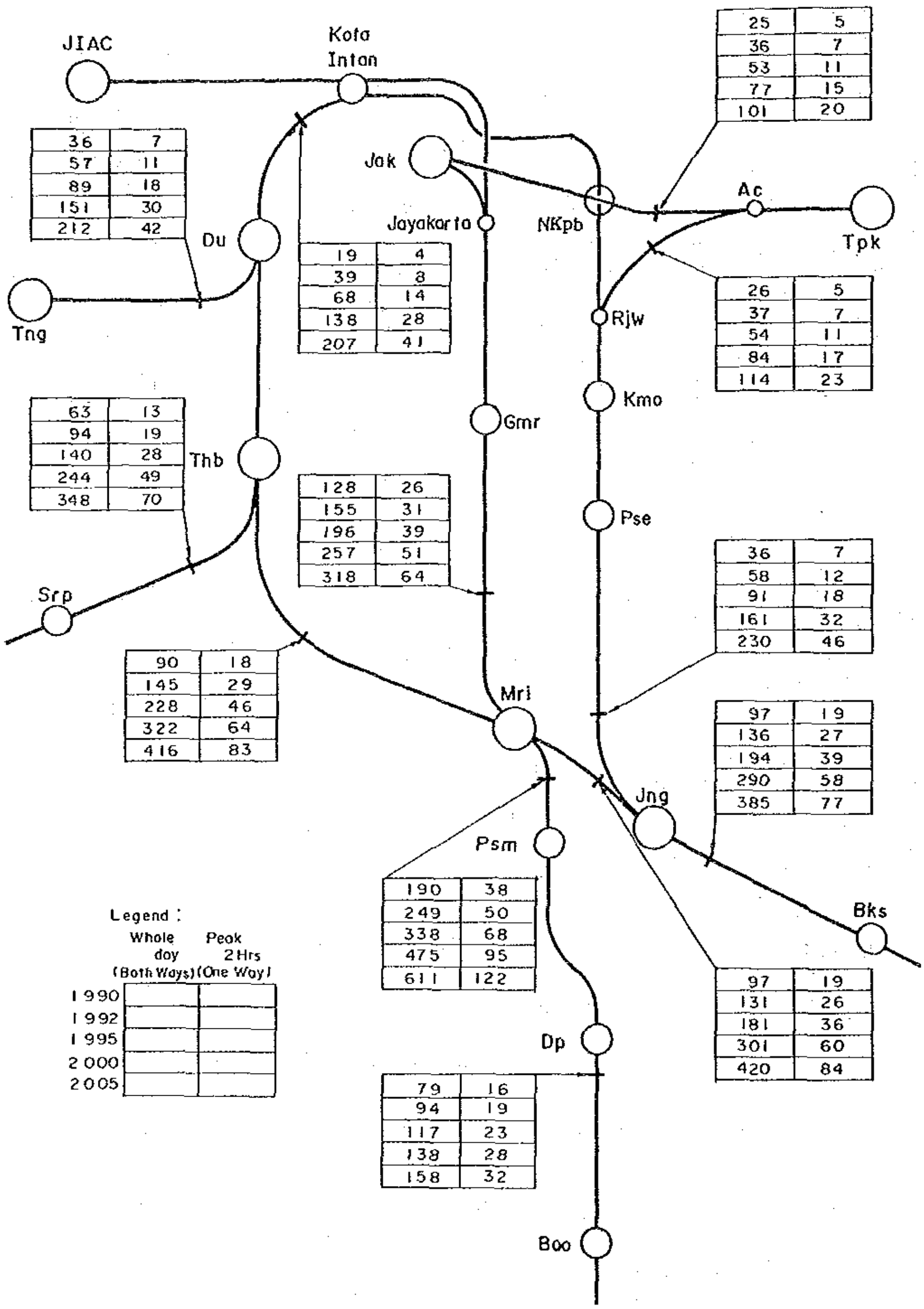


Fig. 4.3 Forecasted Traffic Flows (Whole day and 2-Hr peak in thousands)

4.2.3 Train Operation Route

Under the basic concepts of 4.2.1 and the assumptions of 4.2.2, the train routes conceivable, when the Western-Eastern Line connection is completed, will be as follows.

(1) Commuter Trains

1) The possible train routes are Alternative 1 (p. 71), Alternative 2 (p. 72), and Alternative 3 (p. 73).
   Alternative 1 is considered the best among the three.

2) The features, advantages, and disadvantages, of the Alternatives are summarized, compared, and evaluated in Table 4.2.

3) The following facts revealed in the course of the above analysis are noteworthy.

   a) The traffic demand between Manggarai and Depok requires a small shuttle operation of additional trains to covering the section, especially during peak hours after 1995. (This is commuter train route ⑤, and is not included in the explanations of any of the Alternatives.)

   b) Trains of the Cengkareng Airport Line if they are to avoid disturbing the heavy train flow from Bekasi, are to be terminated at Manggarai instead of at Jatinegara after 2005.

4) Train operation route ⑨ for Alternative, Pse-Tpk can be deleted, but it will have an unfavorable effect on passenger service.

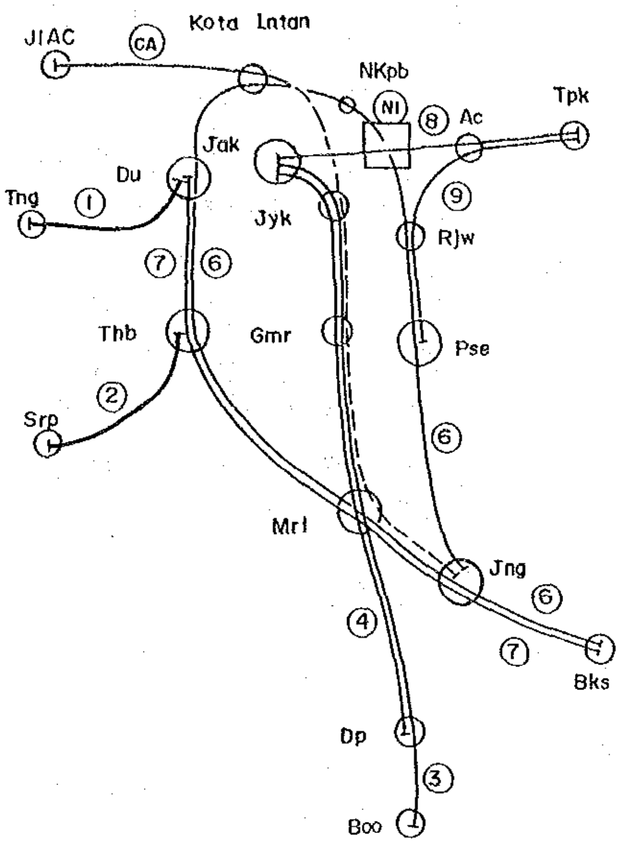
Table 4.2 Comparison and Evaluation of Train Route Alternatives 1, 2, and 3

			Alternative 1	Alternative 2	Alternative 3
Feature	Connection of Lines:		W-E	W-E	W-E
Feature	Facilities to be built: New Station(s)		NKpb at the intersection of T and E	NKpb at the intersection of T and E NS2 at apprx 600m east of Jak	Existing Kpb (signal) upgrated to a passenger station
Feature	New Link(s)		N1 connecting W and E	N1 connecting W and E	N1 connecting W and E N4 connecting Kpb and Ac
Feature	Truck Lines		Loop (W-E) C-Jak T-Jak	Loop (W-E) C-Kota Intan T-Jak	Loop (W-E) C-Jak T-Jak
Feature	Sectional Train Operation		Bks-Mri-Du	Bks-Mri-Du	Dp-Mri-Du
Evaluation	Passenger Service	Passenger Convenience	◎	Passenger Volume from C to Jak is estimated to be the heaviest for this area. Passengers are required to change trains at NS2	◎
Evaluation	Passenger Service	Easy Access to the Railway station	○ Jl M. Dua	○ Jl M. Dua	△ Jl Kampung Bandan
Evaluation	Passenger Service	Compatibility with DKI Project	○ Project Jl. M. Dua	○ Project Jl. M. Dua	△ Future Kota Area redevelopment
Evaluation	Train Operation	Simplicity of Train Operations at Stations	○	○	△ Trains from C bifurcate at Mri in directions C and W
Evaluation	Train Operation	Adaptability of Train Routes to Traffic Demand	○	○	△ Train flow ⑥, between Mri and Jng, does not satisfy the demand
Evaluation	Investment & Construction	Investment Cost	◎	x Additional investment at NS2 and	△ Additional investment at N4
Evaluation	Investment & Construction	Easiness of Construction	○	x NS2 is to be built on the CA elevated structure, and requires construction work while existing tracks, are being used immediately below	△ Kpb is to be improved and requires work while existing adjacent tracks are being used.
Evaluation	Investment & Construction	Provision of space for future improvement of Jak	○ 2 commuter train routes terminate at Jak.	◎ 1 commuter train route terminates at Jak.	○ 2 commuter train routes terminate at Jak.
Final Evaluation			◎	△	○

NS2 : Refer to page 74 in the Report
N4 : Refer to Fig. 4.2 in the Report

Notes:
◎ : Good
○ : No problems
△ : some problems
× : serious problems

Alternative 1 W-E Connection



Commuter train routes:

(1)	Tng-Du
(2)	Srp-Thb
(3)	Boo-Mri-Gmr-Jak
(4)	Dp-Mri-Jak
(6)	Bks-Jng-Mri-Thb-NKbp-Pse-Jng
(7)	Bks-Jng-Mri-Thb-Du
(8)	Jak-NKpb-Tpk
(9)	Pse-Rjw-Tpk
(CA)	JIAC-Kota Intan-Gmr-Mri-Jng

Facilities to be built:

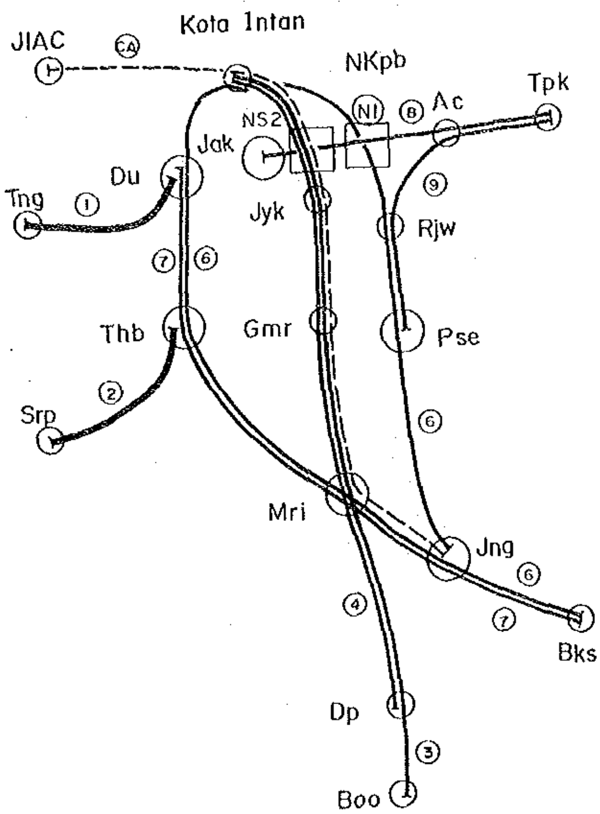
a. A new station (New Kampung Bandan: NKpb) at the intersection of T and E
b. A new link (N1) connecting W and E

Main train routes:
Loop (W-E), C-Jak, T-Jak

Advantages:
a. Train routes are well adapted to the forecasted passenger flows.
b. NKpb is located close to Jl. Mangga Dua and Jl. Gunung Sahari Ancol. Easy access to the station is expected.
c. A direct freight train route is secured from Jak-Gudang to E. Switchback operations at Jak, and Kpb are eliminated.
d. Construction work (cost and time period) is minimal - N1 and NKpb only.

Disadvantages:
Until the CA is completed, passengers going from Gmr to Kota Intan (estimated to be few in number) are required to change trains twice, once at Jak and once at are NKpb.

Alternative 2 W-E Connection



Commuter train routes:

(1) Tng-Du
(2) Srp-Thb
(3) Boo-Mri-Gmr-NS2-Kota Intan
(4) Dp-Mri-Gmr-NS2-Kota Intan
(6) Bks-Jng-Mri-Thb-NKbp-Pse-Jng
(7) Bks-Jng-Mri-Thb-Du
(8) Jak-NKpb-Tpk
(9) Pse-Rjw-Tpk
(CA) JIAC-Kota Intan-Gmr-Mri-Jng

Facilities to be built:

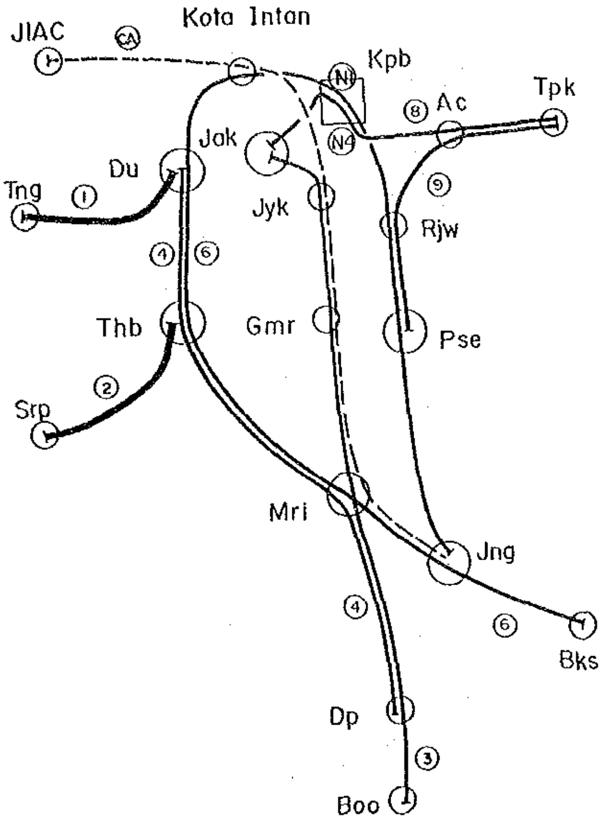
a. A new station (NKpb) at the intersection of T and E
b. Another new station (NS2) at the intersection of T and CA
c. A new link (N1) connecting W and E
d. CA

Main train routes:
Loop (W-E), C-Kota Intan, T-Jak

Advantages:
a. NKpb is located close to Jl. Mangga Dua and Jl. Gunung Sahari Ancol. Easy access to the station is expected.
b. Train handling at Jyk is simplified.
c. A direct freight train route is secured from Jak-Gudang to E. Switchback operations at Jak, and Kpb are eliminated.

Disadvantages:
a. Passengers going from C to Jak (estimated to be great in number) are required to change trains at NS2.
b. Two new stations (NKpb and NS2) are required. NS2 will be expensive and pose constructing difficulties.
c. Not realizable unless CA is constructed.

Alternative 3 W-E Connection



Commuter train routes:

(1) Tng-Du
(2) Srp-Thb
(3) Boo-Mri-Gmr-Jak
(4) Dp-Mri-Thb-Du
(6) Bks-Jng-Mri-Thb-NKpb-Pse-Jng
(8) Jak-NKpb-Tpk
(9) Pse-Rjw-Tpk
(CA) JIAC-Kota Intan-Gmr-Mri-Jng

Facilities to be built:

a. Existing Kampung Bandan (Kpb) Signal Station improved to a passenger station
b. A new link (N1) connecting W and E
c. Another new link (N4) connecting Kpb and Ac

Main train routes:
Loop (W-E), C-Jak, T-Jak

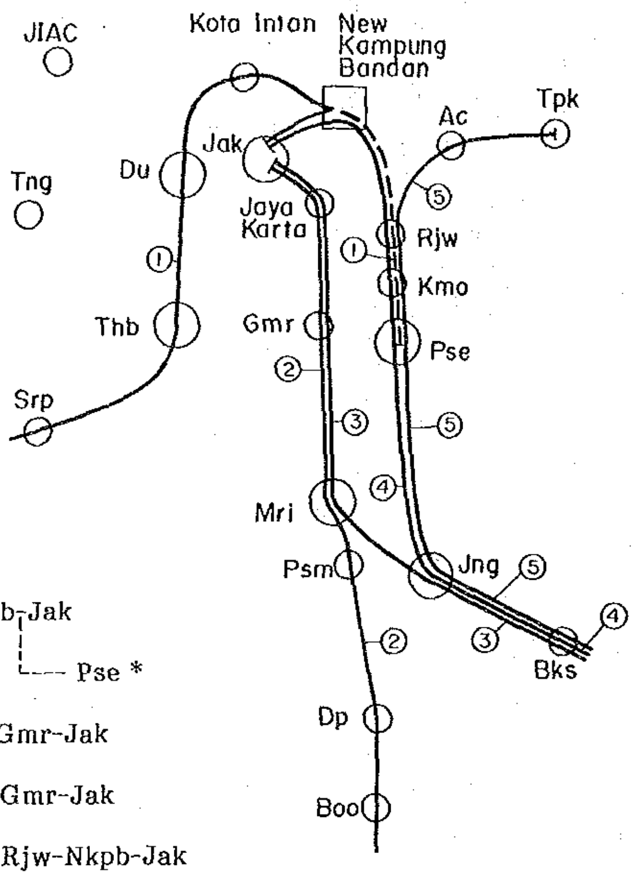
Advantages:
a. A direct freight train route is secured from Jak-Gudang to E. Switchback operations at Jak, and Kpb are eliminated.

Disadvantages:
a. The number of trains for flow (6) between Mri and Bks will be less than what is required. This is due to train flow (4) occupying half of the Mri-Thb-Du track capacity.
This situation can be resolved if additional trains are operated from Mri-Bks.
b. Train handling is complicated at Mri, since trains from Dp bifurcate in the directions of Gmr and Thb. Punctual operation is keenly required.
c. Two new links (N1 and N4) are required.
d. Kpb improvement costs are high; also, construction is complex since work must be conducted while the existing Kpb tracks are being used.

(2) Long-Distance Passenger Trains

Train routes will be as shown below:

No radical modification of the current routes is considered .



Train routes:

1 -Srp-Thb-NKpb-Jak
└--- Pse *

2 -Boo-Dp-Mri-Gmr-Jak

3 -Bks-Jng-Mri-Gmr-Jak

4 -Bks-Jng-Pse-Rjw-Nkpb-Jak

5 -Bks-Jng-Pse-Rjw-Ac-Tpk

Fig. 4.4 Long-Distance Passenger Train Route

* It is preferable, if circumstances permit, that the trains of Merak Line terminate at Pasar Senen instead of at Jakarta Kota. This will eliminate the need for a switchback operation at the New Kampung Bandan Station.

(3) Freight Train

Trains routes will be as shown below:

1) -Srp-Thb-Mri-Jng-Bks -

This route can be used for coal trains from Merak. In this case, it is preferable to change the hauling locomotive at Tanah Abang in order to minimize station stopping time, since the train must change direction there anyway.

2) - Srp-Thb-Du-Kota Intan-New Kampung Bandan Junction ┬ Tpg
└ Jakg

3) - Srp-Thb-Du-Kota Intan-NKpb-Rjw-Kmo-Pse-Jng-Bks-

4) Tpk-Rjw-Kmo-Pse-Jng-Bks-

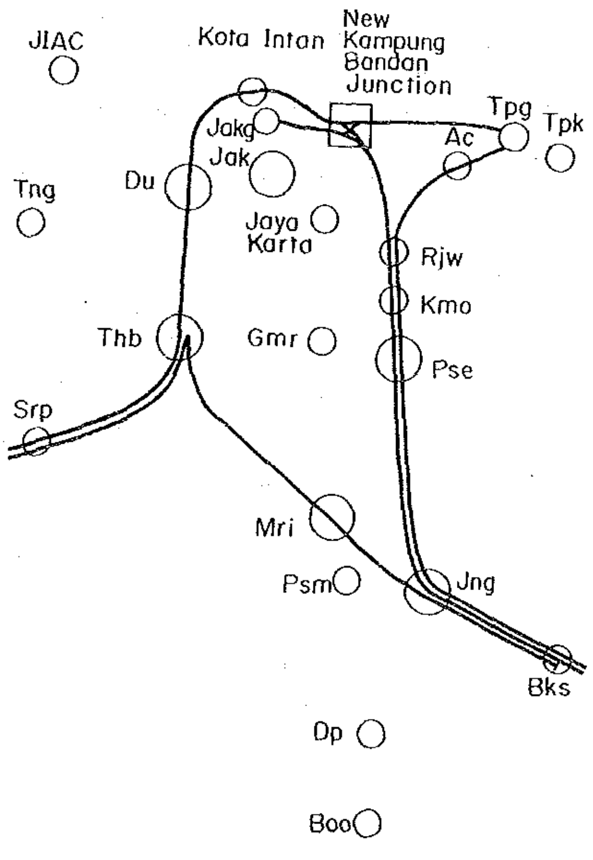


Fig. 4.5 Freight Train Routes

4.2.4 Train Formation and Headway

The number of railcars in each train formation, and the train headway required to meet the transportation demand are indicated Fig. 4.6 below.

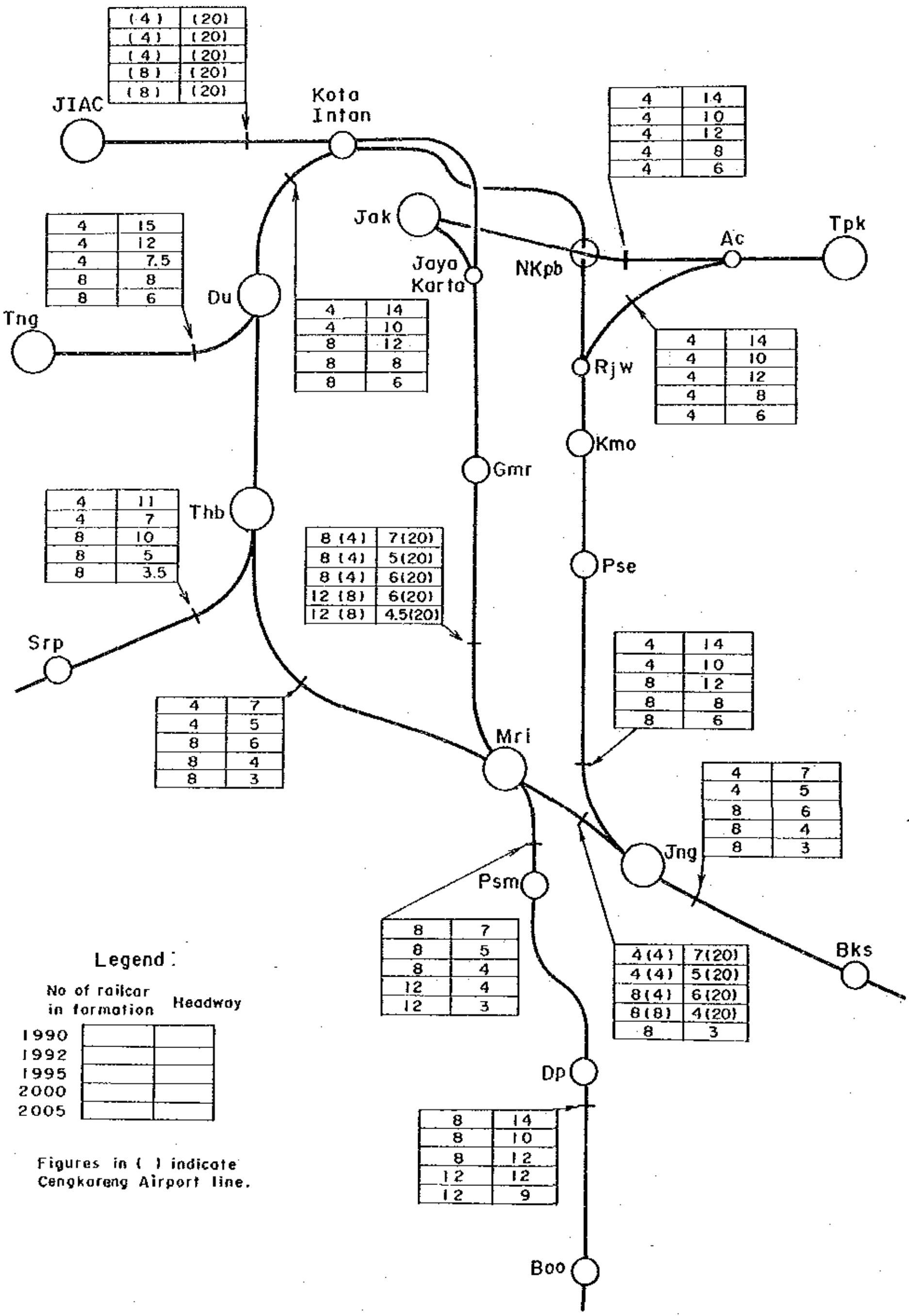


Fig. 4.6 Train Headway and Number of Railcars for Each Train Set (2-Hr. Peak)

4.2.5 Rolling Stock Required

(1) To calculate the required number of railcars, the following assumptions were made.

1) Stopping time at a terminal station is five minutes. This will give the driver time to change operating cab, and station staff to do light cleaning inside the railcars.

2) Maximum operating speed is limited to 60 km/h on and inside the loop lines. Maximum speeds on the radial lines are based on the performance of the railcar.

3) Stopping time at stations is one minute, except at Dp, Psm, Mri, Jng, Thb, and Du where trains stop for two minutes.

(2) Table 4.3 indicates the required number of railcars for the whole JABOTABEK railway network for the "With Project" and "Without Project" cases; this does not include reserve railcars.

Table 4.3 Number of Railcars Required (Whole JABOTABEK Area)

Year	With Project	Without Project
1990	404	412
1992	544	552
1995	672	720
2005	1380	1448

Differences between the "With Project" and "Without Project" is the result of the increased efficiency of train operation after the elimination of the switchback operation at the Kampung Bandan Signal Station (see Appendix 4.1).

4.3 Control of Train Operation

4.3.1 General

Because of poorly maintained track, antiquated facilities, and shortages in the number of rolling stock, train operations at present are in a very poor state.

As modernization of the railway progresses train density will be increased, especially to meet the transportation demand of peak hours.

This Project suggests changes in the train operation routes. In order to ensure a smooth shift to the new train operation system, the connection of lines with new links alone is not sufficient. Punctual train operation and well-trained despatchers must also be secured.

4.3.2 Punctual Train Operation

In a railway system with high-density train operation, especially in urban areas during peak hours, the punctuality of train operation is mandatory. To maintain safe and punctual train operation, all related staff must exert special efforts.

For example, station staff and conductors should exercise care in the movement of passengers. Necessary announcements by conductor must be made to alert passengers of their impending arrival before each station. In the case of train delay, the driver should operate the train faster than usual between stations, but within the permissible speed limits; also, conductors and station staff should make efforts to minimize the time at station stops.

As for the maintenance of the permanent way, good planning is essential to avoid causing train delays. Field staff for maintenance work should follow planned procedures properly so as not to disturb the operation of trains.

Education and training are recommended in the Master Plan, but they are mainly related to training required for new facilities or new machines.

In the future, the JABOTABEK railway will require higher efficiency, more skilled personnel, and the operation of more trains at a shorter headway to cope with increasing transportation demand. Thus, the importance of punctual train operations must be stressed more emphatically than it is at present.

4.3.3 Train control

At present, Inspection-I has train despatchers working in the despatchers office located at Jakarta Kota Station. Their jobs are to trace the operation of long-distance trains. A despatcher should do more than just trace trains, he should command the entire fleet and give instructions to stations, depots, and all these concerned, and, when necessary, make temporary modifications or adjustments of the train shedule to harmonize overall train movements. JABOTABEK commuter trains are not actually under despatcher control. According to a future PJKA plan, a "Despatcher Center" will be established at Manggarai. All trains, including the JABOTABEK commuter trains, will be controlled from there. Special attention should be given to the improvement of the communication system for the Despatcher Center Project. Good performance of a train despatcher is possbile only when access to all relevant information is possible.

CHAPTER 5 RAILWAY FACILITY IMPROVEMENT PLAN (New Kampung Bandan Station)

CONTENTS

CHAPTER 5 RAILWAY FACILITY IMPROVEMENT PLAN (New Kampung Bandan Station)

5.1 Current State of Kampung Bandan Station Area

5.1.1 Geographical Conditions

The Project site and its track layout are shown in Figs. 5.1 and 5.2. It is located on a large delta plain formed by an estuary of the Cilwung River and surrounded by rivers and canals on three sides. These rivers and canals, because of the size, shape, and slope of their catchment areas, lack the ability to discharge the amount of rainfall received, and are adversely affected by tidal movements as well.

The ground in this area is nearly flat and extremely low with an altitude of 1.6 m; furthermore, there is a continuous subsidence due to the lowering of the underground water level.

These factors have resulted in this area being flooded once every two years. The inundation of 1984 is an example of this (see Fig. 5.3).

5.1.2 Present Conditions of Railway Facilities

(1) General Conditions

Jakarta Kota Station juts into the city and has four railway lines (i.e., the Western, Central, Eastern and Tajung Priok Lines) converging there with each forming a dead end.

Kampung Bandan Signal Station is located northeast of Jakarta Kota Station and east of Jakarta Gundang Station. Jakarta Kota Passenger Car Depot is situated east of Jakarta Kota Station and is connected directly to it.

This setup results in the Western Line having to be switchbacked at the

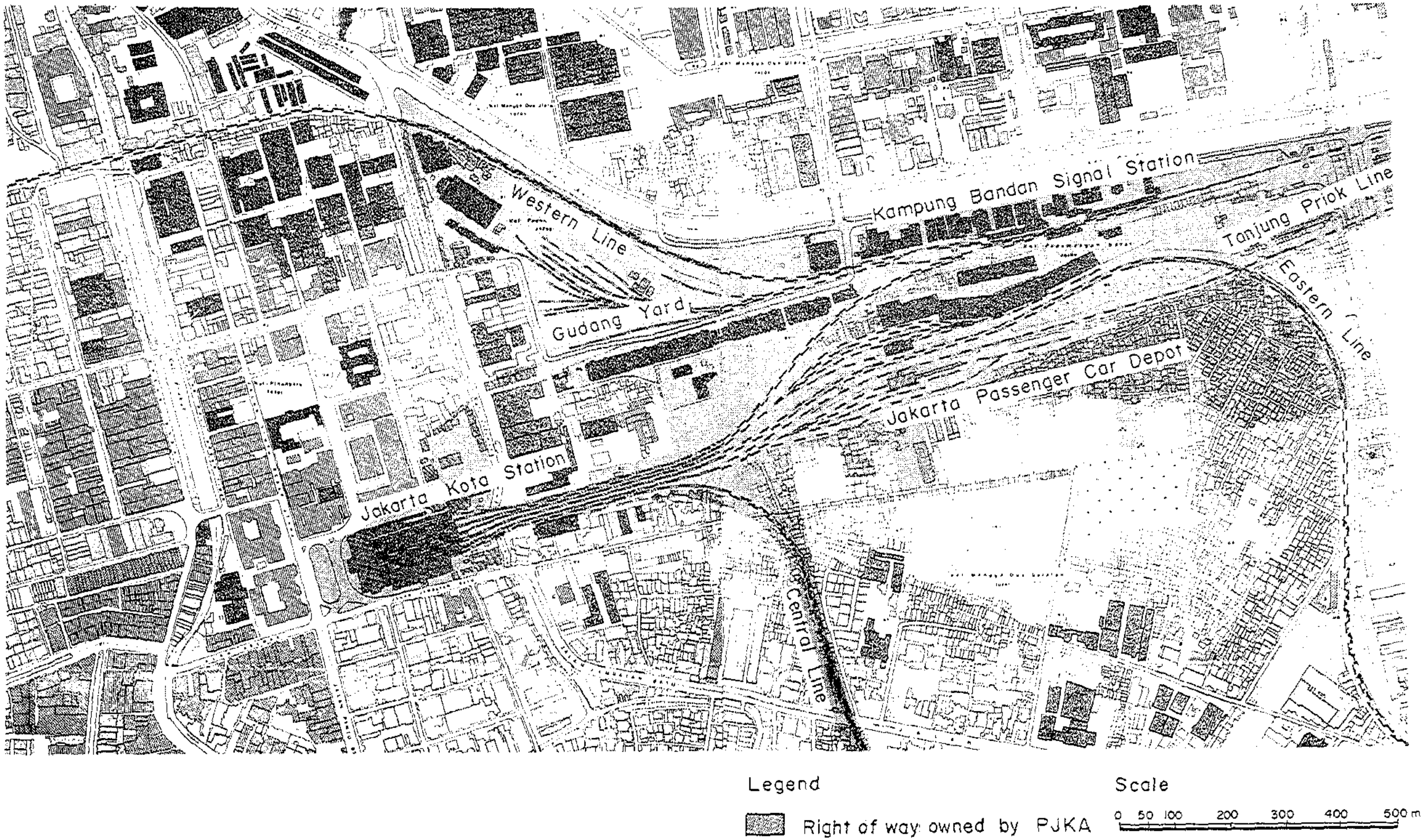


Fig. 5.1 Location Map

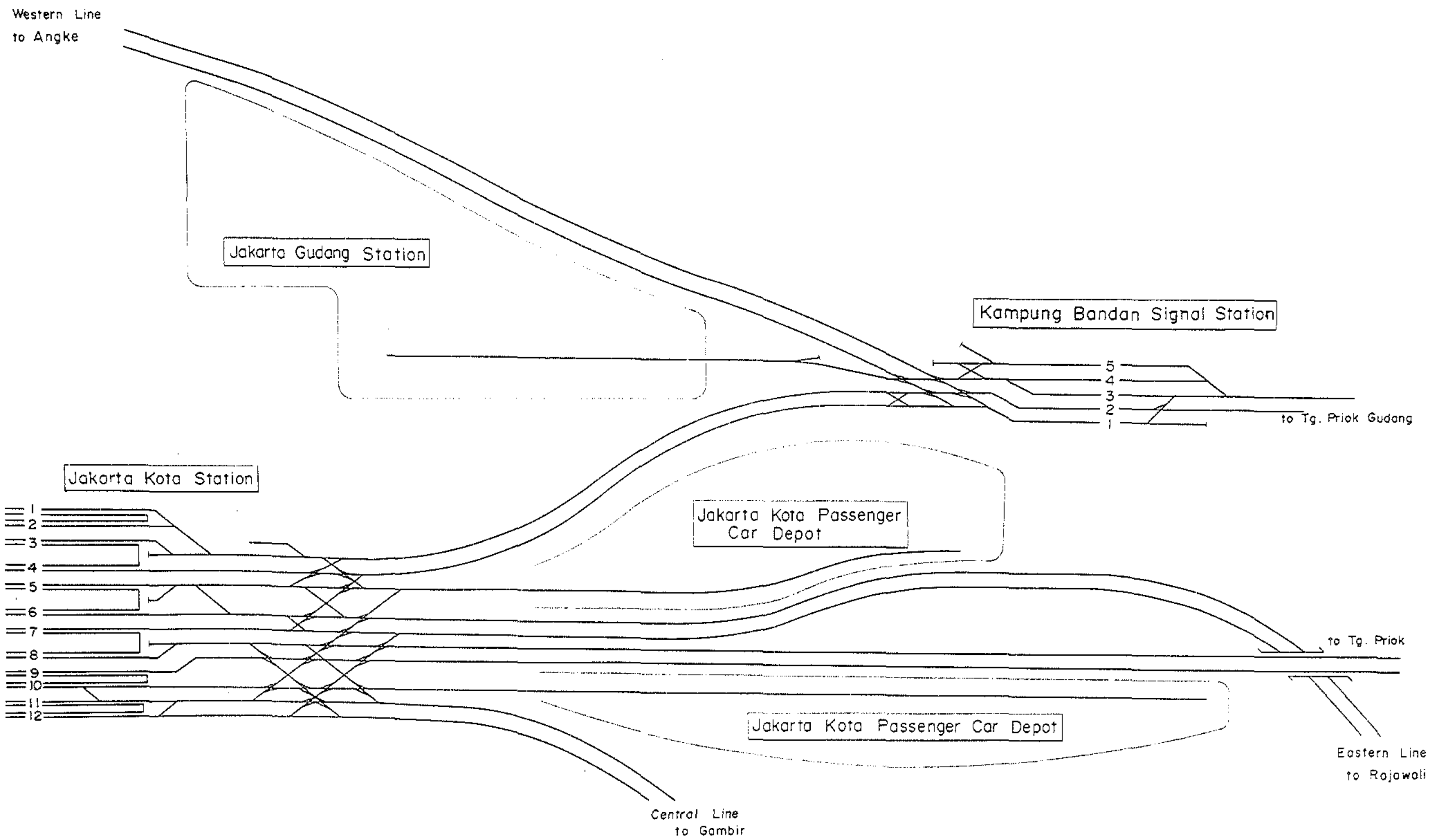


Fig. 5.2 Present Track Layout

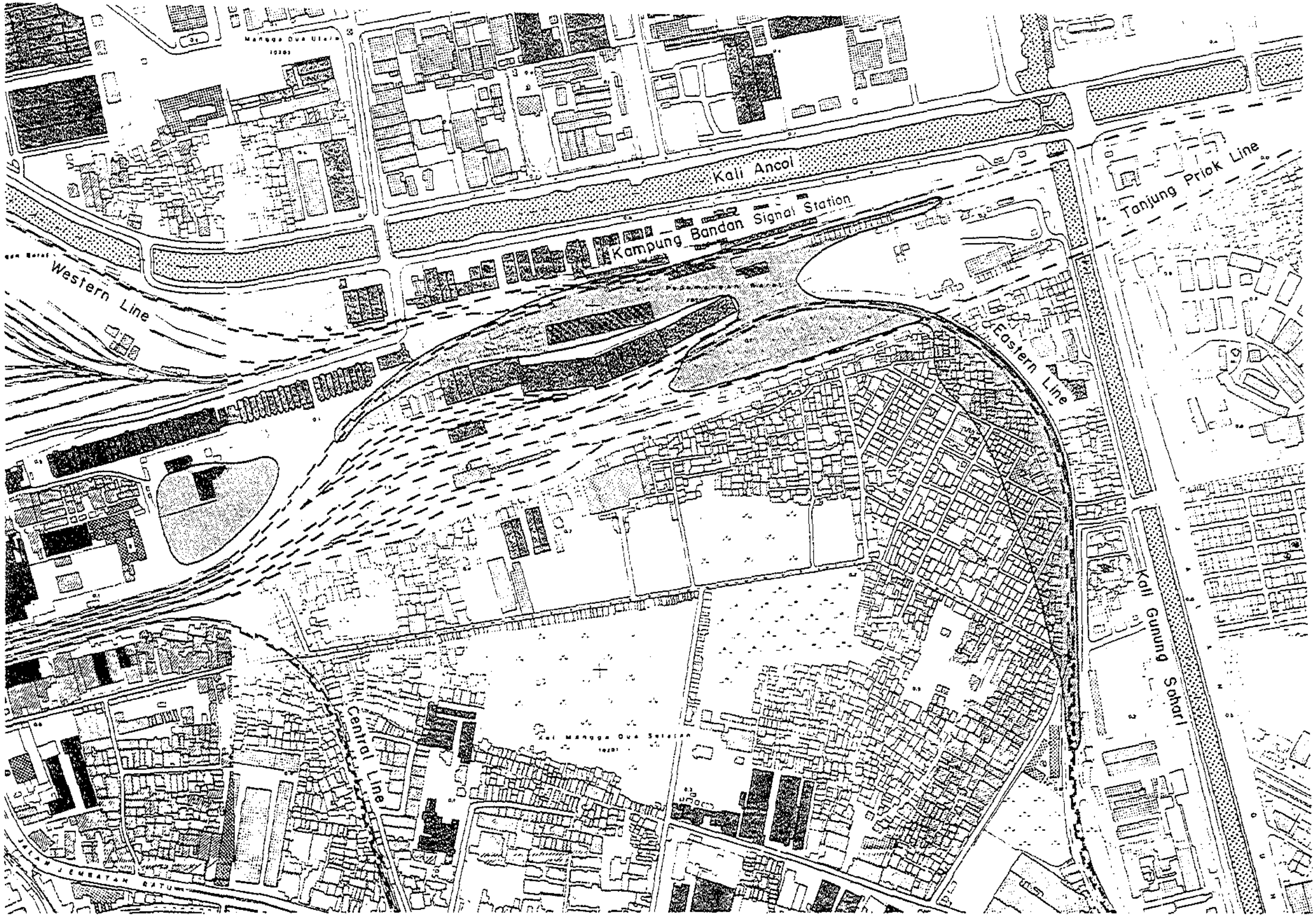


Fig. 5.3 Inundation Area

Legend ▒ : Inundated Area

Kampung Bandan Signal Station in order to get to the Jakarta Kota or Jakarta Gundang Stations. Also, in order to get to the Jakarta Gundang Station, Eastern Line trains must be switchbacked at the Jakarta and Kampung Bandan Signal Stations.

(2) Track

1) 37 kg/m rails and wooden sleepers are generally used.

2) The tracks in Jakarta Kota and Kampung Bandan Signal Stations are not sufficiently maintained, especially on and around the double slip switches. This restricts train speed there.

3) The Tanjung Priok Line had been provided with a double track. However, light traffic resulted in only a single track being used and the unused track being removed. Sleepers on the bridge (No. 252) of this line are superannuated, and there is an insufficient number of them.

4) The Eastern Line has badly deteriorated tracks, rotten sleepers, and loosened tie plates due to repeated inundation. Moreover, the ballast is partly buried in the roadbed, and the phenomenon of mud pumping can be observed almost all along the line.

(3) Station

(a) Jakarta Kota Station

1) Twelve tracks serve the four main lines, including those for baggage and freight train handling (see Fig. 5.4).

2) Eight platforms were installed, four of them have tracks on both sides (#3-#4, #5-#6, #7-#8, #9-#10). Platform widths are only about five meters, and are insufficient to handle commuter trains on both sides simultaneously.

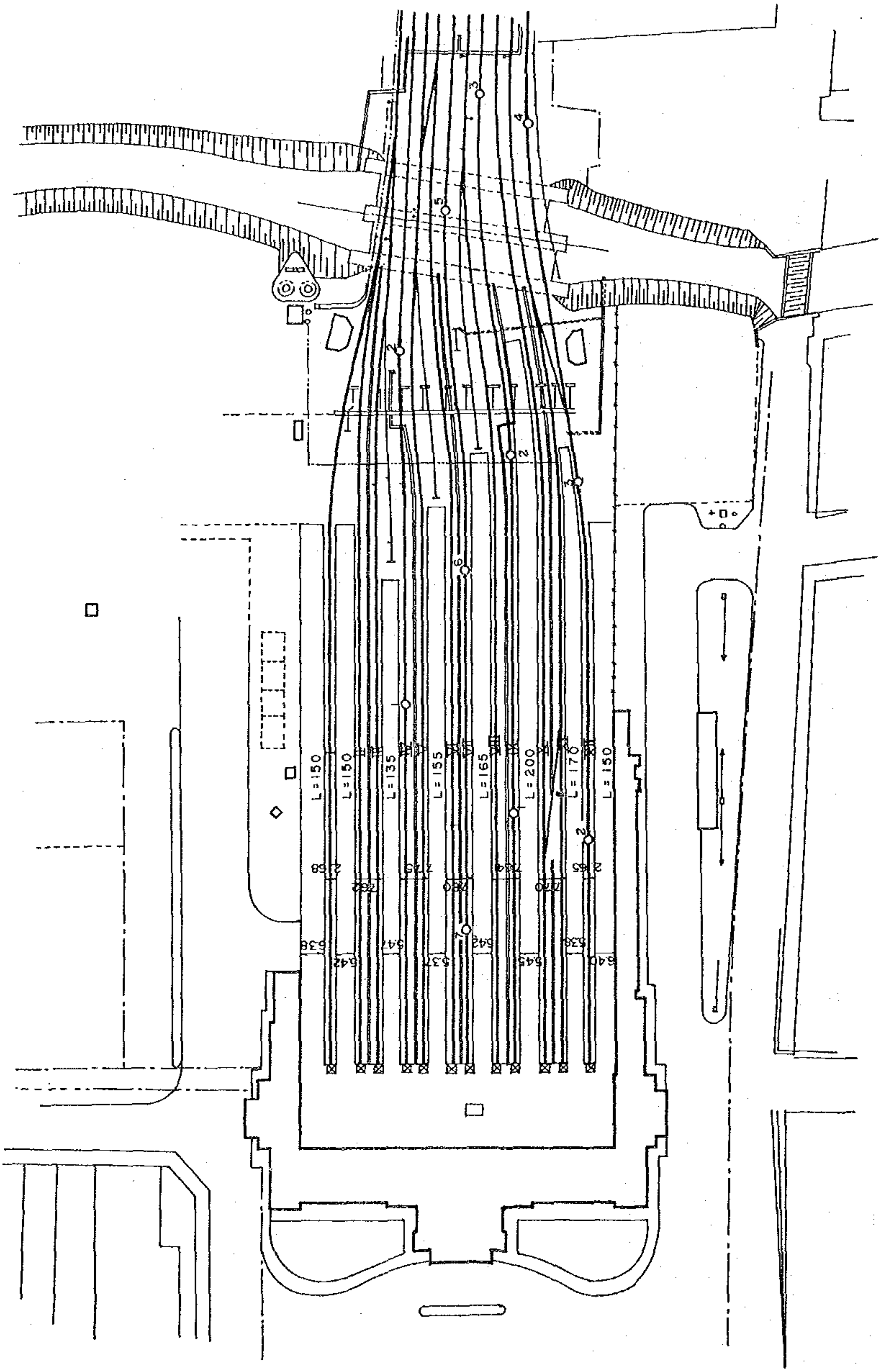


Fig. 5.4 Present Jakarta Kota Station

3) Platform lengths of 130 to 200 m are not enough to handle long-distance passenger trains bound for Bandung or Cirebon.

4) The platform height of 0.43 m is too low for commuter services.

5) The station front plaza provides insufficient space.

6) Each of the tracks for the following lines lead to Jakarta Kota Station.

#8 through #12 can be used for trains arriving from the Central Line.

#1 through #5 can be used for trains arriving from the Western Line.

#5 through #12 can be used for trains arriving from the Eastern Line.

#8 through #12 can be used for trains arriving from the Tanjung Priok Line.

(b) Kampung Bandan Signal Station

1) This signal station has had a number of double slip switches, scissor crossings, and turnouts installed. There are also five tracks for switchback operation, but most of them are not effectively utilized.

2) As to signalling, the superannuated interlocking devices using wire are in service.

3) A level crossing with a wide road is situated at the western part of the station and poses problems for safe pusher train operation.

(c) Jakarta Kota Passenger Car Depot

This Depot, with 21 tracks, is used mainly for long-distance passenger cars.

(d) Jakarta Gudang Station

This station branches off from the Kampung Bandan Signal Station and has many tracks, but only a few of them are actually used.

(4) Embankment

In the project area, the Tanjung Priok Line is located on a high embankment approximately 5 meters in hight, and has adequate width for a double track. The embankment's shoulder and slope have been eroding away for years. The roadway diagraph clearly shows that the embankment is not up to PJKA standards . Furthermore, the toe of the slope has been inundated with stagnant water every rainy season.

(5) Bridge

The Tanjung Priok Line crosses the Eastern Line with a flyover. This bridge has a pile foundation (see Fig. 5.5) and was built in 1925. Judging from the superannuation and the condition of the structure with its reinforced abutment, it is clear that the substructure of this bridge cannot bear any load heavier than that of the superstructures own weight.

(6) Drainage

In the Kampung Bandan Station Area, except for a stream connected to the Kali Gunung Sahari, there are no drainage facilities. Along the Eastern Line there are no ditches or gutters to drain rainfall, only some small open ditches passing through private houses. These minimal drainage facilities make it nearly impossibile to drain the rainfall in Jakarta. Furthermore, rain water cannot be channeled out to either Kali Ancol or Kali Gunung Sahari by any drainage system during the Java Sea's high tide.

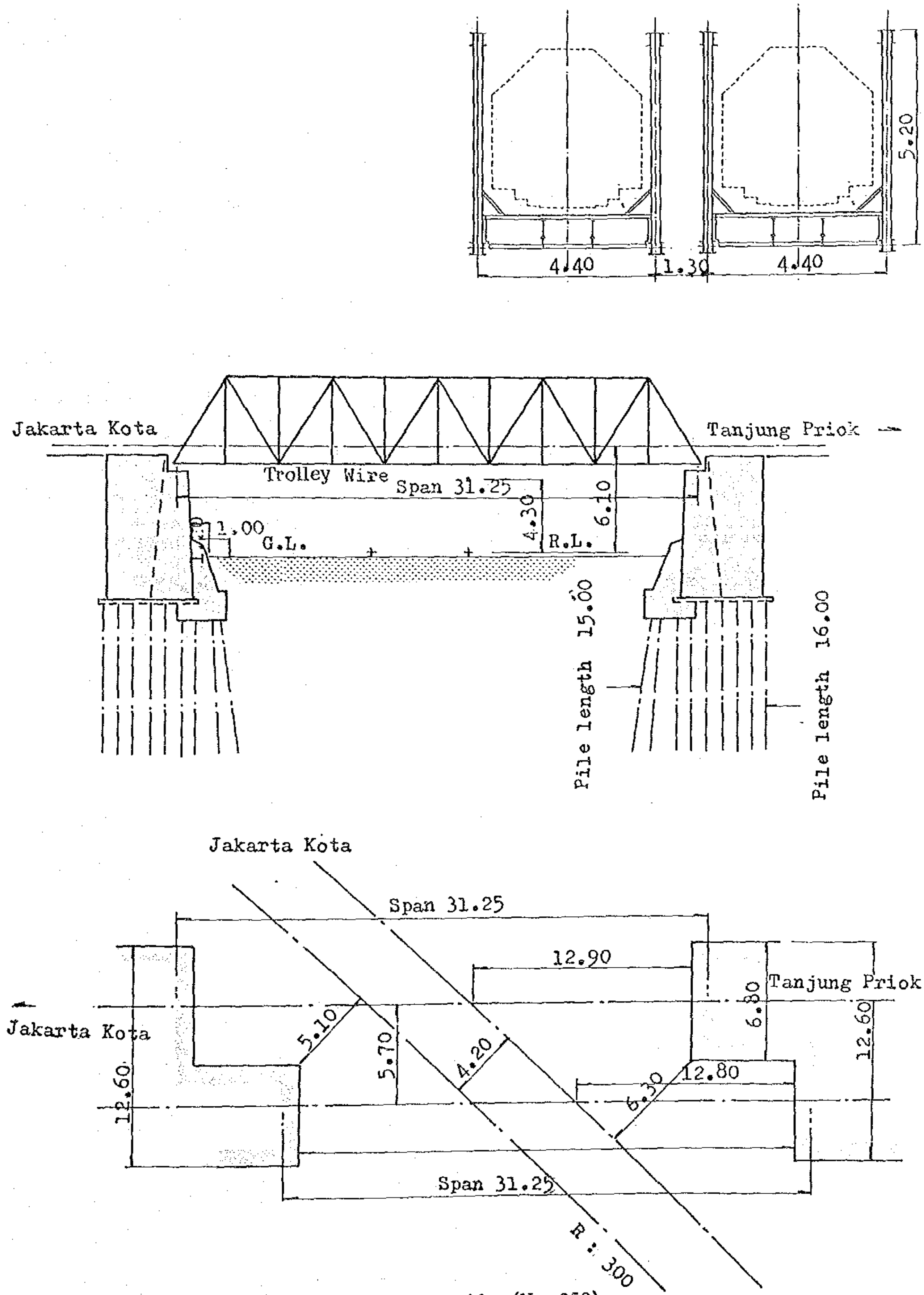


Fig. 5.5 Bridge (No. 252)

(7) Signalling/Telecommunication

(a) Signalling

1) S&H electro-mechanical tokenless devices, which use semaphore signals controlled by wire either from the station or signal cabin, comprise the blocking system. But, distant signals in some stations are left unused, since it is difficult to operate them far from the stations or signal cabins.

2) Because kerosene lamps are used to illuminate semaphore signals at night, signal visibility is very poor. This results in the reduction of approaching train speed.

3)The current interlocking devices, because of the wire operation and superannuation, require considerable amounts of labor for maintenance.

4) At most level crossings, the station masters notify the flagmen of a train's departure and direction by code with hand generators. The flagmen, however, often have difficulty in closing the crossings in time because of the pressure of road traffic.

(b) Telecommunication

1) Telephones and telegraphs are used in relaying information between adjacent stations. The telegraphs are outdated and the apparatuses themselves are superannuated. Spare parts are hard to obtain.

2) The present communication system of PJKA is inadequate to support future intensive train operation in the JABOTABEK Area.

(8) Electrification

1) The trolley wire, gap arresters, and steel poles are reasonably well maintained in spite of their age.

2) Serious voltage drop has not occurred despite the lack of feeder wire. In the future, higher speeds and more frequent train operation will require feeder wire if voltage drops and temperature increases of the trolley wire are to be prevented.

3) Rail bonds are often found to have fallen out of the rail joints. This will cause voltage drops and electrolytic corrosion when train frequency increases. Double rail bonds should be installed to maintain a perfect return circuit in the future.

4) The length of hanger intervals appears to exceed the standard suggested in the report on the "Electrification of Western Line"*, and there are many unfastened hangers as well. Higher train speeds may cause contact loss and more wear of the contact wire.

---

* "Electrification of Western Line" (Sep. 1981 Directorate General of Land Transport and Inland Waterways. The Ministry of Transport, Communications and Tourism).

5.2 Improvement Plan

5.2.1 Basic Concepts

This improvement plan should be made with appropriate consideration given to the following.

1) The construction is to be small in scale, low-cost, and done in a short period of time. The construction of large scale structures is to be limited whenever possible, as such structures might possibly pose obstacles to future large scale improvement.

2) The level-crossing of two lines is to be avoided when each is double-tracked and used for commuter trains.

3) The Western Eastern Lines and are connected.

4) The Western - Eastern Line connection results in both lines losing direct access to Jakarta Kota Station. This access can be had if the frequency of service on the Tanjung Priok Line for commuters and long-distance passengers is increased.

5) A new station is to be constructed near the intersection of the Eastern and Tanjung Priok Lines to provide an easy transfer.

6) Long-distance passenger train and freight train handling is supposed to remain as it is.

7) All the work is to be coordinated with the other JABOTABEK railway projects and with the city's plan.

5.2.2 Design Standard

The design standards within the framework of the feasibility study are as proposed in Table 5.1; construction gauge, roadway diagraphs and standard mounting are as shown in Figs. 5.6, 5.7, and 5.8.

Table 5.1 Design Standard (for Improvement of Kampung Bandan Station Area)

<table>
<tr><th colspan="2">Items</th><th>Standard</th></tr>
<tr><td colspan="2">Max. design speed</td><td>100 Km/h</td></tr>
<tr><td rowspan="4">Min. radius of curvature</td><td>Main track</td><td>600 m (300)</td></tr>
<tr><td>Turnout curve behind frog</td><td>320 m (160)</td></tr>
<tr><td>Section along platform</td><td>600 m (400)</td></tr>
<tr><td>Side track</td><td>160 m (120)</td></tr>
<tr><td rowspan="2">Max. gradient</td><td>Main track</td><td>14/1,000 (for long-distance train)
25/1,000 (for E.C. train)</td></tr>
<tr><td>Main track in station</td><td>2.5/1,000
10/1,000 (for E.C. train, without turnout)</td></tr>
<tr><td>Track-center</td><td>Distance</td><td>4.0 m (3.8)</td></tr>
<tr><td colspan="2">Width of formation level</td><td>2.75 m</td></tr>
<tr><td rowspan="8">Track</td><td>Gauge</td><td>1,067 mm</td></tr>
<tr><td>Weight of rail</td><td>R 54</td></tr>
<tr><td>Sleeper</td><td>Prestressed concrete</td></tr>
<tr><td>Ballast thickness</td><td>250 mm</td></tr>
<tr><td>Turnout</td><td>#10 (#8)</td></tr>
<tr><td>Max. cant</td><td>110 mm</td></tr>
<tr><td>Transition curve</td><td>Cubic parabola</td></tr>
<tr><td>Vertical curve</td><td>4,000 m (R≦800 m)
3,000 m (R>800 m)</td></tr>
<tr><td colspan="2">Bridge bearing capacity</td><td>RM 75% 1921</td></tr>
<tr><td rowspan="2">Platform</td><td>Height</td><td>0.80 m (for commuter and long-distance train)
0.95 m (for commuter E.C. only)</td></tr>
<tr><td>Length</td><td>190 m
270 m (for future use)</td></tr>
<tr><td colspan="2">Standard voltage of overhead contact system</td><td>1,500 V DC</td></tr>
<tr><td>Overhead contact wire system</td><td>Simply catenary</td><td>Messenger wire : St 90 mm^2
Trolley wire : Cu 110 mm^2</td></tr>
<tr><td>Overhead contact wire system</td><td>Height of trolley wire</td><td>5.30 m (normal)
4.25 m (min.)
5.90 m (max.)
5.50 m (min. road level crossing)</td></tr>
<tr><td colspan="2">Clearance (pole center to track center)</td><td>2.7 m</td></tr>
<tr><td rowspan="2">Max. gradient of contact wire</td><td>Main track</td><td>5/1,000</td></tr>
<tr><td>Side track</td><td>15/1,000</td></tr>
</table>

Note : The numbers in parentheses are applicable to unavoidable cases

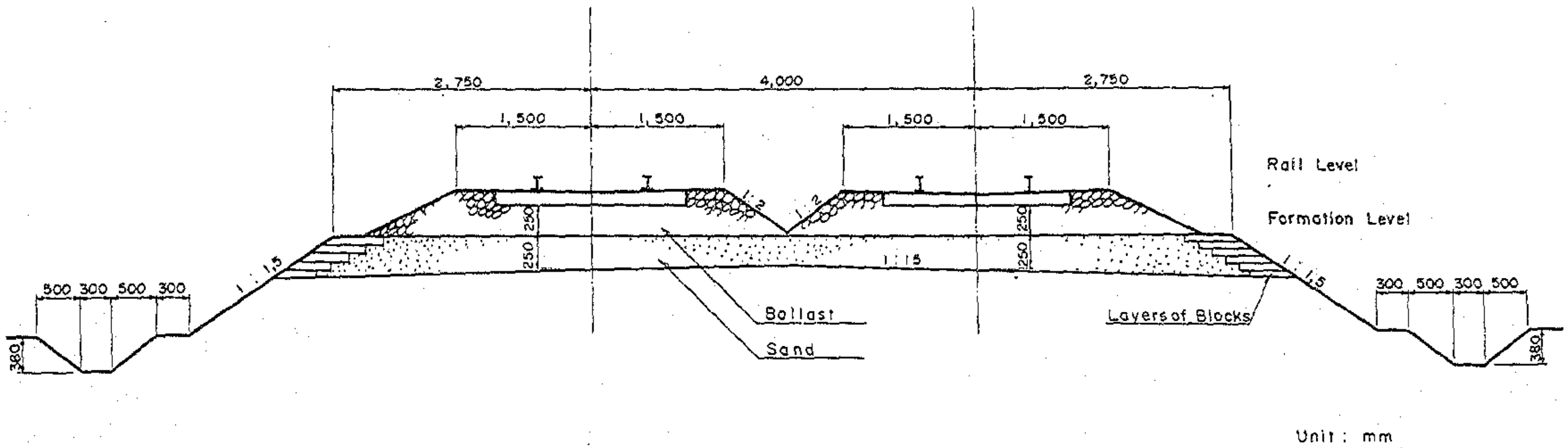
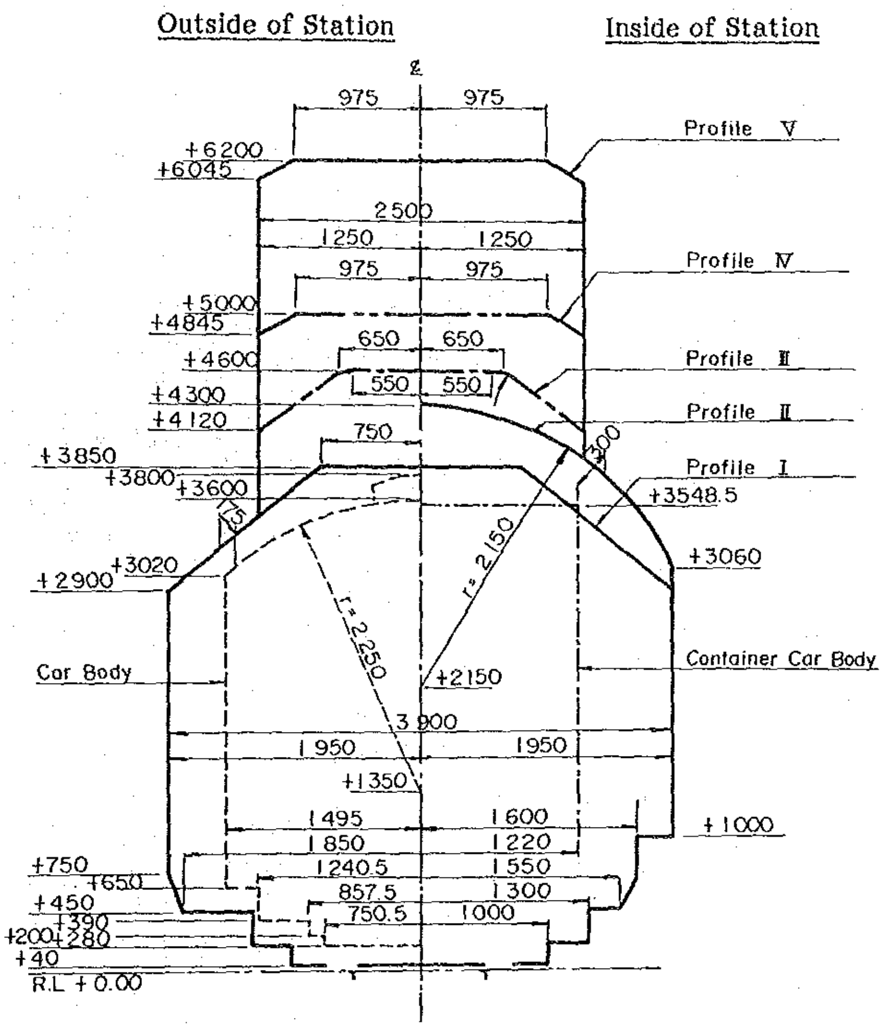


Fig. 5.6 Roadway Diagraph



Profile I : Minimum profile for a bridge with a speed restriction of 60 km/hour.

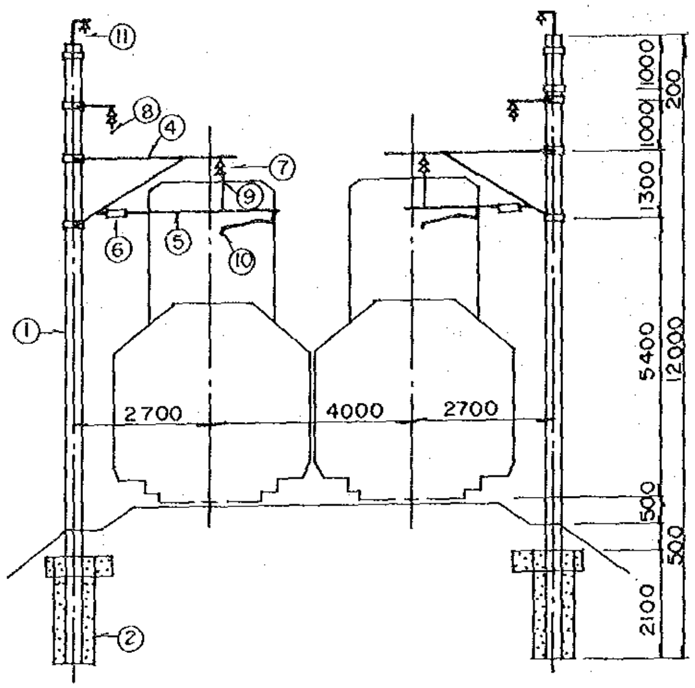
Profile II : Minimum profile for a tunnel and viaduct with speed restrictions of 60 km/hour. Regarding bridges, there is no speed restriction.

Profile III : Minimum profile for new viaducts and new construction, excluding tunnels and bridges.

Profile IV : Normal profile for an electric railcar.

Profile V : Normal profile for new viaducts.

Fig. 5.7 Construction Gauge



(1) Prestressed Concrete Pole
(2) Concrete Foundation
(3) V-Truss Beam
(4) Cantilever Beam
(5) Steadying Equipment
(6) Stem Insulator
(7) Suspension Insulator
(8) Feeder Wire Cu 300-400 mm^2
(9) Messenger Wire St 90 mm^2
(10) Trolley Wire Cu 110 mm^2
(11) Ground wire St 55 mm^2
(12) Pull-off Equipment
(13) Drop Arm

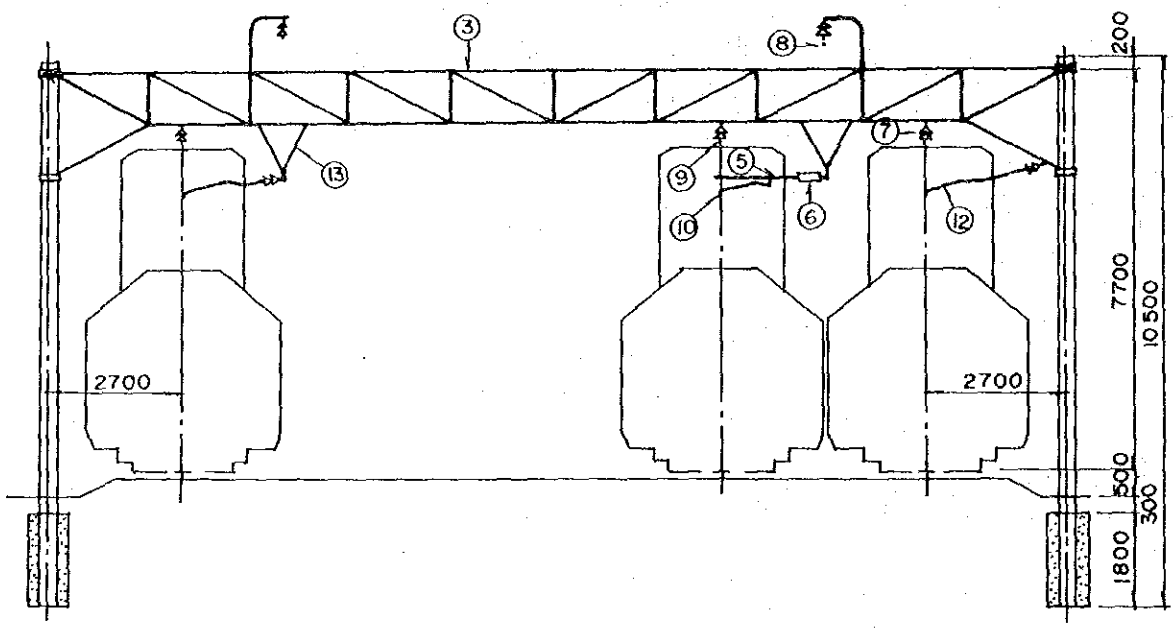


Fig. 5.8 Standard Mounting

5.2.3 Improvement Alternatives

Under the basic concepts of 5.2.1 and the design standards of 5.2.2, the following options are possible.

1) Location of the new Station:

   a) Intersection of the Eastern and Tanjung Priok Lines

   b) Present Kampung Bandan Signal Station

2) Train routes:

   a) Alternatives 1, 2

   b) Alternative 3

   (see 4.2.3)

3) The route of long-distance trains on the Eastern Line going to Jakarta Kota Station

   a) Through the present Western Line

   b) Through the present Eastern Line

   (see Fig. 5.9)

4) Curve radius of the New Station Platform

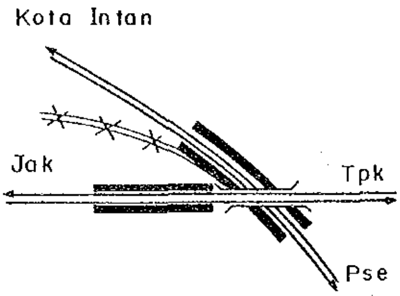
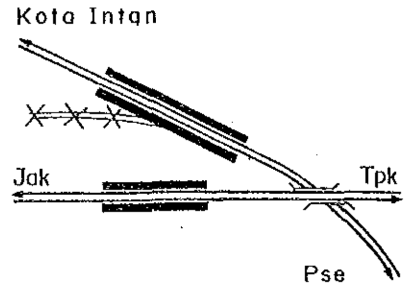
   a) Straight

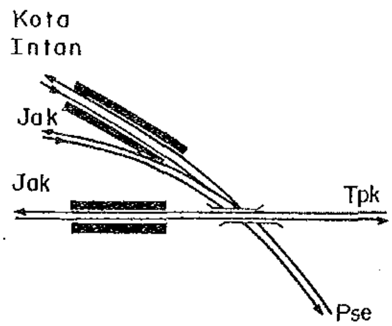
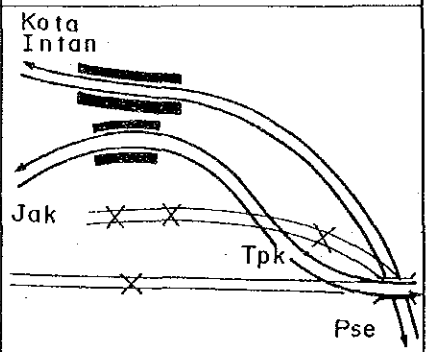
   b) 600 m or more

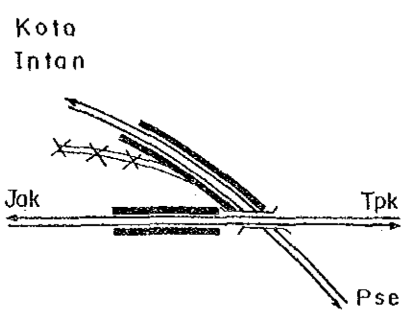
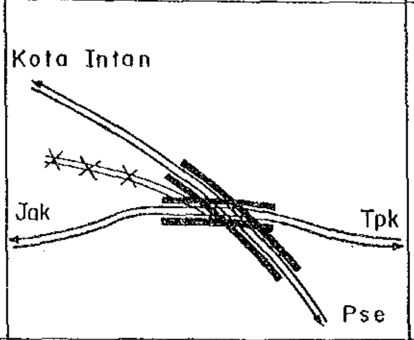
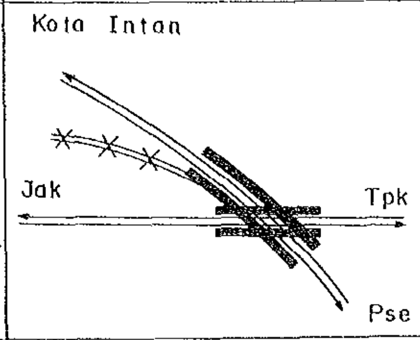
   c) 400 m or more

The combination of the above options offers seven adequate improvement Alternatives (see Table 5.2).

Table 5.2 Comparison of Alternatives from Viewpoint of Railway Facility Plan

Name		P_{1-1}	P_{1-2}
Sketch			
Features	1. Connecting main lines	W - E	W - E
	2. Location of the Station	Intersection of E and T	Intersection of E and T
	3. Train operation route (refer to chapter 4)	Alternative 1 & 2	Alternative 1 & 2
	4. Route of long-distance trains on Eastern L. going to Jakarta Kota	Via access route A (Fig. 5.9)	Via access route A (Fig. 5.9)
	5. Curve radius of platform	600 m	Straight

Name		P3	P4
Sketch			
Features	1. Connecting main lines	W - E	W - E
	2. Location of the Station	Intersection of E and T	Intersection of E and T
	3. Train operation route (refer to chapter 4)	Alternative 1 & 2	Alternative 3
	4. Route of long-distance trains on Eastern L. going to Jakarta Kota	Via access route B (Fig. 5.9)	Via access route B (Fig. 5.9)
	5. Curve radius of platform	400 m	Straight

P_{1-3}	P_{2-1}	P_{2-2}
		
W - E	W - E	W - E
Intersection of E and T	Intersection of E and T	Intersection of E and T
Alternative 1 & 2	Alternative 1 & 2	Alternative 1 & 2
Via access route A (Fig. 5.9)	Via access route A (Fig. 5.9)	Vis access route A (Fig. 5.9)
400 m	600 m	600 m

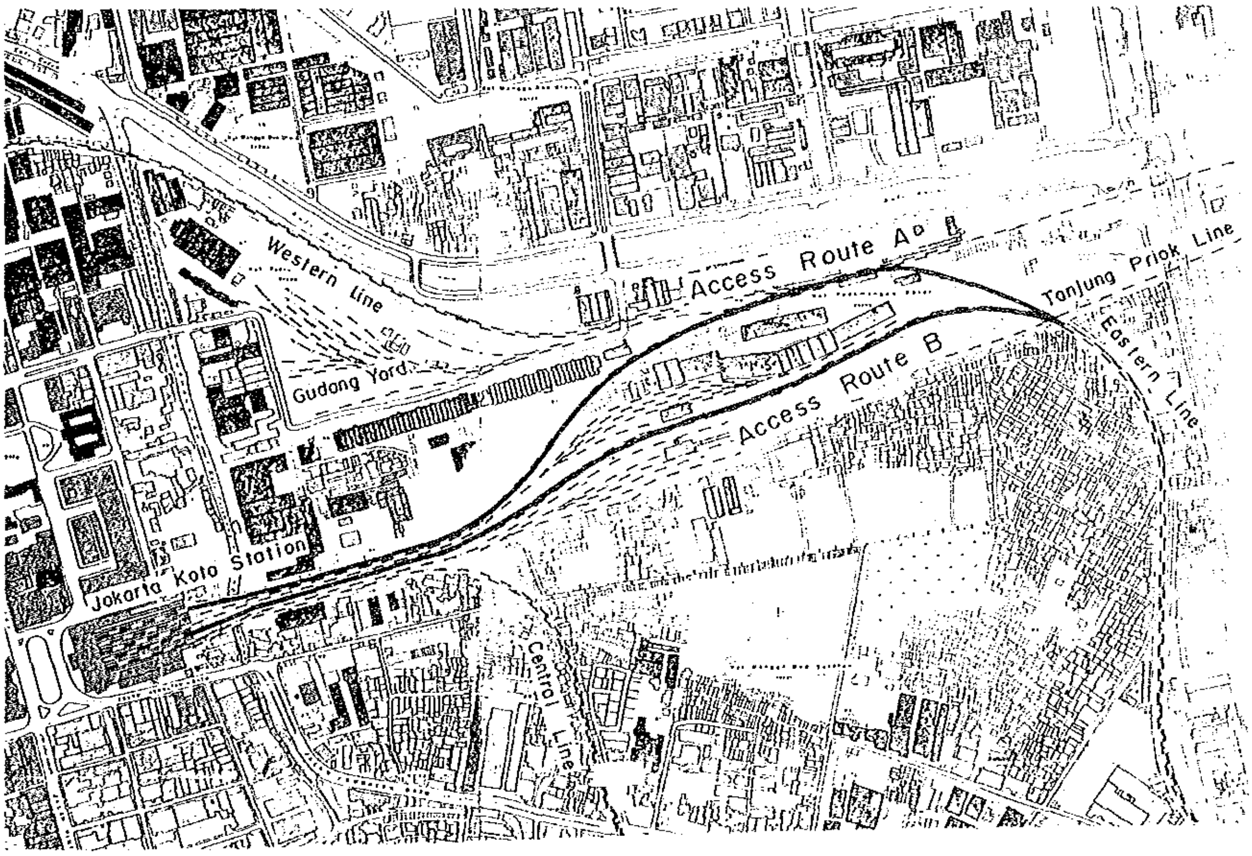


Fig. 5.9 Access Route to Jakarta Kota Station from Eastern Line

The criteria by which to evaluate the improvement Alternatives are as follows.

1) Service criteria

   a) Location of the station

   b) Convenience of passenger transfer

   c) Curve of platforms

2) Cost criteria (including length of construction period)

   a) Land aquisition and warehouse removal compensation

   b) Construction work

3) Impact Criteria

   a) Impact on future plans

P_{1-1} and P_{1-2} are selected for further examination.

5.2.4 Railway Facility Improvement Plan

(1) Track Layout

Track layouts for Alternatives P_{1-1} and P_{1-2} are as shown in Fig. 5.10.
The Western and Eastern Lines are connected by a new link between the west end of the Kampung Bandan Signal Station and the existing intersection of the Eastern and Tanjung Priok Lines. This link provides a route between Kota Intan Station on the Western Line and New Station and Rajawali Station on the Eastern Line, and crosses the Tanjung Priok Line at (or near) the New Station with a grade separation. The Tanjung Priok and Central Line routes remain the same.

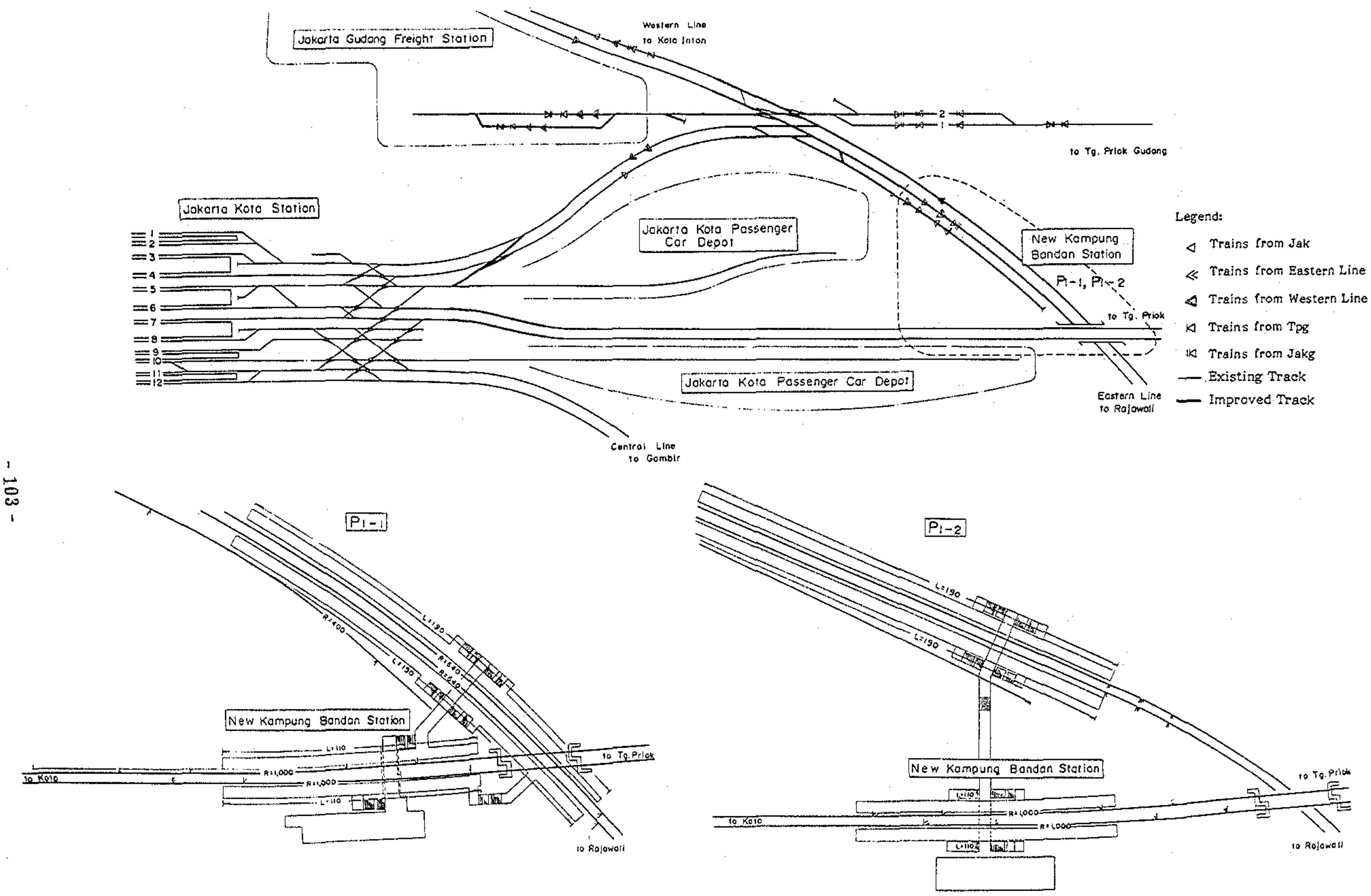


Fig. 5.10 Track Layout

In Alternative P_{1-1} the plaftorms are curved and have a radius of 640 m, while in Alternative P_{1-2} they are straight.

The features of long-distance passenger trains and freight trains in these Alternatives are as follows:

1) Between the Eastern Line and Jakarta Gudang Station, the freight train route will be improved by eliminating switchback operations both at Jakarta Kota and Kampung Bandan Signal Stations.

2) Between the Western Line and Jakarta Kota Station, long-distance passenger trains from/to the Merak Line will be switchbacked at the new Kampung Bandan Station. If service requirements permit, it is preferable to terminate these trains at Pasar Senen Station, since it would dispense with this switchback operation and simplify the track layout. If this can not be done, an exclusive track can be designed for the pusher operation of these trains at this switchback. The pusher operation would prevent these trains from interfering with the Western -Eastern link (i.e., link N_1).

3) Between the Western Line and Tanjung Priok Gudang Station, the freight train routes will remain as they are.

(2) Passenger Facilities of New Kampung Bandan Station

The facilities of the New Station are designed according to the traffic demand forecast (see Figs 5.11 and 5.12). The number of railway passengers getting on/off at the New Station is expected to be approx. 12,000 persons/day in 2005.

(a) Platform

Since the New Station will be constructed at the grade-separated intersection of the Eastern and Tanjung Priok Lines, each line must be provided with a pair of platforms. Taking into consideration both commuter and long-distance trains, the platform height will be 800 mm from the top of the rail with a width of 5.0 m. The minimum platform width of 2.0 m can be secured for the Eastern Line, which will be adjacent to the abutment of the bridge. Platform lengths will be 190 m and 110 m for commuter trains with 8-car and 4-car formations respectively. Track layout is designed so that platforms can be extended when required in the future.

Alternative P_{1-1} has a curved platform with a radius of 640 m; the clearance between the railcar and platform will be around 18 cm at its widest point. Alternative P_{1-2} has a straight platform with a clearnace of approximately 10 cm between it and the railcar.

Taking into account ground and embankment conditions, the structure will be designed by a steel skeleton and concrete panels.

(b) Passageway

To connect the Eastern and Tanjung Priok Line platforms, one overpass and one underground walkway will be built conforming with the ground height of the station.

An overhead connecting passageway 20 m long in P_{1-1}, or a ground level passageway 50 m long in P_{1-2}, are alternatives that can be built between the above-mentioned overpass and walkway.

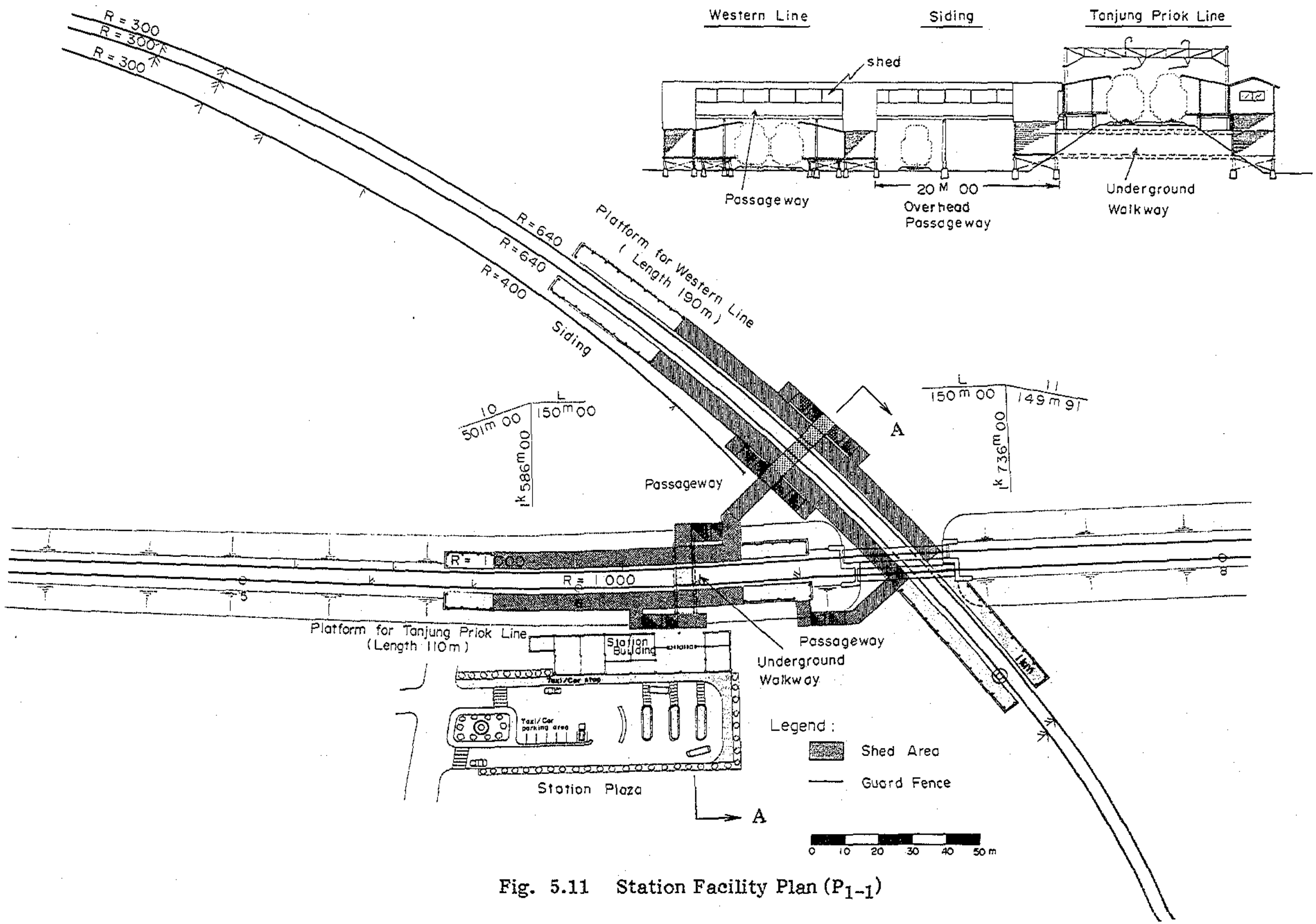


Fig. 5.11 Station Facility Plan (P_{1-1})

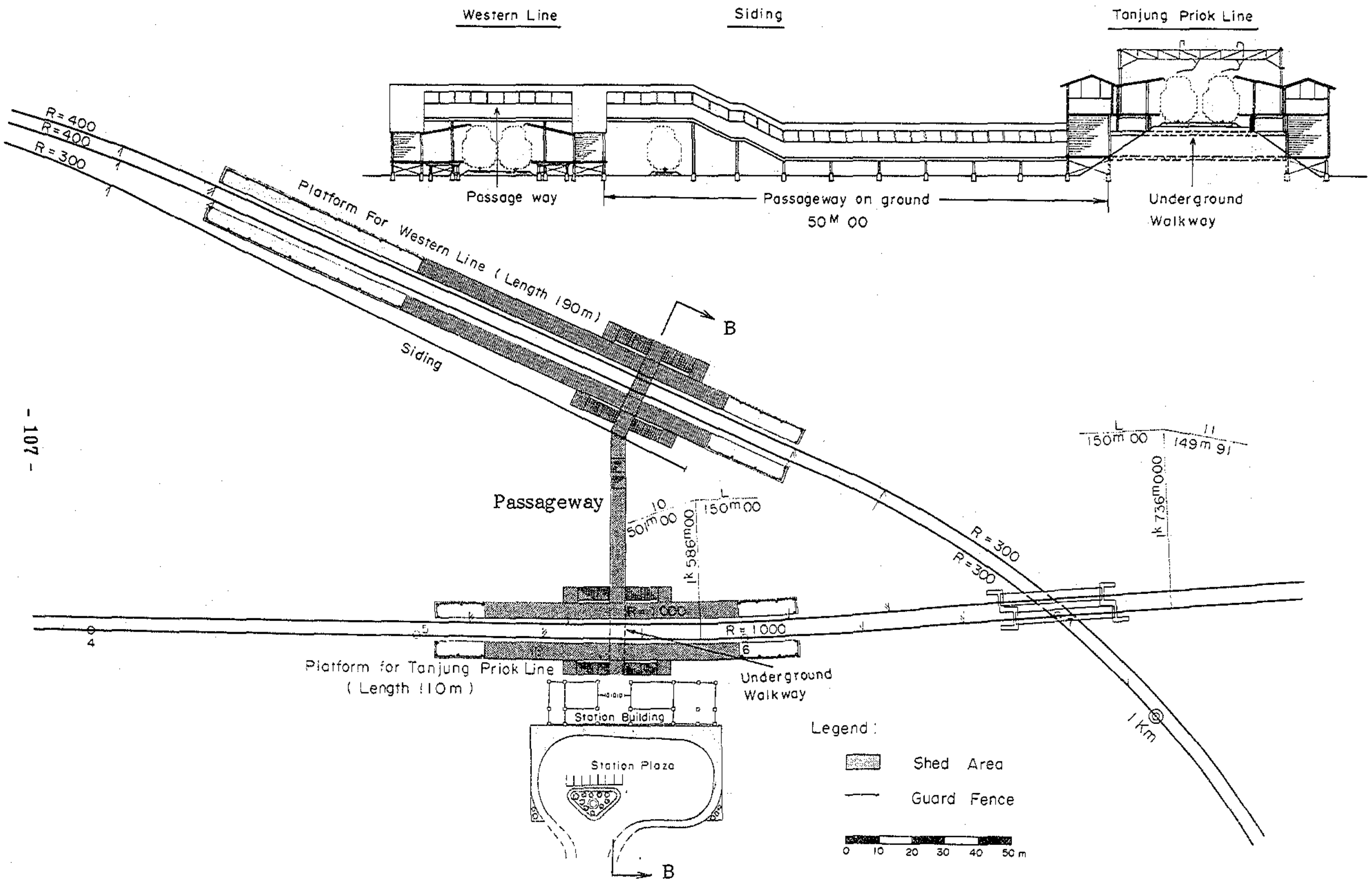


Fig. 5.12 Station Facility Plan (P_{1-2})

(c) Station Building

The New Kampung Bandan Station will serve transferring passengers and passengers who get on/off at this station. The scale of the station is decided based on the number of passengers.

The required area for a station building can be derived from a statistical formula used in Japan:

$$S = \frac{10.5}{N + 0.24} + 4.5 \quad (6 < N < 15)$$

S : Station building area (m^2 per 100 passengers)

N : Passengers getting on/off (1,000 persons per day)

The required area will be 650 m^2. The station building will include such facilties as ticket counters, offices, rest rooms, and space for machinery.

(d) Station Plaza/Access Road

There are two possible alternatives for the location of the station plaza: the south side, or the north side at the intersection of the Eastern and Tanjung Priok Lines. After examining the accessibility of the station, construction required, environmental factors, and the prerequisites of the city's plan, the south side location is proposed.

In the station plaza, such facilites as bus berths, parking lots, walkways, and green spaces are to be provided.

The required area for the station plaza can be derived from the empirical formula given below, as established by the City Planning Association in Japan.

$$S = 0.0904 \times 2 \times N/3 + 818 \qquad (5,000 < N \leqq 100,000)$$

S: Area of station plaza (m^2)

N: railway passengers per day

The required area will be 1,600 m^2.

DKI Jakarta is improving Jl. Mangga Dua[*1], which is located approximately 300 m south of the proposed station plaza. A road running north-south will connect the Jalan and the plaza. JL. Mangga Dua Area will be developed as a commercial area, and the said road to be improved by DKI Jakarta will serve as an access/egress road for the New Station.

(3) Drainage

The ground level of the New Station site is too low to protect the station from being inundated. Tracks will have to be raised, and a drainage system should be provided to cope with the surface runoff.

The area to be drained is approximately 80,000 m^2, and extends from Tanjung Priok Line to a group of tracks in the Kampung Bandan Signal Station, and from the Jakarta Kota Passenger Car Depot to the new link.

Sufficient draining, to be effective even in the case of a simultaneous high tide and heavy rainfall as seen in 1984, should be implemented with the countermeasures proposed in the related Master Plan.[*2]

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*1 The "Mangga Dua Improvement Project" by DKI. Refer to the Socio-Economic Development Plan in Chapter 2 of this report.

*2 "Master Plan for Drainage and Flood Control of Jakarta" (Dec. 1973, Ministry of Public Works and Electric Power)

(4) Signalling/Telecommunication

If the JABOTABEK Railway is to function as an urban transportation system, the present train operation schedule requires a total reshuffling. This involves a systematic reform of the signalling facilities, such as the introduction of a color light signal system and automatic block devices. Superannuated machine interlocking devices currently used must also be replaced by relay interlocking devices. In addition, telecommunication facilities must be furnished with automatic exchange telephones, block telephones, and public address equipment.

(5) Electrification

Specifications should adhere to the recommendations made in the report of the "Electrification of Western Line."

As to wire-supporting facilities, concrete poles are more preferable than combined steel masts because of their high resistance to corrosion, decay, and wear.

(6) Warehouse Removal

Removal of warehouses and squatters' houses from the right of way of the new Western-Eastern link will be necessary. The area encompassed by this right of way is 2,000 m^2 for Alternative P_{1-1} and 16,000 m^2 for Alternative P_{1-2}.

5.2.5 Selection of Alternatives

A comparison of P_{1-1} and P_{1-2} is shown in Tables 5.3 and 5.4.

The following are the major differences between the two: P_{1-1} has curved platforms while P_{1-2} has straight ones; P_{1-1} requires removal of fewer existing warehouses around the New Station than P_{1-2}; and P_{1-1} provides more convenient transfer for railway passengers than P_{1-2}. The difference in construction cost between the two is of no consequence, therefore, P_{1-1} is on the whole more recommendable.

Table 5.3 Comparison of P_{1-1} & P_{1-2}

	Items \ Alternative	Alternative P_{1-1}		Alternative P_{1-2}	
Features	1. Connection of main lines		W - E		W - E
	2. Location of station		Intersection of E and T		Intersection of E and T
	3. Corresponding operation route (refer to Chapter 4)		Alternative 1		Alternative 1
	4. Curve radius applied to large portion of platforms		640 m		Straight
Evaluation	5. Land acquisition	○	unnecessary	○	unnecessary
	6. Warehouse removal	○	2,000 m^2	△	16,000 m^2
	7. Transfer convenience	○	Transfer distance : 20 m	△	Transfer distance : 50 m
	8. Maximum clearance between platform and rolling stock	○	18 cm	○	10 cm
	9. Easiness of construction	○		○	
	10. Construction cost	○	7.1 billion Rp	○	7.3 billion Rp

Notes: ○ : No problems

△ : Some problems

Table 5.4 Estimated Construction Cost

Investment Items	Estimated Construction Cost (Million Rp)					
	P_{1-1}			P_{1-2}		
	Foreign Portion	Local Portion	Total	Foreign Portion	Local Portion	Total
Civil work	300	330	630	300	330	630
Station facilities	900	680	1,580	930	700	1,630
Track	1,720	250	1,970	1,700	250	1,950
Electrical facilities	220	240	460	220	240	460
Signalling facilities	740	100	840	750	100	850
Telecom. facilities	170	10	180	170	10	180
Compensation for land & houses		20	20		100	100
(Sub total)	4,050	1,630	5,680	4,070	1,730	5,800
Engineering service & Supervision of construction	510	170	680	510	170	680
Contingency	540	240	780	560	250	810
(Sub total)	1,050	410	1,460	1,070	420	1,490
Grand total	5,100	2,040	7,140	5,130	2,150	7,290

Note: Figures are rounded off.

5.3 Construction Work

5.3.1 Work Items

The following major construction work is required:

1) Installation of a 400 m link
2) Rearrangement of track alignment
3) Track raising in the project area
4) Construction of station facilities, including a station building, station plaza, platforms, and passageways
5) Related civil work, including drainage installation, and embankment reshaping
6) Installation of signalling facilities
7) Installation of telecommunication facilities
8) Installation of electrification facilities

5.3.2 Essential Items

Among the eight items above, special attention should be given to the following.

(1) Track Raising

Tracks in the project area should be raised to an adequate height to protect the track structure and automatic block signalling facilities from frequent flooding; also, bridge No. 252 (truss) on the Tanjung Priok Line should be raised to a proper height to secure sufficient overhead clearance (see Fig. 5.13). The estimated height of the track and bridge raising is approximately 50 cm. Because of the unsuitable condition of the ground surface, track raising work must be carried out by supplying ballast instead of soil material.

(2) Track Rearrangement

From the link near the Kampung Bandan Signal Station, new tracks will be built to the Jakarta Kota and Jakarta Gudang Stations. This track laying work since it should be carried out while trains are being operated, will require several steps.

(3) Embankment Reshaping

The embankment of the Tanjung Priok Line is sufficiently wide enough for a double track. However, the shoulders and slopes are so eroded that the shape does not meet PJKA standards. The embankment should be reshaped as indicated by the solid line in Fig. 5.14.

Sheathing should be provided at the foot of both sides to prevent possbile erosion by frequent inundation. The surface of the slope should be protected by sodding.

Inquiries regarding the acquisition of embankment material reveal that this material is available in Lengkong Gudang, approximately 11 km south of Tangerang. The material is composed of laterized clayey soil, which is a diluvial deposit containing much clay and little sand. As the natural water content of this material is close to the plastic limit, it can be used for the embankment provided that sufficient control over the water content is maintained during compaction.

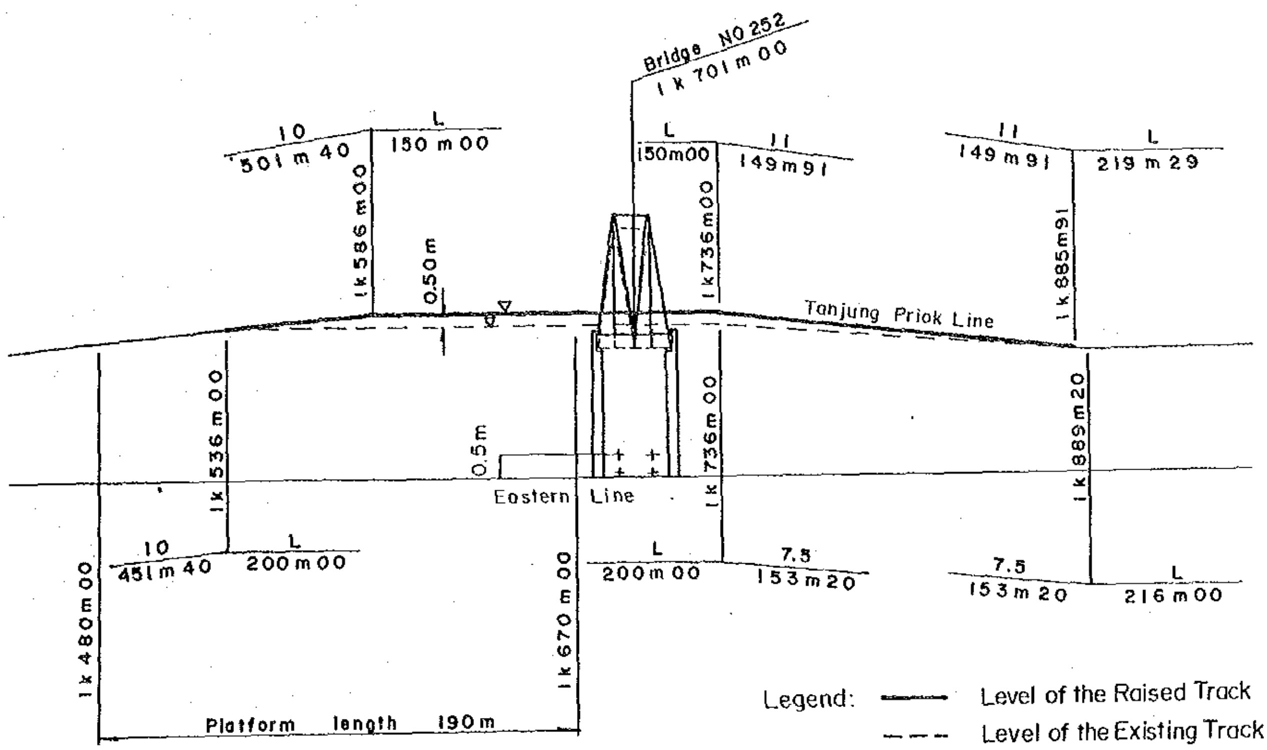


Fig 5.13 Track Raising (Tanjung Priok Line)

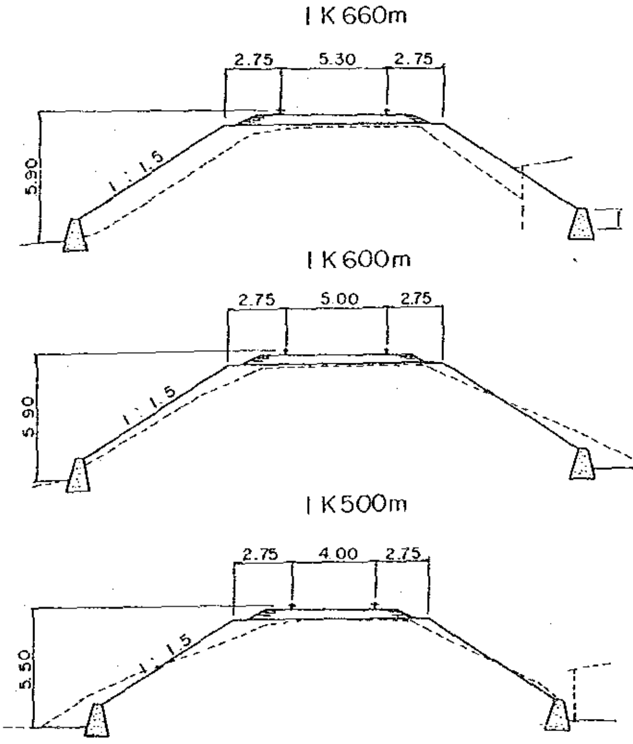


Fig. 5.14 Cross Section of the Embankment (Tanjumg Priok Line)

CHAPTER 6 INVESTMENT SCALE AND SCHEDULE

CONTENTS

CHAPTER 6 INVESTMENT SCALE AND SCHEDULE

6.1 Investment Scale

6.1.1 Cost Estimate Assumptions

Assumptions for cost estimates are as follows.

(1) Construction

1) Costs are calculated as of February, 1985, and an escalation factor is not considered.

2) Each kind of construction work is categorized into labor, material, machinery, and other related costs.

3) Imported materials and machinery are assumed to be tax-exempt.

4) Costs are classified in foreign and local currencies (see Table 6.1).

5) Unit prices for labor, material, and machinery costs are estimated in consideration of actual data compiled in Indonesia and Japan.

Table 6.1 Classification in Foreign and Local Currencies

Currency	Contents
Foreign Currency	1. Imported materials and machinery 2. Foreign currency portion of materials and machinery supplied in Indonesia 3. Foreign labor 4. Foreign currency portion of related costs of construction work executed by foreign contractors
Local Currency	1. Materials and machinery supplied in Indonesia excluding the foreign currency portion 2. Indonesian labor 3. Related costs of construction work executed by Indonesian and foreign contractors excluding the foreign currency portion 4. Taxes

(2) Land Acquisition

No land acquisition is needed, because PJKA's existing right of way has enough largeness for the Project.

Compensation expenses for the removal of houses and warehouses are based on data from DKI Jakarta.

(3) Investigation, Design, and Supervision

A value equivalent to 12% of the total construction cost.

(4) Contingency

For civil engineering work, a value equivalent to 15% of the total of the construction, land acquisition, investigation, design, and supervision costs is assumed.

As for signalling, telecommunication, and electrification work, a value equivalent to 5% of the total of the construction, investigation, design, and supervision costs is assumed.

(5) Exchange Rate

Rp1,088 = Us $1.00 = ¥264 (rates as of Feb. 1985)

6.1.2 Cost Estimate

The cost estimates are shown in Table 6.2.

It is possible, however, to simplify the passenger facilites of the New Kampung Bandan Station and economize on the initial construction cost. However, the facilities involving safe train operation (Alternative P_{1-1}) should be kept intact. A sample plan for the simplification of passenger handling facilites (P_{1-1s}) is shown in Appendix 6.1. The estimated total cost for P_{1-1s} would be Rp6,425 million, Rp719 million less than the total cost of the present Alternative P_{1-1}.

Table 6.2 Estimated Costs

Investment items	Unit	Quantity	Investment Sum (Million Rp)		
			Foreign	Local	Total
1. Civil work			302	331	633
Roadbed	m	350	138	95	233
Box culvert	m	22	71	36	107
Drainage	m	2,875	87	195	282
Temporary road	m	680	6	5	11
2. Station facility			899	684	1,583
Building	m^2	650	298	199	497
Station Plaza	m^2	2,340	22	34	56
Platform	m^2	3,000	427	366	793
Passageway		1	152	85	237
3. Track			1,715	253	1,968
Track & Turnout		1	1,702	231	1,933
Track rehabilitation	m	620	8	12	20
Level crossing	m	60	5	10	15
4. Electrification			216	239	455
Overhead catenary system	km	4.6	216	190	406
Power & Lighting	km	1	0	49	49
5. Signalling & Telecom.			913	107	1,020
Signalling equipment		1	576	57	633
Signalling cable	km	15	80	17	97
Track circuit		26	89	23	112
Telecom. equipment		1	168	10	178
6. Compensation			-	16	16
7. Engineering service Supervision of construction			510	170	680
8. Contingency			544	245	789
Grand total			5,099	2,045	7,144

6.2 Investment Schedule

The construction period for this improvement is expected to be one year and several months, excluding the preparatory work shown in Table 6.3. Since construction work has to be done on sites adjacent to existing lines where commercial trains run, and involves some rerouting of existing tracks, further examination of train schedules will be imperative before the actual implementation.

Table 6.3 Investment Schedule

Work Item	Exceution Year				Remarks
	1986	87	88	89	
Preparatory work	■■	■■■			Detail design Tendering Financing
Roadbed raising			■■■	■	Includes bridge raising
Track			■■■	■■■	Rerouting is included
Station & other facilities			■	■■■	
Electrification Signalling Telecommunication			■■■	■■■	

This improvement work aims to use railcars efficiently by constructing a loop train operation.

This could have been realized earlier if the improvement work had been started on time for the scheduled completion of the Western Line Electrification.

From hereon, it can never be too early to break ground. The improvement of the Jakarta Kota Station, for example, will only accentuate the need for this improvement work even more.

CHAPTER 7 ECONOMIC AND FINANCIAL ANALYSIS

CONTENTS

CHAPTER 7 ECONOMIC AND FINANCIAL ANALYSIS

7.1 Introduction

(1) Objective of Economic Analysis

The main objective of this economic analysis is to evaluate the economic feasibility of the Project from the viewpoint of the Indonesian national economy.

(2) Objective of Financial Analysis

All investment in railway facilities and rolling stock is carried out by the Indonesian Government, while PJKA controls the actual operation of the railway system.

Present railway fares in Indonesia are not intended to cover the operating expenses and interest that must be paid by PJKA to the government as rent on assets. PJKA is not required to operate on a commercially profitable basis, but is expected to make revenue and expenditures balance as closely as possbile.

In this context, the primary objective of this financial analysis is not the calculation of the Financial Internal Rate of Return, but the study of the following items:

1) To determine the required extent of Government subsidies from the profit and loss projection of the Project
2) To study the financing of the debt and debt repayment ability of the Project from the cash flow projection

(3) Study Case

The evaluation is conducted for P_{1-1}, which is the most recommendable among the several alternatives suggested in 5.2.3 and 5.2.5.

(4) Project Area

1) The Railway Improvement in Kampung Bandan Station Area is one of the 26 sub-projects planned for the modernization of the JABOTABEK railway system. In a sense, it is a "point-project" vis-a-vis the whole project. An economic and financial analysis of a point-project can best be made by evaluating its economic/financial contribution to the whole project. But, this type of analysis cannot be made without making numerous assumptions, which would produce dubious results. In this economic and financial analysis, therefore, the following major assumptions are used for the purpose of simplification:

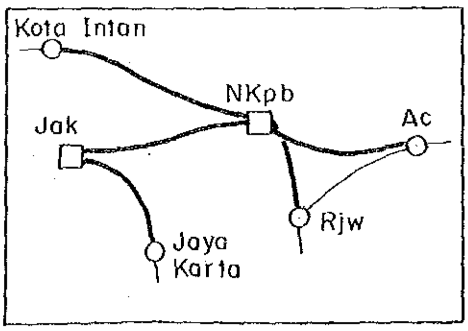
a) The costs are those needed only for this point-project.

b) All other projects for the modernization of the JABOTABEK railway system are completed.

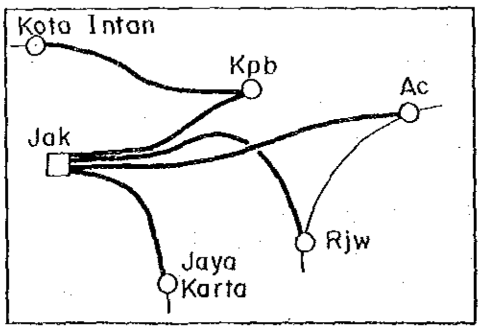
2) Considering the nature of the Project, the project area for evaluating costs and benefits is assumed to be within the Jakarta Kota and Kampung Bandan Areas (not the whole JABOTABEK Area). More precisely, it is the area surrounded by stations adjacent to the Jakarta Kota Station or New Kampung Bandan Station on each line (i.e., Kota Intan on the Western Line, Rajawali on the Eastern Line, Ancol on the Tanjung Priok Line, and Jayakarta on the Central Line).

Project area for the evaluation is illustrated below.

(With Project)



(Without Project)



Based on the above concepts, the required rolling stock acquisition cost and the related operating cost thereof are proportionated to the Project at the ratio shown below.

$$\text{Ratio} = \frac{\text{Electric railcar (or train)-kilometers in Project Area}}{\text{Electric railcar (or train)-kilometers in JABOTABEK Area}}$$

(see Appendix 7.1.)

7.2 Economic Analysis

7.2.1 Methodology

(1) "With/Without" Analysis

1) In economic analysis, the benefits and costs of a project are compared. The costs of the project are assumed to be the difference in costs between the two cases below.

- "With Project"

  The situation assuming that the Project will be implemented.

- "Without Project"

  The situation assuming that the Project will not be implemented.

In "Without Project", railway investment is considered solely as the replacement and indispensable improvement of infrastructure and rolling stock necessary to meet future traffic demand. Road investment is considered to be the purchase of additionally needed buses to carry the traffic which would have been diverted from bus to railway had the Project actually been implemented.

The costs of "Without Project" are deemed inevitable regardless of the project's implementation. This explains why the actual "costs of the

Project" are given by deducting the costs of "Without Project" from the costs of "With Project", thus the costs of "Without Project" are considered negative and are counted as benefits.

2) "Costs" include investment and operating/maintenance costs.

(2) Method of Evaluation

The EIRR (Economic Internal Rate of Return) is used since it is the most commonly used indicator for evaluating the feasibility of railway projects.

The EIRR is a discount rate that equates the present value of benefits with the present value of costs during the project life (see Table 7.1).

In evaluating the project, the EIRR should be compared with the opportunity cost of capital of the country, but the opportunity cost of capital itself is not easy to determine. Therefore, this index is compared with other various criteria (such as interest rates in the country or other certain internal standards).

In general, an EIRR of 12-15% would justify railway project implementation in Indonesia.

(3) Incremental Analysis Method

The additional costs and benefits of "With Project" and "Without Project" are estimated and compared.

All other costs and benefits are considered as "Sunk".

(4) Assumptions

The following assumptions have been made:

(a) Exchange Rate

J. Yen 264 = US$1 = Rp 1,088

These are middle rates quoted by the Bank of Indonesia (for the Rupiah and

Dollar) and by leading banks in Japan (for the Yen and Dollar) during February 1985.

Shadow exchange rates are often used in economic analysis, but in Indonesia the floating official rates seem to reflect somewhat the real value of the Rupiah, so no adjustments were made on the Rupiah rates in this analysis (this holds true for the Japanese Yen also).

(b) Project Life

Taking into account the construction term and useful life of new railway facilities, a project life of 30 years is assumed.

(c) Inflation

Like other JABOTABEK railway feasibility studies, the inflation factor is not taken into consideration.

(d) Reinvestment

It is assumed that the invested amounts for depreciable assets will be reinvested in the year following the expiration of their useful lives.

(e) Salvage Value

A project life of 30 years is used for the purpose of this analysis; however, the railway facilities will last much longer. Therefore, the salvage value (undepreciated value) is assumed to be a negative cost in the final year of the project life.

(5) Framework of Economic Analysis

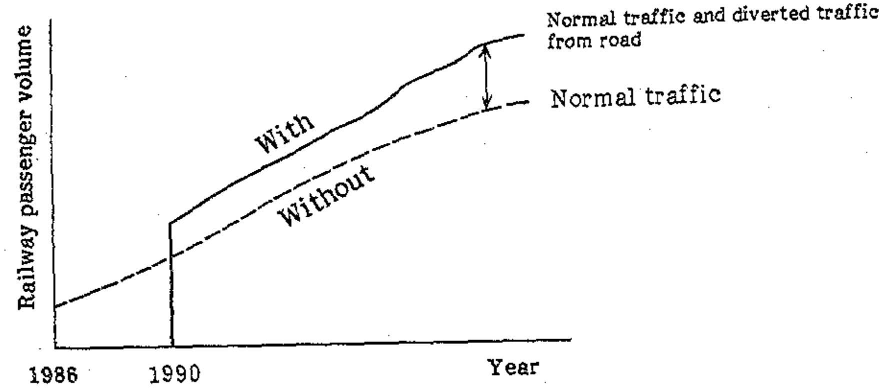
The basic concepts and methods of the economic analysis are summarized in Table 7.1.

Table 7.1 Framework for Economic Analysis

	Estimating Internal Rate of Return		
	Investment costs	Operating and Maintenance Costs	Benefits
With Project The situation assuming the project is implemented	· Railway ground facilities to be improved in Kpb. Station Area (e.g., civil engineering, signal and telecom.) · Rolling stock (E.C)	· Operating cost (Railway) Personnel cost Energy cost · Maintenance cost	**Time saving benefit for railway passengers** Net benefit of railway passenger travel time saving within the Project Area, as a result of the Western and Eastern Line connection
Without Project The situation assuming the project is not implemented	· Railway ground facilities in Kpb. Station Area are limited to replacement and indispensable improvement of infrastructure to meet the future traffic demand · Rolling stock (E.C.) · Road vehicles (buses)	· Operating cost (Railway) Personnel cost Energy cost · Maintenance cost · Operating cost (buses)	

(Remarks)

Railway passenger traffic demand



In "Without", the portion ↕ is carried by buses

Equation for IRR

$$\sum_{t=1}^{n} \frac{C_t}{(1+i)^t} = \sum_{t=1}^{n} \frac{B_t}{(1+i)^t}$$

C: Cost
B: Benefit
i: IRR
t: Number of years
n: Project life (30 yrs)

7.2.2 Economic Cost Estimation

(1) Investment Costs

The construction, improvement, and replacement costs for the required ground facilities (railway) and purchasing of vehicles (railway and road) for "With and Without Project" are compared. The economic costs of the investment result from tax* and subsidy adjustments on the financial costs (i.e., market price) of the investment on the following portions:

1) Foreign currency portion

Neither import duties nor import sales taxes are considered, because PJKA is supposed to be exempted from them.

2) Local currency portion (materials and equipment)

Deductions are made for various domestic taxes at an average rate of 24.5% from the market price.

3) Local currency portion (labor)

No tax adjustment is considered, because average workers' wages are estimated not to reach the taxation department guideline level for taxable income (2.88 Million Rupiah per year for the standard household).

A summary of the economic investment costs is shown in Table 7.2.

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* The new tax system, Value Added Tax (VAT), was introduced in Indonesia in April, 1985. However, in this analysis, tax adjustment is based upon the conventional tax system.

Table 7.2 Investment Costs (Economic Price)

(Unit: Mil. Rp)

Items	With Project				Without Project			
	1986-89	1990-2000	2001-15	Total	1986-89	1990-2000	2001-15	Total
Civil engineering work	5,152	-	-	5,152	400	-	-	400
Signalling, telecom. and electrical work	1,696	-	1,696	3,392	784	-	784	1,568
(Construction costs sub-total)	(6,848)	-	(1,696)	(8,544)	(1,184)	-	(784)	(1,968)
Rolling stock	-	14,386	14,061	28,447	-	22,393	20,375	42,768
Bus					-	774	1,661	2,435
Total	6,848	14,386	15,757	36,991	1,184	23,167	22,820	47,171

Notes: 1) Figures include reinvestment, but do not include the salvage value of each item.

2) Estimated construction costs by item for "Without Project" are shown in Appendix 7.2.

(2) Operating and Maintenance Costs

(a) Railway (Both "With Project" and "Without Project")

1) Operating costs

a) Personnel costs

Increased wages for drivers and conductors are taken into consideration.

b) Energy costs

Electrical costs necessary for train operation are calculated. Consumption of 1.51 kwh of electricity per car-kilometer is applied.

2) Maintenance costs

Maintenance ratios used by JNR are used to estimate the maintenance costs of railway facilities (see Table 7.3).

Maintenance costs per year = Maintenance ratio x original investment value of railway facilities

Table 7.3 Maintenance Ratio and Useful Life of Assets

Items	Maintenance Ratio	Useful Life(Year)
Civil engineering work	0.073	40
Signal & telecom.	0.024	20
Rolling stock	0.035	25

Note: Useful life of assets is based on PJKA regulations.

(b) Road Vehicle ("Without Project") ----- Buses

Using the same method applied in the recent JABOTABEK railway feasibility studies, the annual operating cost of one bus is calculated to be 21.26 million Rupiah.

Operating cost includes the following: fuel, engine oil, tire wear, maintenance (spare parts and maintenance labor), and crew cost.

(c) Unit Prices for Operating and Maintenance Costs

The main operating and maintenance costs items are summarized in Table 7.4.

Table 7.4 Unit Price for Operating and Maintenance Costs

(Unit: Rp)

	Items	Market Price	Economic Price	Remarks
Rail-way	Personnel cost[1]			Annual salary
	Driver	1,580,000	same	
	Conductor	1,130,000	same	2 persons per train
	Energy cost[2]			
	Electricity	69.52/kwh	67.52/kwh	
Bus	Bus vehicle cost[3]	34,650,000	30,400,000	BENZ 0306N
	Personnel cost[4]			Annual salary
	Driver	1,220,000	same	2 persons for 2 shifts
	Conductor	720,000	same	4 persons for 2 shifts
	Mechanic	1,500,000	same	
	Fuel and lubricant oil[5]			
	Diesel oil	220/ℓ	236.14/ℓ	
	Engine oil	850/ℓ	680/ℓ	
	Tire[6]	119,000/pc	113,050/pc	Size 825-20
	Other assumptions[7]			
	Bus : Average running speed	20 km per hour		
	Annual running distance	67,500 km		
	Useful life	7 years		

Sources: 1) PJKA, 2) PLN electricity tariff, PJKA, 3) Car Dealer, 4) PHBD, 5) Dept. of Mining & Energy, Gas Station, 6) Wholesalers, 7) PPD

7.2.3 Benefit Estimation

(1) Direct Benefits

The following benefits derive directly from the Project and are estimated and counted in the calculation of the EIRR.

(a) Cost-saving Benefits

1) Rolling stock

As mentioned in 4.2.5, the number of rolling stock required in "Without Project" is more than that in "With Project". This is due to improved train operation efficiency resulting from the Western and Eastern Line connection. The difference in the number of rolling stock between "Without Project" and "With Project" is the number of rolling stock saved if the Project is implemented; this is the amount of benefit the Project yields.

Thus, the rolling stock and cost saved in the Project Area are estimated in Table 7.5.

Table 7.5 Rolling Stock and Costs Saved

	1990-'95	'96-2005	2006-'15	Total
Number of rolling stock saved	11.1	4.8	2.7	18.6
Costs saved	7,226 Mil. Rp	3,125 Mil. Rp	1,758 Mil. Rp	12,109 Mil. Rp

Notes: 1) Figures do not include reinvestment.
2) Estimated economic price of a railcar is 651 Mil. Rp.

2) Buses

As shown in the Traffic Demand Forecast (see Figs. 3.10 through 3.13), diverted traffic to the railway from buses (i.e., the difference in railway passenger volume between "With Project" and "Without Project" within the Project Area) will arise from the implementation of the Project. The resulting reduction in bus traffic can be counted as a benefit.

Cost-savings in bus purchases, based on the result of the Traffic Demand Forecast, are shown in Table 7.6.

Table 7.6 Buses and Costs Saved

Items	1990	1995	2005
Difference in bus passenger-km between "With" and "Without"	7.1 Mil.pass-km	36.3	86.6
Number of buses saved (Cumulative)	2.1 (2.1)	8.6 (10.7)	15.0 (25.7)
Costs saved	64 Mil.Rp	261	456

Notes: 1) Common bus routes between the railway stations within the Project Area are asssumed for both "With Project" and "Without Project".

2) Annual passenger-km per bus of 3.375 Mil. is assumed.

3) Operating and maintenance

Operating and maintenance costs in "Without Project" are regarded as cost-saving benefits (refer to 7.2.2 - (2)).

(b) Time-saving Benefit for Railway Passengers

Based on the estimated movements of railway passsengers around the Kampung Bandan Area (see Figs. 3.11 and 3.13) and train operation, railway passenger travel time-saving within the Project Area resulting from the Western and Eastern Line connection is calculated.

Net benefit is obtained by multiplying railway passenger travel time-saving with the time value Rp184/h (see Table 7.7).

Table 7.7 Time-saving Benefit for Railway Passengers

Unit: Passenger-hours; Million
Benefits ; Million Rupiah

Route	O/D(or Direction)	Items	1990	1995	2005
A	W — E	Passenger-hour	0.0881	0.2938	2.8485
		Benefit	16.2	54.1	524.0
B	W — T	Passenger-hour	0.3741	0.5248	2.2995
		Benefit	68.8	96.5	423.1
C	W — Kota	Passenger-hour	0.0838	0.2003	0.2297
		Benefit	-15.4	-36.9	-42.2
C	E — Kota	Passenger-hour	0.0083	0.1013	0.4770
		Benefit	-1.5	-18.6	-87.8
Net Time-saving Benefit			68	95	817

Notes : 1) Benefit = Passenger-hour x Passenger time value

2) The passenger time value of 184 Rupiah was obtained from the time value used in the Central Line Track Elevation F/S 1982 (134 Rupiah) and from the CPI change in Jakarta thereafter.

(2) Indirect Benefits

In addition to the direct benefits quantified above, the following indirect and unquantified benefits are conceivable.

1) Job creation during the construction period

2) Probability of decreases in traffic accidents due to the termination of the switchback operation at the Kampung Bandan Signal Station

3) Promotion of land-use development around the Project Area in accordance with the Jl. Mangga Dua Project

4) Decrease in road congestion around the Project Area

7.2.4 Evaluation

The EIRR of the Project (P_{1-1}) is 17.8% (see Appendix 7.3).

Costs and benefits for each year of the Project are shown in Fig. 7.1.

Implementation of the Project is justifiable and feasible from the viewpoint of the national economy (see 7.2.1-(2)).

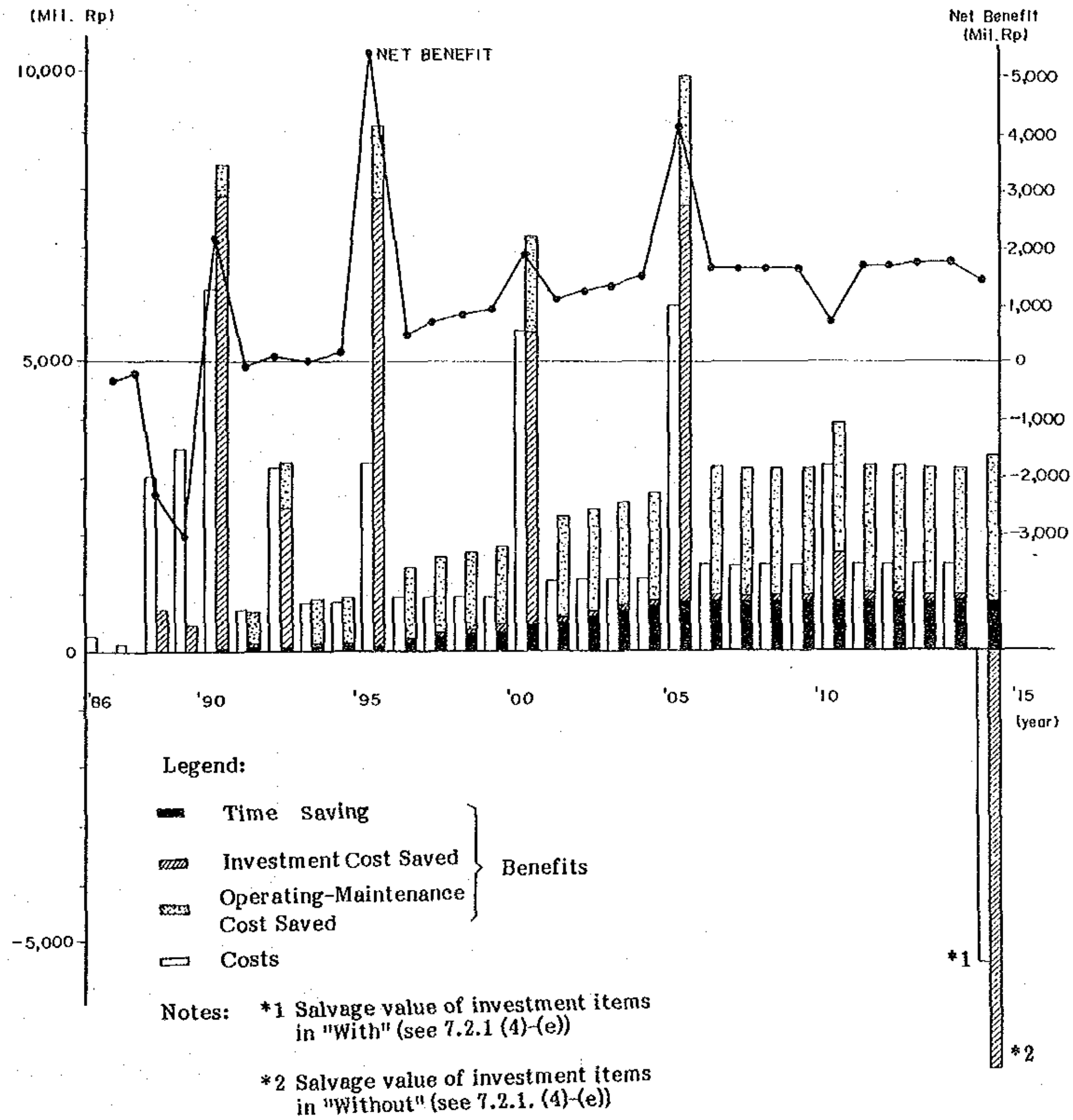

Fig. 7.1 Costs and Benefits for Each Year

7.2.5 Sensitivity Test

An appraisal was conducted using several other most likely variables, to test whether the Project would still remain feasible.

(1) Cases for the Sensitivity Test

The following cases are set for the sensitivity test.

Case 1: An investment cost (including rolling stock and buses) overrun of 10%

Case 2: A construction cost (excluding rolling stock and buses) overrun of 10%

Case 3: A 10% decrease in the cost of rolling stock

Case 4: A 10% decrease in traffic demand

(2) Results

Table 7.8 Results of Sensitivity Test (EIRR)

Case	Base Case		17.8 %
1.	Investment Cost	+ 10%	17.1 %
2.	Construction Cost	+ 10%	15.7 %
3.	Cost of Rolling Stock	- 10%	16.6 %
4.	Traffic demand	- 10%	17.1 %

Note: See appendix 7.3 (Case 1 through Case 4)

The above results show that each case still remains sufficiently feasible. The Project is most sensitive to construction costs, despite the fact that such costs are rather small when compared with the other JABOTABEK railway projects. Therefore, care should be taken when concluding construction contracts, managing project implementation, and simplifying construction work. For reference, Alternative P_{1-1s} (a simplified version of P_{1-1}, see 6.1.2) has an EIRR of 20.6%, this is due to its construction costs being 11.2% decreased compared with Alternative P_{1-1}.

7.3 Financial Analysis

7.3.1 Methodology

A cash flow analysis is made.

The same incremental method is applied as in the economic analysis. The same assumptions given in 7.2.1. (4) are used. As to the project costs, however, market values including taxes and subsidies are adopted.

7.3.2 Items Composing Cash Flow Statement

(1) Items Related to the Revenue and Expenditure of PJKA

(a) Operating Revenue

Railway passenger revenue is calculated by multiplying the fare rate by the additional number of annual passengers which exceeds the 1989 total of 133.5 million passenger-kilometers within the Project Area.

As in the Review of F/S, railway fare is assumed to be 12.4 Rupiah per passenger-kilometer and to remain unchanged during the project life.

The calculated traffic volume within the Project Area is shown in Table 7.9.

Table 7.9 Additional Traffic Volume

(Unit : Million Passenger-km)

Year	1990	1995	2005
Passenger-kilometer	21.9	159.9	336.9

Note: Passenger-kilometer after 2005 is assumed to be constant.

(b) Operating Expenses

Operating expenses can be divided into two groups, working cost and depreciation cost. Working cost is the total of personnel, energy, and railway facility/rolling stock maintenance costs. These are actual cash outflow items in the cash flow statement.

On the other hand, depreciation cost is the mere cost for accounting purposes; thus, it is not a cash outflow item. To compute the depreciation cost, the useful life (years) indicated in Table 7.3 is applied.

(c) Operating Profit and Net Profit

Operating profit is calculated by deducting operating expenses from operating revenues and is classified into two groups: the operating profit before depreciation, and operating profit after depreciation. Profit before depreciation is one of the most important indices for a railway project.

From the standpoint of PJKA, the working ratio [1] and operating ratio [2] are also computed to determine the profitability of the Project.

According to Article 13 of the joint decree of the Ministry of Finance and the Ministry of Communications issued on 30 March 1970, PJKA is supposed to pay a 3% interest on the total assets to the Government. Therefore, net profit is calculated after deducting the 3% interest on the total assets from the operating profit.

Note: 1) Working ratio $= \dfrac{\text{Working Cost}}{\text{Operating Revenue}}$

2) Operating ratio $= \dfrac{\text{Operating expenses (Working Cost+Depreciation)}}{\text{Operating Revenue}}$

(2) Investment and Fund-Raising Plans

(a) Investment Plan

The investment plan used in the economic analysis is applied. All costs are based on market values including taxes.

Table 7.10 shows a breakdown of investment classified by type of construction, kind of currency, and construction term.

Table 7.10 Financial Cost of Investment

(Unit : Million Rp)

Items	Currency	1986-89	1990-2000	2001-15	Total
Civil engineering work	F.C.	3,789	0	0	3,789
	L.C.	1,619	0	0	1,619
Signalling, telecom. and electrical work	F.C.	1,310	0	1,310	2,620
	L.C.	426	0	426	852
Construction cost sub total	F.C.	(5,099)	(0)	(1,310)	(6,409)
	L.C	(2,045)	(0)	(426)	(2,471)
Rolling stock	F.C.	0	14,386	14,061	28,447
	L.C.	0	0	0	0
Total	F.C.	5,099	14,386	15,371	34,856
	L.C.	2,045	0	426	2,471
Grand total		7,144	14,386	15,797	37,327

Notes: 1) The costs include reinvestment, but exclude salvage value.
2) F.C., Foreign currency portion; L.C., Local currency portion.

(b) Fund-Raising Plan

It is assumed that all investment and fund-raising are conducted by the Indonesian Government.

It is also assumed that the foreign currency portion of the investment is borrowed from overseas, and the local currency portion financed by the Government budget or Rupiah-denominated domestic borrowing.

The methods of fund-raising considerably influences the financial viability of a project. In this analysis, fund-raising plans are assumed as shown in Table 7.11.

Table 7.11 Fund-Raising Plan

	Foreign currency portion	Local currency portion	Reference
Base Case	Government-to-Gov't borrowing 3.5% p.a. 30 years, including a 10 year grace period	Government budget	Appendix 7.4
Case - 1	Same as above	(50%) Government budget (50%) Domestic Rp borrowing 16.5% p.a. 10 year, including a 4 year grace period	Appendix 7.4
Case - 2	Official overseas borrowing (including IBRD, ADB) 9% p.a. 15 years, including a 4 year grace period	Government budget	Appendix 7.4
Case - 3	(50%) Government budget Same as above	(50%) Domestic Rp borrowing 16.5% p.a. 10 year, including a 4 year grace period	Appendix 7.4

Notes : The terms of repayment are assumed as follows:

(1) Government budget, No need to repay

(2) Borrowings, Annual equal installments

7.3.3 Results of Cash Flow Analysis

(1) Operating Profit for PJKA

In order to balance operating revenue and expenses, it will be necessary to have government subsidies totaling 2,118 million Rp at the stage of operating deficit after depreciation for a four year period after the completion of the construction (see Table 7.12 and Fig. 7.2).

Table 7.12 Government Subsidies to Cover Operating Deficit

(Unit : Million Rp)

Subsidies \ Year	1990	1991	1992	1993	1994-2015	Total
Subsidies before depreciation	489	146	0	0	0	635
Subsidies after depreciation	932	590	469	127	0	2,118

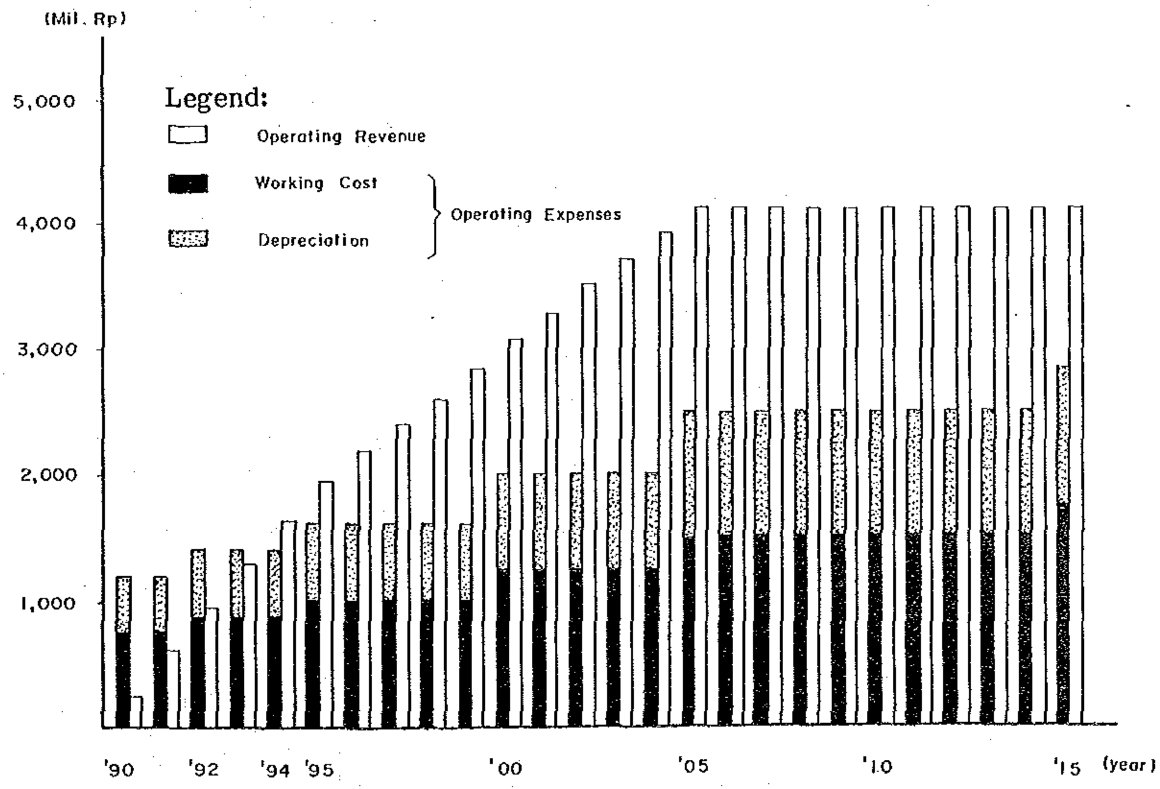

Fig. 7.2 Operating Revenue and Expenses for Each Year

As for the working ratio and the operating ratio (each on cumulative basis), these will be below the desired level of 1.0 in 1994 and 1998 respectively (see Appendix 7.4).

This means that there is no need to raise the railway fare for the whole project life, even if the operating deficits were to be taken care of by the railway entity (PJKA) itself.

(2) Net Cash Flow

Net cash flow is obtained from the difference between the cash inflow and outflow items which are composed of the following.

Cash Inflow:

- Operating profit after depreciation
- Depreciation
- Borrowing

Cash Outflow:

- Investment
- Interest during construction
- Debt service (repayment and interest payments)

Net Cash Flow = Cash Inflow - Cash Outflow

If net cash flow shows a negative value, the shortage of cash flow must eventually be taken care of by the Government.

Table 7.13 shows net cash flows for various cases under the fund-raising plans set out in Table 7.11.

Table 7.13 Cash Flow Result for Each Case

(Unit : Million Rp)

Cases	Items	1986-1995	1996-2005	2006-2015	Total
Common to all cases	Operating Revenue	6,763	31,894	41,726	80,383
	Operating Expense	5,198	11,892	15,536	32,626
	Operating Profit				
	before Depreciation	1,565	20,002	26,190	47,757
	after Depreciation	-1,551	12,536	16,257	27,242
	Net Profit	-3,865	8,538	12,641	17,314
	Investment	17,234	8,788	11,305	37,327
Base Case	Debt Service	1,124	3,620	3,343	8,087
	Net Cash Flow	-9,649	7,595	28,354	26,300
	Ratio	-143%	24%	68%	33%
Case - 1	Debt Service	2,832	4,248	3,343	10,423
	Net Cash Flow	-11,357	6,966	28,354	23,963
	Ratio	-168%	22%	68%	30%
Case - 2	Debt Service	4,648	5,094	0	9,742
	Net Cash Flow	-13,172	6,120	31,697	24,645
	Ratio	-195%	19%	76%	31%
Case - 3	Debt Service	6,355	5,723	0	12,078
	Net Cash Flow	-14,880	5,491	31,697	22,308
	Ratio	-220%	17%	76%	28%

Note : $\text{Ratio} = \frac{\text{Net Cash Flow}}{\text{Operating Revenue}} \times 100$

Under the fund-raising plans, the cumulative net cash flow becomes positive for the Base Case, Case I, Case 2, and Case 3 in the years 2006, 2007, 2008, and 2009 respectively.

This means that, after these years the Government will be relieved of any financial burden.

As can be seen in Table 7.13 and Fig. 7.3, the Project will produce enough cash flow to service the debt for the whole project life.

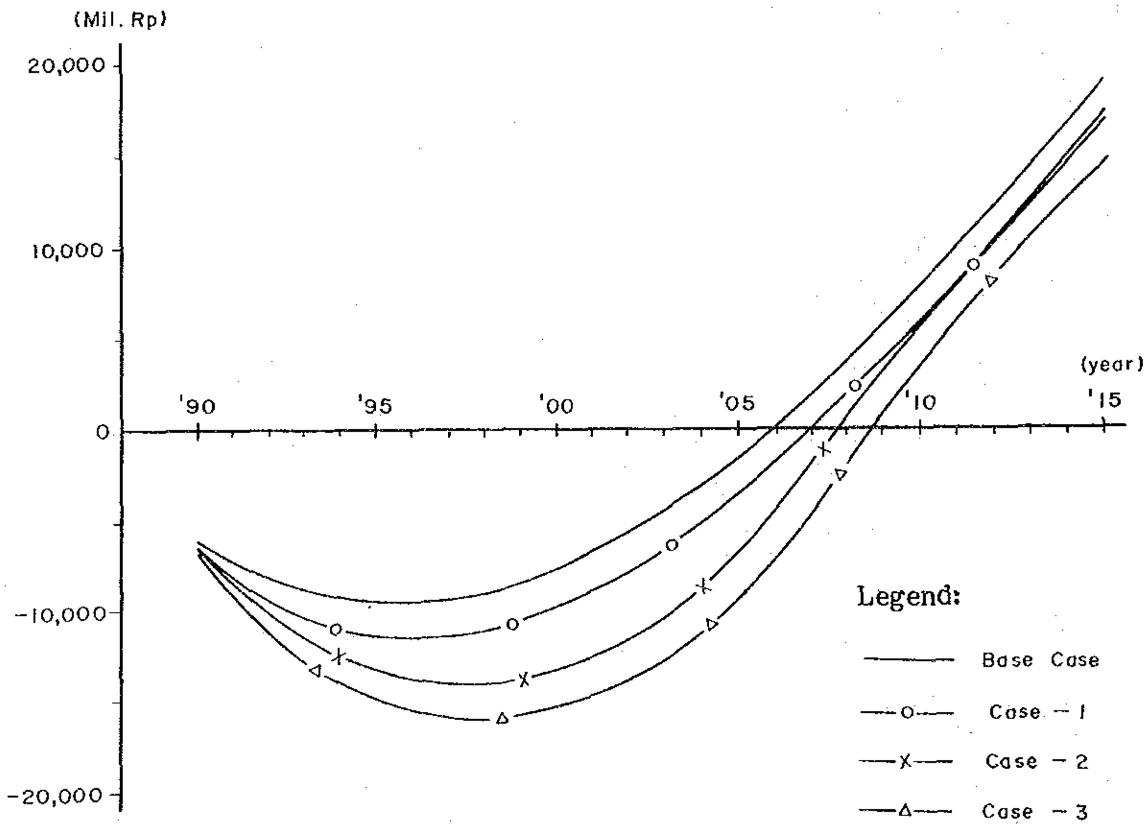

Fig. 7.3 Cumulative Net Cash Flow

7.3.4 Evaluation

The above analysis indicates that implementation of the Project is financially viable, and capable of making a considerable financial contribution to PJKA.

What should be noted, however, is that the Project Area considered in this analysis is only part of the JABOTABEK Railway System (i.e., "a Point Project").

CHAPTER 8 RELATED FUTURE PLAN (New Jakarta Kota Station)

CONTENTS

CHAPTER 8 RELATED FUTURE PLAN (New Jakarta Kota Station)

8.1 Future Requirements

(1) Railway's Viewpoint

1) The Project of the Railway Improvement in Kampung Bandan Station Area will assure a sufficient transport capacity for the JABOTABEK Railway Network for a considerable period of time. But, the expected increases in both commuter and long-distance passenger trains will result in a shortage of the present capacity of the Jakarta Kota Station and of the main lines converging on it.

2) Five stages can be identified in the evaluation of the relationship between the number of trains and track capacity in the JABOTABEK Railway Network.

Stage-1 : A small number of freight and long-distance passenger trains are operated on the same track throughout the day. The track capacity is sufficient for their operation.

Stage-2 : A few commuter trains are added to the above. The capacity is still sufficient.

Stage-3 : Trains of each category increase in number, but are still operated on the same track throughout the day and within the track capacity.

Stage-4 : Commuter trains increase in number, and tracks and stations are assigned exclusively to them during the morning and evening peak hours.

Stage-5 : The number of commuter trains increases even more, and tracks occupied by them are unable to accomodate long-distance passenger trains, not only during peak hours but also throughout the daytime. Although freight trains are operated mainly during the night, track capacity will become insufficient as they increase in number.

3) The present JABOTABEK railway traffic volume and track and station capacity are considered to be at Stage-2. The Project is aiming for Stage-4, and the New Jakarta Kota Station Plan for Stage-5. Implementing the Plan would be premature since the present double-tracked Eastern and Central Line track capacities are sufficient for the traffic volume.

(2) City's Viewpoint

The progress of redevelopment in DKI Jakarta can be subject to a different kind of logic. It is not surprising that the City might urge a relocation, or an abolition (partial or even total) of the railway facilities of the Kota area. Whether the redevelopment process is accelerated or delayed, it may not be too early to prepare plans for a future large-scale improvement of the Kota area, and to verify whether the Project can withstand criticism from a future standpoint.

8.2 Assumptions

8.2.1 Historical Lessons

A quick overview of various railway systems will shed light on the future design of the New Jakarta Kota Station. Observation of the historical progress of railways in a number of cities throughout the world, where railways have served as a vital means of urban transportation, has taught the following:

1) Long-distance train terminals should be located as close to city centers as possible.

2) Long-distance and commuter trains should be connected at the said terminals.

3) Freight stations do not have to be necessarily located in city centers; they could be relocated to other sites to meet future physical flow demands.

4) Rolling stock depots should be located as close to the said terminals as possible.

These concepts must be applied to the New Jakarta Kota Station Plan.

8.2.2 Options

Before starting the inquiry several options are assumed, namely the following:

(1) W-E Commuter Train Route

Commuter train routes will have a W-E connection.

(2) Role of New Jakarta Kota Station

(a) Dual Purpose .... (Option A)

The new station has a dual purpose; it acts as a commuter and a long-distance passenger terminal. In this case, track addition will be necessary. The

Central and/or Eastern Lines should be quadrupled. Taking into account the difficulties in right-of-way acquisition, the Eastern Line is chosen for the track quadrupling.

(b) Single Purpose .... (Option B)

The new station has a single purpose; it acts only as a commuter terminal.

(3) New Jakarta Kota Station Site

Each option for the site depends on the realistic possibility of land acquisition to implement the future design of the New Jakarta Kota Station. The site is to be selected from among the PJKA's present rights-of-way which are unused or used for warehouses .

(a) Present Jakarta Kota Station........................ (Option K)

The New Jakarta Kota Station will be rebuilt at the present Jakarta Kota Station site.

The Jakarta Gudang Station and the Jakarta Kota Passenger Car Depot will remain at their present sites.

(b) Present Jakarta Gudang Station .... (Option G)

The new station will be relocated to the present Jakarta Gudang Station after its relocation.

The Jakarta Kota Passenger Car Depot will remain as it is or be relocated somewhere else.

(c) Present Jakarta Kota Passenger Car Depot .... (Option D)

The new station will be relocated to the present Jakarta Kota Passenger Car Depot after it is relocated.

The Jakarta Gudang Station will remain at its present site by reducing its scale, or be relocated somewhere else.