2) Trip distribution model

Trip distribution model represents relationships between the zonal trip generation/attraction and trip distribution. A gravity model was adopted in this study to represent a trip distribution pattern within the area. The model was estimated through a regression analysis as expressed below.

$$Tij = 0.0001695 \times Gi^{0.70258} \times Aj^{0.70169} \times dij^{-0.26177}$$

where, Tij : trips between i and j zone
Gi : trips generated from i zone
Aj : trips attracted to j zone
dij : road distance between i and j zone

The dij was calculated through minimum path algorithm based on the road network of 1988. Zone pair specific coefficients were also calculated to assure the accuracy of the model.

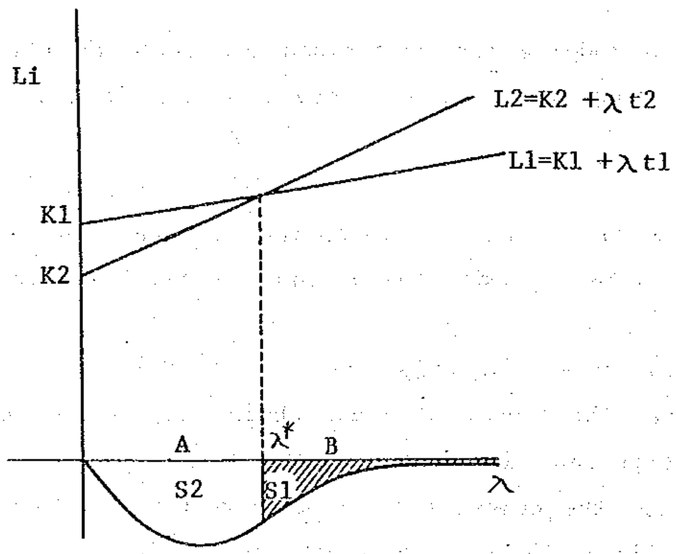
3) Mode split model

A mode split model is a model which determines modal shares between competitive modes according to the given levels of services of the modes.

Passengers who want to use public transportation mode for their travels are assumed to choose a mode considering the service level of the mode.
One of the most popular model in this field is a diversion curve method which assumes that the factor of modal choice is, for example, travel time between origin and destination. Needless to say, it is evident that the cost for the travel has to be considered. Time and cost of travel are considered to be predominant factors in mode choice activity. A time value mode split model was developed as a mode split model in this study. It deals with the two important factors, time and cost of travel, in mode choice. It also allows to forecast various effects by improvement such as travel time, transfer time, waiting time and travel cost.

The effect of the feeder service improvement which is one of the major improvement items can be estimated.

Fig. 6.2.2.10 shows a conceptual figure of the model. A person who wants to travel has to accept a cost in a wide sense for his travel. The model assumes that he chooses a travel mode with a minimum generalized cost. The cost is represented in travel time and cost in monetary term. He examines the times and costs of competitive modes. A total generalized cost of travel is considered to be an aggregation of converted travel time and the monetary cost. So, he converts the time into monetary cost based on his time evaluation function. The model assumes that time value is a probability variable. If he judges his time value higher, he evaluates a faster mode cheaper because the travel time portion is smaller. Taking an example from the Fig. 6.2.2.10, a person who judges his time value as A would choose the second mode, since a total travel cost by the first mode is more expensive than the second mode. If he considers his time value is B, he would choose the first mode although the monetary cost is higher than the second mode.



Li : generalized cost by mode i
Ki : monetary cost by mode i
ti : travel time by mode i
λ : time value (probability variable)
Si : mode i share

Fig. 6.2.2.10 Time Value Mode Split Model

The share of the second mode is calculated by a following equation.

$$S2 = \int_{-\infty}^{\ln\lambda^*} f(\ln\lambda) \cdot d\ln\lambda$$

$$f(\ln\lambda) = \frac{1}{\sqrt{2\pi\sigma/n\lambda^2}} e^{-(\ln\lambda^*-\mu/n\lambda)^2/2(\sigma/n\lambda)^2}$$

where, S2 : modal share of the second mode

λ : $=-(K1-K2)/(t1-t2)$

$\mu\ln\lambda$: mean of $\ln\lambda$

$\sigma\ln\lambda$: standard deviation of $\ln\lambda$

The model assumes the distribution of time value as a logarithmic normal distribution from experience. Two variables which determine the distribution, "mean" and "standard deviation", were estimated through a series of calibrations using travel time and cost of each competitive mode and modal share by each pair of zones.

The estimated mean and standard deviation of ln are shown below.

$\mu\ln\lambda$ = 5.9458

$\sigma\ln\lambda$ = 1.1503

The estimated mean represents the time value of passengers who use public transportation mode within JABOTABEK Area. The value is equivalent to Rp.382 (per hour).

The estimation procedure is shown in Fig. 6.2.2.11. Zone pair specific coefficients were also calculated for the mode split model.

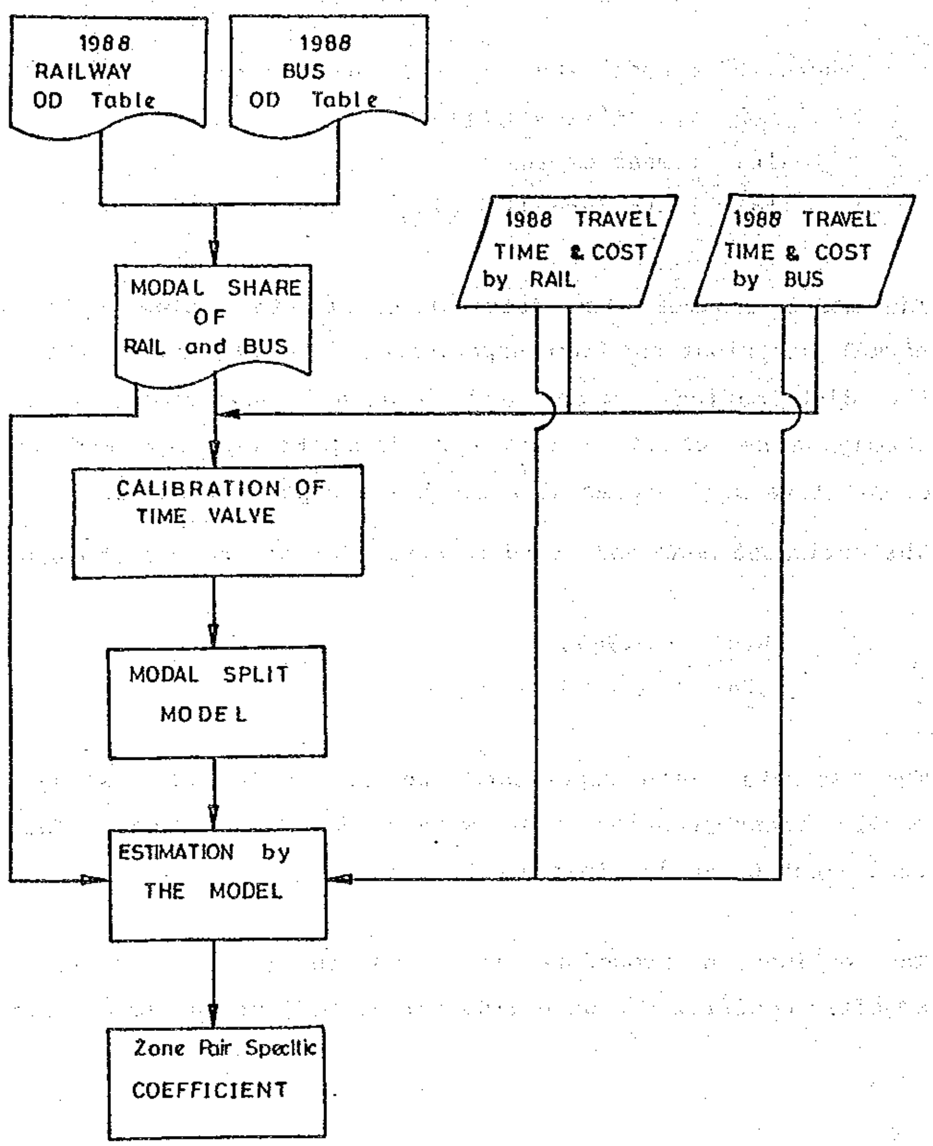


Fig. 6.2.2.11 Mode Split Model Estimation

6-3 Demand Forecast

6-3-1 Socio-economic Framework

(1) Economic development

According to REPELITA IV (1984-1989), the target annual economic growth rate was set at 5%. Although the actual annual growth rate during 1979 to 1985 was 6.8%, a gradual decline in growth rate occurred in the succeeding two years. It is estimated that the annual growth rate between 1984 to 1989 is approximately 2.5%. The economy of Indonesia, however, is gradually showing signs of recovery and the target annual growth of 5% is judged to be a realistic figure for 1988 to 2005.

The growth rate of GRDP in JABOTABEK Area was estimated by analyzing the trend of GRDP per capita of the region against the national one, and multiplying it by the estimated future population. The results are shown in Table 6.3.1.1 and adopted as a future economic framework of the region.

Table 6.3.1.1 Future GRDP in JABOTABEK Area
(1988 constant price, billion Rp.)

Area	1988	1992	2005	Growth Rate 1988-2005
DKI Jakarta	15716.9	20910.2	52885.0	7.4%
Botabek	4818.8	6256.0	14651.3	6.8%
Jabotabek	20535.7	27166.2	67536.3	7.3%

(2) Population and employment

Future population and employment were estimated by adjusting the estimates made by ARSDS in 1985. The ARSDS estimates for 2005 were updated considering information from the Indonesian Government. Major information to estimate the future socio-economic framework are listed below.

- National Development Plan
- JABOTABEK Region Development Plan
- DKI Jakarta Master Plan 2005
- Development Plans for Kabupaten

The estimation results are shown in Table 6.3.1.2 and Fig. 6.3.1.1 to 6.3.1.3.

Table 6.3.1.2 Future Population and Employment (000)

Area	1988 Population	1988 Employment	2005 Population	2005 Employment
DKI Jakarta	8861	2746	12000	5167
Botabek	7160	-	11500	-
Total	16021	-	23500	-

Note : Employment in Botabek area was not estimated.
The Employment indicates the number of workers employed by the secondary and tertiary industries.

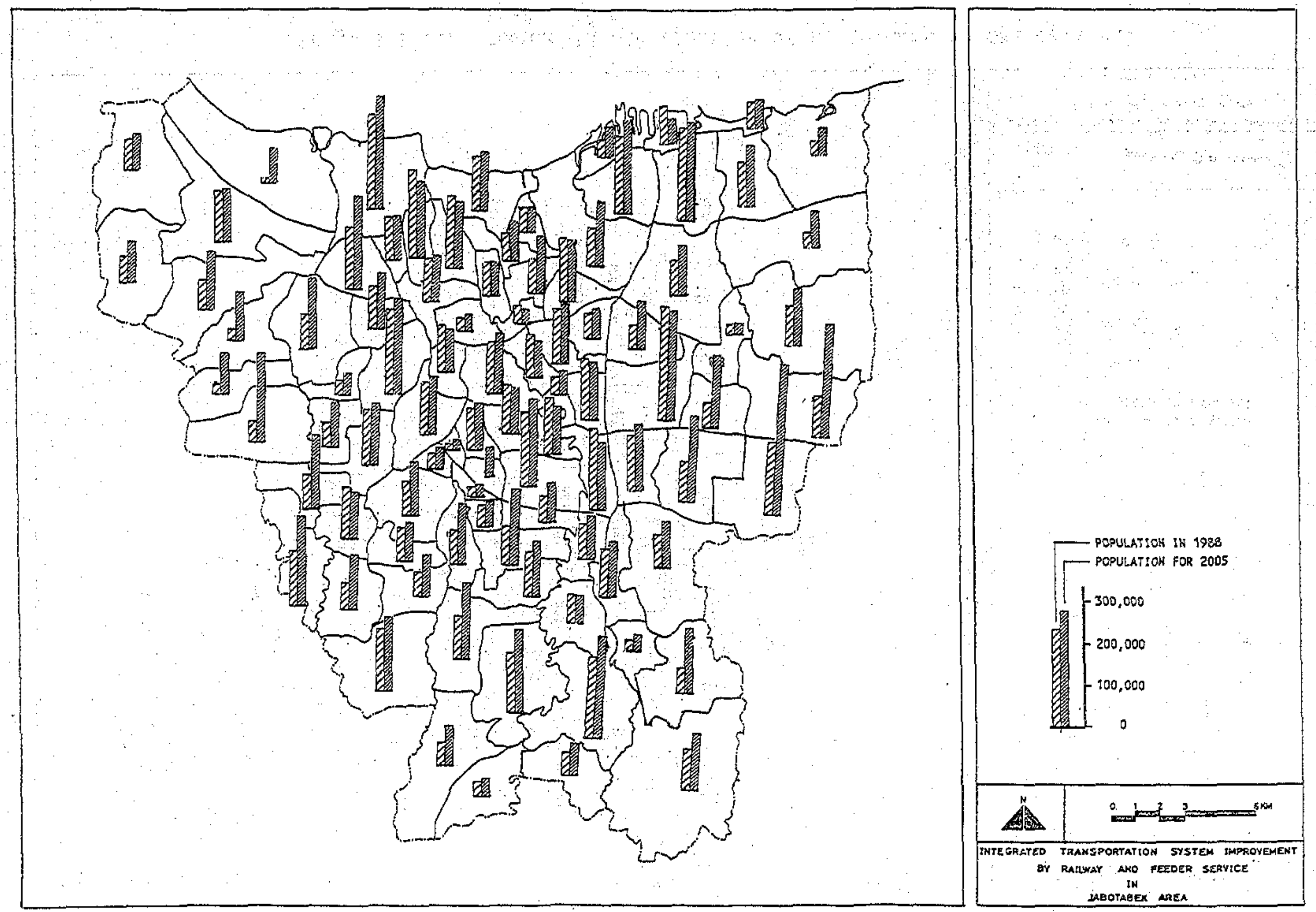


Fig. 6.3.1.1 Change in Distribution of Population in DKI Jakarta, 1988 - 2005

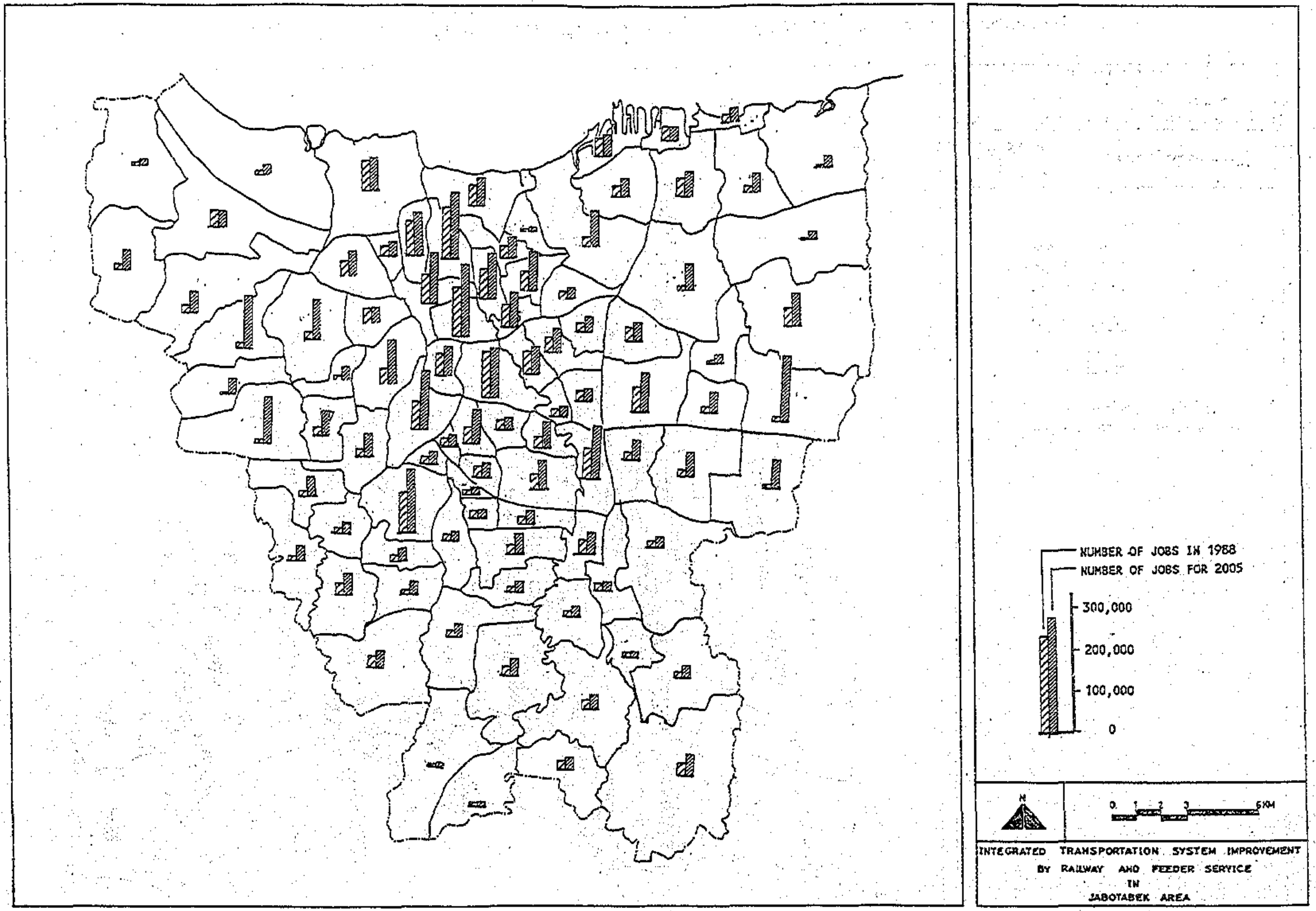


Fig. 6.3.1.2 Change in Distribution of Employment in DKI Jakarta, 1988 - 2005

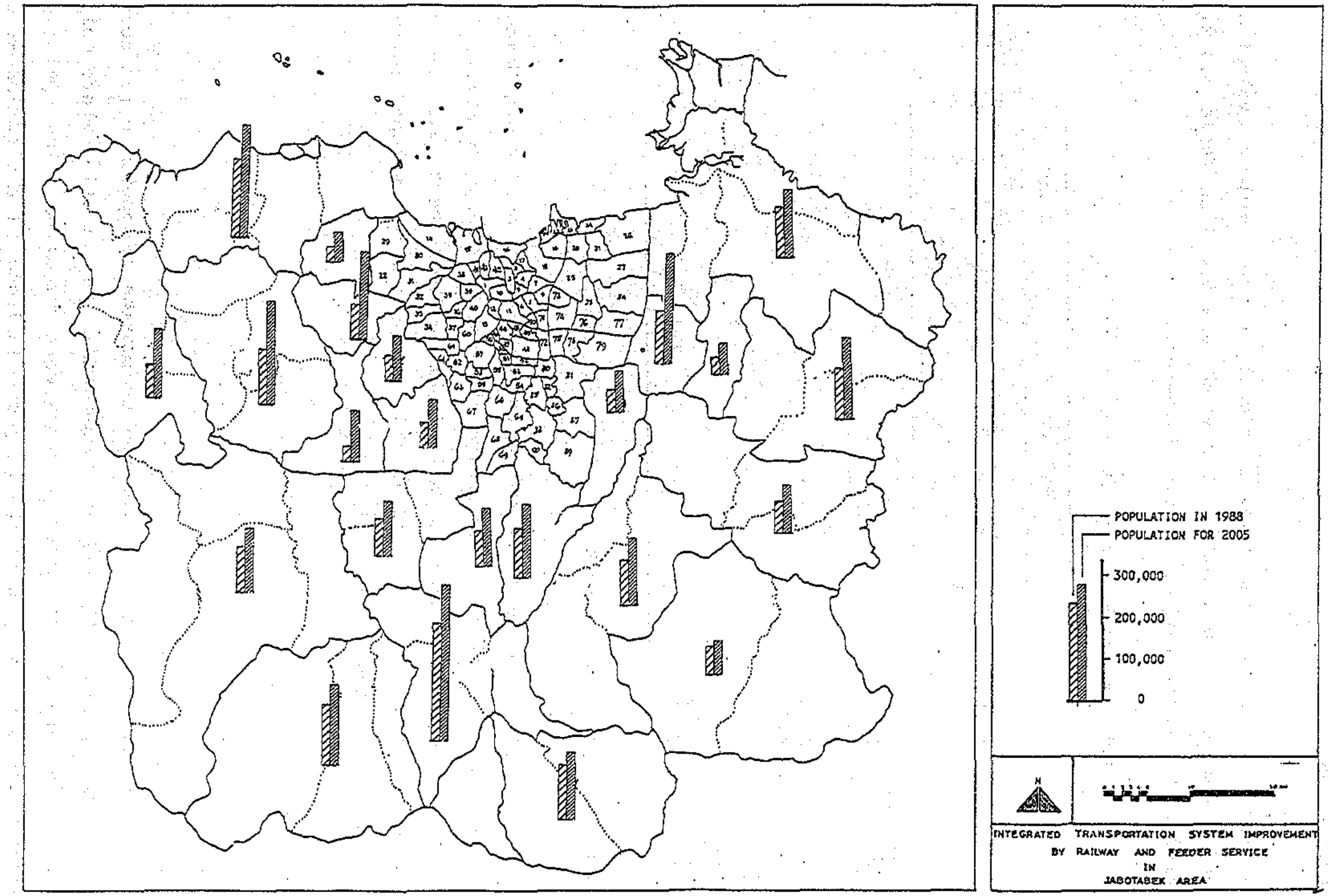


Fig. 6.3.1.3 Change in Distribution of Population in Botabek, 1988 - 2005

6-3-2 Future Transportation Network and Preconditions

(1) Forecast cases

The demand forecasting cases relate closely to the project evaluation cases. The cases forecasted in this study are shown in Table 6.3.2.1 (refer to 5. Details of Alternative Patterns).

Table 6.3.2.1 Demand Forecast Cases

Case	Year	Railway						Road			
		1988	RYa	RYb	RY1	RY2	RY3	1988	BC00	BC01	BC02
Analysis	1988	x						x			
92a	1992		x						x		
92b	1992			x					x		
05a	2005		x						x		
05b	2005			x					x		
051	2005				x					x	
052	2005					x				x	
053	2005						x			x	
054	2005				x						x
055	2005					x					x
056	2005						x				x

(2) Future transportation networks

Future transportation networks were prepared to forecast future demand by mode after a series of discussions with the Indonesian side. An outline of the networks were summarized below, since the details of the network were described in 5-2 to 4. The networks were developed in the same manner as shown in 6-2-2.

1) Railway network

- Ry a, b

These networks were prepared for the evaluation of option b projects of railway by 1992. The option a represents the situation where only the ongoing and the committed projects were completed. The option b assumes the situation where the projects included in the option were completed. Trains are assumed to be operated as scheduled by the completion of automatic signaling system. Travel time is reduced. Frequency of railway service increases by the several railway improvement projects such as double tracking, electrification, automatic signaling system and increase in the number of trains.

- Ry1, Ry2, Ry3

The service level of railway increases moreover. Railway users would be able to travel much faster with reduced waiting time by increased frequency. The railway users can transfer from buses to trains easier by the improved terminal facilities. The improvement level becomes higher as the number of case increases.

2) Road network

- BC00

This network represents a base case for road network comprising of on-going and committed projects. The network was prepared for a 1992 road network. The network includes projected new road constructions, road improvements and three bus priority lanes.

- BC01, BC02

These networks were prepared to set alternative patterns combined with the railway networks in 2005. They include further road development and seven additional bus priority lanes. The difference of these two networks is in the different development level of the new mass transit system.

The type of the mass transit system is not clearly defined. Only the level of service is defined for demand forecast as follows:

- operating speed : 30 km/h
- fare : 20% higher than JABOTABEK trains
- frequency in peak period: every 6 minutes between Kota and Pasar Minggu

: every 10 minutes between North Serpong and Pondok Gede

3) Bus network

Future bus networks were made based on the existing bus routes. A little modification was made on the network considering the new road construction, the bus priority lane developments, relocation of bus terminals.

- 1992 bus network

The network corresponds to BC00 road network. Modification was made on the bus priority lane development. The bus routes were assumed to be changed to the priority lanes if the routes were on the road where the lanes were projected.

- 2005 bus network

The network corresponds to the road networks of BC01 and BC02. The bus routes were amended regarding the increased bus priority lanes. New bus routes were considered between relocated bus terminals and the existing terminals. They are Pulo Gadung - New East Terminal and Cililitan - New South Terminal lines.

A new route between the New Kalideres Terminal and the existing terminal was ignored, since the new terminal is very near from the existing terminal. New bus routes along projected Outer Ring Road were considered as well.

(3) Other preconditions

1) Future time value

The future time value of public mode users were assumed to increase in proportion to the increase of per capita GDP in DKI Jakarta from the experience in Japan. The faster mode become to be chosen with the increase of the time value. The estimated future time values are shown below.

Year	Time Value (Rp./hour)
1988	382
1992	450
2005	949

2) Future fare level

The future fare level of public modes was assumed to be equal to the existing level in constant prices.

3) Average occupancy of road vehicles

The average occupancy of road vehicles were assumed as below. The figures were determined after an examinations of ARSDS and the Outer Ring Road Study. The average occupancies of private modes were assumed to decreases in future. This assumption was considered to be reasonable since the average occupancies in the developed countries show such tendency.

Year	1988	1992	2005
Private Cars	1.76	1.63	1.22
Motorcycles	1.14	1.13	1.09

The average occupancies of buses were estimated from the bus passenger survey results as shown below. The occupancies were assumed to be same during 1988 to 2005.

Small Buses	:	6.7
Medium Buses	:	18.0
Large Buses	:	49.8

4) Private car restraint policies

Two traffic restraint policies were considered through a review of a report titled "Traffic Restraint and Parking Policy Studies" by

Pamintori, Buchanan and others. They are parking charge increase and an area licensing scheme. Although the effects of the two policies were reported drastic, the percentage of private car traffic reduction was assumed as below in consideration of the effects of the similar policies in Singapore.

- Parking charge increase: 10% of all day private car traffic terminating within the parking control boundary proposed by the above study.

- Area licensing scheme : additional 30% of private car traffic terminating within the traffic restraint boundary during 6 to 10 a.m..

The parking charge increase policy and the area licensing scheme were assumed to be executed in 1992 and 2005 respectively. The reduced private car trips were supposed to divert to the public modes. The private car trips were converted by the average occupancy described above.

6-3-3 Future Trip Production

(1) Studies on person trips

The first area wide person trip survey was conducted in 1972, but the area surveyed was not the whole DKI area. The DKI area person trip survey was conducted in 1985 through the ARSDS study. The survey result of 1985 and the forecast for 2005 are shown in Table 6.3.3.1.

In a series of Jakarta Urban Transportation Project Studies, a traffic forecast was conducted. It is summarized in the same table together with population and per capita trip rate for the years in 1982, 1992 and 1995.

(2) Future trip production

The ARSDS study presents the per capita trips of 0.89 on motorized vehicles and 1.68 for the total of motorized and non-motorized in

1985. They seem to be rather low when compared with other large cities shown in Table 6.3.3.2.

Reminding the general tendency that per capita trips increase in the course of economic development and growth of motorized vehicle usage, it sesms increases from 0.98 of 1982 to 0.99 in 1992 and/or 1.02 in 1995 are conservatively estimated.

The forecast in 2005 by the ARSDS study seems to be high when the trend from 1982-92-95 is extrapolated. However, the discussion described above should be taken into account. The per capita trips of approximately 1.29 or 2.08 in the year of 2005 seems still low, but can be considered in the range of reasonable estimate. Then, the per capita trip rate of the ARSDS was adopted as reasonable for this study.

Table 6.3.3.1 Total Person Trips and Population 1972 - 2005

(000)

	1982 1)	1985 2)3)	1992 1)	1995 1)	2005 2)
Railways	45	21	158	406	913
Buses	3,191	3,528	4,173	4,667	(7,681
Bajaj	306	333	306	306	(
Taxis	253	68	357	406	617
Public Total	3,795	4,559	4,994	5,785	9,211
Motor cycles	1,373	1,400	1,787	2,030	2,726
Private cars	1,711	1,522	2,144	2,334	3,548
Trucks, etc.	-	87	-	-	-
Total	6,879	6,959	8,925	10,149	15,485
Non-motorized (including Becak)	-	6,161	-	-	9,425
G. Total	-	13,120 3)	-	-	24,910
Popul. DKI	7,000	7,829	9,022	9,950	12,000
Motorized Trips/ person	0.98	0.89	0.99	1.02	1.29
All Trips/person	-	1.68	-	-	2.08

Source: 1) *DLLAJR, 1982* through Jakarta Transport Investment Program Review (Pamintri, Buchanan, etc. July 1987)

2) ARSD Study (1987, JICA). The report showed the percent distribution. The trips are calculated by using the percentages. The trips using the taxis are estimated by using the percent ratio in 1995 (406/(406 + 2334)).

Table 6.3.3.2 Person Trip Rate in Selected Cities

		Year	Trip rates per person	
1.	Manila	(1980)	1.80	(Excluding walk)
2.	Bangkok	(1978)	1.60	(,, ,,)
3.	Cairo	(1983)	1.00	(,, ,,)
4.	Singapore	(1987)	2.00	(,, ,,)
5-1.	Jakarta	(1985)	0.89	(,, ,,)
5-2.	Jakarta	(1985)	1.68	(Including walk)
6.	Klan Valley	(1985)	2.54	(,, ,,)
7.	Casa Blanca	(1985)	2.64	(,, ,,)
8.	Dabao	(1980)	2.34	(,, ,,)
9.	Panama	(1980)	2.42	(,, ,,)
10.	Tokyo	(1987)	2.53	(,, ,,)
11.	Sapporo	(1972)	2.68	(,, ,,)

From each study report.

6-3-4 Results of Forecast

(1) General

Table 6.3.4.1 shows the results of the transportation demand forecast by case and by mode. The total number of trips (inter-zonal trips) grows from 5,516,000 in 1985 to 13,462,000 in 2005. The share of public modes against the total trips increases from 56% to 58%. The share of railway increases from 2% to almost 15% in case 052. The share of railway against total public trips become 25% from 3.7% in the case 052.

Travel demand by railway exceeds the transportation capacity of railway in case 92a. The railway transports its patronage at the maximum capacity.

Fig. 6.3.4.1 shows the difference of modal share by the alternative case. As the improvement level of railway becomes higher, railway trips increase. However, the railway trips decrease in case of advanced road improvement.

(2) Trips between aggregated zones

Fig. 6.3.4.2 shows aggregated zones for a convenient understanding of person trip movements between zones. The 131 traffic zones were aggregated into 33 large zones.

Fig. 6.3.4.3 shows the person trip flows between the large zones. Person trip flows within DKI Jakarta are described considerably thick. Trips to and from Bekasi, Tangerang, Depok and Cibinong can not be ignored. Fig. 6.3.4.4 shows the railway passenger flows in case 052. Flows within DKI Jakarta are similarly big.

Table 6.3.4.1 *Transportation Demand Forecast Results*

\- Number of Passengers - (1000 passengers)

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

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

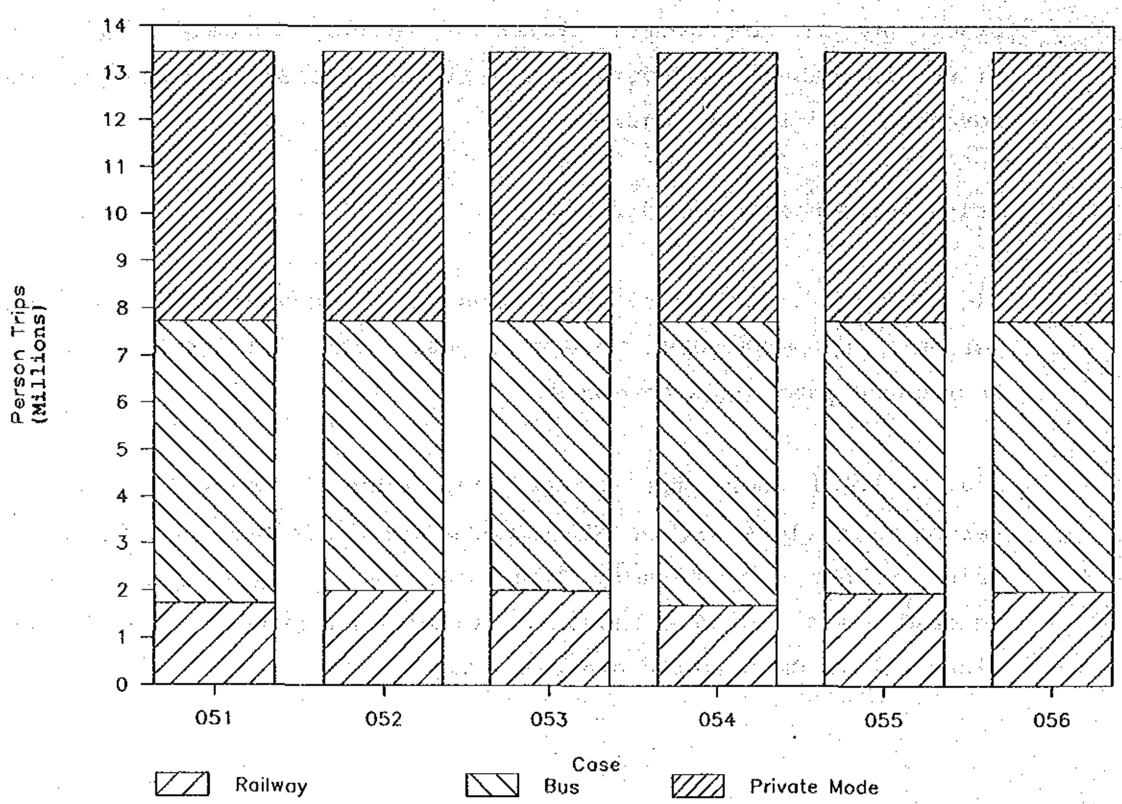
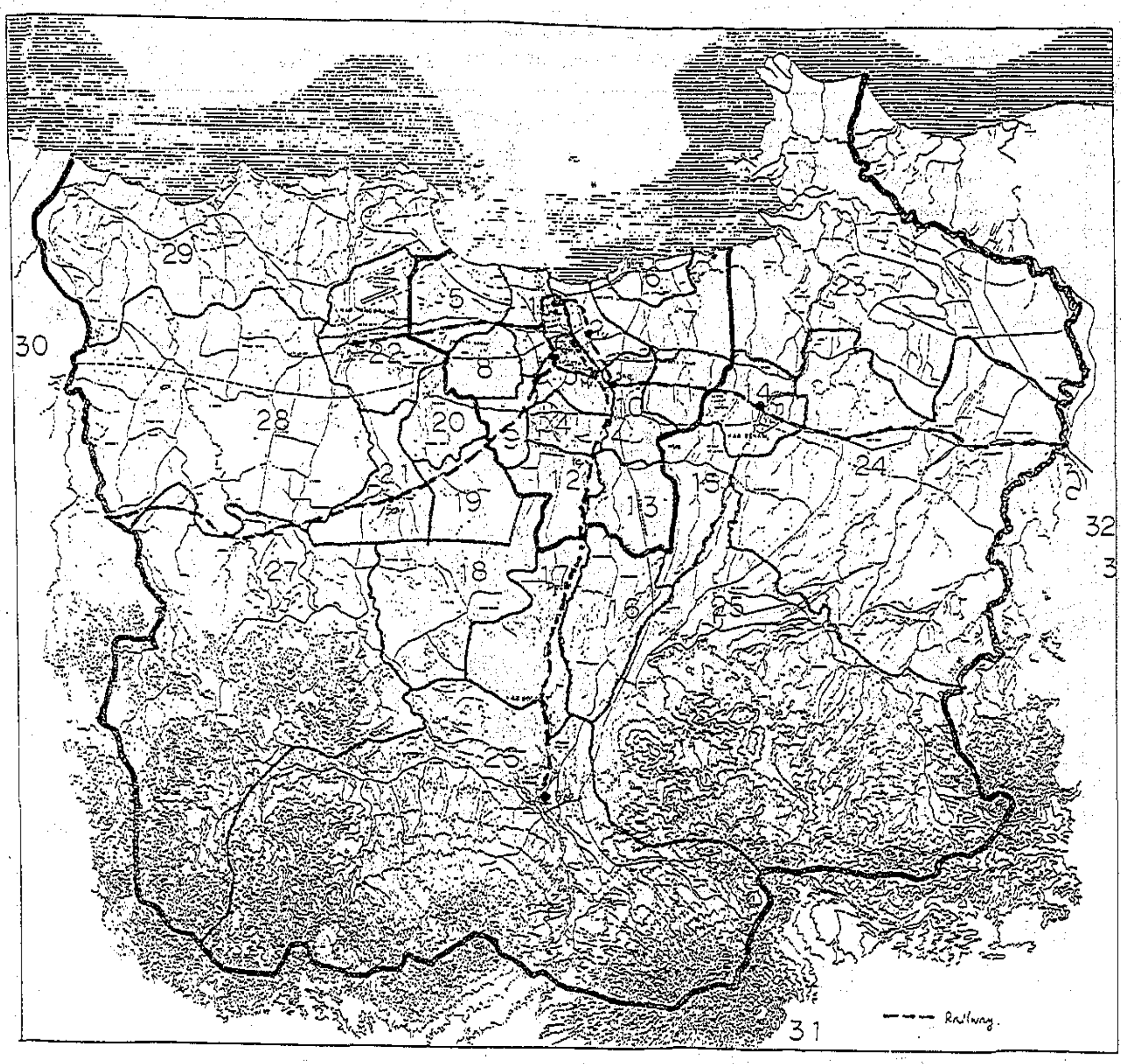


Fig. 6.3.4.1 Future Demand by Mode and by Case



Large Zone Code

Zone	Name		
1	N.Jkt-1	DKI Jakarta	Jabotabek Region
2	N.Jkt-2		
3	C.Jkt-1		
4	C.Jkt-2		
5	N.W.Jkt		
6	Tng.Priok		
7	N.E.Jkt		
8	W.Jkt-1		
9	W.Jkt-2		
10	E.Jkt-1		
11	E.Jkt-2		
12	S.Jkt-1		
13	S.Jkt-2		
14	Bekasi	Botabek	
15	Prd.Gede		
16	Cibinong		
17	Depok		
18	Parung		
19	Ciputat		
20	Ciledug		
21	Serpong		
22	Tangerang		
23	Sukatani		
24	Cikarang		
25	Jonggol		
26	Bogor		
27	Jasonga		
28	Batuceper		
29	Mauk		
30	W.Java.W. *1		West Java (excluding Botabek)
31	W.Java.S.		
32	W.Java.E.		
33	C/E.Java *2		Central/ East Java

Note: *1 includes Sumatra region
*2 includes remained regions

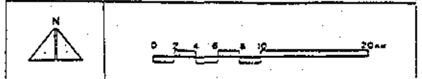


Fig. 6.3.4.2 Aggregated Traffic Zones

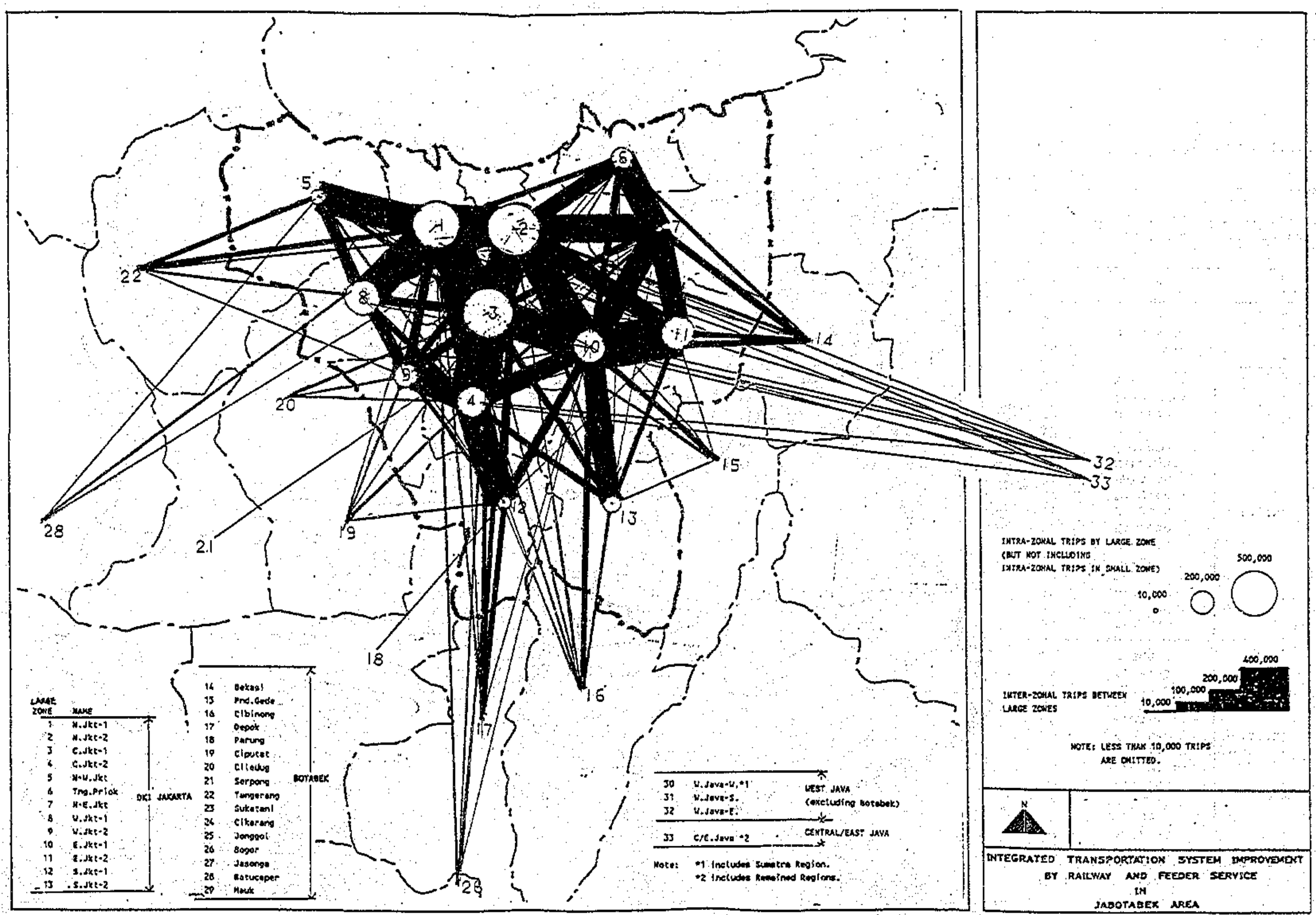


Fig. 6.3.4.3 Person Trip Flows by All Modes in JABOTABEK, 2005
-- By Large Zone --

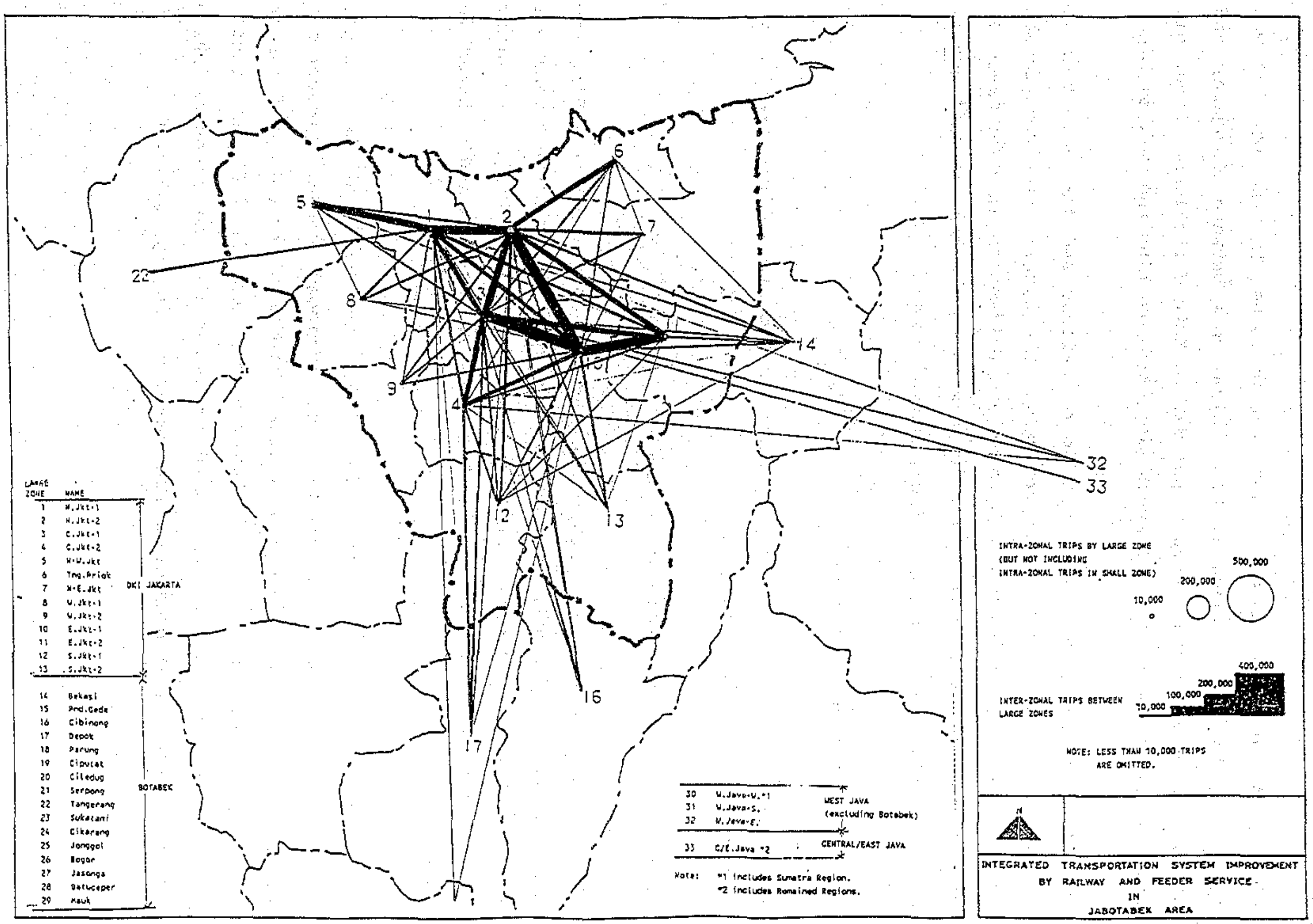


Fig. 6.3.4.4 Person Trip Flows by Railway in JABOTABEK, 2005
Case: (Basic Case=01; Ry=02)
-- By Large Zone --

(3) Railway link traffic

Fig. 6.3.4.5 describes railway link traffic volume in case 92b. It was estimated that the biggest traffic volume was between Manggarai and Jatinegara of 254,000 passengers per day to both directions. Other big traffic volumes were on the Eastern Line, Western Line and Central Line.

Fig. 6.3.4.6 and 7 show link traffic of railway and the mass transit system in case 052 and 055, respectively. The biggest link traffic was estimated on a link between Manggarai and Jatinegara in both cases as same as the case 92b. Transportation demand to the mass transit system was also estimated as big as railway in both cases.

(4) Bus passengers and road traffic

Fig. 6.3.4.8 and 9 show bus passenger traffic and vehicle traffic in PCU of case 052, respectively.

(5) Railway Freight Transportation Demand

The railway freight transportation demand was considered regarding the Cibinong New Line construction of option Ry3. The future demand was not forecasted but quoted from "Developed Summary of Feasibility Study of the U.K. Association for the JABOTABEK Railway Project" issued in 1986.

The demand dealt with in this study was limitted to freight transportation demand in relation to Cibinong cement production. According to the above report, a total volume of cement produced at Cibinong is estimated to be 16,500 thousand tons in 2005 (hypothesis 2). Railway transportation demand of materials and products which relate to the cement production are summarized in Fig. 6.3.4.10.

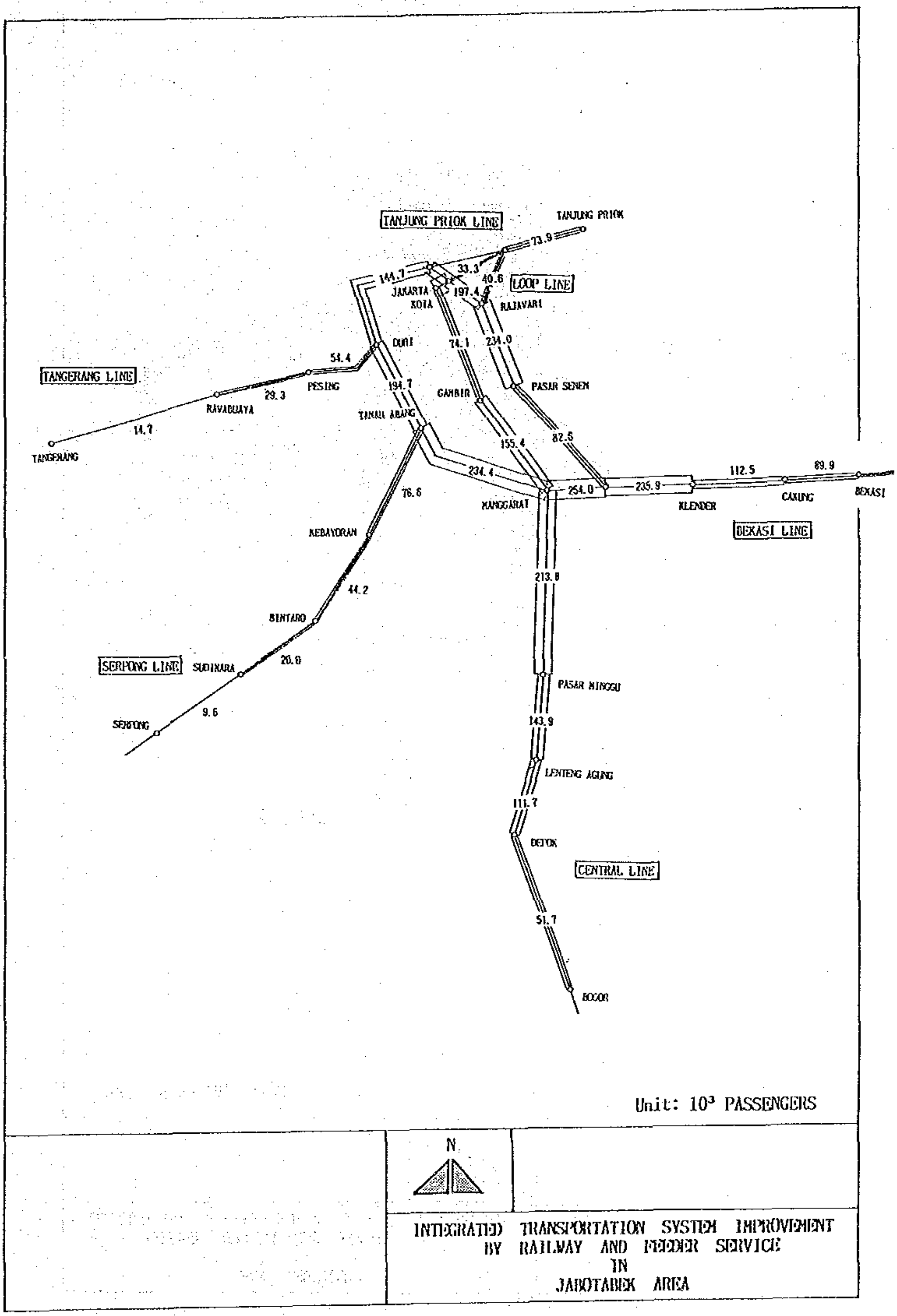


Fig. 6.3.4.5 No. of Railway Passengers
(Case: b Option)

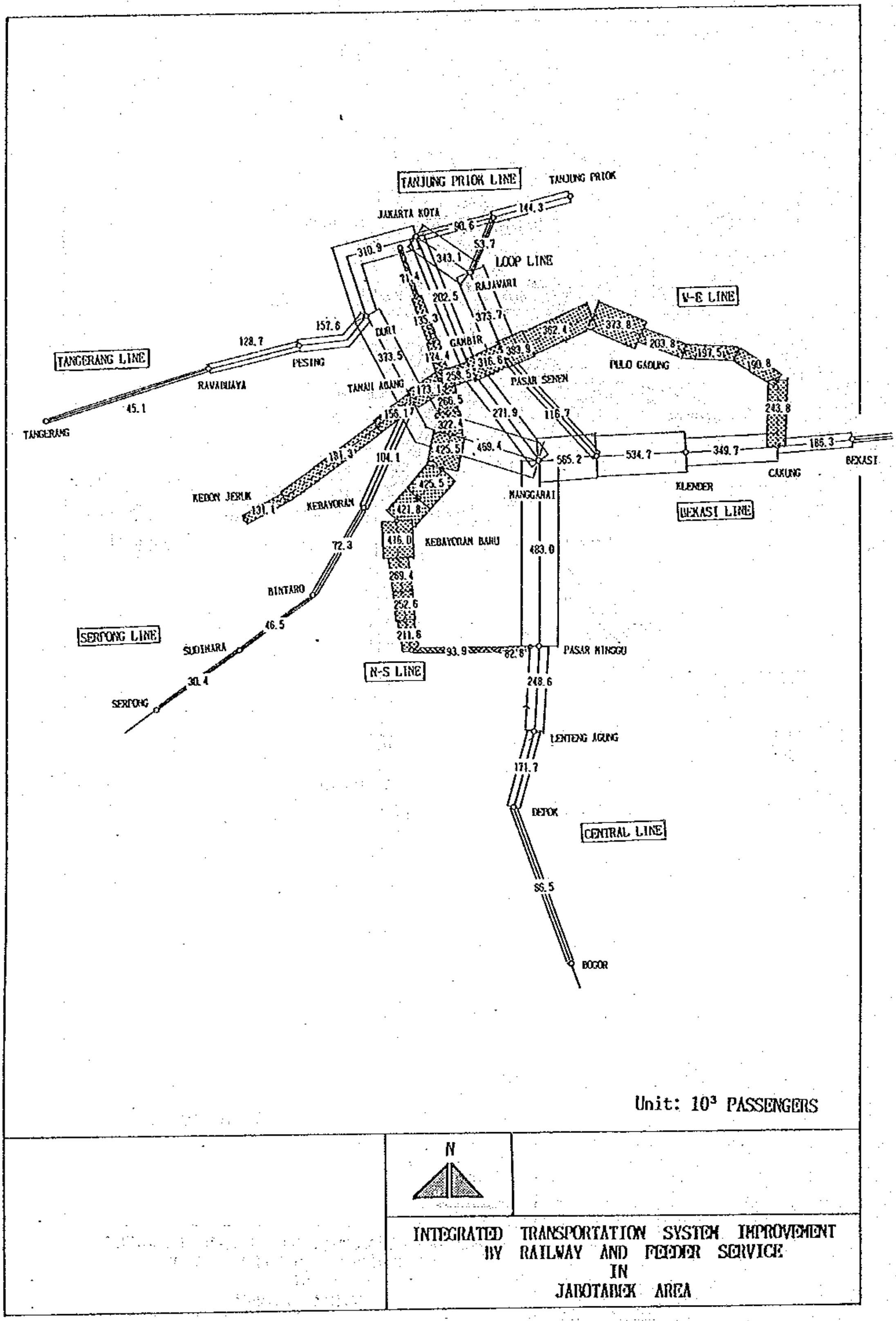


Fig. 6.3.4.6 No. of Railway Passengers

(Case 052: Ry2, BC01)

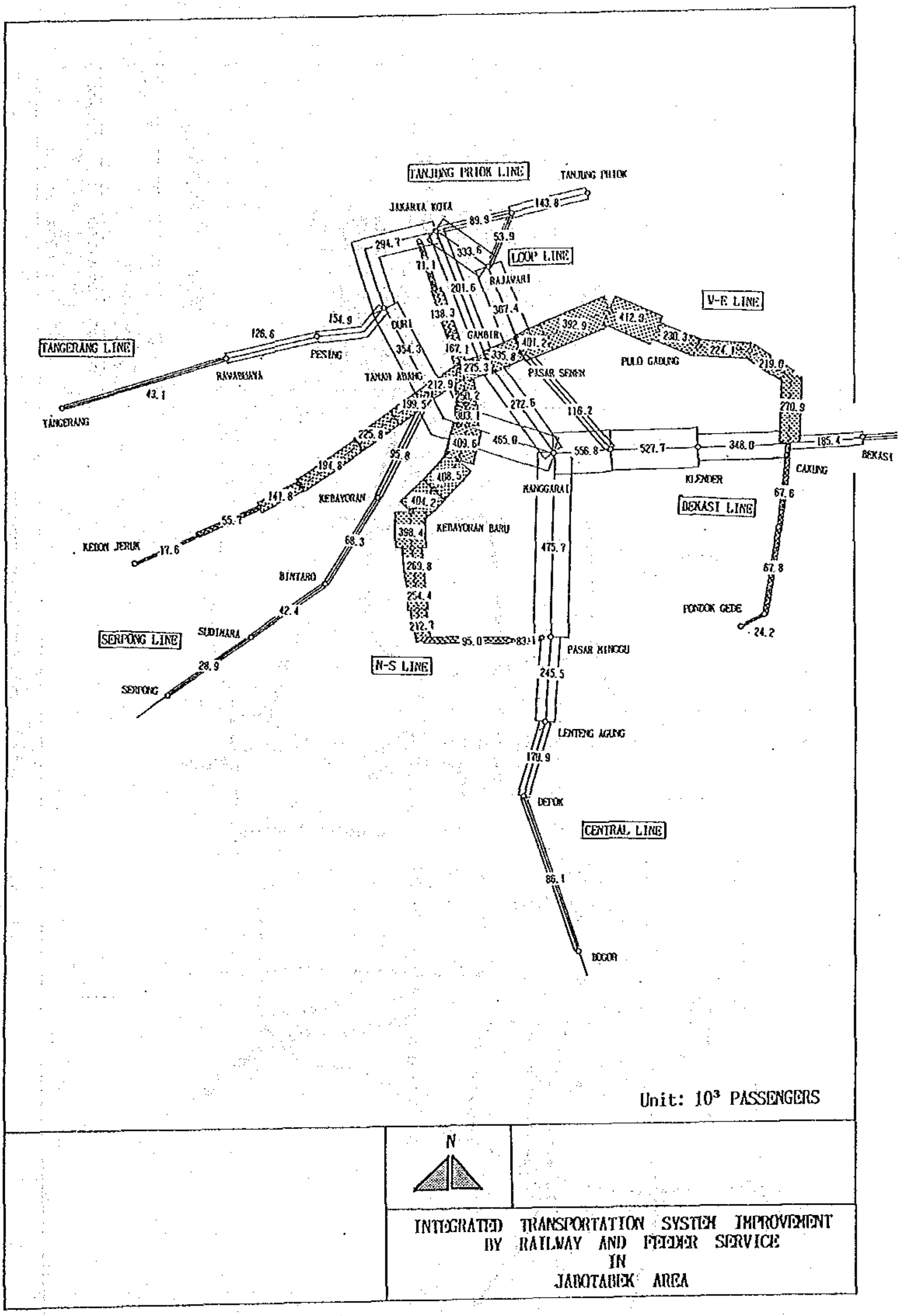


Fig. 6.3.4.7 No. of Railway Passengers

(Case 055: Ry2, BC02)

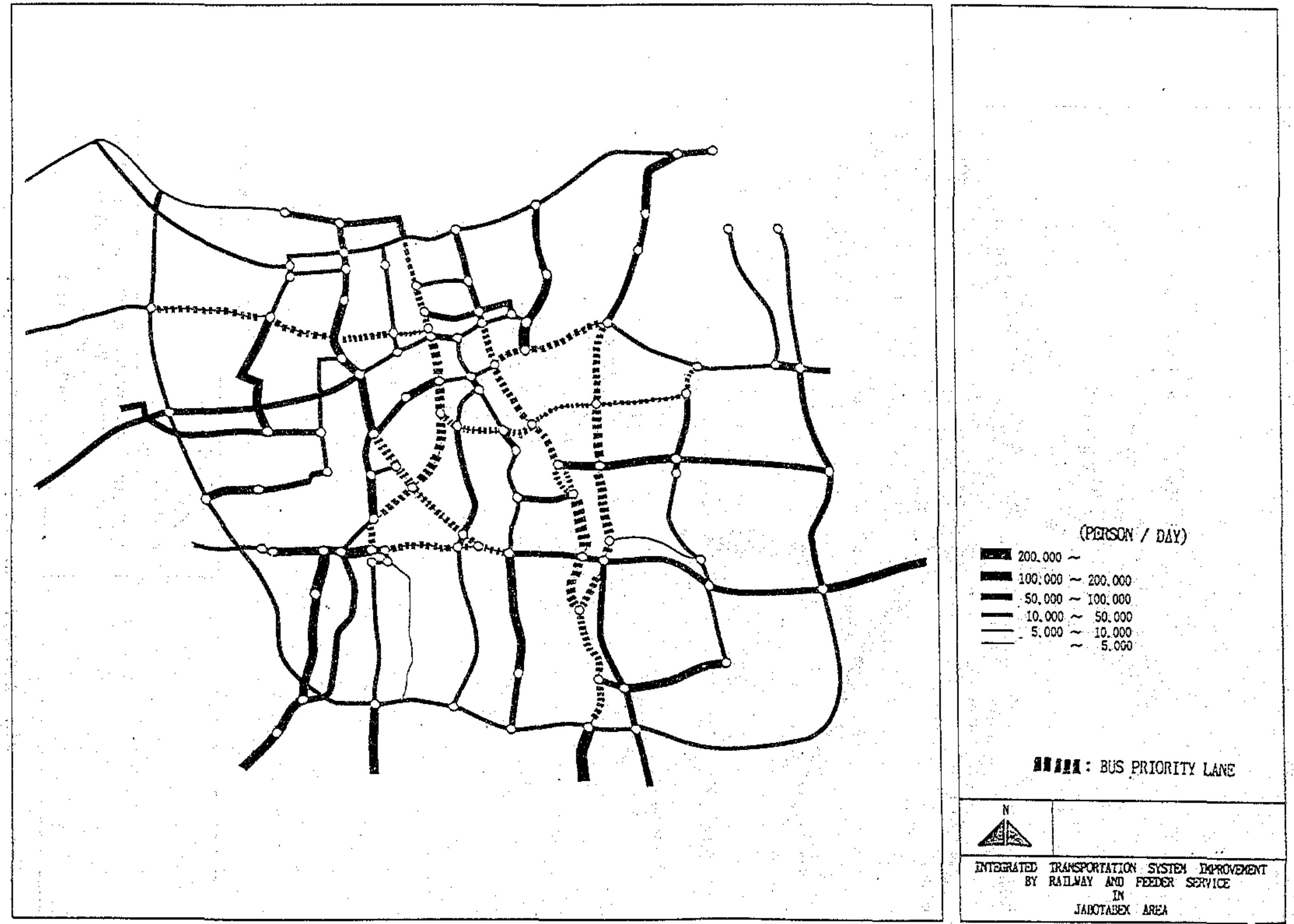


Fig. 6.3.4.8 Number of Bus Passengers

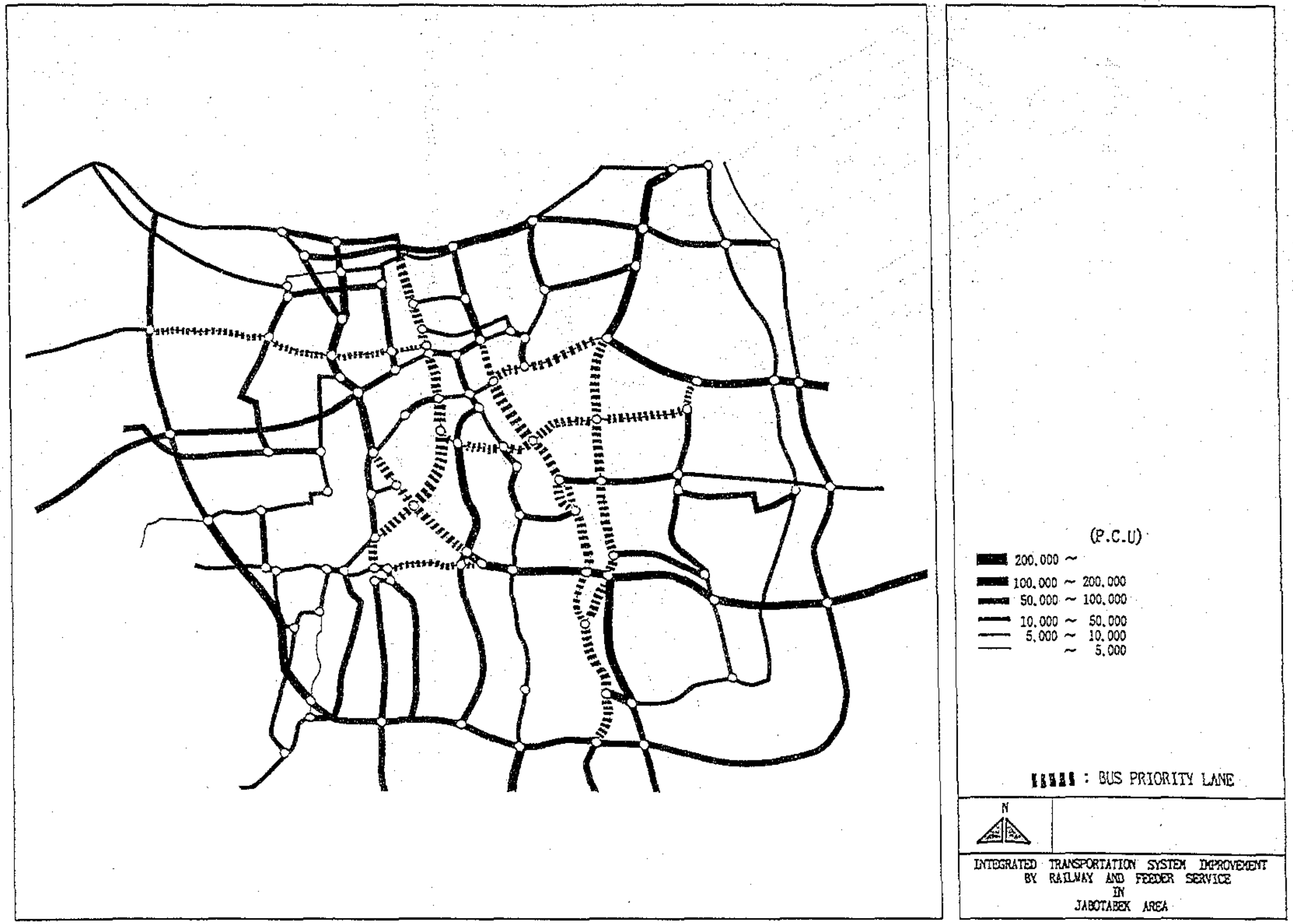


Fig. 6.3.4.9 Traffic Volume in PCU

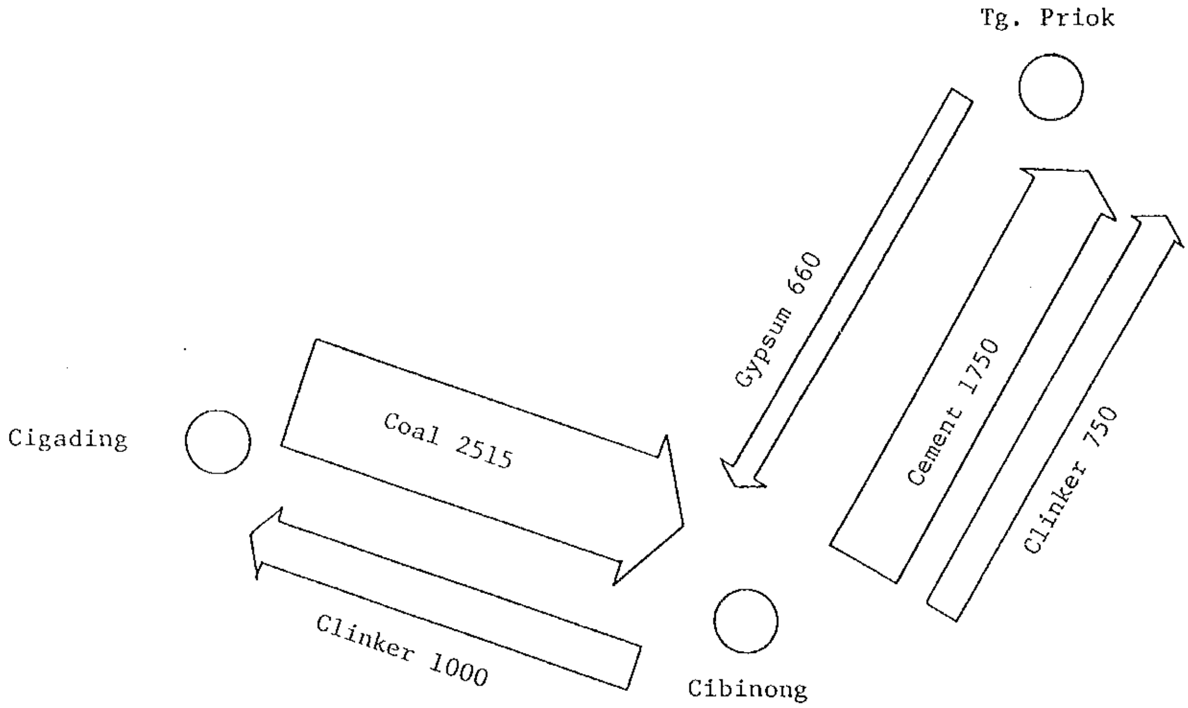


Fig. 6.3.4.10 Freight Transportation on Cibinong Line

Source: "Developed Summary of Feasibility Study of the U.K. Association for the JABOTABEK Railway Project" March 1986

CHAPTER 7 SELECTION OF OPTIMAL PATTERN

Chapter 7 Selection of Optimal Pattern

7-1 Economic Evaluation

7-1-1 Methodology

(1) Generalized cost approach

In order to select the optimum alternative pattern among 6 alternatives for Master Plan, a generalized cost will be calculated for each alternative pattern and, besides generalized cost, the Steering Committee will carry out the overall evaluation of the alternative patterns from various social aspects. This approach adopted by JICA study team has been presented in the Inception Report, and a generalized cost will be calculated for each alternative pattern at 2005 and will be used as an evaluation index for comparison of alternative patterns. The outline of calculation method of generalized cost will be described in the following paragraphs. BC00 will be considered as "without" case and other 6 alternative patterns will be considered as "with" cases. Generalized cost will be calculated as the difference between "with" and "without" cases.

Generalized cost is given by the following equation:

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

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

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

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

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

V = time value per passenger

B_i = other benefits of alternative i (in 2005)

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

(2) Basic idea for use of annualized generalized cost at 2005

Without considering the difference of effects due to the various investment schedules in the period between 1990 and 2005 during which the master plan is formulated year by year, and also without considering the contribution of the benefits generated by partially completed master plan in the same period mentioned above, annualized general cost index, cost/performance of alternatives for master plan will be evaluated at their completed situations at 2005.

Generalized cost index, which is calculated for 2005 as an annualized cost, may become a further better evaluation index, if it is calculated based on the present value of investment and benefits which have taken place during the period of 1990 to 2005. However, we may have numerous conceivable proposals for investment schedule between 1990 and 2005, and it may not be efficient to calculate by the above mentioned present value method. In this regard, the annually calculated generalized cost approach which is proposed by JICA study team is considered efficient and sufficient for relative comparison analysis of many large scale alternative patterns.

Performance is related to the item of VT_i which represents the annual total time cost for all modes of transportation in JABOTABEK Area (the value as the difference from that for BC00) and other benefits such as development value of the land under the elevated structure. Cost is given by IC_i, annual investment cost and OC_i, annual operating cost, both for all transportation systems in JABOTABEK Area.

(3) Calculation of VT_i and other benefits

T_i, annual total travel time in 2005 is calculated based on demand forecast at 2005. V, unit time value per one traveller, will be suitably estimated.

Other benefits include development value of land under elevated structure or vacant land from which Kota Station will be shifted.

(4) Calculation of cost

Calculation of ICi

All investment costs between 1990 and 2005 will be broken down into several major items, and for each item, service life will be assumed. Then IC_i is given by the following equation:

$$IC_i = \sum_k \frac{TIC_i k}{L_k}$$

where, $TIC_i k$ = total investment for k-th item made between 1990 and 2005.

Lk = service life of k-th item.

The usual broken down items for the railway systems and their service lives will be prepared appropriately. With respect to road transportation system, the similar data could be provided.
The basic idea underlying this calculation method is that to keep its function properly, each major item, say k-th item, which constitutes a master plan, will necessitate annual reinvestment cost of $TIC_i k/L_k$ on an average from the long term and macroscopic point of view.

Calculation of OCi

With respect to railway systems, train operation plan and facilities plan will be prepared based on demand forecast and with due consideration on track length, invested facilities and equipments, such items as car-kilometers, personnel, electric power, fuel, maintenance (materials and subcontract) will be suitably considered for calculation of annual expenditures.

With respect to road transportation, based on demand forecast at 2005, necessary number of road vehicles, total vehicle kilometers, will be estimated and with due consideration on these, annual operating expenditures will be estimated taking into consideration such items as personnel, fuel, maintenance of vehicle (tyre, etc.) and road repair.

(5) Justification of adoption of annualized generalized cost approach for evaluation of alternative patterns

The followings support the appropriateness of adoption of annualized generalized cost for evaluation of alternative patterns at 2005.

1) The investment levels for railway and road were set up based on the discussion with the counterpart team and Indonesian authorities concerned, and are considered to cover the realistic range of investments scale for railway and road. In this regard, the 6 combinations of these investment levels could be considered to cover the realistically conceivable combination of investment for railway and road. Thus the optimum alternative pattern among these 6 combinations would give us the optimal combination of investment level for railway and road in JABOTABEK Area.

2) Optimality after 2005

a) In case traffic demand is not increased significantly after 2005, the evaluation by annual generalized cost will be appropriate based on the basic idea given in (2) above.
It is because $GC_i = IC_i + OC_i + VT_i - B_i$ will take a constant value after 2005.

b) In case the traffic demand is increased significantly after 2005

If we assume that the minimum investment will be made for railway and road so that after 2005 they maintain respectively the same service level as that of 2005, railway traffic share and that of road will be, after 2005, remain the same as those at 2005.

In this case, each item of $GC_i = IC_i + OC_i + VT_i - B_i$, namely VT_i will increase approximately at the rate of traffic demand increase. B_i will be composed of constant part and variable part, and variable part will increase approximately at the rate of traffic demand forecast. OC_i and IC_i may be assumed to increase approximately at the rate of traffic demand increase. As the result, even in the case the traffic demand increases after 2005, the relation among GC_is in terms of magnitude will not change after 2005. In this regard comparative analysis of alternative patterns by means of annual generalized cost in 2005 makes sense.

3) When many large scale packages which are alternatives for a master plan are to be evaluated for comparison, such simplified and rational methodology as annualized generalized cost approach will be necessary, considering time frame constraint and limited resources.

(6) Evaluation criteria

Annualized generalized cost index will be calculated for each alternative pattern in the way explained in the above paragraphs. The pattern which has the minimum generalized cost index will be a candidate for the optimum pattern. However as mentioned above, the annualized generalized cost is one index for evaluation. The Steering Committee, which is composed of various experts from the wide range of the economic and social field, will select the optimal pattern based on the overall evaluation, with annualized generalized cost being used as one evaluation index.

7-1-2 Economic Costs

(1) Railway investment cost

Table 7.1.2.1 and 7.1.2.2 show railway investment costs by project and by investment item. The former shows the cost for BC01 case while the latter for BC02 case. These project costs were aggregated into the alternative cases described in chapter 5 and were converted into economic cost through the same method as described in the same chapter. Table 7.1.2.3 shows the economic cost of railway investment by case and by investment item. Table 7.1.2.4 shows annualized costs by case and by item with useful life. The land acquisition costs were annualized by using an official discount rate.

(2) Road investment costs

Road investment costs to complete the primary and secondary road development, the traffic management projects and the tollway development plan were described in Chapter 5. The costs in financial and economic terms are summarized in Table 7.1.2.5. The total economic cost was annualized by dividing by 25 which is the assumed useful life of roads.

(3) Mass transit system investment costs

As described in Chapter 5, the LRT system was selected as the mass transit system for the generalized cost calculation. The annualized investment cost of the system is shown in Table 7.1.2.6. The annualization method is the same as the railway investment.

Table 7.1.2.1 Investment Cost of Railway Project (Case 051 - 053)
(Financial Cost in Million Rupiahs)

Itmes \ Project Number	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	Total
Civil Engineering	32172	24180	0	239941	30444	229712	114105	4565	3009	32681	2431	32617	0	284	347705	0	1093846
Foreign Portion	25567	12636		126791	12636	144197	74705	2265	1970	18586	2305	26090		188	270010		717946
Local Portion Labour Cost	1982	2676		33945	5342	25655	11820	690	312	3373	38	1958		29	23309		111129
Local Portion Others	4623	8868		79205	12466	59860	27580	1610	727	10722	88	4569		67	54386		264771
Station Building	0	490	0	84859	0	78313	0	19032	1495	0	0	0	0	3525	0	0	187714
Foreign Portion		322		60059		60568		12462	978					2305			136694
Local Portion Labour Cost		50		7440		5324		1971	155					366			15306
Local Portion Others		118		17360		12421		4599	362					854			35714
Track	50565	0	0	15973	8904	12405	0	32108	0	0	0	52927	0	0	351659	0	524541
Foreign Portion	43295			6673	6821	6727		28904				45346			340146		477912
Local Portion Labour Cost	2181			2790	625	1703		961				2274			3454		13988
Local Portion Others	5089			6510	1458	3975		2243				5307			8059		32641
Signals	3661	0	0	24050	3921	22560	0	0	0	0	0	3847	0	0	112480	0	170519
Foreign Portion	3404			20020	3417	20194						3578			109612		160225
Local Portion Labour Cost	77			1209	151	710						81			860		3088
Local Portion Others	180			2821	353	1656						188			2008		7206
Telecommunications	2411	0	0	980	415	907	0	0	0	0	0	2527	0	0	73723	0	80963
Foreign Portion	2224			670	348	670						2332			71636		77880
Local Portion Labour Cost	56			93	20	71						59			626		925
Local Portion Others	131			217	47	166						136			1461		2158
Workshop	0	0	0	0	10484	0	0	0	0	0	0	0	0	0	0	0	10484
Foreign Portion					4100												4100
Local Portion Labour Cost					1915												1915
Local Portion Others					4469												4469
Electric Power Facilities	2128	0	0	4089	2152	4056	0	0	0	0	0	2227	0	0	5554	0	20206
Foreign Portion	2010			3779	1715	3819						2104			5481		18908
Local Portion Labour Cost	35			93	131	71						37			22		389
Local Portion Others	83			217	306	166						86			51		909
Catenary	5473	0	0	7549	2253	6618	0	7185	0	0	34861	5725	0	0	11680	0	81344
Foreign Portion	3940			4449	1715	4489		6218			28220	4127			10747		63905
Local Portion Labour Cost	460			930	161	639		290			1992	479			280		5231
Local Portion Others	1073			2170	377	1490		677			4649	1119			653		12208
Machinary	0	0	0	0	3484	0	0	0	0	0	0	0	0	0	0	0	3484
Foreign Portion					3417												3417
Local Portion Labour Cost					20												20
Local Portion Others					47												47
Rolling Stocks	0	0	127038	0	0	0	0	0	0	0	0	0	89674	0	11953	89674	318339
Foreign Portion			125746										88762		9916	88762	313186
Local Portion Labour Cost			1292										912		2037	912	5153
Local Portion Others															0		0
Land Aquisition and Compensation	481	8232	0	0	5712	13013	0	0	0	19824	0	0	0	0	18393	0	65655
Foreign Portion																	0
Local Portion Labour Cost																	0
Local Portion Others	481	8232			5712	13013				19824					18393		65655
Total	96891	32902	127038	377441	67769	367584	114105	62890	4504	52505	37292	99870	89674	3809	933147	89674	2557095
Foreign Portion	80440	12958	125746	222441	34169	240664	74705	49849	2948	18586	30525	83577	88762	2493	817548	88762	1974173
Local Portion Labour Cost	4791	2726	1292	46500	8365	34173	11820	3912	467	3373	2030	4888	912	395	30588	912	157144
Local Portion Others	11660	17218	0	108500	25235	92747	27580	9129	1089	30546	4737	11405	0	921	85011	0	425778

Table 7.1.2.2 Investment Cost of Railway Project (Case 054 - 056)
(Financial Cost in Million Rupiahs)

Itmes \ Project Number	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	Total
Civil Engineering	32172	24180	0	239941	30444	229712	114105	4565	3009	32681	2431	32617	0	284	347705	0	1093846
Foreign Portion	25567	12636		126791	12636	144197	74705	2265	1970	18586	2305	26090		188	270010		717946
Local Portion Labour Cost	1982	2676		33945	5342	25655	11820	690	312	3373	38	1958		29	23309		111129
Local Portion Others	4623	8868		79205	12466	59860	27580	1610	727	10722	88	4569		67	54386		264771
Station Building	0	490	0	84859	0	78313	0	19032	1495	0	0	0	0	3525	0	0	187714
Foreign Portion		322		60059		60568		12462	978					2305			136694
Local Portion Labour Cost		50		7440		5324		1971	155					366			15306
Local Portion Others		118		17360		12421		4599	362					854			35714
Track	50565	0	0	15973	8904	12405	0	32108	0	0	0	52927	0	0	351659	0	524541
Foreign Portion	43295			6673	6821	6727		28904				45346			340146		477912
Local Portion Labour Cost	2181			2790	625	1703		961				2274			3454		13988
Local Portion Others	5089			6510	1458	3975		2243				5307			8059		32641
Signals	3661	0	0	24050	3921	22560	0	0	0	0	0	3847	0	0	112480	0	170519
Foreign Portion	3404			20020	3417	20194						3578			109612		160225
Local Portion Labour Cost	77			1209	151	710						81			860		3088
Local Portion Others	180			2821	353	1656						188			2008		7206
Telecommunucations	2411	0	0	980	415	907	0	0	0	0	0	2527	0	0	73723	0	80963
Foreign Portion	2224			670	348	670						2332			71636		77880
Local Portion Labour Cost	56			93	20	71						59			626		925
Local Portion Others	131			217	47	166						136			1461		2158
Workshop	0	0	0	0	10484	0	0	0	0	0	0	0	0	0	0	0	10484
Foreign Portion					4100												4100
Local Portion Labour Cost					1915												1915
Local Portion Others					4469												4469
Electric Power Facilities	2128	0	0	4089	2152	4056	0	0	0	0	0	2227	0	0	5554	0	20206
Foreign Portion	2010			3779	1715	3819						2104			5481		18908
Local Portion Labour Cost	35			93	131	71						37			22		389
Local Portion Others	83			217	306	166						86			51		909
Catenary	5473	0	0	7549	2253	6618	0	7185	0	0	34861	5725	0	0	11680	0	81344
Foreign Portion	3940			4449	1715	4489		6218			28220	4127			10747		63905
Local Portion Labour Cost	460			930	161	639		290			1992	479			280		5231
Local Portion Others	1073			2170	377	1490		677			4649	1119			653		12208
Machinary	0	0	0	0	3484	0	0	0	0	0	0	0	0	0	0	0	3484
Foreign Portion					3417												3417
Local Portion Labour Cost					20												20
Local Portion Others					47												47
Rolling Stocks	0	0	119565	0	0	0	0	0	0	0	0	0	89674	0	11953	97146	318338
Foreign Portion			118349										88762		9916	96158	313185
Local Portion Labour Cost			1216										912		2037	988	5153
Local Portion Others																	0
Land Aquisition and Compensation	481	8232	0	0	5712	13013	0	0	0	19824	0	0	0	0	18393	0	65655
Foreign Portion																	0
Local Portion Labour Cost																	0
Local Portion Others	481	8232			5712	13013				19824					18393		65655
Total	96891	32902	119565	377441	67769	367584	114105	62890	4504	52505	37292	99870	89674	3809	933147	97146	2557094
Foreign Portion	80440	12958	118349	222441	34169	240664	74705	49849	2948	18536	30525	83577	88762	2493	817548	96158	1974172
Local Portion Labour Cost	4791	2726	1216	46500	8365	34173	11820	3912	467	3373	2030	4888	912	395	30588	988	157144
Local Portion Others	11660	17218	0	108500	25235	92747	27580	9129	1089	30546	4737	11405	0	921	85011	0	425778

Table 7.1.2.3 Economic Investment Cost of Railway Project

(Million Rp.)

Itmes \ Case	051	052	053	054	055	056
Civil Engineering	55126	726737	1069776	55126	726737	1069776
Station Building	479	181020	184467	479	181020	184467
Track	50102	170647	521574	50102	170647	521574
Signals	3645	57566	169864	3645	57566	169864
Telecommunications	2399	7177	80767	2399	7177	80767
Workshop	0	10078	10078	0	10078	10078
Electric Power Facilities	2120	14574	20123	2120	14574	20123
Catenary	5375	68614	80234	5375	68614	80234
Machinary	0	3480	3480	0	3480	3480
Rolling Stocks	127038	216712	318339	119565	209239	318338
Land Acquisition and Compensation	7921	42965	59686	7921	42965	59686
Total	254206	1499570	2518388	246733	1492097	2518387

Table 7.1.2.4 Annualized Investment Cost of Railway Project

(Million Rp.)

Itmes \ Case	Life	051	052	053	054	055	056
Civil Engineering	50	1103	14535	21396	1103	14535	21396
Station Building	45	11	4023	4099	11	4023	4099
Track	25	2004	6826	20863	2004	6826	20863
Signals	20	182	2878	8493	182	2878	8493
Telecommunications	35	69	205	2308	69	205	2308
Workshop	45	0	224	224	0	224	224
Electric Power Facilities	30	71	486	671	71	486	671
Catenary	45	119	1525	1783	119	1525	1783
Machinary	20	0	174	174	0	174	174
Rolling Stocks	25	5082	8668	12714	4783	8370	12714
Land Acquisition and Compensation	-	1188	6445	8953	1188	6445	8953
Total		9828	45988	81677	9529	45690	81677

Table 7.1.2.5 Road Investment Cost

- BC01 and BC02 -

(Million Rp.)

	Foreign Portion	Local Portion Labour	Others	Financial Total	Economic Total
Primary and Secondary Road	423100	85400	321100	829600	800409
Traffic Management and etc.	85000	17100	64500	166600	160736
Tollway	988100	199400	749900	1937400	1869227
Total	1496200	301900	1135500	2933600	2830373

Table 7.1.2.6 Annualized Investment Cost of Mass Transit System

(Million Rp.)

Case	051	052	053	054	055	056
Total Investment (Financial Cost)	149496	147036	146568	190022	188552	188147
Foreign Portion	89101	86666	86202	112026	110571	110170
Local Portion - Labour -	11867	11842	11838	14267	14252	14248
Local Portion - Others -	48528	48528	48528	63729	63729	63729
Total Investment (Economic Cost)	145084	142624	142156	184228	182758	182353

7-1-3 Economic Benefits

(1) Maintenance & operation cost difference

The difference of the maintenance and operation costs between "with" and "without" cases were appropriated as benefits generated by the execution of the each "with" case. The costs of the "with" cases were calculated reflecting transportation demand of the cases basically.

1) Railway

a) Maintenance Costs

The maintenance costs of railway were calculated according to the maintenance rates and the total investment costs by asset. The method was described in 5-2-4 (1). The costs by case are shown in Table 7.1.3.1. The costs for the New Cibinong Line operation are included.

b) Operation costs

The operation costs of railway comprise personnel costs, electricity costs and fuel cost. Table 7.1.3.2 shows these costs by case. The average personnel costs by occupation are shown in 5-2-4 (1). The costs for the New Cibinong Line operation are included.

2) Road

a) Tollways

The maintenance and operation cost of tollways were estimated according to the existing tollway cost data.

The annual cost per 1 km is 80 million Rp. in terms of financial cost. The economic cost were assumed 90% of the financial cost. The annual costs for the tollways were estimated Rp. 6,934 million is terms of economic cost.

Table 7.1.3.1 Annual Maintenance Cost of Railway Masterplan

(Million Rp.)

Itmes \ Case	Rate	051	052	053	054	055	056
Civil Engineering	0.0017	94	1235	1819	94	1235	1819
Station Building	0.0067	3	1213	1236	3	1213	1236
Track	0.1500	7515	25597	78236	7515	25597	78236
Signals	0.0210	77	1209	3567	77	1209	3567
Telecommunications	0.1200	288	861	9692	288	861	9692
Workshop	0.0057	0	57	57	0	57	57
Electric Power Facilities	0.0130	28	189	262	28	189	262
Catenary	0.0130	70	892	1043	70	892	1043
Machinary	0.0500	0	174	174	0	174	174
Rolling Stocks	0.0137	1689	1843	3417	1587	1740	3417
Land Acquisition and Compensation	-	0	0	0	0	0	0
Total		9763	33271	99503	9661	33169	99503

Table 7.1.3.2 Annual Operation Costs of Railway Masterplan

(Million Rp.)

Itme \ Case	05B	051	052	053	054	055	056
Personnel Cost	6518	7253	7320	7545	7236	7247	7530
Driver	668	945	970	998	943	939	990
Conductor	576	829	852	877	826	823	870
Station Staff	3136	3136	3136	3151	3136	3136	3151
Workshop	1222	1339	1350	1439	1332	1343	1439
Depot	916	1004	1012	1080	999	1007	1080
Electricity Cost	18945	29793	33237	34658	32927	33160	34474
Fuel Cost	1197	1245	1065	1148	1245	1065	1148
Total	26660	38291	41622	43351	41408	41472	43152

b) Arterial and secondary roads

The annual maintenance cost for the arterial and secondary roads were estimated Rp. 48,057 million. The assumption of the estimation is that the cost is 5% of the total investment cost in economic terms.

3) Mass transit system

The maintenance and operation costs of the mass transit system were estimated as same as the railway costs. The costs are shown in Table 7.1.3.3.

4) Road vehicle

The operation costs of road vehicles were estimated for the established cases using the same method described in 5-2-4 (1). The costs to transport the products and the materials of the Cibinong Cement plants by truck are included.

(2) Time savings

The time saving benefits considered in the generalized cost calculation are the travel time decrease of travelers, the freight transportation time decrease and the waiting time decrease of passengers and freight at major railway crossings.

1) Travel time decrease

The travel time decrease was calculated from the difference of total travel time of public mode passengers and road vehicle users between "with" and "without" cases. The time value variables to convert the time saved into monetary term were described in 5-2-4 (1).

2) Freight transportation time decrease

The freight transportation time savings by truck derived from the decreased traffic congestion of roads were calculated as same as the method described in 5-4-2 (1). In addition, time savings caused by the operation of the New Cibinong Railway Line were appropriated, assuming that some parts of products and materials of Cibinong Cement plants would be transported by railway as explained in Chapter 6. The estimated time savings of the freight transportation are shown in Table 7.1.3.4. The time value of the freight was estimated Rp. 54.8 per ton-hour.

3) Time savings at major railway crossings

The cases of 052 and 055 include the track elevation project of the East Line and the flyover construction project of the West Line. By the completion of these projects, the waiting times of road vehicles at the railway crossings disappear. On the contrary, the waiting times at the other railway crossings are expected to increase because of the increased frequency of the JABOTABEK trains.

Table 7.1.3.5 shows the waiting times per a day at the major railway crossings which were calculated according to the future train frequency by case. The time saving benefits at the major railway crossings in monetary term are shown in Table 7.1.3.6.

(3) Utilization of Land

As described in Chapter 5, the cases of 052 and 055 includes the track elevation project of the East Line and the new Kota station construction project.

Table 7.1.3.3 Maintenance and Operation Costs of Mass Transit System

(Million Rp.)

Case	051	052	053	054	055	056
Total Investment (Financial Cost)	52931	49085	48634	71843	68617	68402
Foreign Portion	8471	7855	7783	11490	10974	10939
Local Portion - Labour -	31754	29447	29176	43119	41183	41054
Local Portion - Others -	12706	11783	11675	17234	16460	16409
Total Investment (Economic Cost)	51776	48014	47573	70276	67121	66910

Table 7.1.3.4 Time Saving Benefeit of Freight Transport by Cibinon Line Project

(thousand hours, million Rp. per year)

	051	052	053	054	055	056
Railway Ton-Hour Savings	0.0	-823.0	1247.0	0.0	-823.0	1247.0
Truck Ton-Hour Savings	0.0	0.0	-10180.0	0.0	0.0	-10180.0
Railway Time Saving Benefit	0.0	-45.1	68.3	0.0	-45.1	68.3
Truck Time Saving Benefit	0.0	0.0	-557.9	0.0	0.0	-557.9

By the execution of the track elevation, the land under the elevated railway track is expected to be utilized. The land of the existing Kota station is also expected to be utilized after the completion of the new station. The benefit derived from the utilization was calculated as shown in Table 7.1.3.7, assuming the annual benefit is 15% of the prevailing price of the land.

Table 7.1.3.7 Benefits from Land Utilization

Location	Area (sq. meter)	Price (Million Rp.)	Benefit (Million Rp.)
Under the East Line	101,116	33,903	5,085
Existing Kota Area	61,200	55,100	8,262

Source: PJKA, study team

7-1-4 Result of Generalized Cost Analysis

The result of the generalized cost analysis is shown in Table 7.1.4.1. The case 055 is the most generalized cost saving improvement case among the six alternative cases. But the case 052 is the most preferable in terms of the annualized benefit and cost ratio.

Table 7.1.3.5 Waiting Time at Railway Crossing

(Minutes per day)

No.	Name of Road \ Case	05B	051	052	053	054	055	056
1	Jl.Manggadua	141	177	0	0	177	0	0
2	Jl.Gunung Sahari	141	177	0	0	177	0	0
3	Jl.Industri	141	177	0	0	177	0	0
4	Jl.Angkasa	141	177	0	0	177	0	0
5	Jl.Garuda	141	177	0	0	177	0	0
6	Jl.Kramat Bundar	141	177	0	0	177	0	0
7	Jl.Pramuka	141	177	0	0	177	0	0
8	Jl.Teuk Cik Ditiro	240	353	0	0	353	0	0
9	Jl.KH.Mas Mansur	240	353	0	0	353	0	0
10	Jl.KH.Hasyim Ashari	240	353	0	0	353	0	0
11	Jl.Tubagus Angke	240	353	0	0	353	0	0
12	Jl.Bandengan	240	353	0	0	353	0	0
13	Jl.Lapangan	210	237	237	270	237	237	237
14	Jl.Pahlawan	210	237	237	270	237	237	237
15	Jl.Raya Pasar Minggu	210	237	237	270	237	237	237
16	Jl.Pasar Depok	210	237	237	270	237	237	237
17	Jl.Bakasi Timur Raya	240	353	353	353	353	353	353
18	Jl.Bakasi Raya	240	353	353	353	353	353	353
19	Jl.Prof.Dr.Ltumeten	57	57	68	77	57	68	68
20	Jl.Daan Mogot	57	57	68	77	57	68	68
21	Bypass to Tol Jakarta Merak	57	57	68	77	57	68	68
22	Jl.Bintaro Prima	63	63	35	35	60	32	34

Table 7.1.3.6 Time Saving Benefit At Railway Crossing

(Million Rp. per year)

No.	Name of Road \ Case	051	052	053	054	055	056
1	Jl.Manggadua	23	-654	-654	45	-654	-654
2	Jl.Gunung Sahari	213	-667	-667	204	-667	-667
3	Jl.Industri	19	-81	-81	19	-81	-81
4	Jl.Angkasa	235	-843	-843	249	-843	-843
5	Jl.Garuda	28	-277	-277	28	-277	-277
6	Jl.Kramat Bundar	36	-1343	-1343	21	-1343	-1343
7	Jl.Pramuka	436	-1918	-1918	449	-1918	-1918
8	Jl.Teuk Cik Ditiro	51	-179	-179	84	-179	-179
9	Jl.KH.Mas Mansur	421	-1747	-1747	325	-1747	-1747
10	Jl.KH.Hasyim Ashari	619	-1575	-1575	622	-1575	-1575
11	Jl.Tubagus Angke	414	-1876	-1876	493	-1876	-1876
12	Jl.Bandengan	63	-900	-900	60	-900	-900
13	Jl.Lapangan	106	85	273	109	83	82
14	Jl.Pahlawan	89	122	257	100	120	120
15	Jl.Raya Pasar Minggu	235	278	506	243	219	219
16	Jl.Pasar Depok	31	31	42	33	34	35
17	Jl.Bakasi Timur Raya	292	41	35	60	40	34
18	Jl.Bakasi Raya	158	158	215	201	203	203
19	Jl.Prof.Dr.Ltumeten	68	128	174	69	130	130
20	Jl.Daan Mogot	-25	21	60	-61	9	10
21	Bypass to Tol Jakarta Merak	-1	12	17	-1	12	12
22	Jl.Bintaro Prima	3	-72	-72	-11	-82	-77

Table 7.1.4.1 Result of Generalized Cost Analysis by Case

(Million Rp.)

Benefit and Cost\ Case	051	052	053	054	055	056
Investment Cost	268126	301827	337047	306881	341520	377156
Railway	9828	45988	81677	9529	45690	81677
Road	113215	113215	113215	113215	113215	113215
Mass Transit	145083	142624	142155	184137	182615	182264
Benefit	-654429	-789938	-768377	-708523	-857557	-839474
Maintenance & Operation	-187947	-221910	-199471	-214297	-245206	-222811
Railway	21394	48233	116195	24409	47981	115996
Road	54991	54991	54991	54991	54991	54991
Mass Transit	51776	48014	47573	70276	67121	66910
Road Vehicle	-316108	-373148	-418230	-363973	-415299	-460707
Time Savings	-466482	-554680	-555559	-494226	-599004	-603317
Railway User	82204	102911	108935	71460	92759	99218
Bus User	-366562	-446016	-454640	-372516	-449829	-458876
Road Vehicle User	-185636	-200321	-199300	-196509	-230643	-232367
At Railway Crossings	3512	-11255	-10553	3340	-11290	-11292
Utilization of Land	0	-13347	-13347	0	-13347	-13347
Generalized Cost Saving	-386303	-488111	-431330	-401642	-516037	-462319
Benefit/Cost	2.44	2.62	2.28	2.31	2.51	2.23

7-2 Selection of Optimal Pattern

Concerning the six alternative patterns, the annual average investment costs and annual generalized cost savings (against BC00) were compared as shown in Fig. 7.2.1.1. Comparisons were also made with respect to the economy and promotional urban development and traffic integration, as shown in Table 7.2.1.1.

The economy was evaluated according to the size of the annual generalized cost savings, the ratio of annual generalized benefits/annual investment in the annual generalized cost, and the scale of investment, namely, the annual mean investment during 1992-2005.

As for the annual mean investment, it was about 32.3 billion RP and 79.3 billion RP, respectively, for the railway and roads during the six-year period until fiscal 1986. These amounts are smaller than that in the current Master Plan. A pattern with a smaller annual mean investment should be more highly evaluated.

As for the promotion of urban development, an evaluation was made of the contribution to development around Kota Station, of enhancing urban continuity via track elevation and flyover construction, and of strengthening the east-west axis. Furthermore, traffic integration via feeder service reinforcement was evaluated.

According to the results of the comprehensive evaluation in Table 7.2.1.1, Pattern 052 or 055 is generally superior. These patterns are generally the same in economic evaluation. However, from the viewpoint of suppressing investment as much as practicable, the survey team tentatively chooses Pattern 052 (Ry2+BC01), but would like to have a final optimal pattern chosen with the broader general evaluation of the Steering Committee of the Government of Indonesia taken into consideration.

In this report, the pattern Ry2+BC01 has been chosen as an objective of the Master Plan.

As seen from Fig. 7.2.1.2, MRT construction cost accounts for 51% of the annual investment under Ry2+BC01.

The cost of construction the MRT was calculated on the assumption that LRT operates underground inside the Inner Ring Road, on elevated tracks outside the Inner Ring Road, and at ground level outside the Outer Ring Road. However, a more detailed study, including the reduction of cost, is required at the F/S stage.

Table 7.2.1.1 Characteristics of Alternative Patterns

Alternative pattern	051	052	053	054	055	056
		BC01			BC02	
Characteristics	Ry1	Ry2	Ry3	Ry1	Ry2	Ry3
1. Economy						
(*1) (annualized generalized cost saving (10^9Rp))	(386) ×	(488) ○	(431) △	(402) △	(516) ◎	(462) ○
Benefit/Investment Ratio (*2)	(2.44)	2.62) ◎	(2.28) △	(2.31) △	(2.51) ○	(2.23) △
(*3) Scale of investment (10^9Rp)	(713) ◎	(814) ○	(897) △	(802) ○	(905) △	(989) ×
2. Urban Development (*4)						
o Development around Kota Station	×	◎	◎	×	◎	◎
o Urban integration via construction of track elevation and flyover	△	◎	◎	△	◎	◎
o Strengthening of east-west axis	○	◎	◎	○	◎	◎
3. Traffic Integration (*4)						
(Feeder service reinforcement)	○	◎	◎	○	◎	◎

(*1)
350 - 400 (×)
400 - 450 (△)
450 - 500 (○)
500 - 550 (◎)

(*2)
2 - 2.2 (×)
2.2 - 2.4 (△)
2.4 - 2.6 (○)
2.6 - (◎)

(*3)
650 - 750 (◎)
750 - 850 (○)
850 - 950 (△)
950 - (×)

(*4)
very good (◎)
good (○)
some (△)
poor (×)

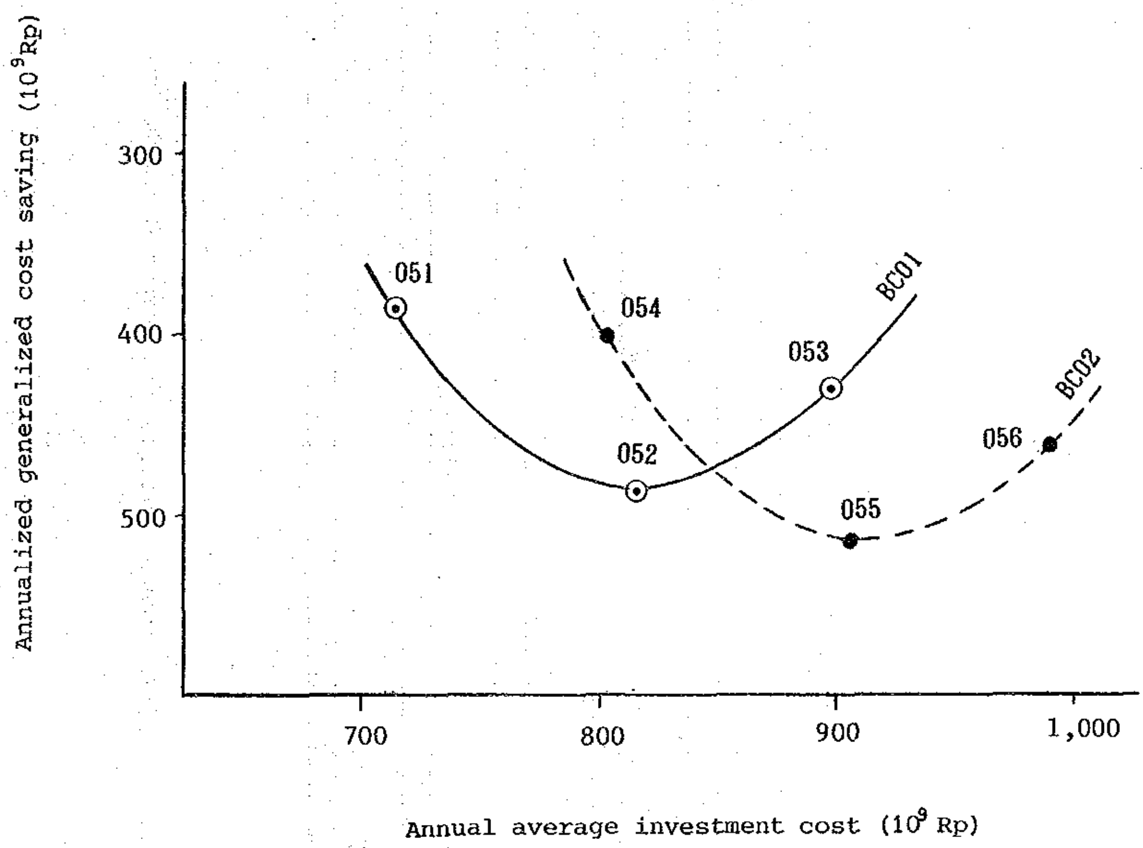


Fig. 7.2.1.1 Annualized generalized cost saving vs. annual average investment cost for each alternative pattern

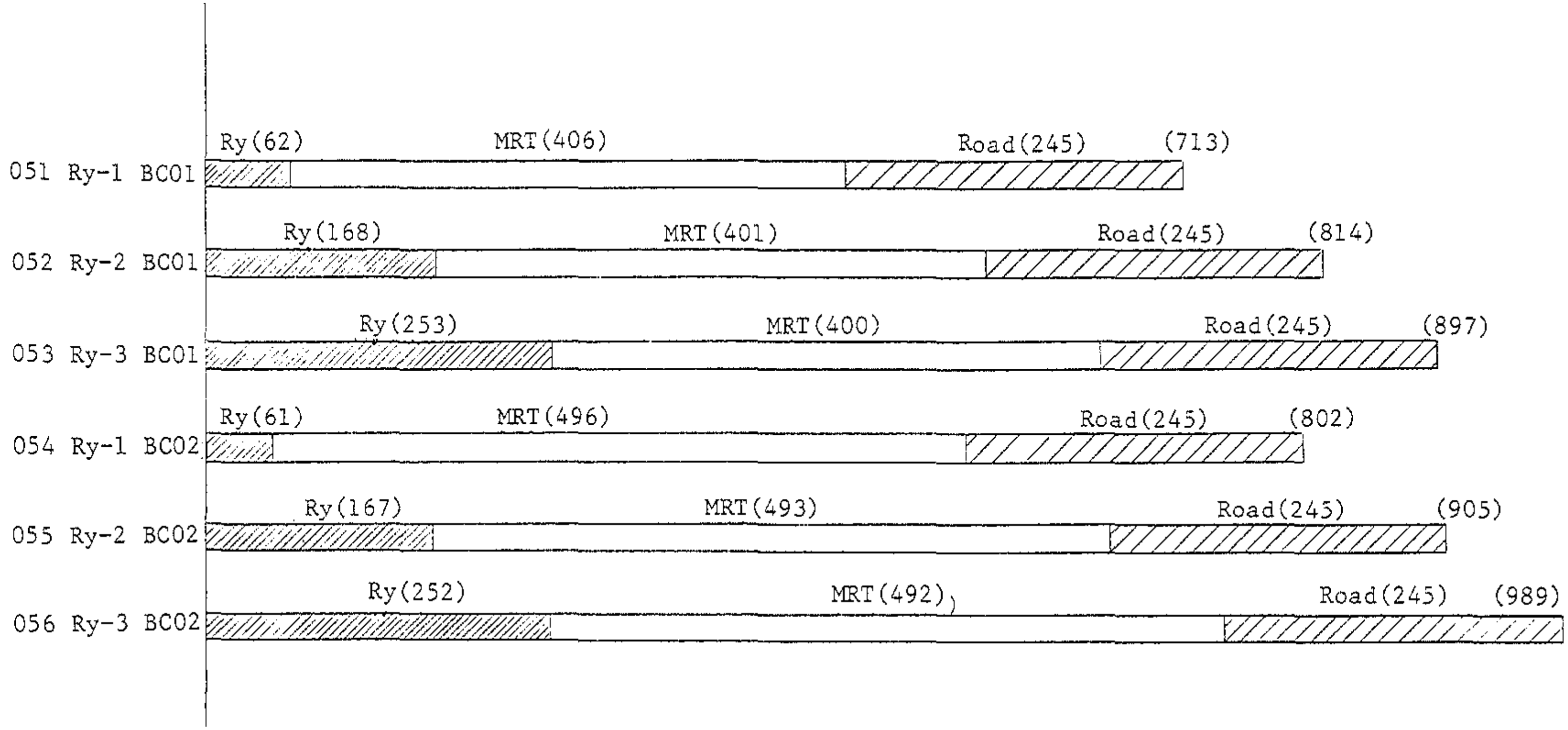


Fig. 7.2.1.2 Annual Average Investment Cost (10^9Rp)

CHAPTER 8 DRAWING-UP OF MASTER PLAN

Chapter 8 Drawing-up of Master Plan

As the result of the comparative study of the cases, which took into account the generalized cost, as mentioned in Section 7-2, case Ry2. BC-01 was chosen, and a master plan has been drawn up for this case.

8-1 Concepts of the Master Plan

For the Railway Case, Ry2 was chosen, thus excluding the Cibinong New Line which was contained in Ry3. Ry2 will lead to a JABOTABEK Railway which will have an increased transportation share as the result of improvement and strengthening of existing facilities.

Although the project items chosen have been briefly described in the preceding Chapter, they will be described in a more detailed and orderly manner below.

(1) The "b" option will be completed by 1992 and will include the following:

1) Automatic signalling will be installed on almost all lines, and all lines except the Tangerang Line will be electrified, resulting in the standardization of the systems of the JABOTABEK Railway.

2) With standardization of the systems, the Kampung Bandan Station will be improved, and pendulum operation at Kota will be eliminated. Electric car operation and automatic signalling along the Extended Loop Line from the Bekasi Line to the Eastern-Western Line will also be possible. However, at this stage, road crossings on the Eastern and Western lines have not yet been eliminated, thus these lines will operate with a minimum headway of 10 minutes.

3) The Central Line will have its crossings eliminated through track elevation between Kota-Mri and through grade separations along the Loop Line at Mri Station, making operation with a 6-minute headway possible.

4) The Serpong Line will operate with 15-minute headway which will be realized through electrification and automatic signalling, and the Tangerang Line will be able to operate with a 20-minute headway as a result of the installation of automatic signalling.

5) In order to ensure operation with the headways mentioned above, a Train Operating Center will be established in Mri.

6) For the improvement of passenger services, feeder service facilities mainly along the Central and Bekasi Lines will be improved. At the same time Jng, Pse and Thb Stations will be improved to accomodate increased passenger flows.

7) The Depok Depot will be expanded to allow for increasing car traffic, and the Mri Workshop will be expanded so that it can provide repair services.

8) In order to achieve the "b" option, a fund containing nearly 50% (1,740 billions) of the Ry2 Project cost will be required.
It is therefore necessary to raise this fund in the relatively short period of time from now until 1992.

(2) Ry2 will be completed by 2005 and will result in the following:

1) An increase in the number of cars to meet demand, and the operation of the Central Line with a 3 minute headway.

2) The Eastern Line will have track elevation, and the Western Line will have flyovers in order to allow for Extended Loop operation with a 6 minute headway.

3) Kota Station will be relocated for ease of transfer between the Central Line and the Loop operation making suitable for 3 minute and 6 minute headway operations.

4) Through the double tracking of the Serpong Line and the electrification of the Tangerang Line, operation with headways of 10 minutes and 15 minutes respectively will be achieved.

For the Road, Case BC-01 was chosen. BC-01 and BC-02 are almost the same in terms of road improvement and management policy.

These will be developed by 2005, however, these road improvements would not be taken up in the Master Plan. For the mass transit system, the track system LRT was chosen, and as it is closely related to the existing railways, it will be taken up in the Master Plan.

8-2 Outline of the Selected Pattern

Those projects included in Ry2 are as shown in Fig. 8.2.1.1.

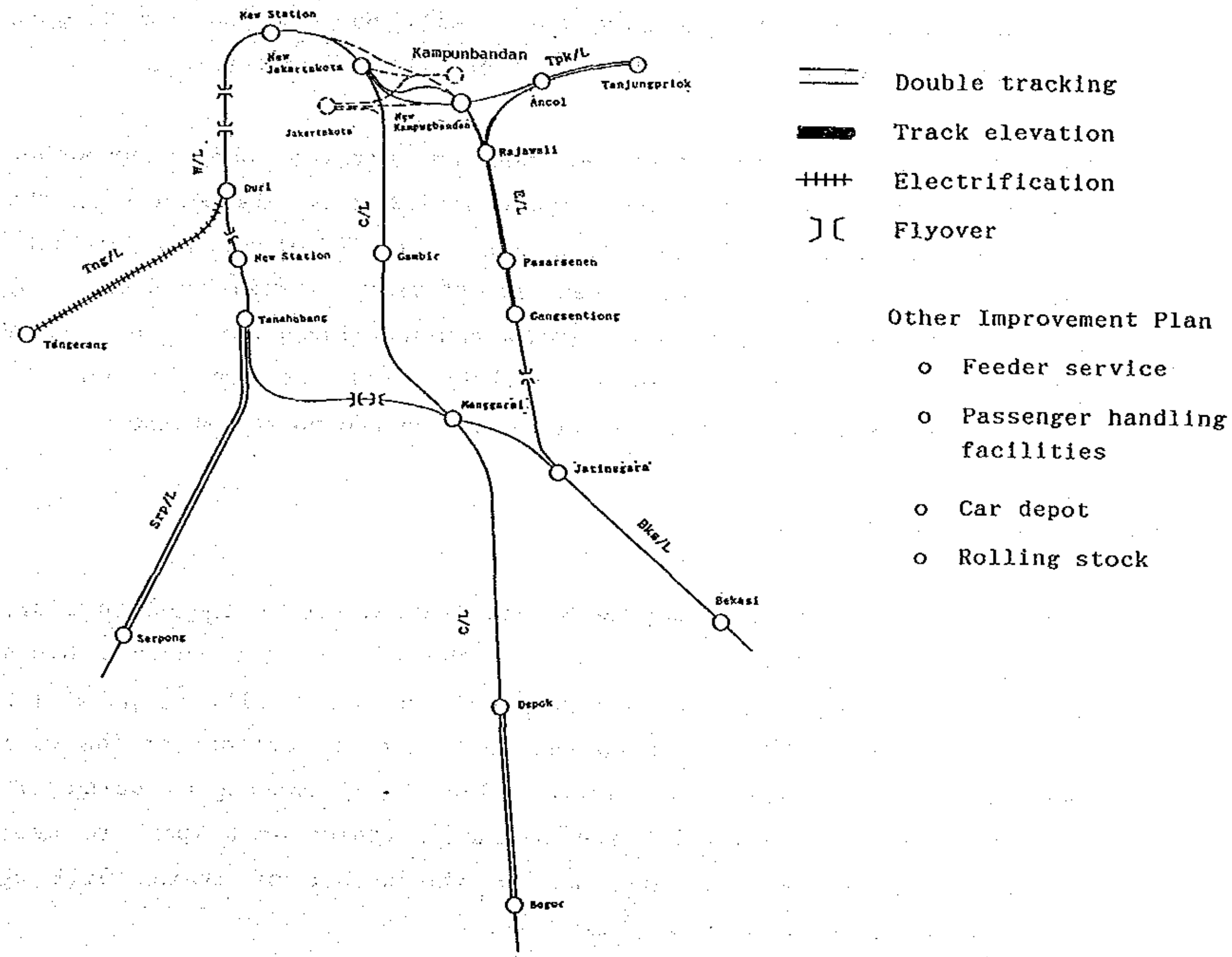


Fig. 8.2.1.1 Railway Improvement Plan (Ry2)

These projects are outlined below.

(1) Double Tracking, Electrification and Automatic Signalling on C/L (Dp-Boo)

A 22.3 km single track extension from Depok to Bogor has been electrified and automatic signalling of this single track will be completed by 1992.

This project calls for the electrification, installation of automatic signalling, and double tracking in order to accomodate the increasing transportation demand in the south of Depok.

Also, for improvement of passenger services, the station buildings will be remodeled, new platform sheds will be constructed, and to ensure punctual operation, the platform widths will be extended and heights elevated, and new overbridges for transfer will be constructed.

New stations will be installed between Citayam and Bojonggedeh (L=5.2 km) and Bojonggedeh and Cilebut (L=4.3 km). In addition, the old line track will be reinforced using rails of greater weight, ballast thickness will be increased and PC sleepers will be used. For track maintenance work, material yards and a maintenance depot with a repair shop for track maintenance equipment will be constructed. To prevent trespassing, a fence will be installed around the stations.

(2) Relocation of Kota Station

When improvements in the Kampung Bandan Station are completed in 1992, there will be a shorter route between the Eastern and Western Lines through the New-Kpb Station, and semi-loop operation will be possible. As a result, JABOTABEK trains on the Loop Line and freight trains will not run directly into Kota Station. Therefore, passengers using C/L from the Loop via Kota will have to change trains at N-Kpb. To meet demand up until 2005, an increase in the number of trains will be necessary both on C/L and the Loop Line.

Running shuttle trains between N-Kpb and Kota, to transfer passengers between C/L and Loop Line would be very inconvenient.

At the same time, the Kota Station is situated in the old urban area of Jakarta, the station building and the other buildings in the vicinity of the station are obsolete, and the road is congested with pedestrians and cars. There is no station plaza, and the station building is immediately in front of the road, which is not very desirable from a safety standpoint.

For these reasons, it is the city side's intention to redevelop the station area. From a railway point of view, it would be very convenient for passengers if the Kota Station were relocated in the vicinity of the Jakarta Gudang Freight Station which would allow direct connection with the Loop Line.

The city will be able to promote city planning, including the station and track sites, while the railway will be able to effectively use the sites, helping to add value and to enhance and develop related business.

The New Kota Station will no longer be of the dead-end type. It will be a through station, there by simplifying track layout in the compound.

The new station building will have efficiently arranged "flow facilities" such as a councourse and a passage, "passenger facilities" such as booking clipping, and fare adjustment facilities, "service facilities" such as a waiting room and water closet, and "station office facilities" such as a station master room and office room.

A station plaza will also be developed to ease transfer between the station and road transportation.

(3) Track Elevation of E/L (Kota-Gangsentiong)

E/L crosses the road in 15 places, and at each crossing, there are crossing warnings and barriers. At the crossings where there is greater traffic volume, railway personnel are posted.

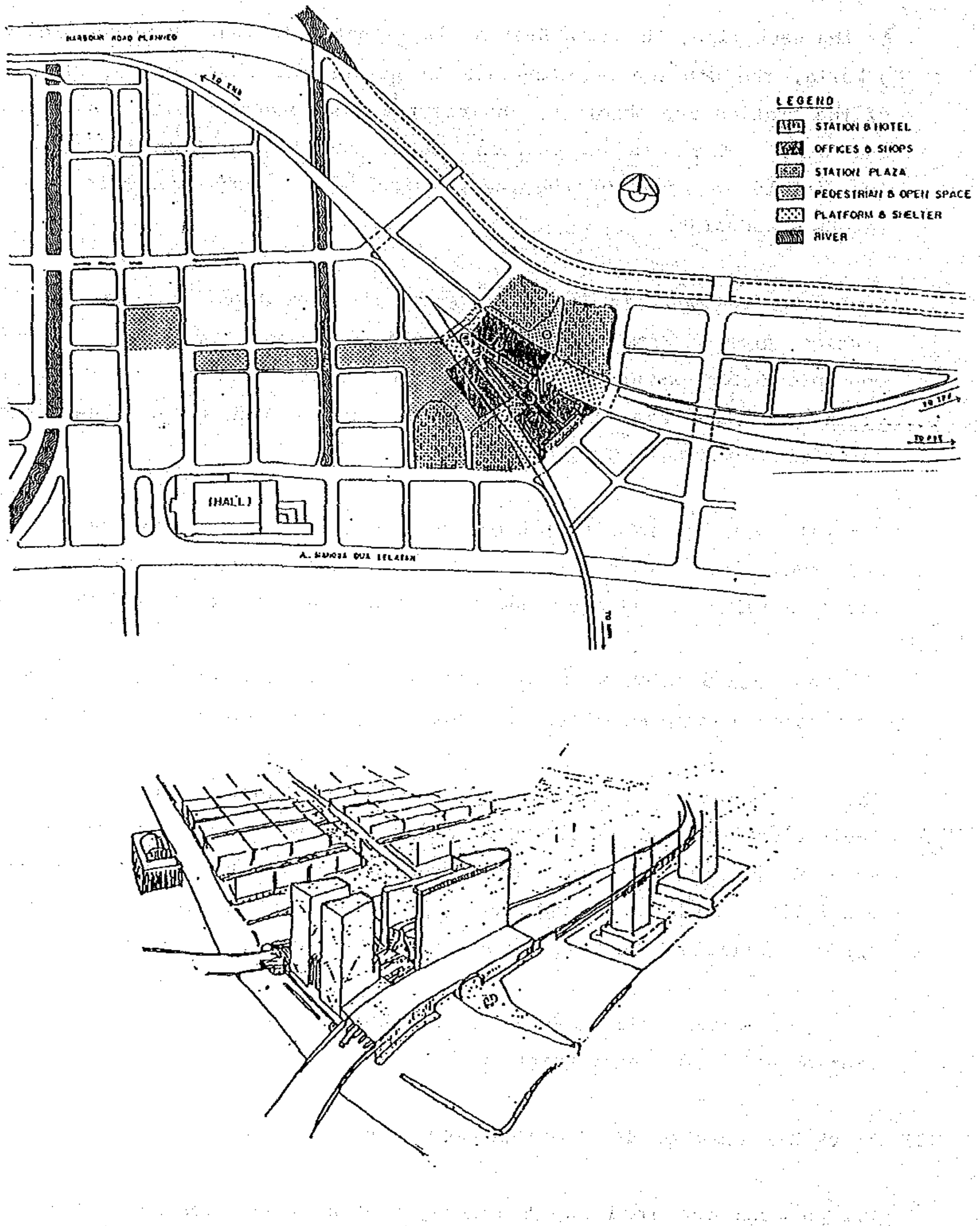


Fig. 8.2.1.2 General View of New Kota Station

At crossings, trains reduce their speed, which affects on-time operation. Crossings also, interrupt, automobile traffic which causes road traffic congestion.

In 2005, the road traffic volume will be doubled, and the railway will operate a loop with a 6 minute headway which will connect the Eastern and Western Lines. This will cause far more traffic interruption at the crossings. The flow in the midtown area will become smooth with the elevation of the Central Line which is now in progress. Unless, however, the Eastern and Western Lines are grade separated, considerable congestion is likely to occur in the area, and considerable difficulty in developing the area will result from its division by the railway into two parts. Thus, for future urban development and on-time operation of trains, grade separation of the railway and road is required.

For the grade separation, the railway or road may be placed underground or elevated. An underground system is generally more costly in its construction and maintenance, thus elevation is the preferred option. It is also desirable to elevate the railway to encourage city development and the effective use of land.

As all of the crossings are now level crossing, the railway should be elevated from JI. Manggadua to JI. Pasar Gaplok where crossings are present at short intervals, and a flyover should be employed for JI. Pramuka.

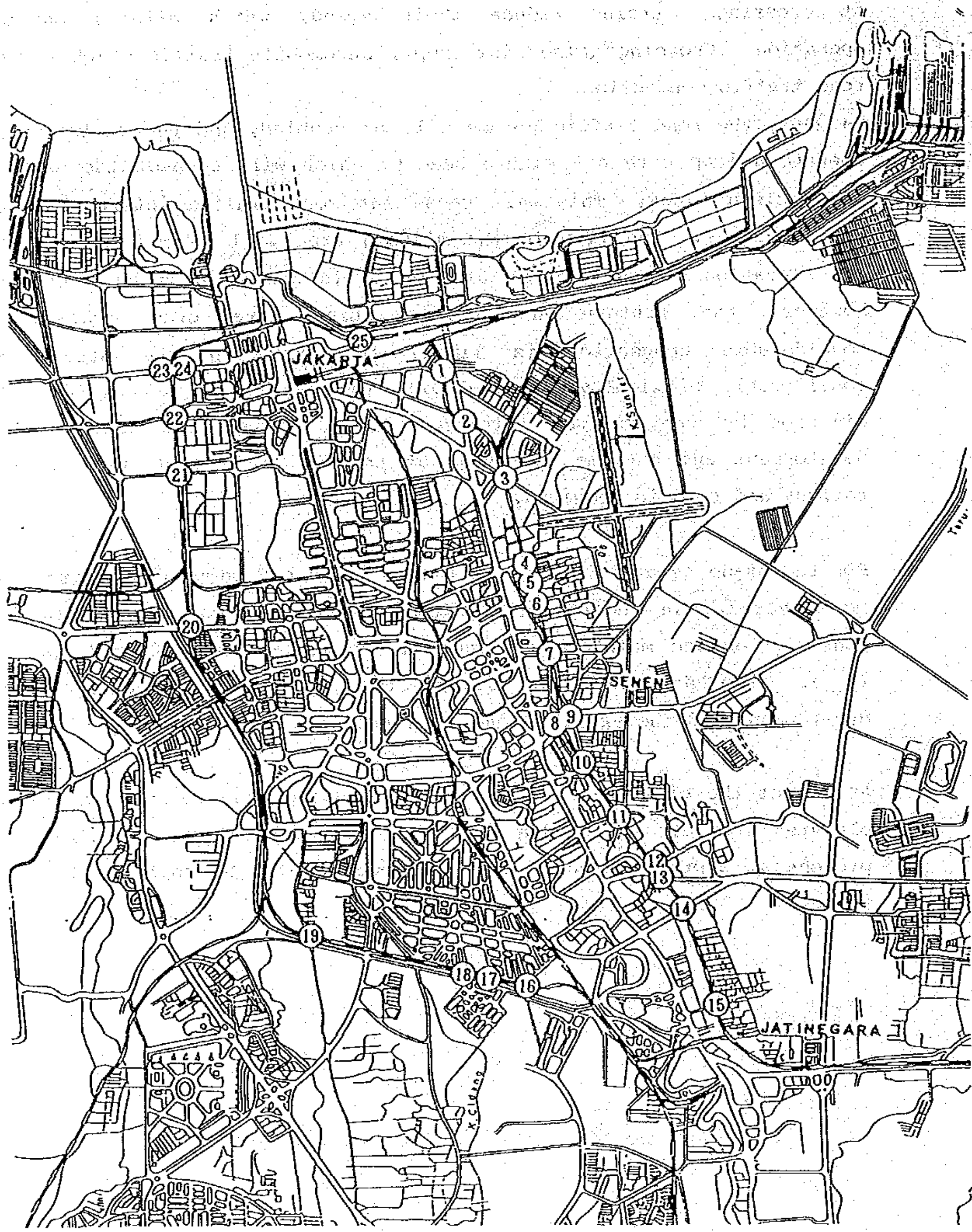


Fig. 8.2.1.3 Existing Level Crossing (E/L,W/L)

Table 8.2.1.1 Existing level crossing on E/L

Unit: Passenger Car Unit/Day

Name of Line	No.	Station to Station	Km	Name of Road	Situation of Road			Number of Cars (A)	Closing Time			(A)x(D)	Remarks
					Width (m)	Lane	Way		minute (B)	No. of trains (C)	(D)=(B)x(C)/60		
Eastern	1	Kota - Rajawali	0 K 868 M	Jl. Manggadua	40	10	Both	20,984	1.46	65	1.58	33,150	Track Elevation
	2	Kota - Rajawali	2 K 587 M	Jl. Gunung Sahari	30	8	Both	81,130	1.46	65	1.58	128,185	Ditto
	3	Rajawali - Kemayoran	3 K 100 M	Jl. Industri	12	2	Both	23,640	1.46	65	1.58	37,351	Ditto
	4	Rajawari - Kemayoran	4 K 245 M	Jl. Patrice Lumumba	12	4	Both	53,850	1.46	65	1.58	85,083	Ditto
	5	Rajawari - Kemayoran	4 K 450 M	Jl. Gang Spoor					1.46	65	1.58		Ditto
	6	Kemayoran - Pasar Senen	4 k 700 M	Jl. Garuda	20	4	Both	59,300	1.46	65	1.58	93,694	Ditto
	7	Kemayoran - Pasar Senen	5 K 425 M	Jl. Bungur	10	2	One		1.47	66	1.58		Ditto
	8	Pasar Senen - Gang Sention	6 K 235 M	Jl. Let Jen. Suprapto	35	6	Both	98,740	1.50	76	1.90	187.606	Ditto
	9	Pasar Senen - Gang Sentiong	6 K 277 M	Jl. Kramat Bundar									
	10	Pasar Senen - Gang Sentiong	6 K 770 M	Jl. Pasar Gaplok					1.50	76	1.90		Ditto
	11	Pasar Senen - Gang Sentiong	7 K 708 M	Jl. Gang Sentiong					1.50	76	1.90		
	12	Gang Sentiong - Kramat	8 K 484 M	Jl. Percetakan Negara	14	2	Both	29,420	1.50	76	1.90	55,898	
	13	Kramat - Pondok Jati	8 K 766 M	Jl. Utan - Kayu					1.50	76	1.90		
	(14)	Kramat - Pondok Jati	9 K 037 M	Jl. Pramuka	35	10	Both	110,680	1.50	76	1.90	210,292	Flyover
	15	Kramat - Pondok Jati	10 K 473 M	Jl. Pondok Jati					1.50	76	1.90		

Track elevation length l=6.46km

(4) Flyover on W/L

The Western Line crosses the road in 17 places including 7 flyovers, and crossings conditions are the same as those on E/L.

The crossings are relatively dispersed, and there is a canal running parallel to the Western Line which separates the area into an eastern and western part. In this case, it is economically advantageous to have the roads pass over the railway, and to employed flyovers in the following 6 places.

JI. Guntur
JI. KH. Mas Mansyur
JI. KH. Hasyim Ashari
JI. Tubagus Angke
JI. Bandengan Selatan
JI. Bandengan Utara

(5) Improvement of passenger handling facilities

In order to improve passenger service and to promote on-time operation of trains, station buildings and platforms will be improved and overbridges and platform sheds will be constructed.

1) Station building

The station building will be connected to the station plaza and to the platforms, forming a space for the smooth flow of passengers and providing an area for services incidental to trips.

Facilities of the station building will include:

- o Flow facilities: Concourse, passage, etc.:
- o Passenger facilities: Booking, clipping and fare adjustment facilities;
- o Service facilities: Waiting room, water closet, etc.; and
- o Station office facilities: Station master room, office room, rest room, etc.

Table 8.2.1.2 Existing Level Crossing on W/L

Unit: Passenger Car Unit/Day

Name of Line	No.	Station to Station	Km	Name of Road	Situation of Road: Width (m)	Lane	Way	Number of Cars (A)	Closing Time: minute (B)	No. of trains (C)	(D)= (B)x(C)/60	(A)x(D)	Remarks
Western	16	Mampang - Manggarai	4 K 824 M	Jl. Menteng Sukabumi	12	3	One	45,886	1.05	35	0.61	27,990	
	(17)	Dukuh - Mampang	4 K 533 M	Jl. Guntur	12	3	Oneh	38,550	1.05	35	0.61	23,516	Flyover
	18	Dukuh - Mampang	4 K 086 M	Jl. Halimun	16	4	Both		1.05	35	0.61		
	(19)	Tanahabang - Karet	1 K 926 M	Jl. KH. Mas Mansyur	16	4	Both	47,770	1.05	35	0.61	29,140	Flyover
	(20)	Duri - Tanahabang	5 K 420 M	Jl. KH. Hasyim Ashari	30	6	Both	88,594	1.05	35	0.61	54,042	Ditto
	21	Angke - Duri	4 k 300 M	Jl. Kamp. Keredang					1.20	42	0.84		
	(22)	Kampung Bandan - Angke	3 K 451 M	Jl. Tubagus Angke	16	4	Both	44,250	1.10	38	0.70	30,975	Flyover
	(23)	Kampung Bandan - Angke	2 K 850 M	Jl. Bandengan Selatan	12	3	One	80,771	1.10	38	0.70	56,540	Flyover
	(24)	Kampung Bandan - Angke	6 K 277 M	Jl. Kramat Utara	12	3	One						
	25	Kampung Bandan - Angke		Jl. Kampung Bandanplok	12	3	Both		1.10	38	0.70		

These facilities should be efficiently arranged so as to simplify passenger movement.

The size of the building will be determined by the number of passengers getting on and off the trains at the station in 2005 (Ry2-BC01) and the scale of the "ongoing project."

Most of the buildings will be constructed at ground level. However, for integration of the front and back of the station and for securing the land for a station plaza, over-track stations with over track passages, will be constructed at Pasarminggu on the Central Line, Klender on the Bekasi Line, and Tanahabang and Jatinegara on the Western Line.

2) Platform

Providing smooth access to trains for easy entrance and exit will reduce the amount of time necessary to get on and off the trains, and will promote on-time operation. Smooth access to the trains can be achieved through the elimination of the step between the platform and the car floor. In order to remove the step in the cars, they would have to undergo major modifications, thus it has been determined that the car step should not be removed. Therefore the platform height must be 0.95 m over the rails on JABOTABEK trains and 0.8 m on middle- and long-distance trains. Island platforms should have a width of 6 m and side platforms should have a width of 4 m so that there is enough room for smooth flow of passengers. Presently, the cars overlap the platform, and to eliminate any danger to passengers, the separation from the center of the rails should be 1.6 m.

Eight car trains in JABOTABEK are 180 m long while 12 car middle- and long-distance train are 270 m long.

3) Overbridge for transfer

With reduction of headway, it will be necessary to grade separate passages, to secure passenger safety and the on-time operation of trains. Structurally, an underpass is possible, but in terms of construction and maintenance costs, it is advantageous to construct an overbridge with a width of 3 m.

4) Platform shed

For better passenger service, construction of a platform shed which covers about 60 percent of the platform area should be considered.

(6) Construction of new stations

New stations were planned by considering the station-to-station distances the condition of development in the surrounding area and the convenience for passengers, which will help attract them from buses, etc. to the railway. (Fig. 8.2.1.4)

(7) Improvement of feeder services

1) Station plaza

Less people utilize the railway than the road. One of the reasons for this is that there is no transfer system between the road and railway. Therefore, access to the railway for people using road transportation, such as buses and Bajaj as well as for pedestrians, will have to be improved. For this purpose, a station plaza should be developed, which includes increasing the width of the road leading to the plaza, and the installation of signals and pedestrian bridges.

The station plaza will function as binding force between the railway and road and also as a community center.

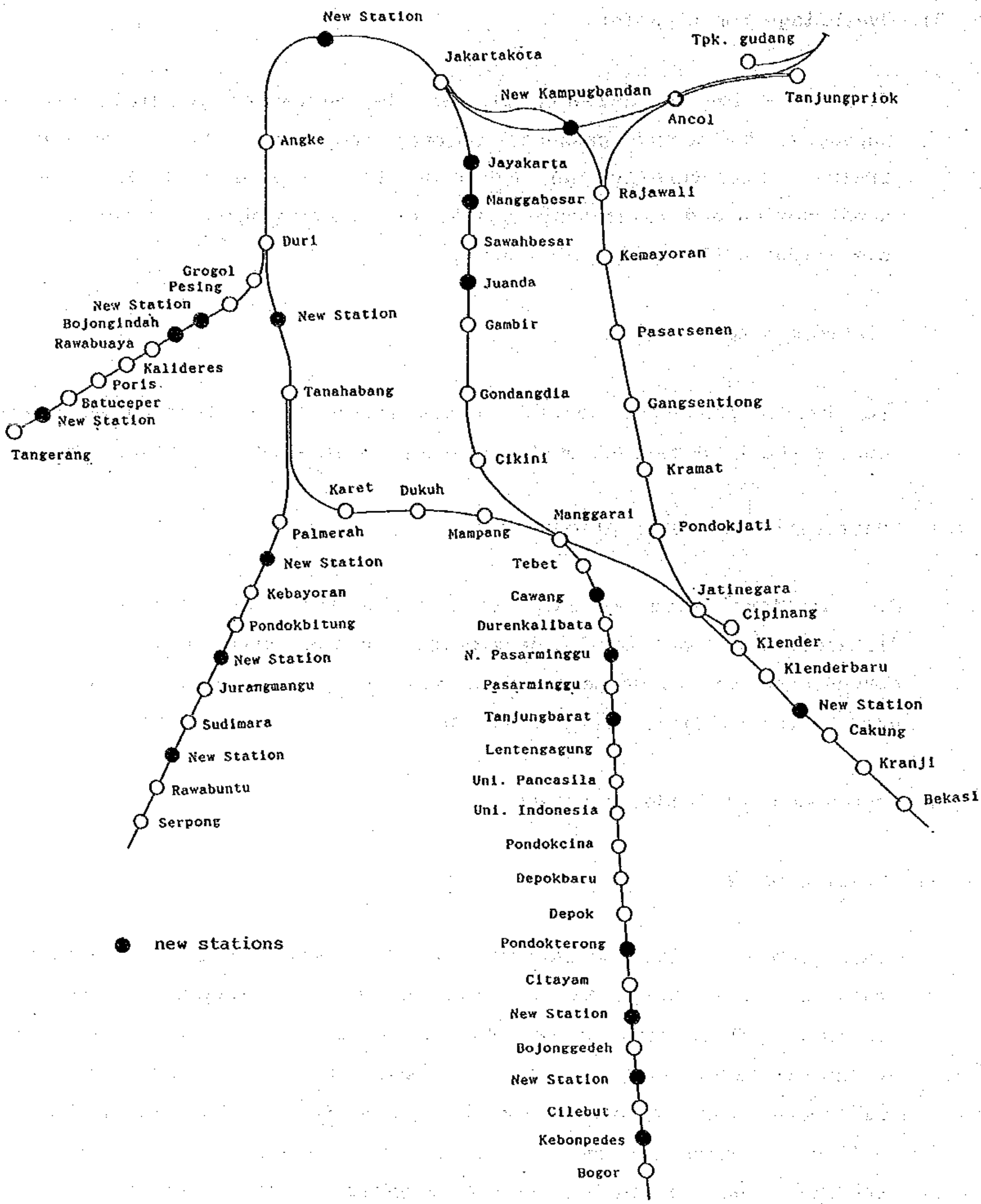


Fig 8.2.1.4 Location of New Stations

The size of the station plaza will be determined by the number of passengers getting on and off the trains per day, according to the formula developed by "Station Plaza Development Plan Investigation Committee."

5,000 persons/day < N (Number of passengers)

100,000 persons/day

$$S \text{ (area)} = 0.0904N/3 + 818 \ (m^2)$$

or 100,000 persons/day < N (Number of passengers)

$$S \text{ (area)} = 0.0189N/3 + 18.316 \sqrt{N/3}$$

The foregoing formula is applicable, where the peak rate in the morning rush hours is about 10% an hour.

For N, an estimation of transportation demand in 2005 was made, and three possible station plaza sizes were determined with consideration for the "ongoing project," condition of development of the surrounding area and plans for land use in the future.

- o Large scale plaza: About 8,000m^2, with a bus terminal allowing railway-to-bus and bus-to-bus connections.

- o Medium scale plaza: About 5,000 m^2, with a bus terminal allowing railway-to-bus connection.

- o Small scale plaza: About 3,000 m^2, with a bus terminal allowing railway-to-medium bus and small bus connection.

2) Feeder service facility

In accordance with the survey result mentioned in chapter 3-4-2 we set up the feeder facility improvement plan by station. In this section we prepare the direction of improvement.

According to the capacity of station front plaza, improvement scheme are divided into three groups as follows

a) in the case of enough space to accomodate access cars,

b) in the case of insufficient space, and

c) in the case of station faces to major road

If station plaza has enough space, it is recommended to improve access road and traffic control system for improvement accessibility. However some facilities shall be improved under present conditions.

On almost road right turning is controlled by traffic regulation. Therefore, the car which runs on the opposite lane cannot enter into the station front plaza. To establish easy access and to save transfer time, three sets of traffic signals will be required. And to minimize the enfluence on other car the road shall be widened as shown in Fig. 8.2.1.5.

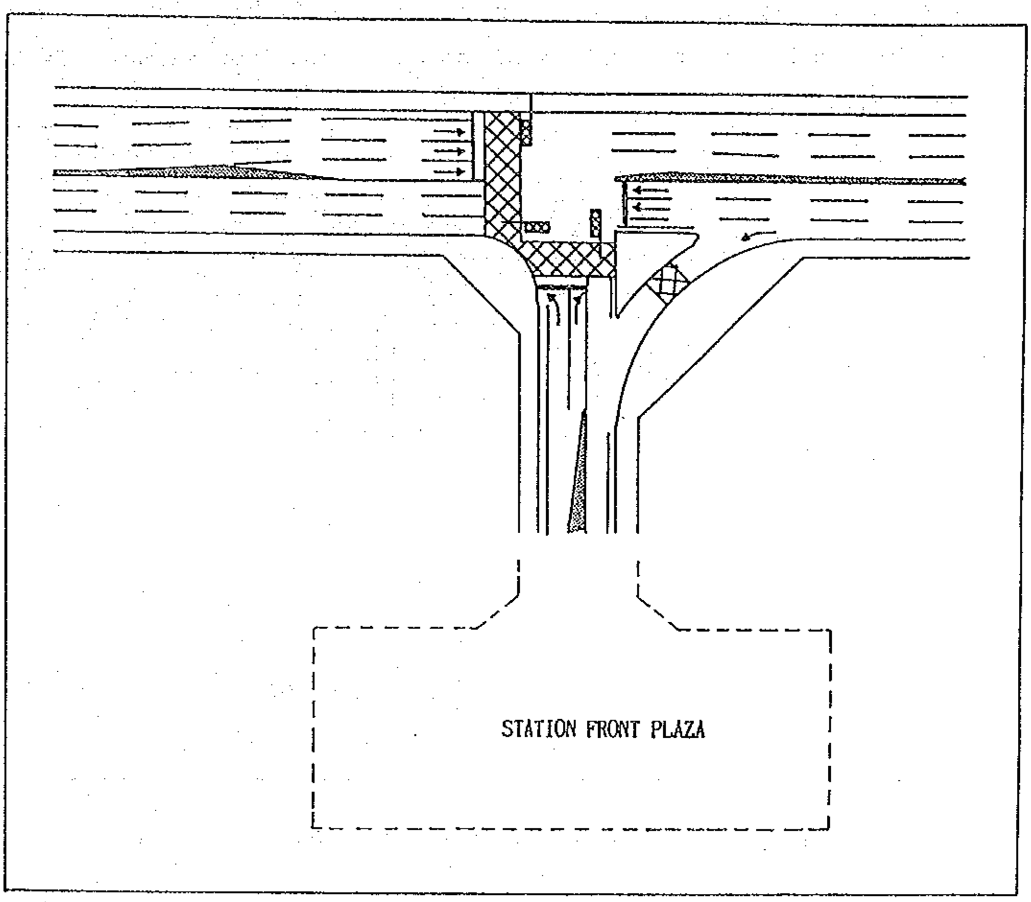


Fig. 8.2.1.5 Proposed Traffic Control System and Access Road

In case the station doesn't have enough space to park, buses cannot enter into station plaza. Bus stops are expected to be provided along the road and a transferer will be enforced to cross the road and sidewalk to the station. Under such condition it is necessary to provide a bus bay and a crosspath with signals. And sidewalks shall be improved for the safety of pedestrians. An example is shown in Fig. 8.2.1.6.

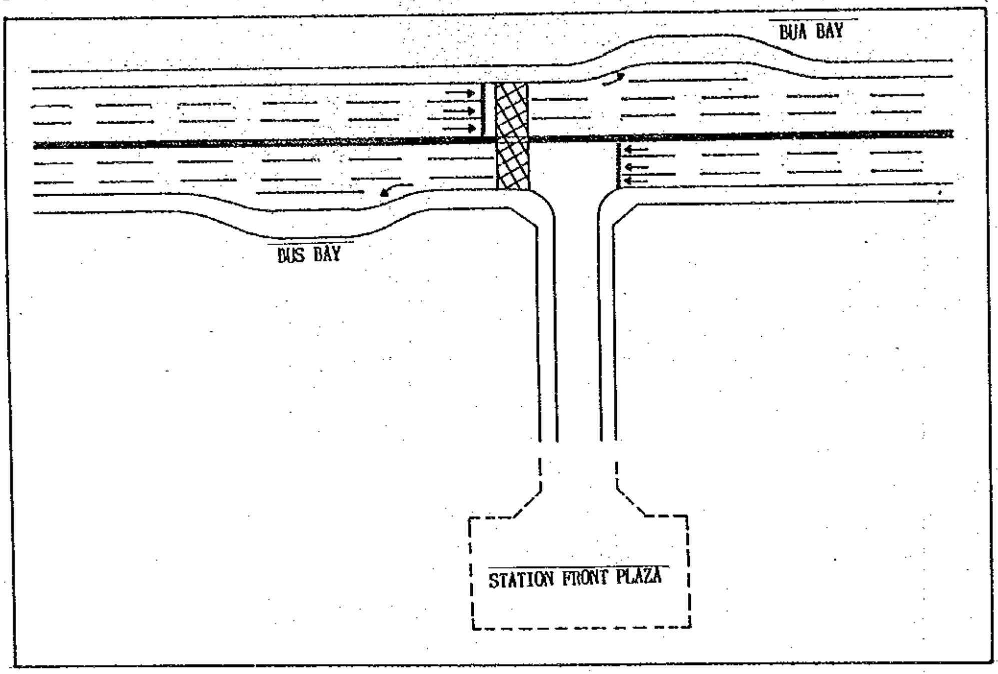


Fig. 8.2.1.6 Access to Small Size Station Plaza

In the case of Pasar Minggu and Jatinegara station, along the station yard major road run as said in chapter 3-4-2.

As a safety facility for pedstrians, overhead pedstrian bridge shall be built. And a bus bay shall be moved to the overhead pedstrian bridge. The proposed bus bay has a roof for comfortability while waiting for the bus, and a light is also installed for safety in the night.

(8) Electrification on Tangerang Line

The Tangerang Line is a 19.3 km unelectrified single track line running from Duri Station on the Western Line to the terminal at Tangerang Station. From now until 1992, refuge tracks will be constructed along sections where there is a long station-to-station distance, such as between Pesing and Bojongindah (L=4.9 km) and between Batuceper and Tangerang (L=3.6 km) to increase the track capacity.

Also, automatic signalling will be installed for improving safe operation, and the platforms will be improved to enhance the on-time operation of trains.

In order to meet the demand in 2005 , which will result from new housing and industrial development in the Tangerang area, the line will be electrified so that it can be operated at higher speeds.

Through electrification, it will be possible to operate the cars commonly with the other lines, and the transportation cost will be reduced. Along with electrification, the station buildings will be for an improvement in passenger service.

(9) Double tracking of Serpong Line

The Serpong Line is a 23.3 km single track line running from the Tanahabang Station on the Western Line to the Serpong Line, which is not electrified. The line will be electrified by 1992, and refuge tracks will be installed in 4 places along the line to increase track capacity.

Also, automatic signalling will be installed to improve operational safety, and the platforms will be improved to promote the on-time operation of trains.

In 2005, the line will be double tracked to meet increasing demand resulting from housing development in the Serpong area.

Furthermore, for better passenger service, the station buildings will be remodeled, new platform sheds will be constructed, and a overbridges for transfer will be installed in order to achieve on-time operation of trains. Two new stations will be constructed where the station-to-station distance is considerable. One between the Palmerah and Kebayoran Stations (L=3.7 km), and the other between the Sudimara and Rawabuntu Stations (L=4.5 km). This will result in an increase in the number of railway passengers and improved passenger service.

8-3 Implementation Schedule of Master Plan and Selection of Urgent Project for F/S

The implementation schedule was prepared as shown in Table 8.3.1.1, taking into consideration the urgency of the respective projects, smoothing of annual investment, and the results of the demand forecast.

In addition, it was assumed that the projects under Option b would be completed by 1992.

As for the order of investment in the respective projects, it is considered as described below. Here, it should be added that the investments in Table 8.3.1.1, in such projects as the relocation of Kota Station, Track elevation of E/L, and construction of flyovers on the W/L would provide great benefits to the city, so the costs of these projects should be borne by both the railway and city based on the proportion of benefits each receives after the respective improvements. In this report, the cost to be borne by the railway was calculated using the burden-sharing rate for railways and cities in Japan, with the cost to be borne by a city contained in parentheses. Refer to Appendix 8-1.

As for the projects deemed urgent, which should start immediately after completion of Option b, feeder service improvement, station facility improvement, elevation of the Eastern Line, and flyover construction on the Western Line were chosen. Details on the urgency and outlines of the respective projects are described in Section 8-4.

(1) Feeder service improvement
Station facility improvement

These projects are highly related to each other and the amount of money for their investment is relatively smaller than that of other projects. In addition, improvement of the feeder service will greatly contribute to increasing the demand of railway passengers.

As for the improvement of station facilities, it will consist of such things as improving the main stations, overbridges, and raising platforms, as well as having JABOTABEK trains function as commuter transportation and bettering ticketing equipment to obtain a higher rate of fare collection.

(2) Track Elevation of Eastern Line
Flyover construction on Western Line

Along with the 6-minutes headway of the loop line of these projects, it is predicted that there will be heavy road congestion due to an increase in the length of time railway crossing barriers are down. Therefore, it is suggested that these projects be carried out after the elevation of the Central Line, provided that the flyover on the Western Line is excluded from the F/S as road improvement work.

(3) Construction of new stations

This consists of only two stations on the Western Line included in Item 8 of Table 8.3.1.1. As for the construction of the other new stations, this is to be done along with the projects for double tracking the Central and Serpong Lines, etc., included in Items 1 and 10. The new stations on the Western Line, since they will be located in an urban area, will be constructed earlier as they can expect passengers.

(4) Relocation of Kota Station

Construction of a Car Depot incidental to New Kota Station

These projects should be started soon, since they enhance passenger convenience, renew the urban area around the present Kota Station, and utilize the site to be vacant by Kota Station. However, since they involve a large amount of investment and have to be coordinated with the city plan, which will take much time before it is decided, the implementation of these projects has been left for the latter half of the schedule.

(5) Double tracking, electrification and automatic signalling on Central Line (Dp-Boo)

Electrification of Tangerang Line

Double tracking, electrification and automatic signalling on Serpong Line

According to the results of the demand forecast for these projects, capacity will not be in shortage until after the year 2000, so these projects may be considered last among the other Ry2 projects.

(6) Mass transit corridor

Judging from the present condition of road traffic congestion and the future growth in traffic volume, buses will not be able to cope with the needs of mass transit around 2001 or 2002. The realistic transportation limit of buses is generally believed to be 20,000 persons/hr/direction. It is estimated that the transportation volume in the MRT Main Corridor will reach this level in 2001-2002. However, the MRT project will take much time to execute, so its F/S should be started immediately around 1990.

The investment amount shown in Table 8.3.1.2 was calculated assuming that the mode was LRT and that the running level was an underground structure inside the Inner Ring Road. For MRT, it is desirable that a detailed F/S be executed that includes selection of optimum mode and running level.

Furthermore, to construct MRT, employment of a BOT system, that is, a system that constructs and operates the MRT with private funds and transfers to the government after a certain period of time elapses, is conceivable.

Table 8.3.1.1 Investment Schedule for Railway Improvement (Ry2)

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

	Project Item	Investment Cost (10^6 Rp)	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
1	Double tracking Electrification and Automatic Signalling on C/L (Dp -Boo)	96,900											.....	.....	====	====	====	
2	Improvement of Feeder Service	(65,990) 19,970	.....	.....	.....	====	====	====	====	====	====	====	====	====	====	====	====	
3	Relocation of Kota -Station	(339,730) 37,710						.....	.....	.....	====	====	====	====	====			
4	Construction of Car-depot in relation to Kota -Station	(32,280) 36,160				.....	.....	.....	====	====	====							
5	Track elevation of E/L	(325,600) 42,600	.....	.....	.....	====	====	====	====	====								
6	Flyover on W/L	(76,410) 38,030	.....	.....	.....	====	====	====	====	====								
7	Improvement of Station Facilities	62,580	.....	.....	.....	====	====	====	====	====	====	====	====	====	====	====	====	
8	Construction of new Station	4,280					.....	====	====									
9	Electrification on Tangerang Line	37,620											.....	.....	====	====	====	
10	Double Tracking of Serpong Line	99,380										.....	.....	====	====	====	====	
11	Rolling stock (EC : 376 Cars)	702,440				====	====	====	====	====	====	====	====	====	====	====	====	
	Total	(840,010) 1,177,670				(58) 86	(108) 100	(108) 102	(115) 88	(70) 81	(47) 75	(64) 64	(94) 73	(94) 89	(74) 140	(4) 139	(4) 141	

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

Table 8.3.1.2 Investment Schedule for Road Improvement (BC01)

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

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

Note: The doted lines mean preliminary works.

8-4 Outline of F/S Projects

The schedule for drawing up the Master Plan was described in "8-3." The urgent projects chosen to be taken up in the F/S include, improvement of feeder services, improvement of station facilities, and track elevation on the Eastern Line. Construction of flyovers on the Western Line is an urgent project, but it is not a railway improvement work and thus will not be included in the present F/S.

The urgency of the respective F/S projects, and an outline of each is shown below.

8-4-1 Improvement of Feeder Services

(1) Urgency of the improvement

1) Present condition of the feeder facilities

The railway stations in the JABOTABEK area have generally been used as facilities for interchange of passengers on medium and long distance trains, and the urban area has developed along main roads.

On the other hand, bus transportation, which has been a major means of public urban transportation, has an efficient transportation network which consists of main roads which connect the bus terminals with one another and a feeders system where concentrates to the bus terminals. However, the access roads connecting railway stations to urban areas or main roads and the station plazas serving as a contact point for various means of transportation are not yet well developed. Thus access to the railway is not satisfactory, and this makes it difficult for the railway, even with the improvements in facilities now in progress, to fulfill its function as a means of urban transportation.

2) Demand forecast

The passenger demand forecast was made for buses and the railway by establishing an urban development frame based on various levels of road and railway improvement.

According to the results of the forecast, the number of railway trips, under BC01 Ry2 (the optimum plan for improvement), will increase when based on the number in 1985 (115,000 trips/day), by 7.50 times (868,000 trips/day) in 1992, and by 17.30 times (1,995,000 trips/day) in 2005.

Under the railway development plan, the steps to be taken include increasing the number and speed of trains, modernization of facilities, and improvement of rail-to-bus transfer. When these are implemented, the railway's share of public transportation is expected to rise to about 25% by the year 2005.

3) Urgency and establishment of the order of priority for improvement

The JABOTABEK railway will have 73 stations including the new stations which are to be constructed. It is desirable that the improvement of feeder facilities be carried out in order of urgency by considering various regional conditions, including transportation and land use in the area surrounding a station, as well as conditions inherent to the railway such as railway improvement programs and the higher number of passengers using a station.

The scale of feeder improvement should be determined by the number of passengers using each station. In an attempt to estimate the urgency of improvements, a comparison was made, as shown in Fig. 8.4.1.1, between present passenger flows at stations and tentative estimates of flows in 1992 (option "b") based on inter-zone railway traffic volume.

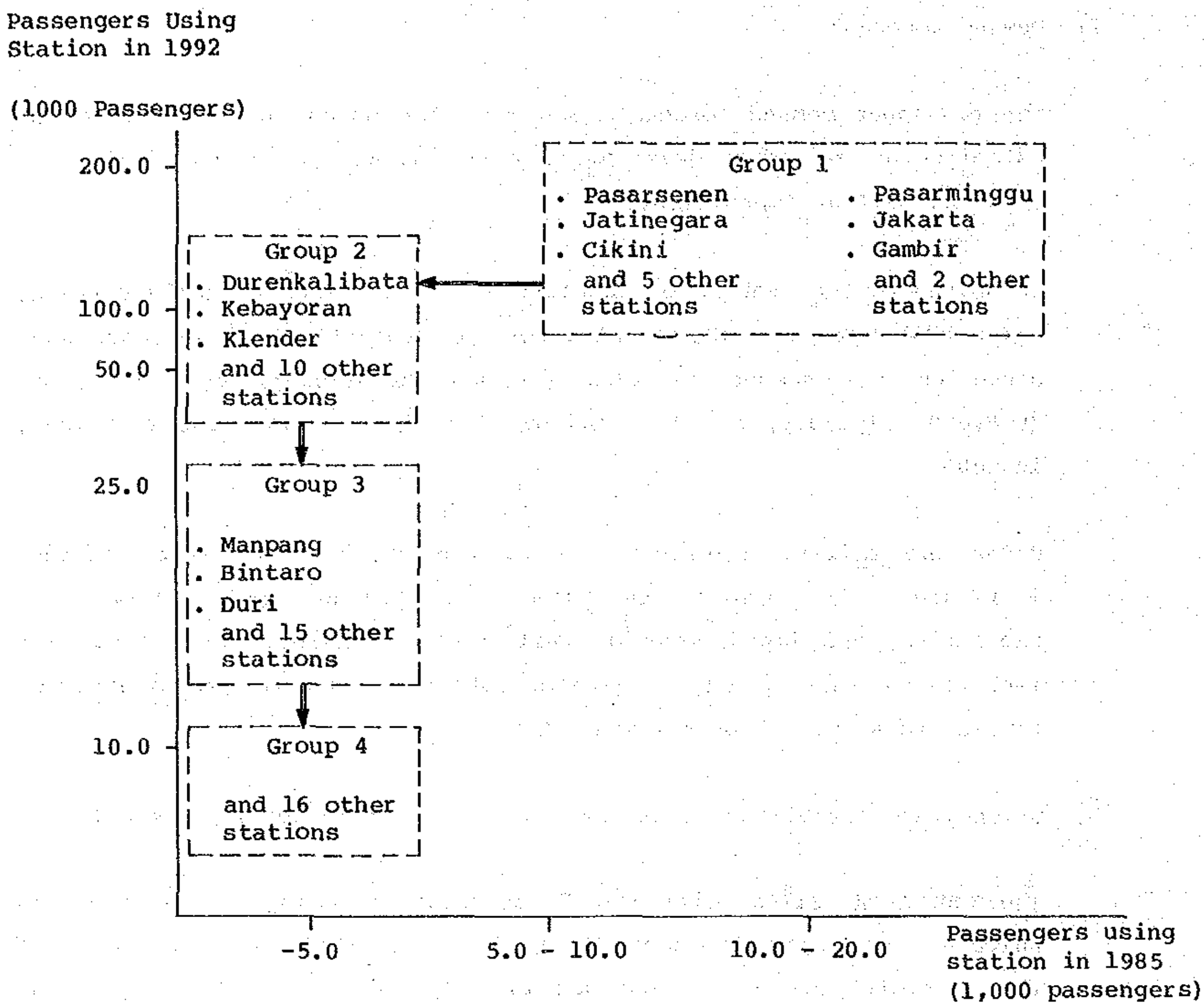


Fig. 8.4.1.1 Passengers Getting on and Off Trains at Stations (1985 and 1992, Option "b")

Note: New stations are not included.

Note: In the improvement plan, each feeder facility will have its scale determined from a long-term standpoint, by considering forecasts of the number of passengers expected to use the station in 2005.

Group 1: The stations in this group are at present (1985) used by about 5,000 to 20,000 passengers, and many are currently considered key stations. They have good connections with other means of transportation and transportation demand is expected to be greater in the future (at least 10 times greater than present demand). However, with present facilities, it will become difficult in future to offer satisfactory passenger services, therefore the urgent review and improvement of station and feeder facilities is required.

Group 2: At present the number of passengers using stations in this group is just under 5,000. With the development of the surrounding area in future including land use and traffic, a sharp increase in the number of railway passengers can be expected (at least 20 times the present), thus improvements can be made by considering the level of development.

Group 3: Increased demand is expected in the future, but the level of development in the surrounding area is below that of Group 2. However, for some of the stations of this group depending on the situations, improvements should preferentially be made.

Group 4: The number of passengers will be no more than 10,000, thus it will be possible to cope with the situation with the present facilities for the time being.

It is the intention of the railway improvement projects in Option "b" for 1992 to improve service and increase use of the railway. But, if feeder facilities are not improved, it will be impossible to offer satisfactory services to railway passengers, and a gap will be produced between the railway transportation capacity and the number of persons utilizing the railway. Therefore, the improvement of feeder service is a very important and urgently required project in the improvement of the urban railway.

The stations forming the groups shown in the foregoing diagram show a similar trends in transportation demand for 2005 with demand increasing. The improvement of key stations belonging to Group 1 and some of the stations in Groups 2 and 3, are a higher priority because, it is expected that improvements in these stations will have the greatest impact. Through further study of land use and traffic conditions around the stations and consultation with the Indonesian side, stations for the feasibility study will be objectively chosen from these groups.

(2) Policy for improvement

1) Components of feeder facilities

In order to implement feeder improvement projects, the condition of the area surrounding the station and the effect of improvements on the station and other facilities in the area will be examined. Regional conditions and elements constituting the feeder facilities are as follows.

Regional conditions

- Land use: Land use and distribution of population in areas within walking-distance and areas that depend on other means of transportation.

- Traffic condition: City-plan roads, main roads and existing and new bus routes.

Facilities

- Transfer facilities: Station plazas, access roads, bus terminals, pedestrian bridges and other traffic safety facilities

- Station facilities: Rehabilitation and construction of station buildings, elevation of platforms, construction of over bridge station buildings and overpasses for transfer.

Also, studies will be made on reducing fares involving the combined use of the railway and buses, organizing a system of management for new bus operation routes and the sharing of construction costs.

2) Feeder improvement projects which reflect the railway transportation plan and local needs

The frequency of train operation will be the greatest, in both 1992 and 2005, between Jakarta Kota and Depok on the Central Line and Duri and Bekasi on the Bekasi Line, and passengers using stations located along these sections will account for about 70% of all passengers in 1992 and about 60% in 2005. Thus, projects will be chosen which comprise stations along sections of high transportation demand and reflect local needs.

3) Selection of projects taken up in F/S

Under the F/S, highly urgent improvement projects will be classified according to items such as region, station characteristics, integration of transportation, and representative cases will be studied.

8-4-2 Improvement of Station Facilities

(1) Urgency of improvement

1) Present condition of station facilities

Facility improvements are in progress in stations between Kota and Manggarai along with the elevation of the Central Line. Improvements will also be completed in major stations such as Jng, Pse and Thb by 1992, but have thus far been only partially undertaken. In most stations in the JABOTABEK Area, the station facilities have not been well developed or improved for commuter services. The station passenger facilities are narrow, and the flow space is inadequate. Moreover, in most stations, platforms are low and are too close to the center of the track, and passengers must cross the track at ground level to move from one platform to another.

This results in poorly functioning of commuter railway, and a lack of promptness in getting on and off trains, which adversely effects on-time operation.

2) Demand forecast

According to forecasts, the number of railway passengers under BC01, Ry2 (Case 052) which was chosen as the optimum plan for improvement, there will be a significant increase in demand with over 1985 (The base year) levels (reference "8-4-1 Improvement of Feeder Services, (1)").

In order to accomodate future demand, it will be necessary to ensure the smooth flow of passengers, with efficient station facilities which are well balanced with the station plaza which serves as a junction point with feeder services.

3) Judgement of urgency and establishment of priorities for improvement

The principle for determining the order of improvement priorities is the same as in "8-4-1 Improvement of Feeder Services,". That is priority should be given to key stations belonging to Group 1 and those high demand stations in Groups 2 and 3 where the effects of improvement will be the greatest. However, of these stations, those improvements scheduled in Option "b" and those in improvement level Ry2 but which would be better improved in other projects, will be excluded. Thus, the stations to be included in F/S, will be chosen with the relationship to the improvement of feeder services taken into account.

(2) Principle of improvement

To ensure improvement of passenger services and punctuality of train operation, the station buildings will be improved, width and height of platforms will be increased, and transfer overtrack bridges and platform sheds will be constructed.

1) Station building

A station building is a point of contact between railway transportation facilities and passengers. It connects the station plaza with platforms, to form a space for the smooth flow of passengers and, at the same time, provides services incidental to trips.

The facilites of the station building, are listed below.

o Flow facilities: Concourse, passage, etc.;
o Passenger service facilities: Ticketing, fare adjustment, etc.;
o Service facilities: Waiting room, toilet, etc.
o Internal facilities: Stationmaster's room, operation room, room for rest, etc.

These facilities will be efficiently laid out so that passenger flows are simplified.

The station buildings will be generally constructed at ground level. However, in the cases of Pasarminggu on the Central Line, Klender on the Bekasi Line and Tanahabang on the Western Line, the station building will be constructed over the track with a free passage provided for smooth connection between the front and back sides of the station and for securing land for the station plaza.

2) Platform

With passengers getting on and off the trains in a smooth manner required the time will be reduced and punctual train operation will be secured. For this reason, it is desirable that the platforms be at the same level as the car floor. In order to remove the steps in the existing cars, the cars would have to be greatly modified. In view of this, the steps will be left as they are, and the platform height will be raised to 0.95 m above the rails for JABOTABEK trains and 0.8 m above the rails for middle and long distance trains. Also, separation from the center of the rails to the platform edge should be set at 1.6 m to ensure passenger safety.

The platforms for JABOTABEK trains should accomodate 8 cars, while platforms for middle and long distance trains should accomodate 12 cars.

3) Overbridge

As the headway is reduced, it will be necessary, in order to ensure the passenger safety and the punctuality of the trains, to grade separate the transfer passages. The construction of underground passages is possible, but overbridges, will be used because they are advantageous in terms of construction and maintenance costs.

4) Platform shed

Sheds will be constructed on platforms for the convenience of passengers and to ensure the smooth flow of passengers getting on and off trains.

8-4-3 Track Elevation of Eastern Line

(1) Present condition

The Central, Eastern and Western Lines which pass through the urban areas now cross roads at ground level. The roads in the midtown area now have considerable traffic volume, and at railway crossings train speed is reduced for automobiles. This has an adverse effect on train punctuality and, at the same time, impedes road traffic at crossings, and causes traffic congestion.

On the Central Line, continuous grade separation through track elevation is being carried out by 1993 set as the target year of completion. Thus traffic congestion in the urban area resulting from railway crossings will be eliminated. If, however, level crossing on the Eastern and Western Lines remain at present, the increasing traffic volume at the crossings will further aggravate traffic congestion.

(2) Necessity of grade separation

Table 8.4.3.1 shows the traffic volume at the crossings on the Eastern and Western Lines. The data for 1985 was obtained from our Indonesian counterpart, and the traffic volume at each crossing in 1992, 1995 and 2005 was extrapolated from the data for 1985, using growth rates obtained from the estimated traffic in 1992 and 2005 at main rail-road crossings along the Eastern and Western Lines of ITSI.

In 2005, traffic at rail-road crossings will increase to about 2 times the 1985 level on both the Eastern and Western Lines, while the railway will start the loop operation connecting Eastern and Western Lines at short headways. As a result, the road traffic congestion due to interruption at the rail-road crossings will increase, and if trains are slowed at rail-road crossings, it will be difficult to reduce train operation time and to ensure the punctuality of trains. Further, if the railway crossings remain as they are, the city is divided by the railway, making the integral development of the city difficult. Therefore, for smooth development of the city in the future and for punctual operation of trains as well as the elimination of road traffic congestion, grade separation of railway and road is required.

(3) Urgency of grade separation

Table 8.4.3.2 shows the automobile traffic volume at rail-road crossings on sections to be elevated on the Central Line.

It is expected that by about 1997 the mean automobile traffic volume at rail-road crossings on the sections to be elevated on the Eastern Line will be nearly same as the present volume on the sections to be elevated on the Central Line that will be completed in 1993.

Thus, for integral development of the city, grade separation of the Eastern Line is urgently required. The urgency of grade separation of the Western Line, is the same as the Eastern Line in view of traffic volumes at rail-road crossings. (See Table 8.4.3.1.)

(4) Scope of work to be taken up in the F/S

As an objective of the F/S project, the track elevation of the Eastern Line will be taken up on the sections between JL. Manggadua and JL. Pasar Gaplok (1-10, 6.5 km) where the rail-road crossings exist at a small intervals and traffic volume is considerable. The flyover system will be applied to JL. Pramuka (14).

The plan for grade separation of the Western Line calls for a flyover system which is entirely based on road improvement work, and thus is not included in projects to be taken up by the F/S at this time.

Table. 8.4.3.1 Future Traffic Volume at Railway Crossing
(East and West Lines)

Crossing Road	Railway Line	Traffic Volume 1985	1992	1995	2005
1 Jl. Manggadua	East	20984	25901	27196	34800
2 Jl. Gunung Sahari	East	81130	97009	105146	134545
3 Jl. Industri	East	23640	28267	30638	39204
4 Jl. Angkasa	East	53850	64390	69791	89304
5 Jl. Gang Spoor *	East	11944	14282	15480	19808
6 Jl. Garuda	East	59300	70906	76854	98342
7 Jl. Bungur *	East	11944	14282	15480	19808
8 Jl. Let Jen.Suprapto	East	98740	118065	127969	163749
9 Jl. Kramat Bundar **	East				
10 Jl. Pasar Gaplok *	East	11944	14282	15480	19808
11 Jl. Gang Sentiong *	East	11944	14282	15480	19808
12 Jl. Parcetakan Negara	East	29420	35178	38129	48790
13 Jl. Utan - Kayu *	East	11944	14282	15480	19808
14 Jl. Pramuka	East	110680	132342	143443	183550
15 Jl. Pondok Jati *	East	11944	14282	15480	19808
16 Jl. Menteg Sukabumi	West	45886	62460	72129	109347
17 Jl. Guntur	West	38550	52474	60597	91865
18 Jl. Halimun	West				
19 Jl. KH.Mas Mansyur	West	47770	65025	75090	113837
20 Jl. KH.Hasyim Ashari	West	88594	120594	139262	211121
21 Jl. kamp. Kerendeg	West				
22 Jl. Tubagus Angke	West	44250	60233	69557	105449
23 Jl. Bandengan Selatan	West	80771	109945	126965	192479
24 Jl. Bandengan Utara ***					
25 Jl. Kampung Bandan					
East Line Total		549408	656938	712042	911129
West Line Total		345821	470732	756975	985677

Note:The traffic volume represents the number of vehicles in passenger car unit in 1985.

* :Traffic volume in 1985 is assumed as 20% of the average traffic of the observed crossings.

** :Traffic volume is included in Jl.Let Jen.Suprapto.

*** :Traffic volume is included in Jl.Bandegan Selatan.

Table 8.4.3.2 Future Vehicle Traffic Forecast of Central Line Railway Crossings

	Bajaj	M-cycle	Sedan	Bus	Truck	PCU
1985	155220	213399	267255	18168	48727	552164
1995	155220	303940	461970	33150	74950	858233
2005	155200	428740	903120	40410	87840	1380459
PCU	0.50	0.33	1.00	1.50	2.25	

Note: PCU of Bus is a value for medium bus.
PCU of truck is an average value of small and large truck.
PCU of Bajaj is assumed as a half of sedans.