CHAPTER I: GENERAL SITUATION OF URBAN/SUBURBAN RAILWAY TRANSPORTATION IN JABOTABEK AREA

CHAPTER 1 GENERAL SITUATION OF URBAN/SUBURBAN RAILWAY TRANSPOTATION IN JABOTABEK AREA

1.1 Present Status on Population, Land Use and Development

1.1.1 Population

The JABOTABEK Area comprises D.K.I. Jakarta, Kotamadja Bogor and 3 Kabupatens of Bogor, Tangerang and Bekasi as divided by its administrative jurisdiction. The area has its total population of 10.5 million as a whole with an expansion of 550.000 ha. (Table 1.1.1)

Table 1.1.1 Population in JABOTABEK Area

Unit: 1,000 persons

Year / Area	1971	1975	1977	1978	Average Growth Rate (%)
D.K.I. Jakarta	4,685	5,404	5,925	6,082	4.0
BOTABEK	3,648	4,074	4,372	4,485	3.3
KM Bogor	196	206	210	222	
Kabupaten Bogor	1,660	1,792	1,990	2,056	
Kab. Tangerang	978	1,090	1,234	1,257	
Kab. Bekasi	814	828	938	950	
JABOTABEK	8,333	9,478	10,297	10,567	3.7 %

Source: Census and Statistical Office, Jakarta and West Java.

In terms of the working population by industries in 1978, it is featured as follows. Namely, whilst the three quarters of the total in D.K.I. Jakarta are engaged in the trade and other service industries, the two-third of the total in BOTABEK are farmers. As the general tendency over the whole area of JABOTABEK, the centripetal disposition toward D.K.I. Jakarta may continue vigously in the future as well as at present and there still remains much potential to be further developed in its environs. (Table 1.1.2)

Table 1.1.2 Working Population by Industries in JABOTABEK in 1978

Area	Agriculture	L & M Manufac-turing	S Manufac-turing	Govt.	Tertialry	Total
D.K.I. Jakarta	55,7	134,5	68,6	241,1	1411,4	1911,3
BOTABEK	914,4	69,0	62,3	65,7	334,9	1446,3
JABOTABEK	970,1	203,5	130,9	306,8	1746,3	3357,6

1.1.2 Land use and development

Land use in D.K.I. Jakarta as of 1977 is as shown in Table 1.1.3, in which it is noted that roughly two-third of the total 654 km^2 land area is shared by agricultural and green land.

Table 1.1.3 Present Situation of Land Use in D.K.I. Jakarta (1977)

Zoning	Area (ha)	%
Commercial and administration	3,496	5
Industrial	1,543	2
Housing	19,899	31
Agricultural	28,101	43
Green land	12,367	19
Total	65,406	100

Under the present condition of land use, the industrial facilities, especially petty household industries, lie scattered in the residential zone. To cope with this situation, the administrative authority contemplates to bar the industrial site from the southern district with special care for its environmental preservation by concentrating those industries into the northern district. This administrative guideline was taken over by the state authority of West Java, as the result of which there are obvious signs that many industries tend to concentrate and select their sites in close vicinity of Tangerang and Bekasi – Jakarta. Especially, Tangerang can provide the favorable environmental conditions for industrial plant siting with the Cilegon steel industrial complex on its western side. Also in Bekasi, the same tendency toward industrial land utilization still continues, being stimulated by existence of the planned land for industrialization near the eastern boundary to the city area of Jakarta.

With regard to housing construction, it spreads over the whole area of JABOTABEK, regardless of whether inside the city or outside. Especially, the housing construction project on a large scale is encouraged in the south of Jakarta, the northeast of Tangerang County, Depok of Serpong and Bogor County and Bekasi of Bekasi County.

The potentiality for establishment of the Activity Center is predicted in the Sunter District of Jakarta, Serpong of Tangerang County and Pondok Gede of Bekasi County.

1.2 Present Status of Urban and Suburban Traffics

1.2.1 General speciality

The metropolitan area of Jakarta is developed with its road network as the principal axis of traffic. The transport means may be divided, as the privately owned, into motorcars, motorcycles and bicycles according to the income startum of each user. For the public transport service, it comprises many variaties ranging from the Beca, now falling into disuse though available for a close distance, Hellica, Bajai, Bemo and Oplet to the minibus, bus and taxi. In terms

of the traffic volume, the bus service takes the overwhelmingly greater share in all. (Table 1.2.4 ~5)

Table 1.2.1 Passenger Trip Generation in D.K.I. Jakarta by 1978

TRANSPORT	AM 3-HOUR PEAK		DAILY TRAFFIC-24 HOURS	
	ABSOLUTE	%	ABSOLUTE	%
Bus Public	479,987	61.5	2,158,811	59.6
Railway	11,384	1.4	44,001	1.2
Passenger car	182,314	23.4	855,332	23.6
Motorcycle	99,907	12.8	532,638	14.7
Taxicab	780	0.1	7,246	0.2
Truck	6,244	0.8	25,363	0.7
Total	780,256	100.0	3,623,391	100.0
Public service	491,281	62.9	2,202,812	60.08
Private service	289,245	37.1	1,420,579	39.2

Source: Table A-3 p. 162 ORSA–ATP, based on the data available from DLLAJR – D.K.I. JAKARTA – F. Suwarto.

At a glance of the transport means by distance, it seems to be distinguishable that the main role is being played by the vehicles such as Bajai, Bemo, bus and motorcar within the city area, by bus and motorcar between cities of short and medium distances and principally by motorcar, bus and train for long-distance transport.

The present situation of urban traffic demand is featured by less necessity of using the public transport services for commutation to offices and schools over a long distance. This may be because those employed locally in the suburb of large cities and other local towns account for a greater percentage and also because the existing traffic service network for commuters between cities or towns of short and medium distance still remains unimproved.

Note: It is understood from the hearing that the local employment in the BOTABEK Area will account for 60 percent by 2000 in its urban areas.

Table 1.2.2 Comparison of Morning 3-Hour Peak Passenger Traffic Load and Road Vehicle Trip Required in 1977

	Passengers at AM Peak (10^3)	Average Occupancy #	Vehicle Trips Required	Share Rate of Utilization	Vehicles	
					(A)	(B)
City bus	585	56,0*	10450	40,9	3,7	2,3
Mini bus	30	24,0*	1250	2,1	0,4	0,3
Taxi	39	1,6*	24400	2,7	8,7	5,4
Private car	130	2,4	54200	9,1	19,4	12,4
Business car	97	1,3*	74650	6,8	26,7	16,5
Oplet	108	9,0*	12000	7,6	4,3	2,6
Bemo	58	5,5*	10550	4,1	3,8	2,3
Helicak	52	1,4*	37150	3,6	13,3	8,2
Bajaj	26	1,4*	18550	1,8	6,6	4,1
Becak	44	1,2*	36700	3,1	13,1	8,1
Motorcycle	260	1,5	17335	18,2	—	38,2
Total	1429		279900 (A) 453250 (B)	100,0	100,0 (A)	100,0 (B)

Notes: 1. By exclusion of motorcycles
2. With inclusion of motorcycles
* Drivers and conductors are not included
"Vehicle trips required" suggests incorrectness of the data on helicak, bemo and mini-bus

Source: JARTS' "JARDEP"

1.2.2 Road transport and railway traffic utilization

Frequency of all-mode person trips and the ratio of railway traffic frequency in 1978 are as shown respectively in Table 1.2.3.

In terms of all-mode trips, the total in the BOTABEK Area reaches 90.6 thousand persons while the total within the D.K.I. area shows 440.6 thousand persons, about firefold as compared with the former case. However, at a look into the railway traffic, the total passenger trips fall only to one-twentieth (0.41 thousand persons) of the total (8.08 thousand) in the BOTABEK Area. The railway traffic ratio in all-mode traffic person trips accounts for 0.09 percent in the D.K.I area as compared with 8.9 percent in the BOTABEK Area. When compared by railway lines, the utilization rate of the Central Line (BOTABEK to D.K.I.) accounts for 15.8 percent, far above any other existing lines showing less than 10 percent, especially even less than 1 percent within the D.K.I. area.

The causes to be generally considered with regard to such low utilization of the railway traffic may be cited as follows:

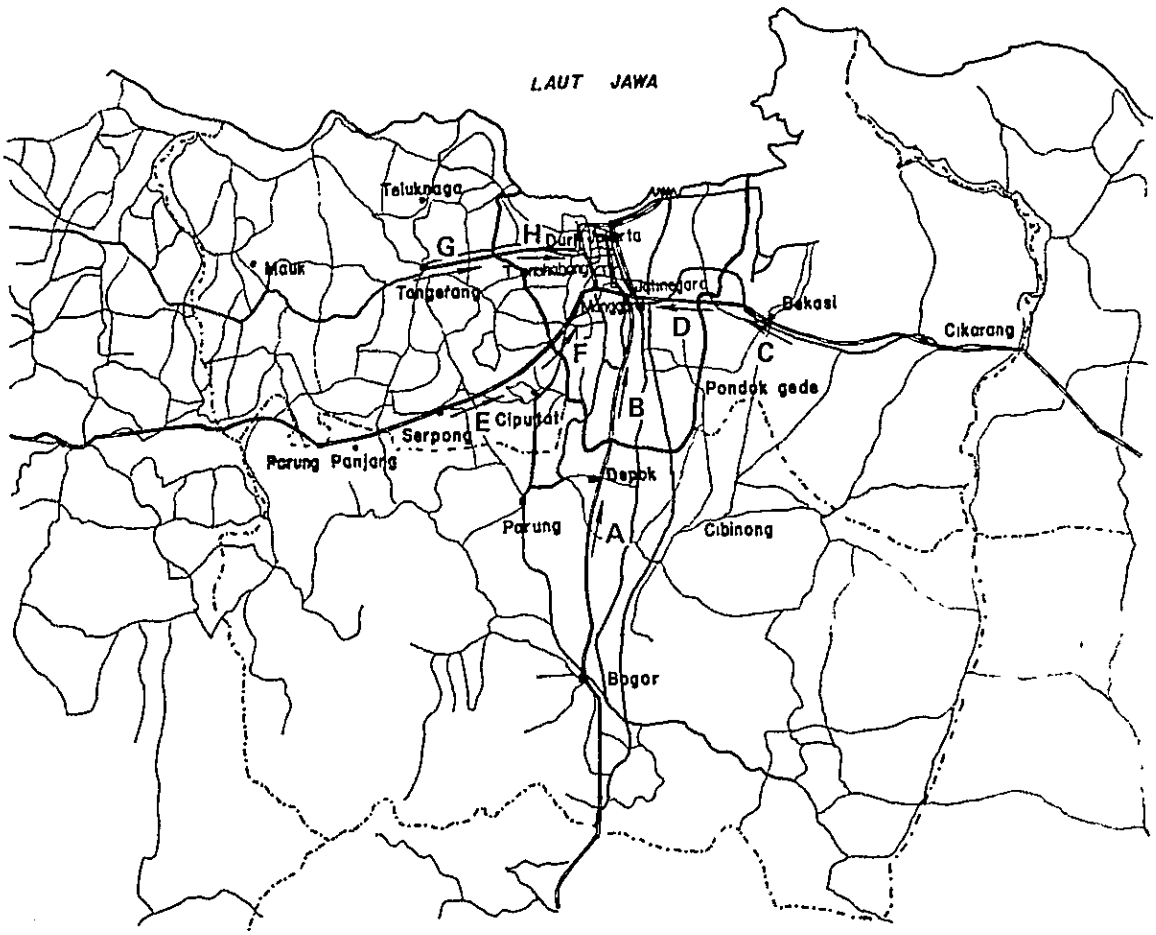
1) Because the railway traffic service does not fully satisfy public requirements in both

Table 1.2.3 Existing Railway Utilization Ratio

(Unit : 1000 persons/day)

	BOTABEK to D.K.I.			D.K.I. to D.K.I.		
	All mode	Railway	Ratio	All mode	Railway	Ratio
Central Line	38.36	6.07	A 15.8 %	132.7	0.198	B 0.15 %
Bekasi	23.40	0.904	C 3.9	97.26	0.118	D 0.9
Merak	14.41	0.889	E 6.2	127.5	0.004	F 0.003
Tangerang	14.43	0.220	G 1.5	83.14	0.089	H 0.10
Total	90.60	8.08	8.9 %	440.6	0.409	0.09 %

Data: 1. All mode: Jakarta Intra-urban Tollway Phase 1 Report Sept. 1978
2. Railway: Passengers by Railway OD Matrix in 1978 (PJKA)



aspects of operational frequency and high speed running of trains.

2) Because the existing railway is not provided with sufficient accommodation facilities capable of accepting a great many passengers at the peakload time (for instance, such as station front area and building, etc.)

Besides the above two,

3) Because the feeder mode of mutual complement to road and railway traffics remains unimproved.

This factor should not be overlooked, in that it works against the advantage of utilizing the railway for a relatively short distance travel within the D.K.I. area.

1.3 Present Status on Railway Transport

1.3.1 General situation

The railway network in the JABOTABEK Area comprises, as shown in Fig. 1.3.1, Central, Western and Eastern (Bekasi) Lines running in the urban area, which are therefore called the 'intra-urban lines' as a general term for them, and other suburban lines extending radially from the city center to Tangerang, Serpong, Bogor and Bekasi and the total line length reaches about 156 km.

The Western, Eastern (Bekasi Line) and Central (Jakarta to Manggarai) Lines are of double-track construction while all the rest are of single-track structure. Already electrified are the Jakarta to Bogor section of the Central Line and the Jakarta to Jatinegara and Jakarta to Tanjungpriuk sections of the Eastern Line. Electrification between Jakarta and Manggarai on the Western Line is scheduled by the Intermediate Program.

The railway existing in the JABOTABEK Area has its long historical background with initial start of electrical train operation far back in 1925. However, with growth of motorization at a later date the motor vehicle took the place of the train as the new leading player in the urban traffic and thus the railway was buried in oblivion for a long time. Recently, because of the road traffic congestion intensified as the result of rapid increase in the number of motorcars, the Indonesian Government finally came to recognize the worthiness of the railway traffic as the soluble means of the urban traffic problem. Thus, the 'interim plan' was formulated, under which necessary steps have been taken by electric and diesel railcars, improvement of the track lines and expansion of substations in and after 1976. By 1984 as the year of final goal of the 'Intermediate Program,' the railway facilities will be completed as outlined hereunder.

1) Rolling stock

Electric railcars	100
Diesel railcars	56

2) Ground facilities
   a. Completion of electrification on the Western line
   b. Completion of track improvement on the intraurban line (except turnouts)

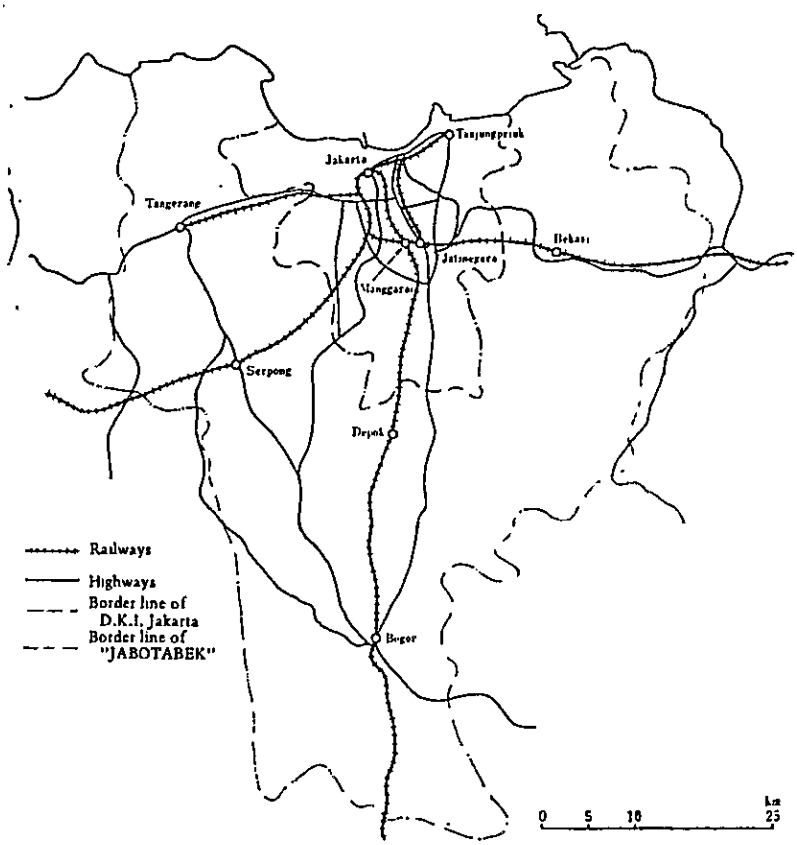


Fig. 1.3.1 Railway Network in JABOTABEK Area

Table 1.3.1 Outline of Each Line

Dec. 1980

Line	Section	Distance	Single or Double	Electrification	Railcars
Eastern Line	Jakarta – Jatinegara	11.8	Double	O	EC, DC
	Jatinegara – Bekasi	14.8	Double	X	DC
Bekasi Line	Jakarta – Tanjung priuk	8.1	Double	O	EC, DC
	Tanjung Priuk – Kemayoran	4.2	Double	O	EC, DC
Central Line	Jakarta – Manggarai	9.7	Double	O	EC
	Manggarai – Bogor	44.9	Single	O	EC
Western Line	Jakarta – Kampungbandan	2.7	Single	X	DC
	Kampungbandan – Manggarai	14.3	Double	X	DC
	Manggarai – Jatinegara	2.9	Double	O	DC
Tangerang Line	Duri – Tangerang	19.3	Single	X	DC
Merak Line	Tanah Abang – Serpong	23.3	Single	X	DC

c. New installation of silicon rectifiers at 11 substations
d. Conversion into automatic operation at 42 railway crossings mainly on the intra-urban line
e. Conversion of telecommunication lines into cable and employment of the train radio system
f. Raising-up of platform elevation at main stations on the Western Line.

The transport capacity of each line by operation of 100 electric cars upon completion of the Intermediate Program may be estimated as shown in Table 1.3.2.

Table 1.3.2 Transport Capacity Estimated for the Target Year of Intermediate Program Completion (2-hour rush time)

Line	Section	1980			Completion year (1983)			Ratio (B/A x 100 %)
		No. of trains	No. of cars for train-set	Capacity (A)	No. of trains	No. of cars for train-set	Capacity (B)	
Central Line	Manggarai ~ Depok	7	4	7.9	7	8	15.8	200
	Depok ~ Bogor	5	4	5.7	5	8	11.3	200
Eastern Line	Jakarta ~ Jatinegara	4	2	2.2	4	4	4.5	205
Western Line	Jakarta ~ Duri	2	2 or 4	1.6	4	4	4.5	281

Note: 1. The train-set at completion of the Program is estimated on a basis of 8 cars for the Central Line and 4 cars each for the Eastern and Western Lines.
2. The transport capacity is estimated for 2 rush hours at an unit of one thousand.

1.3.2 Train operation

The present status of train operation in the JABOTABEK Area is as shown in Table 1.3.3.

1.3.3 Operational problems

The problems, together with their causes, in train operation within the JABOTABEK Area may be summarized as follows in Table 1.3.4.

In order to cope with future train operation of high speed and high frequency, it is of equal importance to improve the software involved in the working step of train operation as well as the hardware related to track and signals.

1.3.4 General status of railway utilization and problems

The remarkable characteristic points of passengers utilizing both medium and short distance railway traffics may be summarized for short as follows:

1) Generally, passengers comprise the general public of lower income bracket than the middle class.

Table 1.3.3 Train Operation (Jan. 1981)

Line	Sections	No. of Trains (both directions) per Day				
		E C	D C	Long Distance Train	Fraight Train	Total
Central	Jakarta – Manggarai	42	4	24	–	70
	Manggarai – Depok	42	4	(2)	2	50
	Depok – Bogor	38	4	(2)	2	46
	Bogor –	–	6	–	–	6
Eastern	Jakarta – Jatinegara	3	20	16	8	47
	Tanjungpriuk – Kemayaran	1	2	2	4	9
Bekasi	Jatinegara – Bekasi	–	16	46	8	70
Western	Jakarta – Manggarai	–	16	2	7	25
Merak	Tanahabang – Serpong	–	4	4 (4)	10	22
Tangerang	Duri – Tangerang	–	10	–	–	10
	Tanjungpriuk – Jakarta	7	–	–	–	7

Note: 1. In the columa of Long-Distance Train, ( ) showes passenger train which stops at all stations.
2. Including extra train
3. Excluding service train

Table 1.3.4 Problems in Train Operation

Problem	Description with its cause
(1) Slow operating speed	a) Scheduled speed for EC and DC trains, as follows: city line About 20 km per hr Suburban line 30 ~ 50 km per hr b) Insufficiency of track, signal system and crossing equipment c) Double slip point within station yard d) Illegal occupation inside track line
(2) Large time delay in operation	a) Extra stoppage of train due to delay in handling of crossing gate or signals b) Guidance is required for train operators and station staff to make them adhere to on-time operation of trains
(3) Prolonged stopping time	a) Often longer than scheduled in the time table b) Delay in handling of crossing gate and signal c) Low platform at stations. d) Confusion in train diagram
(4) Insufficient function of train dispatching service	a) Incomplete dispatching system b) Insufficient instruction to station staff and train operator
(5) Predictable shortage of car accommodation capacity in near future	a) Bukitduri depot has only a very low accommodation capacity, allowing no further expansion in future
(6) Others	a) Insufficient safety facilities for train operation b) Review must be made on operation for the sake of safety

2) All the commuters accounting for 90 percent of total passengers at peak hours are shared by city workers for 80 percent and by commercial passengers (for carriage of goods) for a little over 10 percent. Almot none of passengers going to school utilizes the railway traffic. (Table 1.3.4)

Although the present composition of railway passengers may be bound strictly to the existing socio-economic structural characteristics in this region, it may be changeable to a certain extent by the manner in which the railway should be managed and operated.

Underirable phenomena as observed from the actual railway use may be summarized as follows:

1) Problems related to passenger behaviour

   i) Hand baggages admitted unlimitedly into the train
   ii) Occupancy by large quantity of goods, especially at car doors, at peak hours
   iii) Entry by passengers into the operator's cabin, especially illicit use of the cabin space for standing passengers at rush hours
   iv) Climbing to the car roof at rush hours
   v) Direct passage between the train and out-side of the station without passing through ticket inspection gate
   vi) Passengers' walk on the track line

2) Problems related to railway operation and management

   i) Competitive use of small freight cargo inside the facilities for passengers only
   ii) Congestion at ticket counters and wickets at tickets for a long-distance train.
   iii) Because of no definite functional division in ticket handling counters for long and short distance ticket, the speed of selling out ordinary tickets to short-distance passengers is slowed down during the sale of long distance ticket. This discourages those short-distance travelers to utilize the railway traffic.

1.4 Planning Requirement for Future Railway Development

1.4.1 Basic conception

Main characteristic features which the railway can provide to serve as the urban transport means may be cited as follows:

1) Mass transit is available at high speed punctually and continuously on a stabilized operation basis.
2) Transport efficiency of the railway for its per unit space occupation and energy consumption is remarkably higher than that of the road vehicle traffic.
3) The railway traffic produces less environmental effects, such as air pollution and noise, as compared with the road vehicle traffic.

Especially, in the event that the railway would be improved as the main transport means for urban commuters for identity of its characteristic (1), it would serve as the backbone of the urban function, thus being able to contribute widely and uniformly toward stabilization and efficiency improvement of the social and economic activities of the urban population. Together with further advantage related to effective utilization of oil energy resources, it may be said that the future improvement and expansion plan for the urban traffic facilities should be switched over mainly to the railway utilization.

However, it should be noted that unlike the case of road traffic the high-level plan of the urban railway development should naturally require the following conditions.

1) The initial investment requires a large sum and such investment must be made concentrately (by a single body)
2) In order to ensure its fullest function as the urban transport means modernized to most up-to-date, the railway system must be staffed with well trained and disciplined employees and operated with preciseness and strictness.
3) In view of the fixed nature of the railway, it is necessary that its permanent improvement and expansion should be planned in line with the socio-economic and traffic policy and plan of the city. In order to draw out full effect from such improvement and expansion, it is further necessary that the plan should be accompanied by improvement of the subsidiary systems and backed up by active cooperation on the municipal side.
   All those things considered, it is obvious that the plan for a full scale development should be carried out with scrupulous consideration and toward the realistic target on the basis of objective analysis of all relevant conditions.

1.4.2 Setting of required conditions for railway development plan

As relevant conditions to the development of the JABOTABEK urban railway system, current conditions of railways and urban transportation market in this region are summarised as follows:

1) The existing railway facility consists of a rudimentary network of rail tracks and a system of generally timeworn equipment, with the exception of some limited areas of recent inprovement. It thus requires heavy renewal in order to become operational as a means of modern mass transportation service.
2) To meet the operation and maintenance requirements which are due to increase in parallel with future railway facility development, extensive efforts will have to be made to trackle the essential but demanding tasks of personnel development in all lines and fields, and in development of the operation management system into a highly disciplined modern establishment.
3) Having been developed on the basis of a fundamentally automobile oriented transportation network system, the urban setting in general has become morphologically and functionall almost irrelevant to the existence of the railway facility. Furture railway development therefore, requires the complement of compatible urban developments in order to achieve its full effect. Introduction of a developments scheme of larger scale than is warranted by the forecast future demand

based on extrapolation of current urban situations and trends can only be justified when supported by authorized future urban management and traffic policies, and future urban development plans.

These requirements lead to the following considerations from the standpoind of long term development program planning:

1) Relating to facility development:
   Although the elements and composition of facility development programs are subjects of engineering studies and judgements, the main areas of considerations in planning the practical program are the area, quatity and timing of investment and basis of decisions are found on judgements of cost versus socio economical benefits and operational feasibilities on the one hand and budget situations on the other.

2) Relating to personnel and organization development:
   The personnel and organization development which is a demanding and time consuming process, belongs in nature to an internal affair of the railway establishment.

   The main points to be focalized in this regards are:

   i) How to nurture capable and motivated leaders in all fields of operation to form cores of the personnel and organization
   ii) How to produce and maintain adequate staff and ranks to meet the requirement.

3) Relating to compatability and development of relevant urban conditions:
   Urban conditions in nature belong to external circumstantial conditions, and to the reality of a development plan which requires the effecting of corresponding changes in the urban conditions, the close cooperation from other relevant government agencies is a prerequisite.

Although matters regarding Items 2) and 3) of the above are equally important subjects of engineering studies and planning considerations in establishing long term development plans, they belong to different categories of problems, being non-engineering restraining factors, in contrast to the case of Item 1).

Table 1.4.1 shows three alternative cases of possible combination of conditions regarding these restricting factors. The current Urban and Suburban Railway Transportation Study in JABOTABEK Area is premised on conditions of case II in establishing target volume of future railway transportation as basis of railway facility development plan. It is a prerequisite for the implementation of the master plan thus established that it be reviewed and revised at due intervals during its implementation, based on reviews of the development of personnel situations and relevant urban conditions.

Table 1.4.1 Possible Combination of Premises for Railway Facility Development Planning

Case	External Factors: (Commuter traffic demand structure)	Internal Factors: (Personnel development capacity)
I	A. Current structure basically maintained during planned period	B. Current training and mobilization system basically maintained during planned period
II	A' - ditto -	B' Personnel supply non restriated
III	A' Current structure basically changed within planned period	B' - ditto -

CHAPTER 2. RAILWAY TRAFFIC DEMAND

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2.1 Socio-Economic and Land Use Study

2.1.1 Future population of the JABOTABEK Area in the year 2000

(1) Future Population by Kabupaten

Future population by Kabupaten in the JABOTABEK Area is as estimated in Table 2.1.1.

Table 2.1.1 Future Population of Kabupaten

(Unit: 1,000 persons)

Kabupaten	1978	2000
D.K.I. Jakarta	6,082	10,500
Bogor	2,236	4,606
Bekasi	953	2,610
Tangerang	1,288	2,451
*Karawang	81	240
Cikampek	82	186
R. Bitung	50	63

Source:– City Planning Reports by Cipta Karya D.K.I. Reports

Note: 1. All the populations shown in the Table above are based upon the reports and the city plans of concerned local governments and Cipta Karya, except the populations for Bogor. The natural increase ratio of Bogor in after areas than the city areas is assumed to be 2%.

2. The area marked with asterisk * is out of the JABOTABEK Area. However, since it is situated within the influence sphere of the JABOTABEK train traffic, it has been taken into consideration.

3. According to the JABOTABKE METROPOLITAN Development Planning (June 1980, CIPTA KARYA) the future population in the year 2003 is forecasted up to the figures indicated in the following Table.

(Unit : 1,000 persons)

BOTABEK	Kabupaten Bogor	4,398
	Kabupaten Tangerang	2,819
	Kabupaten Bekasi	2,258
BOTABEK Sub – Total		9,475
D.K.I. Jakarta		11,315
JABOTABEK Total		20,790

This estimated population in BOTABEK is larger by about 2 % than the JICA team's estimation.

(2) Estimation on future distribution of population (BOTABEK Area)

The distribution map of population in the year 2000 is drawn up in order to forecast the population in the same year within the station influence sphere in the BOTABEK Area. The Flow chart for preparation of the map and the result of forecast are as shown in Fig. 2.1.1 and Table 2.1.2.

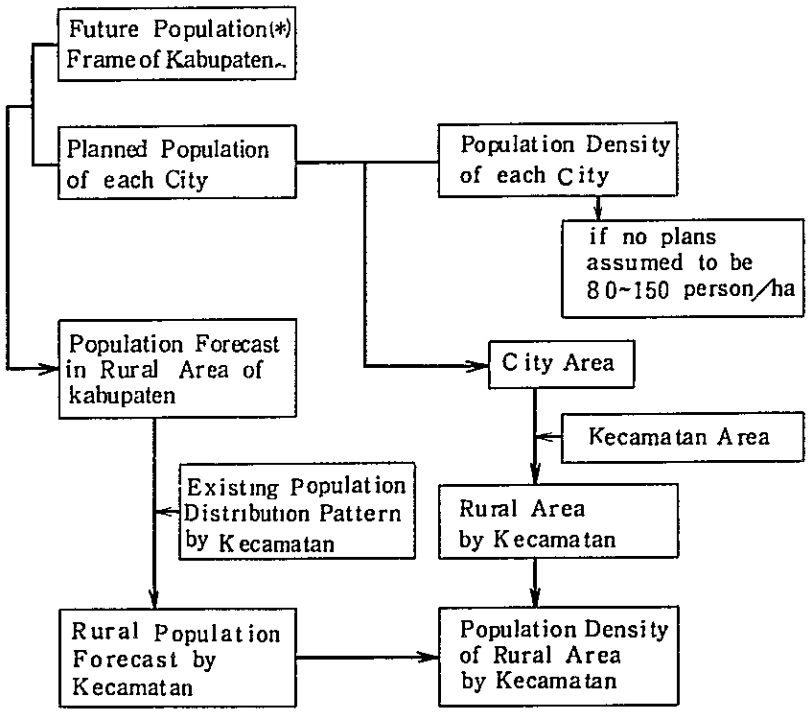


Fig 2.1.1 Flow Chart of Future Population Forecast in BOTABEK Area

(Kabupaten Bogor, Bekasi and Tangerang)

Note: 1. See Table 2.1.1.

2. Each city is categorized into four by population density e.g. 150 pop/HA, 120 pop/HA, 100 pop/HA and 80 pop/HA.

Table 2.1.2 Population Density in 2000

Bogor		
Kecamatan	City	rural
Bogor Utara	154.0	–
" Selatan	362.0	–
" Tengah	268.0	–
" Timur	200.0	–
" Barat	238.0	–
Ciomas	–	16.6
Kedung Halang	–	18.9
Semplak	–	22.9
Ciawi	–	10.9
Cisarua	100.0	9.7
Cijeruk	100.0	16.1
Cibinong	120.0	17.5
Cimanggis	–	20.2
Citeureup	100.0	10.5
Gunung Putri	100.0	7.0
Depok	88 0	47.4
Sawangan	–	15.0
Parung	100.0	69.0
Gunung Sindur	100.0	6.6
Leuwiliang	100.0	7.8
Rumpin	100.0	6.8
Ciampea	100.0	24.0
Cibung Bulang	100.0	10.6
Jasinga	100.0	10.2
Cigudeg	100.0	5.0
Parung Panjang	100.0	7.3
Jonggal	150.0	4.2
Cariu	100.0	6.2
Cileungsi	100.0	9.6
Total	112.5	11 0

Bekasi		
Kecamatan	City	rural
Bekasi	120.0	22.4
Babelan	100.0	10.4
Cilincing	100.0	7.6
Pondok Gede	100.0	18.4
Tambun	100.0	14.0
Cibitung	100.0	13.2
Setu	100.0	9.5
Cikarang	120.0	87.2
Lemahabang	100.0	13.8
Cibarusa	100.0	10.8
Sukatami	100.0	4.4
Pebayuran	100.0	16.6
Cabangbungir	100.0	8 1
Total	114.0	13.0

Tangerang		
Kecamatan	City	rural
Tangerang	150.0	115.7
Batu Ceper	100.0	8.9
Teluk Naga	100.0	6.6
Serpong	120.0	4.7
Ciputat	120.0	8 0
Cileduq	120.0	10.0
Curug	100.0	4.9
Legok	100.0	2 3
Cikupa	100.0	4.5
Belaraja	100.0	5.2
Tigraksa	100.0	3.5
Kresek	100.0	4.7
Kronjo	100.0	5.4
Mauk	100.0	5.4
Sepatan	100.0	6.6
Rajeg	100.0	4.6
Pasar Kemis	100.0	4.6
Total	124.0	6 1

Note: Source of Data

– Bogor –

(1) Kompilasi Rencana Tata Kota Bogor, Cipta Karya
(2) Rencana Tata Kota Bogor, book 2 Cipta Karya (Distribution by 1978 population proportion)
(3) Rencana Tata Kota Bogor, book 2. Cipta Karya (JABOTABEK Center's Policy)
(4) Rencana Tata Kota Cibinong, Analisa dan Rencana, Cipta Karya
(5) Rencana Pendahuluan Kota Citeureup, BAPPEMKA, Bogor
(6) Rencana Kota Depok s/d tahun 2000, Cipta Karya
(7) Rencana Tata Kota Parung, Analisa dan Rencana, Cipta Karya
(8) Rencana Pendahuluan Kota Jonggal, BAPPEMKA, Bogor Bekasi
(1) Kompilasi Data Rencana Kota Bekasi, Cipta Karya
(2) Rencana Kota Bekasi, Cipta Karya
(3) Rencana Garis Besar Pembangunan Kabupaten Bekasi Tahun 1975–2000
(4) Rencana Garis Besar Pembangunan Kabupaten Bekasi Tahun 1975–2000

– Tangerang –

(1) Kabupaten Dati II Tangerang selama Pelita II (1974/75–1978/79), PEMDA Dati II Tangerang
(2) Pola Dasar Pembangunan Daerah Kabupaten Dati II Tangerang, 1979, PEMDA Dati II Tangerang

2.1.2 Land use plan

(1) Housing development

The cities in which housing developments are planned on a large scale by 2000 are as shown in Fig. 2.1.2. The largest development project for each line is planned at Depok on the Central Line, at Cikarang on the Bekasi Line, at Serpong on the Merak Line and at Tangerang on the Tangerang Line.

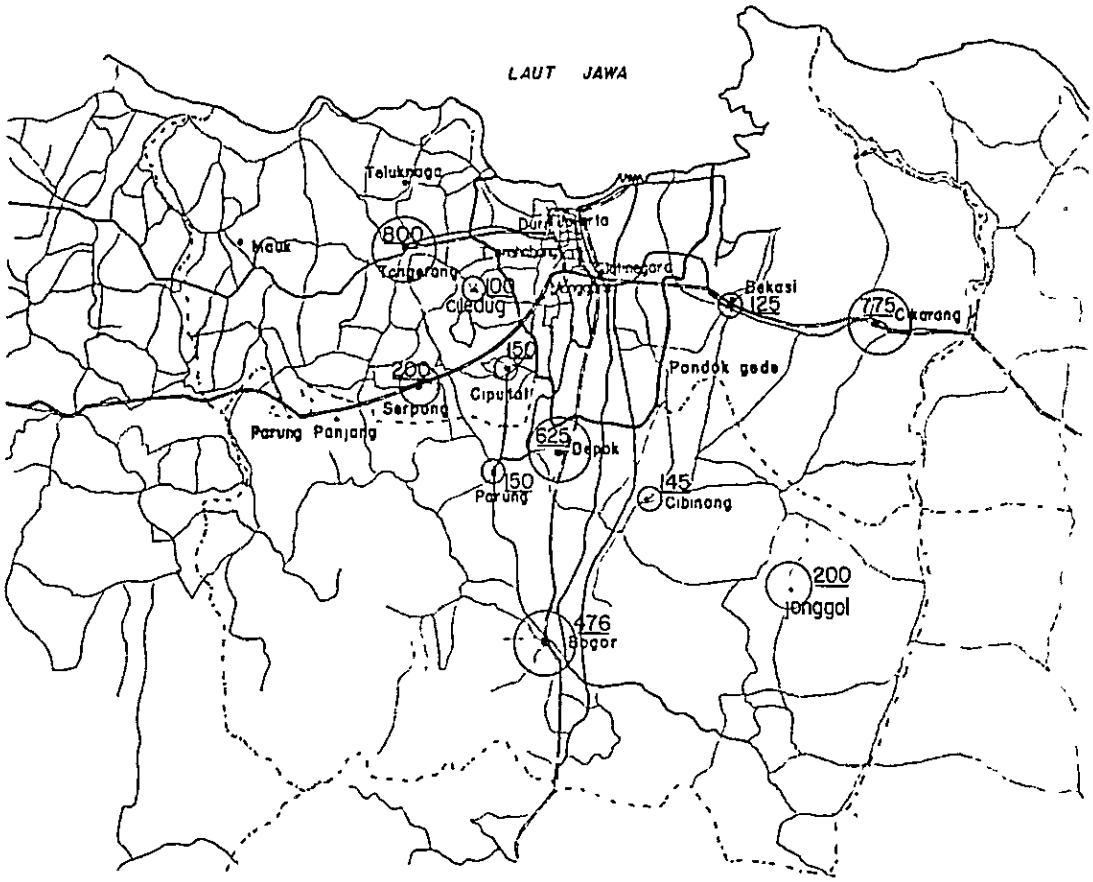


Fig. 2.1.2 Housing Development in Year 2000 (Unit : 1,000 persons)

(2) Industrial development

The following are the cities in which industrial development projects are planned on a large scale by 2000.

①	Kabupaten Bogor	Cibinong	350 HA
		Jonggol	100 HA
②	Kabupaten Bekasi	Cikarang	330 HA
③	Kabupaten Tangerang	Tangerang	1,179 HA

In the northeast of Cakung, East Jakarta of D.K.I. the industrial project on a large-scale is planned.

(3) Other development projects

The construction project of a New Airport (New Cengkareng Jakarta Airport) at Batuceper in Kabupaten Tangerang is scheduled to be opened in 1984.

2.2 Present Situation of Railway Use

2.2.1 Passengers between origin-destination stations

The cross-sectional link load between stations on each line as estimated from ticket sales in 1978 for JABOTABEK trains is as shown in Fig. 2.2.1. In 1978 the section between Angke and Kampunbandan was closed because of bridge construction work. Therefore, the traffic load from Merak and Tangerang Lines to Jakarta Kota, which was sought by way of Gambir according to the statistics, is amended herein on an assumed basis via Angke.

The following characteristic features may be pointed out from the present status of passengers between O.D. stations in the JABOTABEK Area.

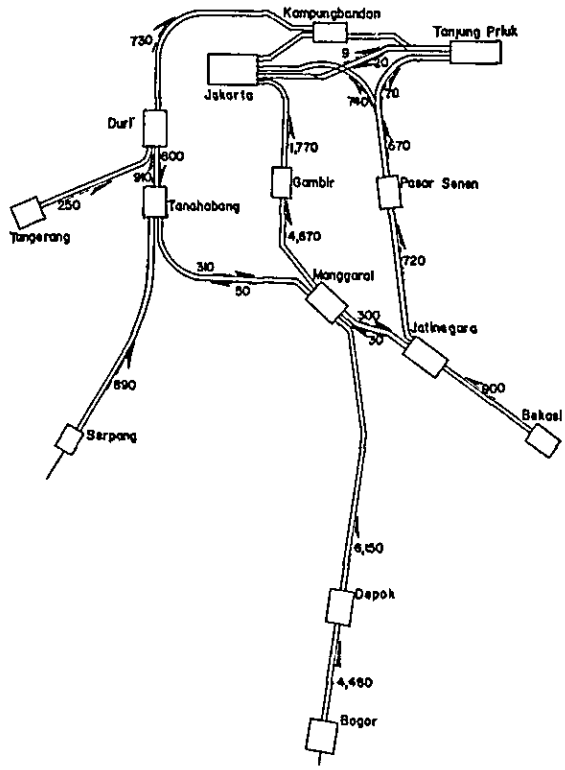


Fig. 2.2.1 Cross-sectional Link Load of Each Railway Line
(Unit: Passengers/Day)

1) All the existing lines except the Central Line are characterized respectively by the cross-sectional link load below 1,000 passengers a day and, in particular, the Tangerang Line is worse with the volume of only 250 passengers a day.
2) The destination of most of the passengers using the Central Line is Gambir or Jakarta Kota, and few passengers change trains on the way or at their destination stations.
3) The majority of passengers using Bekasi and Merak Lines come from outside the JABOTABEK Area.

2.2.2 Purpose of use

Commuters using each line at peak hours reach such a high ratio as 90 %, the highest of which is recorded at 94.1 %. However, only the Merak Line makes an exception, showing a relatively low ratio of 61.7 % as compared with the other three lines.

As for purpose of trips, both the Central Line and Tangerang Line are shared by passengers for jobs at such an overwhelmingly high ratio as nearly 80 % respectively while on the Bekasi and Merak Lines passengers for the same purpose show a low ratio. The share of merchants on the Bekasi Line is noteworthy, showing a relatively high ratio of 20 %.

Note: The above result was sought from the train interview survey (by JICA Team on 16 and 17 July, 1980)

Then, the commuters' ratio on each line is obtained as shown in Table 2.2.1 from the result of latest survey.

Table 2 2.1 Commuter's Ratio in Each Line

Line	Commuter's Ratio in Peak	Daily Commuter's Ratio
Central	87.5 %	49 5 %
Bekasi	86.7 %	49 1 %
Merak	61.7 %	34.9 %
Tangerang	94 1 %	53.3 %

Note:

1. Peak ratio in 2 hours is assumed to be 30 %
2. Commuter's peak ratio in 2 hours is assumed to be 53%。(Peak 3 hours 75% x 70 %)

2.2.3 Feeder mode

The following points may be cited as the main characteristics with regard to the feeder modes to the origin station and from the destination station.

1) Nearly half of the total passengers using both origin and destination stations trip to and from the station within a walking distance.
2) The bus for the urban station and the omnibus like 'Colt' for the suburban station serve respectively as the important means of feeder transport system connected to the railway.
3) Early in the morning, 'Beca' is used at a pretty high rate, instead of the bus and 'Colt' service.

As for required time for a trip to the origin station and from the destination station, the general tendency is that the required time to the origin station is longer than that from the destination station, though the average time may be varied according to station and feeder mode. The maximum required time for a trip to the origin station is recorded approximately at 20 minutes for each feeder mode, except the extreme case where the maximum time of 45 minutes is required by 'Colt' at Station Bogor on the Central Line.

From the result above, it may be possible that the station influence sphere on the traffic generating side should be defined to cover the distance of 20 minutes walk or vehicle riding.

Note: 1. Sought from the train interview survey (by JICA Team on July 16 and 17, 1980)
2. 'Colt' includes 'Bajaj,' 'Oplet,' 'Bemo' and 'Helicak.'

2.3 Railway Traffic Demand Forecast

2.3.1 Demand forecasting method

As for forecasting railway traffic demand in the year 2000 in the JABOTABEK Area, demand was estimated firstly by forecasting demand on its generating side and then by assignment of such forecasted demand according to the ratio of concentrated demand into each station existing inside the city line.

The calculation is based on the estimation of the traffic generating side as well as, on the assignment of this number according to the proportion of the concentrated demand for each station existing inside the city line.

Generated demand may be divided largely into demand generated from the BOTABEK Area into D.K.I. and demand generated between stations within D.K.I.

1) Demand (generated) from the BOTABEK Area into D.K.I. was estimated from the future distribution of population as referred to in 3.1.1 (2).
2) Demand between stations within D.K.I. was estimated from generated demand by all-mode as forecasted in the Intra-urban Tollway Phase I Report (1978).
With regard to concentrated demand, generated demand was assigned at the ratio obtained from the estimated concentration of demand at each station by due reference to the all-mode traffic concentration as forecasted in the Intra-urban Tollway Phase I Report.

2.3.2 Generated demand

1) Generated demand in the year 2000 within the BOTABEK Area
Generated railway traffic demand from the BOTABEK Area into D.K.I. Jakarta was calculated from the flow chart as shown in Fig. 2.3.1. The result of calculation is as shown in Table 2.3.1.
2) Generated demand in the year 2000 within D.K.I.
Generated demand within D.K.I. was calculated from the flow chart as shown in Fig. 2.3.2. The result of calculation is as shown in Table 2.3.2.

2.3.3 Distribution of demand

Demand coming into D.K.I. and that generated within D.K.I. are assigned to each railway station according to the flow chart as shown in Fig. 2.3.3. The results are as shown in Tables 2.3.3 ~ 2.3.4.

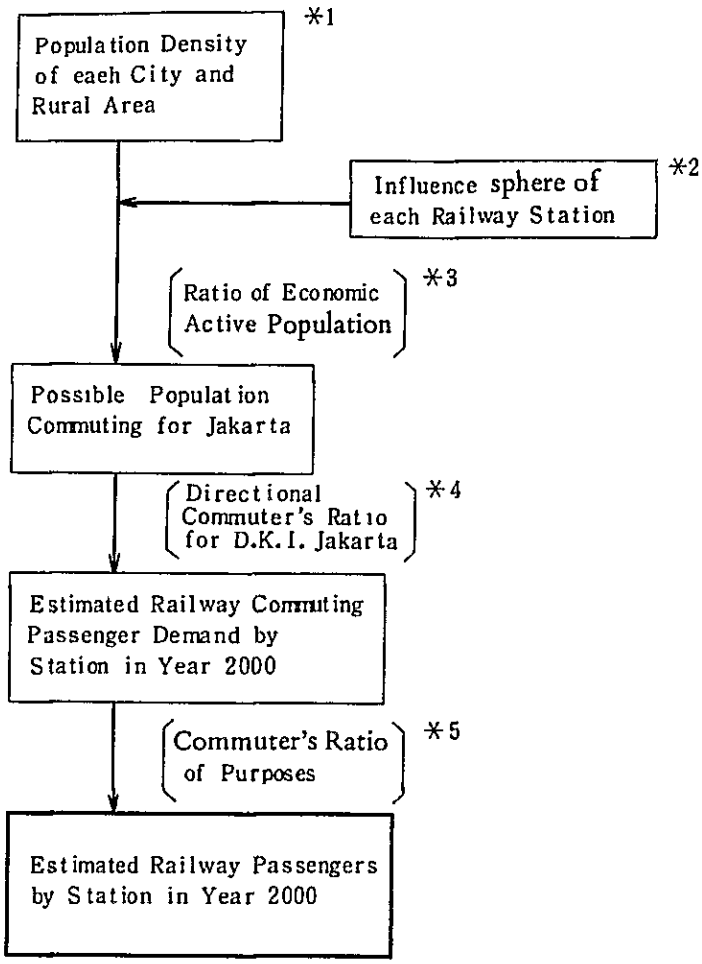


Fig. 2.3.1 Flow Chart of Demand Forecast in BOTABEK Area

Note: *1 See 2.1.1 (Table 2.1.2)

*2 on foot: 20 min. (1.33 km radius)
by vehicle: 20 min. (15 km length along highway) and 500 m each for both sides of highway
(from interview survey results in 1980)

*3 Estimated to be 28 % (Intra Urban Tollway Phase I Report, 1978)

*4 Already builtup area = 40 %
New developped area = 60 % (from hearing data)

*5 Commuter's Ratio by line is estimated as follows respecting interview survey results in 1980

Central Line	= 49.5 %	Merak Line	= 34.9 %
Bekasi Line	= 49.1 %	Tangerang Line	= 53.3 %

Table 2.3.1 Generated Demand in BOTABEK Area

(Unit : 1,000 persons)

Line	Station	Influence sphere(Km^2)	Population	Railway Commuter	Railway Passengers	Passengers in Peak2hr	Commuter Ratio
Centrl	Bogor	8.32	146.4	20.4	41.2	12.4	
	Febon Pedes	5.58	12.0	1.3	2.6	0.8	
	Cilebut	5.58	11.7	1.3	2.6	0.8	
	Bojonggede	5.58	26.4	3.0	6.1	1.8	49.5 %
	Citayan	5.58	34 6	4.9	9.9	3 0	
	Pondokterum	5.58	49.1	8.2	16.6	5.0	
	Depok	8.68	71.1	11.3	22.8	6.8	
	Depok Baru	5.58	41.0	6.4	12.9	3 9	
	Sub-Total	–	–	56.8	114.8	34.4	
Bekasi	Lewahabang	6.41	48.6	5.8	11.8	3.5	
	Cikarang	6.36	50.8	8.4	17.1	5.1	
	Cipinang	6.23	29.9	3.3	6.7	2.0	
	Tambun	5.94	29.8	3.3	6.7	2.0	49.1 %
	Bekasi	8.48	74 4	8.3	16.9	5.1	
	Kranji	6.52	14 6	1.6	3 3	1.0	
	Krawang	–	–	6.6	13.4	4.0	
	Cikampek	–	–	5.1	10.4	3.1	
	Sub-Total	–	–	42.4	85.2	25.6	
Merak	Tenjo	5.58	21.6	2.4	6.9	2.1	
	Daru	5.58	21.6	2.4	6.9	2.1	
	Cilejut	7.14	21.8	2 4	6.9	2.1	
	Parung Pamjang	7.08	61.9	6.9	19.8	5 9	34.9 %
	Cicayur	5.58	1.9	0.2	0.6	0.2	
	Cisauk	5.58	2.0	0.2	0.6	0.2	
	Serpong	4.04	48.5	8.1	23.2	7.0	
	Rawabufu	4.04	48.5	8.1	23.2	7.0	
	Sudimara	7.01	16.4	1.8	5.2	1.6	
	Jurangumangu	5.58	4.5	0.5	1.4	0.4	
	Rangkas Bitung	–	–	3.7	10 7	3.2	
	Sub-Total	–	–	34.3	14.0	29.4	
Tangerang	Tangerang	14.09	125.0	14.0	26.3	7.9	
	Batuceper	5.58	68.7	7.7	14.4	4.3	53.3 %
	Sub-Total	–	–	21.7	40.9	12.2	
Total	–	–	–	155.2	339.0	101.6	

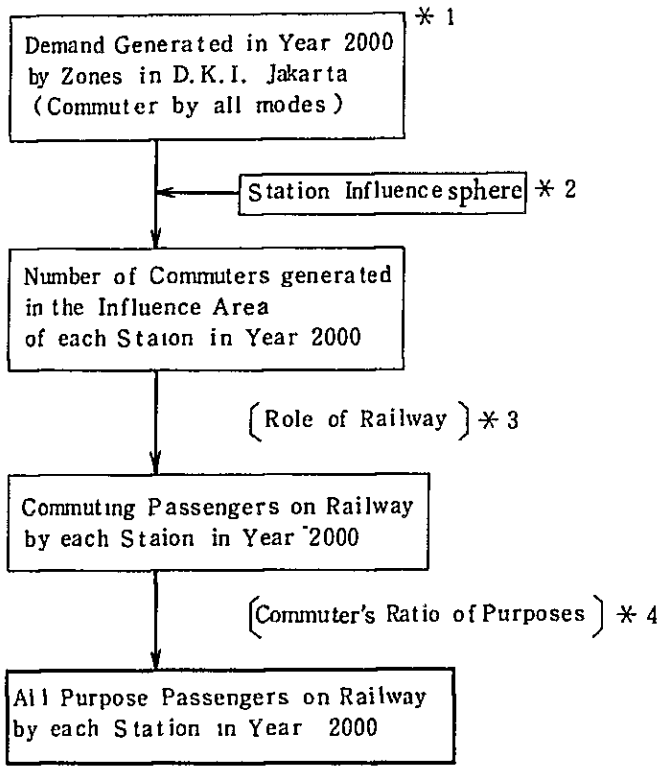


Fig. 2.3.2 Flow Chart of Demand Forecast in D.K.I. Jakarta

Note: *1 Intra Urban Tollway Phase I Report (1978)

*2 Central District; 1.0 km radius on foot
Out of Central District; 1.33 km radius on foot

*3 Estimated as follows in Central Area; 5.0 %
Out of Central Area; 50.0 %

*4 Peak 2 hours ratio of passengers to all day is 35 %. In peak 2 hours commuting purpose occupies 65 % of all purposes of trip. And commuting passengers concentrate in peak 2 hours by 70 % (from hearing data). So Commuting Ratio of purposes to all day is calcurated to be 33 %.

Table 2.3.2 Generated Demand in D.K.I. Jakarta

(Unit : 1,000 persons)

Line	Station	Influence sphere(km²)	possible Commuters	Railway Share	Railway Commuter	Railway Passengers	Passengers in Peak2hrs
Central	Lentengagung	5.58	12.4		6.2	18 8	6.6
	Tanjung Barat	5.58	13.5		6.8	20.6	7.2
	Pasar Minggu	5.58	13.0	50 %	6.5	19.7	6.9
	Durenkalibata	5.58	17.5		88	26.7	9.3
	Manggrai	2.51	18 2		9.1	27.6	9.7
	Sub-Total	–	74.6	–	37.3	113.0	39 6
Bekasi	Klender	4.46	17.8		8.9	27.0	9.5
	Cipinang	4 19	19.5	50 %	9.8	29.7	10.4
	Jatinegara	2.36	13.8		6.9	20.9	7.3
	Sub-Total	–	51.1	–	25.6	77.4	27.1
Merak	Pondokbitung	5 58	22.3		11.2	33.9	11.9
	Kebayoran	5.58	23.0	50 %	11.5	34.8	12 1
	Palmerah	5.40	29.8		14.9	45.2	15.8
	Tanahabang	3.00	16.7		8.4	25.5	8.9
	Sub-Total	–	91.8	–	45.9	139.0	48 7
Tangerang	Kalderes	5 58	13.2		6.6	20.0	7.0
	Rawabuaya	5.58	13.2		66	20.0	70
	Pesing	4.46	15.5	50 %	7.8	23.6	8.3
	Grogol	4 46	26.7		13.4	406	14.2
	Duri	3.00	24.1		12.1	367	12.8
	Sub-Total	–	92.7	–	46.4	140.5	49.2
Tanjung Priuk	Tanjung Priuk	4.19	13.0		6.5	19.7	6.9
	Sungati rem	4.19	13.0	50 %	6.5	19.7	6.9
	Ancol	4.19	11.4		5.7	17.3	6.1
	Sub-Total	–	37.4	–	18 7	56.7	19.8
City	Pegangsaan	2.75	15.5		0.78	2.36	0 8 3
	Gondangdia	2.51	13.5		0.68	2.06	0.7 2
	Gambir	2.36	11.6	50 %	0.58	1.76	0.6 2
	Pintuair	1.05	5.5		0.28	0.85	0.3 0
	Sawahbesar	2.36	15.5		0.78	2.36	0.8 3
	Jakarta Kota	2.09	17.9		090	2.73	0.9 6
	Pondok Jati	2.36	20.9		1.05	3.18	1.1 1
	Kramat	2.36	20.4		1.02	3.09	1.08
	Gang Sentiong	2.36	20.4		1.02	3.09	1.08
	Pasar Senen	2.36	17.3		0.87	2.64	0.9 2
	Kemayoran	2.51	18.7	50 %	0.94	2.85	1.00
	Dukuh	2.09	11.7		0.59	1.79	0.6 3
	Karet	2.09	11.5		0.58	1.76	0.6 2
	Angke	2.75	23.0		1.15	3.48	1.2 2
	Gudang	2.36	11.2		0.56	1.70	0.6 0
	KampungBandan	2.36	7.5		0.38	1.15	0.4 0
	Gunung Sahari	2.36	6.8		0.34	1.03	0.3 6
	Sub-Total	–	248.9	–	12.4	37.7	13.2
Total		–	596.5	–	186.3	564.5	197.5

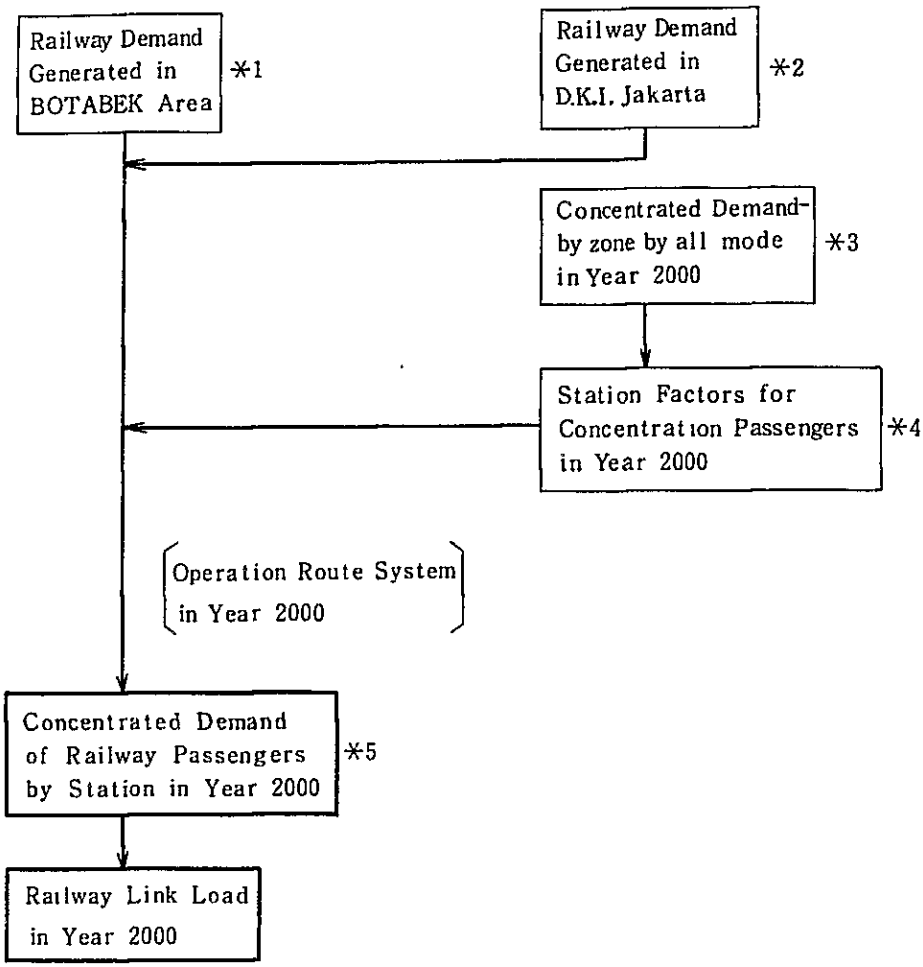


Fig. 2.3.3 Flow Chart of Demand Assignment in JABOTABEK Area in Year 2000

Note: *1 See Fig. 2.3.1

*2 See Fig. 2.3.2

*3 Intra Urban Tollway Phase I Report (1978)

*4 The following formula applied to calculation of demand only for the station where concentrated demand was in excess of generated demand.
(Concentrated traffic volume in the zone in which the station is situated + 1/2 x Σ (Concentrated traffic volume in the adjacent zone)

*5 Distribution was calculated for each operating unit. The operating unit in the year 2000 was assumed as follows:

Table 2.3.3 Distribution of Demand from BOTABEK
(in peak 2 hours)

(Unit: 1,000 passengers)

LINE	Station	Distribution of Passengers
CENTRAL LINE	Lenteng Agung	1.52
	Pasar Minggu	1.82
	Duren Kalibata	2.23
	Manggarai	1.79
	Gambir	4.83
	Jakarta Kota	2.98
	Jatinegara	1.52
	Tanahabang	3.66
	Duri	2.67
	Angke	2.67
	Kampungbandan	2.59
	Ancol	2.84
	Tanjung Priuk	3.28
BEKASI LINE	Klender	1.99
	Jatinegara	0.88
	Pondok Jati	0.92
	Kramat	0.76
	Gang Sentiong	0.76
	Pasar Senen	2 28
	Kemayoran	2.22
	Jakarta Kota	1.72
	Ancoi	1.64
	Tanjung Priuk	1.90
	Manggarai	1.04
	Tanahabang	2.12
	Duri	1.55
	Angke	1.55
	Kampung Bandan	1.50
	Gambir	2.80

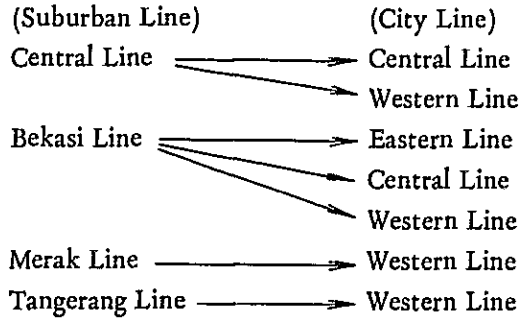
LINE	Station	Distribution of Passengers
MERAK LINE	Kebayoran	2.41
	Palmerah	2.55
	Tanahabang	3.72
	Jatinegara	1.55
	Manggarai	1.82
	Duri	2.72
	Angke	2.72
	Kampungbandan	2.63
	Jakarta Kota	3.03
	Ancol	2.89
	Tanjung Priok	3.34
TANGERANG LINE	Kalideres	0.81
	Rawabuaya	0.81
	Pesing	0.66
	Grogol	1.08
	Duri	0 98
	Jatinegara	0.56
	Manggarai	0.66
	Tanahabang	1.35
	Angke	0.98
	Kampung Bandan	0.95
	Jakarta Kota	1.10
	Ancol	1.05
	Tanjung Priok	1.21

Table 2.3.4 Distribution of Demand in D.K.I.

(Unit: Passengers / Peak 2 hours)

LINE	Station	Distribnted Demand
CENTRAL LINE	Lentengagung	2,462
	Pasar Minggu	2,543
	Duren Kalibata	3,036
	Manggarai	2,430
	Gambir	3,528
	Jakarta Kota	1,892
	Jatinegara	2,021
	Tanahabang	4,756
	Duri	3,320
	Angke	3,802
	Kampungbandan	3,708
	Ancol	3,809
	Tanjung Priuk	4,370
EASTEAN & BEKASI LINE	Klender	4,367
	Jatinegara	1,131
	Pondok Jati	1,281
	Kramat	1,062
	Gang Sentiong	1,345
	Pasar Senen	3,209
	Kemayoran	3,130
	Jakarta Kota	2,429
	Ancol	1,151
	Tanjung Priuk	1,326
	Manggarai	553
	Tanahabang	1,128
	Duri	826
	Angke	826
	Kampung Bandan	798
	Gambir	2,046

LINE	Station	Distribnted Demand
MERAK LINE	Kebayoran	3,452
	Palmerah	3,409
	Tanah Abang	2,271
	Duri	1,704
	Angke	1,704
	Kampungbandan	1,646
	Ancol	1,762
	Tanjung Priok	2,036
	Jakarta Kota	2,977
	Manggarai	1,113
	Jatinegara	947
TANGERANG LINE	Kalideres	3,196
	Rawabuaya	3,196
	Pesing	2,544
	Grogol	4,182
	Duri	1,522
	Angke	1,503
	Kampunbandan	1,529
	Ancol	1,713
	Tanjung Priuk	1,799
	Jakarta Kota	1,844
	Tanah Abang	1,667
	Manggarai	1,022
	Jatinegara	867



2.3.4 Gross railway traffic demand of JABOTABEK Area in the year 2000 and cross-sectional link load on each line

(1) Gross railway traffic demand

It is estimated that in the year 2000 railway-trip demand will be generated in peak 2 hours to a total of 299.1 thousand passengers, summing up 101.6 thousand from BOTABEK to D.K.I. plus 197.5 thousand within D.K.I.

It is further estimated that in the year 2000 the total trips by all modes will be 3,100 thousand in peak 2 hours.

The share ratio of railway trip in the total trip by all modes, if limited only within station influence sphere, is as shown in Table 2.3.5.

Table 2.3.5 Railway Ratio in Year 2000

(in peak 2 hours)
(Unit : 1,000 trips)

	All mode trip in Station Influence Sphere	Railway trip	Railway Ratio
BOTABEK to D.K.I.	259.3	101.6	39.2%
D.K.I.	1,321.0	197.5	15.0%
Total	1,580.3	299.1	18.9%

Table 2.3.6 shows the result of the railway share ratio if the trip by all modes is limited only to a pair of origin – destination zones situated along the operating unit of each line.

Table 2.3.6 Railway Ratio in Each Line

(in peak 2 hours)
(Unit : 1,000 trips)

Line	All mode trip in O–D pair	Railway trip	Railway Ratio
Central	138.0	43.64	31.6%
Bekasi	106.3	36.38	34.2%
Merak	100.6	40.05	39.8%
Tangerang	40.5	22.57	55.7%

This method of demand forecast uses a realistic process of summing up demand to be generated, not reflecting any strategic calculation method for railway share. As the pre-requisite condition to future demand generation, the following approaches to both city planning and traffic planning are required.

i) Construction of new railway stations and the improvement of their facilities and the feeder system (especially, the access road to the station).

ii) Population settlement and land use plan (for residential area) within the station influence sphere.

iii) Land use plan (for employmentarea) with objective to change the commuting pattern. If any attempt to satisfy the above requirements is considered necessary for future urbanization of Jakarta, the first immediate matter to be done is to increase the present railway traffic capacity to comply with future increase of railway demand. If those requirements will be satisfied, the railway-share in 2000 that is forecasted about 10% may be increased to 20 % ~ 30 %.

(2) Cross-sectional link load

Fig. 2.3.4 illustrates the cross-sectional link load as estimated for each section between stations of each line from the Origin-Destination table prepared by assignment of generated demand to each station on the urban lines. The result of comparison on traffic load at present with that in the year 2000 is as shown in Table 2.3.7.

Table 2.3.7 Cross-sectional link load 2000 v.s. 1978

(in Peak 2 hours)
(Unit : 1000 Passengers)

Line	Section	Cross-sectional link load 1978	2000	Ratio
Central	Bogor ~ Depok	1.34	22.89	17.1
	Depok ~ Manggarai	1.85	43.64	23.6
	Manggarai ~ Gambir	1.40	19.47	13.9
Bekasi	Bekasi ~ Jatinegara	0.27	36.38	134.7
Eastern	Jatinegara ~ Pasar Senen	0.22	18.59	84.5
Merak	Serpogn ~ Tanahabang	0.27	40.05	148.3
Tangerang	Tangerang ~ Duri	0.075	22.57	300.9
Western	Tanahabang ~ Duri	0.27	76.12	281.9

From the results thus obtained, the following matters may be pointed out as conclusive findings.

1) Increase ratio of demand on each line of Bekasi, Merak and Tangerang is much greater than that on the Central Line. This is because greater effect can be brought about from improvement of these existing lines which show, at present, a very low rate of utilization, against the Central Line already winning a pretty high utilization factor (15 %). (Fig. 2.3.5)
2) It is forecasted that in the year 2000 the cross-sectional link load between Tanahaban and Duri of the Western Line would be the maximum among others. Angke, Duri and Tanahaban are now being developed into the commercial and business centers which will bring about demand of extremely high concentration. This result depends on the dissolution of the inconvenience for passengers to change trains on their way from the Central and Bekasi Lines, electrification of the Western Line, and increase in the frequency of train operation.

2.3.5 Staging of cross-sectional link load

Table 2.3.8 shows staged forecast of change by stage of the demand trend from 1978 to 2000 for each line section with maximum load. Fig. 2.3.6 to 2.3.10 show a graphic view of such results.

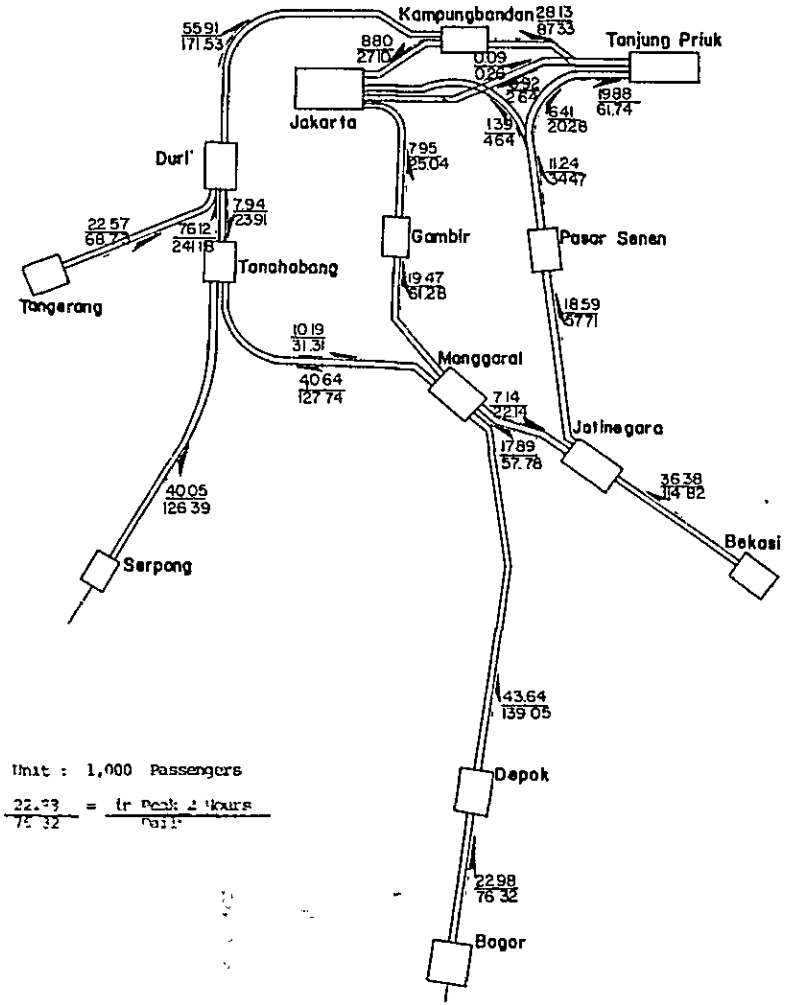


Fig. 2.3.4 Cross-sectional link load Forecast in Year 2000

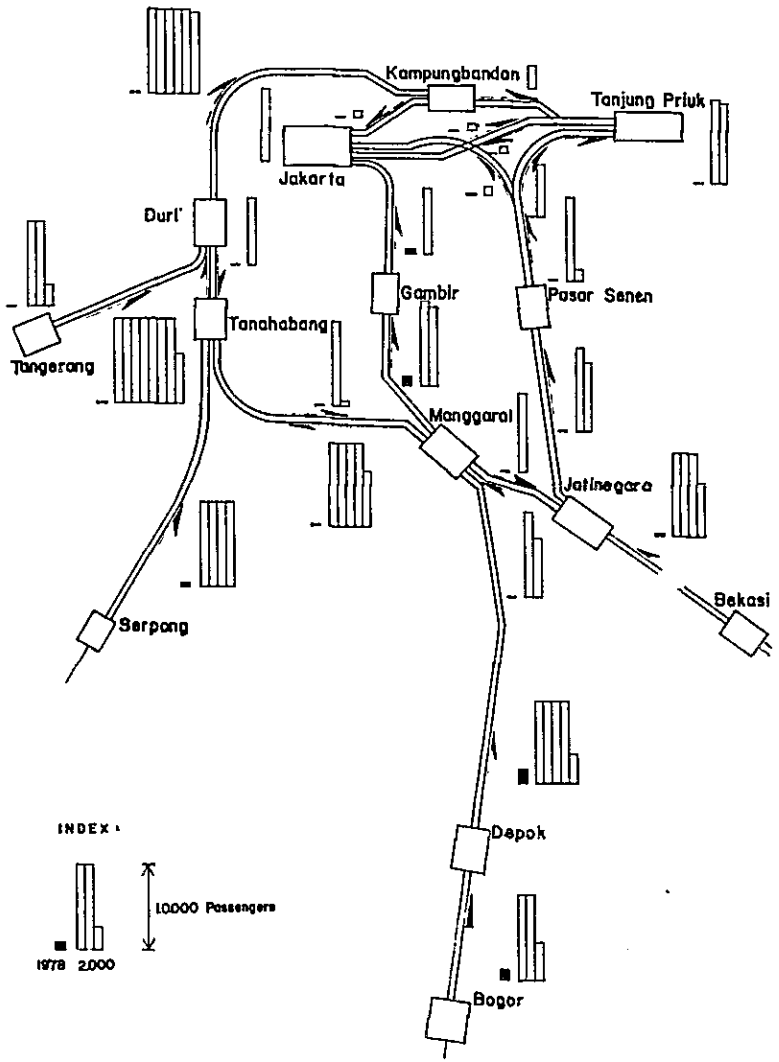


Fig. 2.3.5 Cross-sectional link load 1978 vs. 2000

Table 2.3.8 Railway Traffic Demand by Stage

(in peak 2 hours)
(Unit : 1,000 passengers)

Line		Year	1978	85	90	95	2000
Central	(Bogor−Depok)	All mode	38.4	65.5	87.2	109.9	138.0
		Railway	1.34	6.89	12.18	17.50	22.89
		Ratio	3.49%	10.52%	13.89%	15.59%	16.59%
	(Depok− Manggarai)	All mode	38.4	65.5	87.7	109.9	138.0
		Railway	1.85	10.17	20.61	31.57	43 64
		Ratio	4.81%	15.53%	23.50%	28.73%	31.62%
Bekasi		All mode	23.4	47.2	66 4	85.5	106.3
		Railway	0.27	5.51	13.89	22.83	36.38
		Ratio	1.15%	11.67%	19.19%	26.70%	34.22%
Merak		All mode	21.0	44.1	60.0	81.3	100.6
		Railway	0.27	5.98	13.38	25.25	40.05
		Ratio	1.29%	13 55%	22 30%	31.06%	39.81%
Tangerang		All mode	9 4	18 4	25.7	32.9	40.5
		Railway	0.075	3.36	7.90	14 22	22.57
		Ratio	0.80%	18.27%	30.75%	43 22%	55.70%
Western		*	2.47	25.02	55 78	93.87	142 64
		Railway	0.27	6.11	19 01	41.04	76.12
		Ratio	10.93%	24.43%	34.08%	43.72%	53.37%

* Railway passengers from each lines into city lines.

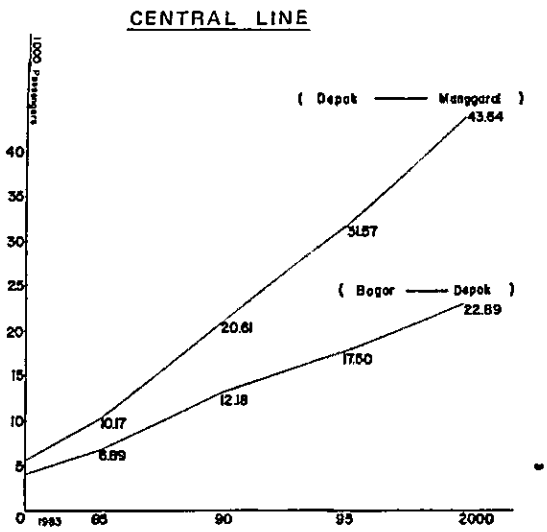


Fig 2.3.6 Railway Traffic Demand by Stage (1)

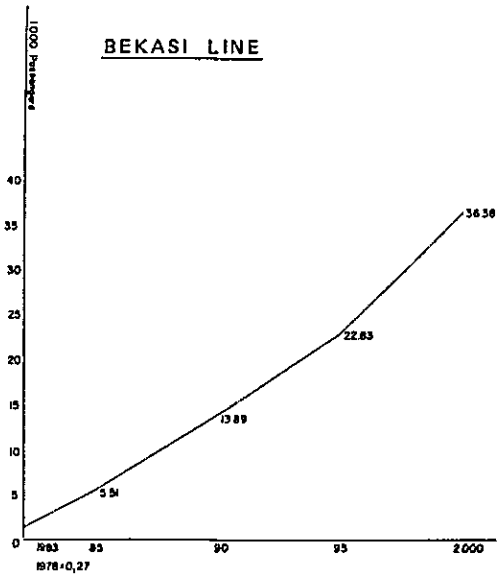


Fig 2.3.7 Railway Traffic Demand by Stage (2)

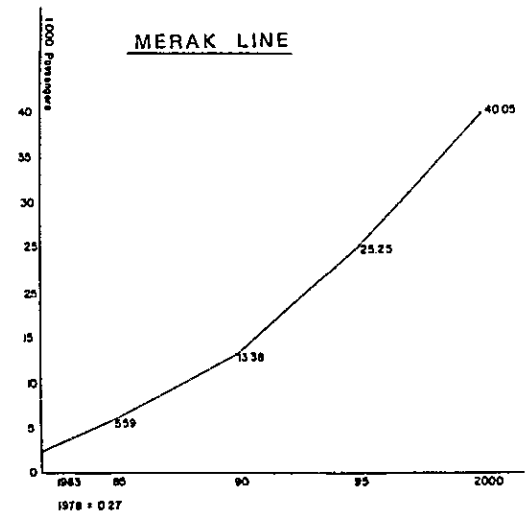


Fig 2.3.8 Railway Traffic Demand by Stage (3)

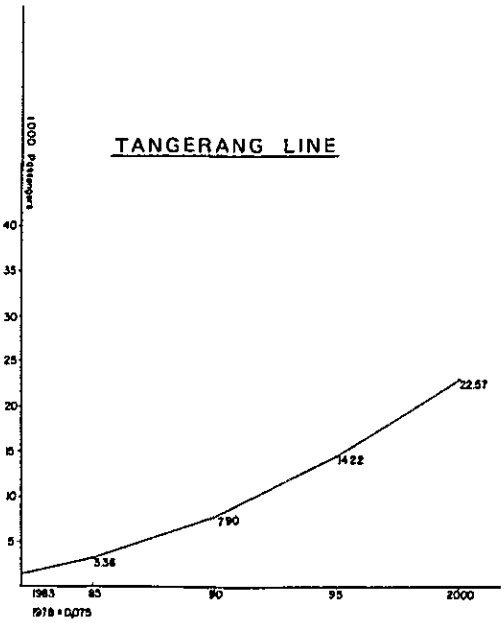


Fig 2.3.9 Railway Traffic Demand by Stage (4)

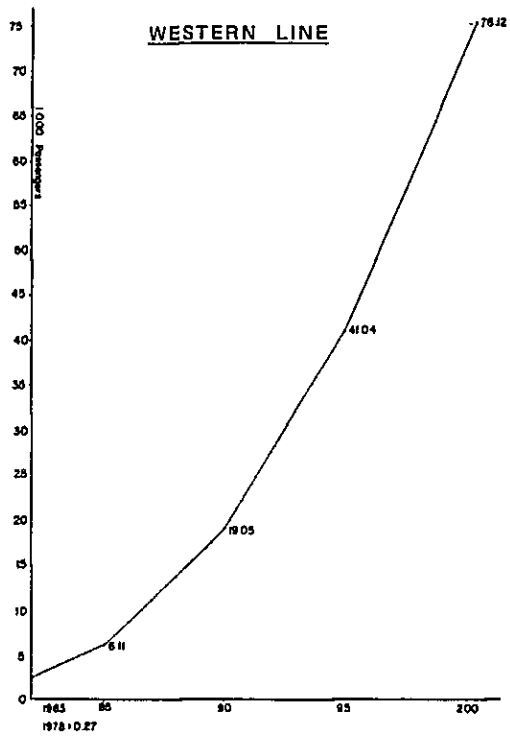
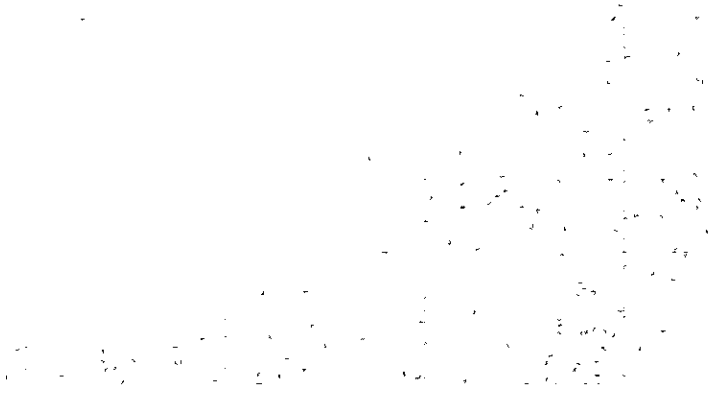


Fig 2.3.10 Railway Traffic Demand by Staqe (5)

The forecasted demand increase shows within 20 years more than 100 times as now. The increase will not be in a linear pattern. Because of the fact that the increase of the share of railways in all mode transportation appears as the effects of improvement, forecast was made with both of the growth of demand in the past and the expected growth of demand in the future taken into consideration.

As the result, it is noted that demand on each line will increase at slowdown paces until 1985 but will show rapid increase after that year. It is further noted that Merak, Tangerang and Western Lines will be delayed in starting increase of demand behind the Central and Bekasi Lines which will show relatively linear-shaped demand increase.

CHAPTER 3. PLANNING OF RAILWAY TRANSPORTATION



CHAPTER 3 PLANNING OF RAILWAY TRANSPORTATION

3.1 Proposal on Train Operation Routes

3.1.1 Future railway network

In the anticipation that the population in the JABOTABEK Area would grow at rapid paces in the future, it is most probable that necessary steps will be taken to promote reformation of the urban structure and the urban development alongside the railway line.
In such an instance, it is conceivable that there would be significant increase in future railway traffic demand. It will therefore become necessary that the railway network should be reformed accordingly so as to be able to meet such increasing demand.

Inasmuch as the Master Plan aims at completion of the project by the target year 2000, study will be made for feasibility of the railway network to cope with traffic demand in 2000. It should be noted that the Master Plan should be worked out with continuity to the perspective framework of railway network beyond the future year 2000. In other words, the railway network in the year 2000 should hold its position as the pre-stage for the future network after the year 2000.

According to the D.K.I. Master Plan, it is estimated that the railway traffic passengers by 1985 would amount to 1.6 million in rush 2 hours (at 50 % railway traffic share). Preliminary study was made to determine the railway network, track scale, number of trains, train interval, number of electric railcars and investment for ground facilities in the year 2000 with reference to three alternative cases of 1.6 million passengers, 0.96 million (30 % share) and 0.64 million (20 % share).

Table 3.1.1 summarizes the total investment which do not include the investment sum under the 2000 year Master Plan.

Table 3.1.1 Railway Investment

(Unit: Billion R_p.)

Railway share (passengers in rush 2-hours)	Rolling stock cost	Installation cost	Total
20 % (0.64 million)	330	110	440
30 % (0.96 million)	930	2,090	3,020
50 % (1.60 million)	2,020	4,300	6,320

(1) Railway network

The railway network envisaged by share ratios is as shown in Fig. 3.1.1 ~ 3. The loop operation by installation of a separate line is planned for a share of 30 % and 50 %. The network for 30 % and 50 % share proposes relocation of the Jakarta Kota station to the vicinity of the Jakarta freight station.

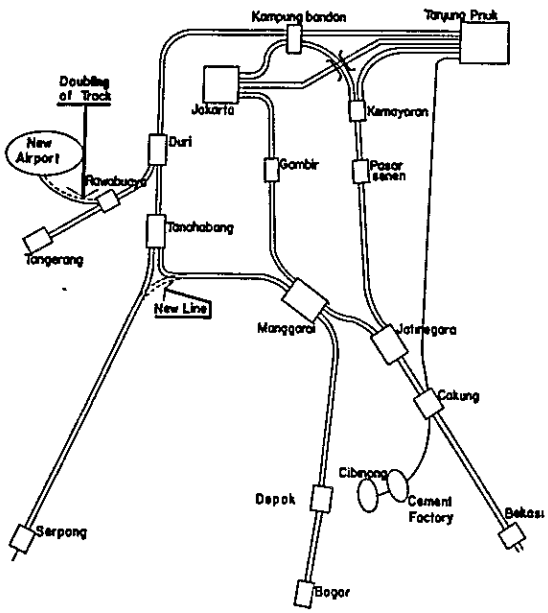


Fig. 3.1.1 Railway Network (Railway Share 20 %) (Beyond Year 2000)

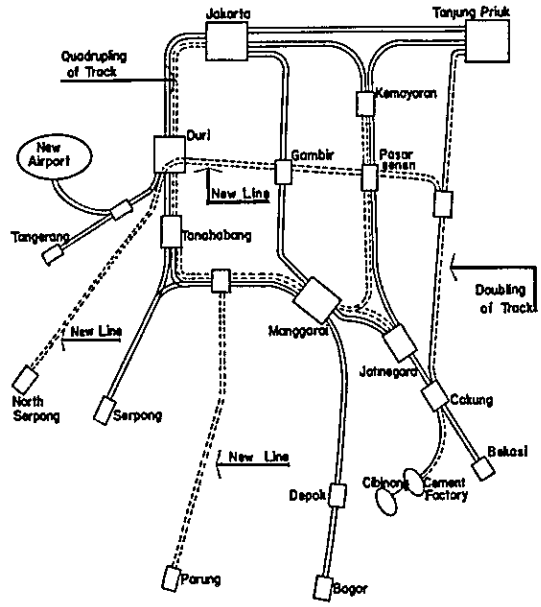


Fig. 3.1.2 Railway Network (Railway Share 30 %) (Beyond Year 2000)

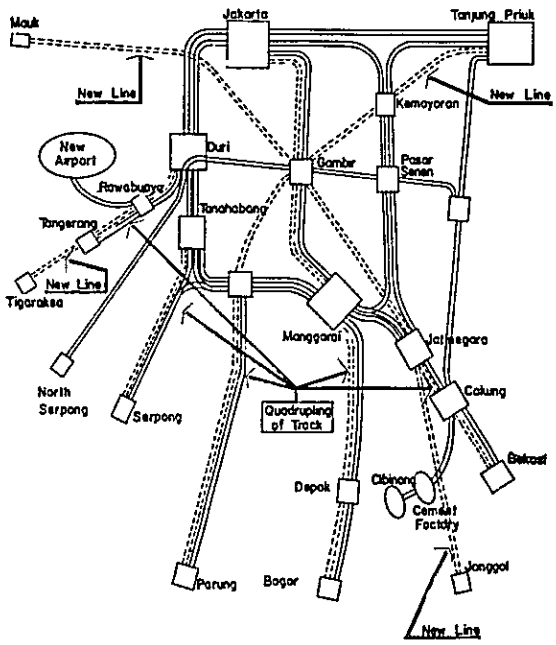


Fig. 3.1.3 Railway Network (Railway Share 50 %) (Beyond Year 2000)

(2) Train operation plan and No. of railcars

Table 3.1.2 ~ 4 summarize train operation, number of train-sets to be operated and total number of cars with full sufficiency to satisfy traffic demand at each estimated share. Each train-set consists of 12 cars.

Table 3.1.2 Train Operation and Required Number of Cars at 20 % Railway Traffic Share

Line	No. of trains (rush 2-hours)	Headway (min.)	No. of train-set in service (12-car makeup)	Required number of cars
Bekasi	26	4.5	32	410
Central	26	4.5	31	400
Merak	24	5	27	350
Tangerang	19	6	18	240
Cibinong	5	24	4	50
Total	100	–	112	1,450

Note: 1. Tangerang Line includes traffic on the New Airport Line.
2. Each train-set consists of 12 cars.
3. Preceding Notes 1. and 2. apply similarly to other Alternatives of 30 % and 50 % share.
4. Required number of cars are calculated, for any alternative cases of 20 %, 30 % and 50 %, by reference to the operating system Alternative D.

Table 3.1.3 Train Operation and Required Number of Cars at 30 % Railway Traffic Share

Line	No. of trains (rush 2-hours)	Headway (min.)	No. of train-set in service (12-car makeup)	Required number of cars
Bekasi	39	3	48	620
Central	39	3	46	620
Merak	36	3	40	520
Tangerang	28	4	26	340
Cibinong	8	15	5	70
North Serpong	28	4	15	190
Parung	20	6	18	230
Circle Operation	20	6	15	190
Total	218	–	213	2,780

Table 3.1.4 Train Operation and Required No. of Cars at 50 % Railway Traffic Share

Line	No. of trains (rush 2-hours)	Headway (min.)	No. of train-set in service (12-car makeup)	Required number of cars
Bekasi	65	1.9	80	1,040
Central	65	1.9	77	1,000
Merak	60	2	67	870
Tangerang	47	2.6	43	560
Cibinong	12	10	8	100
North Serpong	46	2.6	25	320
Parung	52	2.3	54	700
Telukamaga ~ Jonggol	16	7.5	30	390
Circle Operation	20	6	15	190
Total	383	–	399	5,170

(3) Investment outline

It is planned that the urban section of the existing line will be converted into the continuous grade crossing and the new line (urban area) will be constructed underground.

(4) It is expected that the railway traffic will take a share of more than 20 % in total traffic demand, provided that the urban tasks, such as reformation of the urban structure and strengthened linkage between railway and road, including the plans for urban development and road traffic can be achieved as planned.

In this instance, the railway traffic will become capable of absorbing its demand over 20 % of the total traffic demand by additional use of electric railcars and new construction of car depot without any modification to the network as drawn in Fig. 3.1.1. It is characterized to be worthy of consideration as the alternative draft to the Master Plan if it is reviewed at the interim stage in 1990.

3.1.2 Railway network envisaged for year 2000

The railway network in the year 2000 must be capable of fully absorbing the section volume as estimated from demand forecast for each line. To meet this requirement, the plan aims at completion of doubling of track, electrification, automatic signal control and relay interlocking for all the lines in the JABOTABEK Area and new construction of the Kampungbandan station and the junction line between the Western Line and the Eastern Line.

The plan includes, as additions, construction of New Airport Line and Cibinong Line. The future transport plan is drafted after review of the train operation system in the year 2000 by reference to the envisaged future network (Fig. 3.1.4).

Suppose if the Jakarta Kota station is moved to the vicinity of the Jakarta Gudang station, it would be very effective for the convenience of passengers and the train operation plan because of future possibility to concentrate all the trains into one single junction point on the

Table 3.1.5 Required Installation for Each Line by Railway Traffic Shares

Line \ Share	20 %	30 %	50 %
Bekasi	• New station (1) • New depot		• Quadrupling of track between Jatingara and Bekasi (ℓ = 14.8 km) • New depot
Central	• New station (3)		• Quadrupling of track between Jakarta and Bogor (ℓ = 54.8 km) • New depot
Merak	• New short-circuit line toward Manggarai station of Western Line (ℓ = 0.7 km) • New station (4) • New depot (1)		• Quadrupling of track in Tanahabang ~ Serpong section (ℓ = 23.3 km) • New depot (1)
Tangerang (Including New Airport Line)	• Doubling of track on New Airport Line (ℓ = 10 km) • New station (1) • New depot (1)		• Double doubling of track in Duri ~ Tangerang section (ℓ = 19.3 km) • Route extension ℓ = 20 km 7 stations • New depot (1)
Cibinong		• Doubling of track (ℓ = 66 km)	
North Serpong		• New route construction (double track) ℓ = 43 km (including 14.5 km underground section) 17 stations 1 depot	
Parung		• New route construction (double track) ℓ = 29 km (including 8.5 km underground section) 11 stations 1 depot	• New route construction (ℓ = 11 km) • Quadrupling of track (ℓ = 29 km) • Expansion of depot
Telukumaga ~ Jonggol			• New route construction (double track) ℓ = 80 km 30 stations 1 depot
Loop Line	• New station (6)	• Relocation of Jakarta Kota Station • Quadrupling of track on loop route (ℓ = 24.6 km) • Quadrupling of track in Manggarai ~ Jatinegara section (ℓ = 1.5 km)	

Central, Eastern and Western Lines. On the other hand, however, since the plan would require vast sum of investment for transfer of Jakarta Kota Depot and Jakarta freight yard, in addition to new construction of a large-scale station, it was deferred to further review far ahead in the future beyond the year 2000.

3.1.3 Urban/suburban train operation route

The sectional traffic volume for each suburban line in the year 2000 is estimated at 36 thousand passengers (peak 2 hours) at the entrance of Jatinegara on the Bekasi Line, 44 thousand at the entrance of Manggarai on the Central Line, 40 thousand at the entrance of Tanahabang on the Merak Line and 23 thousand at the entrance of Duri on the Tangerang Line. On each urban line, the sectional volume on the Western Line is far greater than that on the Central and Eastern Lines; 76 thousand passengers between Duri and Tanahabang and 41 thousand between Tanahabang and Manggarai.

In considering the future train operation system, the problem to be considered is how to transport such large volume of traffic as estimated for the Western Line. It is planned, as a solution of this problem, that the transport between Duri and Tanahabang will be served by trains in extended operation from the Merak Line into the Western Line and from all other lines available. Several alternative plans are taken into consideration so as to determine assignment of trains to the operational share in the section between Tanahabang and Manggarai. With emphasis upon those points, five (5) alternatives are proposed.

With regard to train operation on the Western Line, there would be such difficult problems as shuttling and level crossing to be required at Kampungbandan if the Jakarta Kota station serves for arrival and departure of all trains on the Western Line. For this reason, it is planned that the Tanjungpriuk station will serve as the alternative station for arrival and departure of all Western Line trains.

However, since there will be no connecting route from the Western Line to Jakarta Kota if the plan is carried out, a new station will be constructed at Kampungbandan with new routing of the connection line between the Eastern and Western Lines with the objective to operate all the Eastern Line trains to arrive at and depart from the Jakarta Kota Station via the Kampungbandan. Each alternative plan is explained briefly hereunder, as shown in Figs. 3.1.5 ~ 9.

1) Alternative A
   All the Central Line trains will be operated from the Manggarai station into the Western Line. The trains on the Bekasi Line will be divided into three operating routes with a part of them to be operated on the Central Line and all the remainder to be operated on the Eastern Line.
2) Alternative B
   One of the three operating routes for the trains on the Bekasi Line will be semi-looped through both Eastern and Western Lines. The other two lines will be connected to Jakarta Kota and Tanjungpriuk respectively as the station of arrival and departure for trains by way of the Eastern Line.

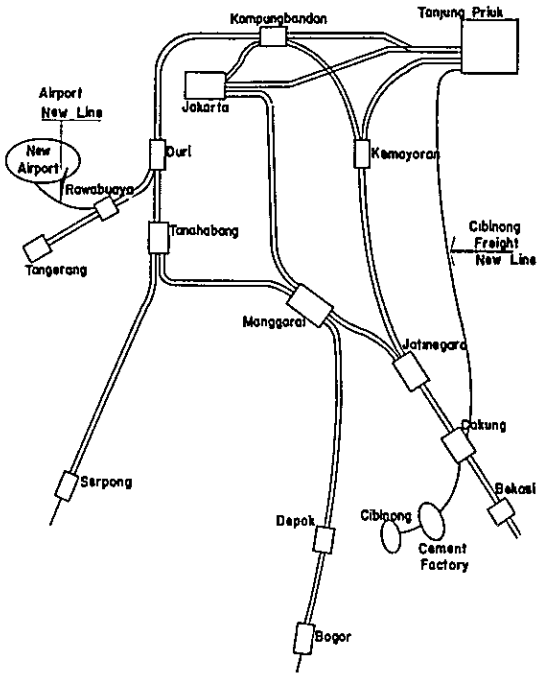


Fig. 3.1.4 Railway Layout in JABOTABEK Area in 2000 A.D. (Including New Airport Line and Cibinong Freight Line)

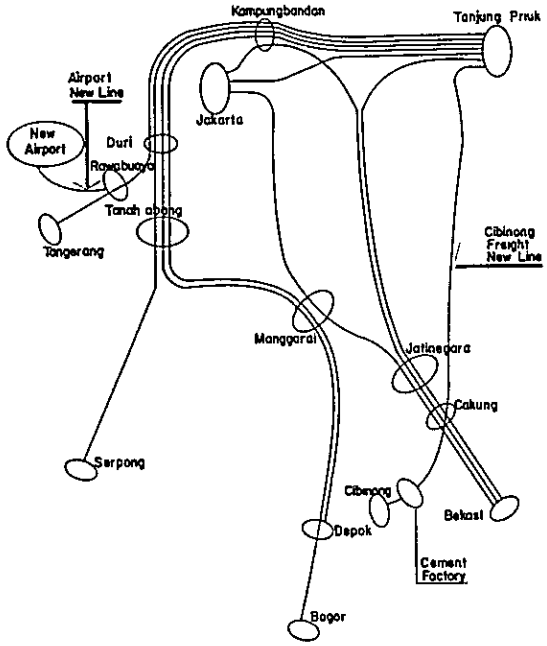


Fig. 3.1.5 Train Operation Route-Alternative A

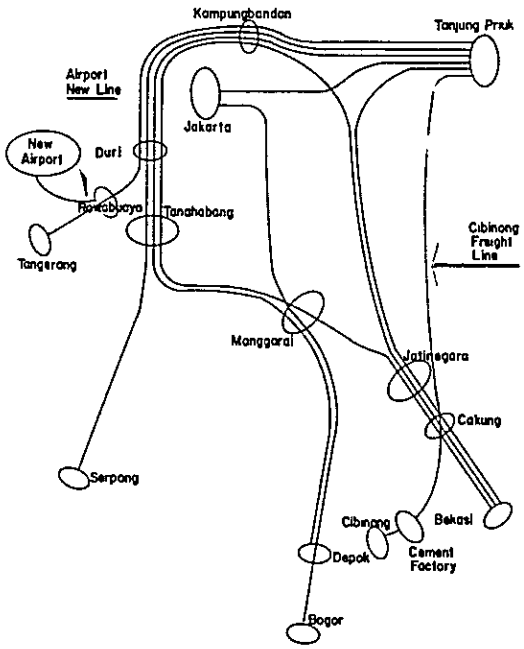


Fig. 3.1.6 Train Operation Route-Alternative B

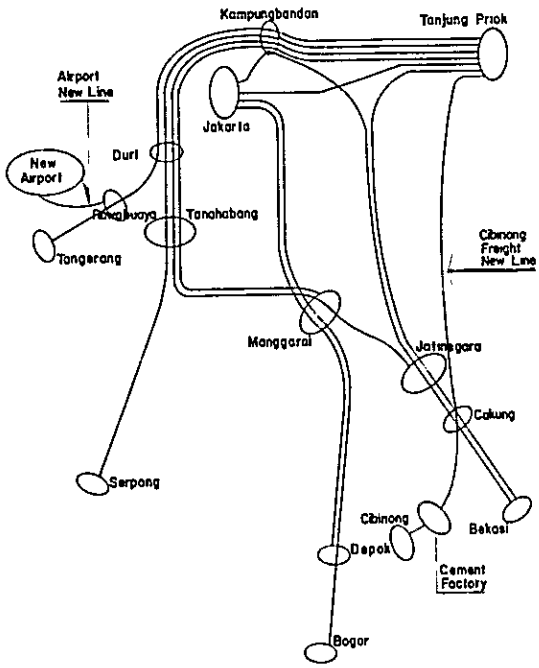


Fig. 3.1.7 Train Operation Route-Alternative C

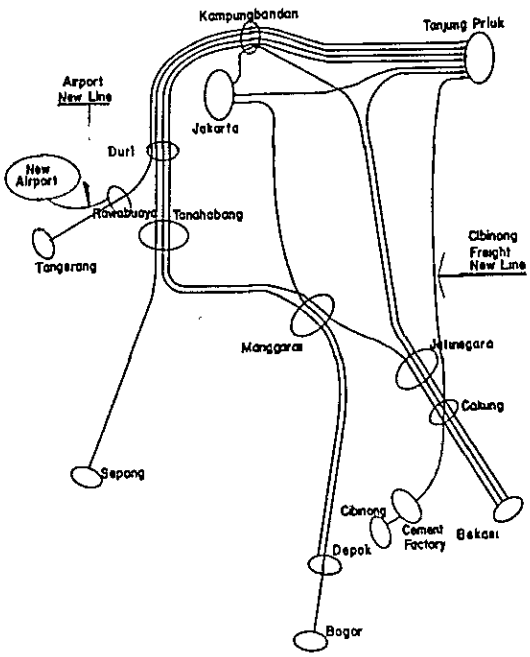


Fig. 3.1.8 Train Operation Route-Alternative D

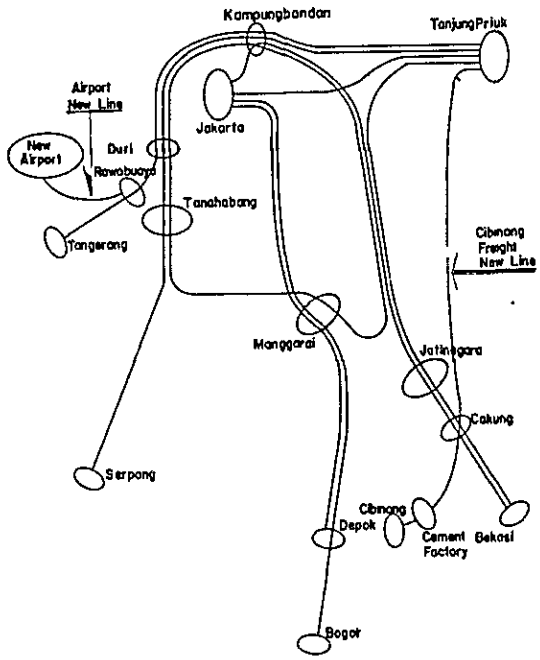


Fig. 3.1.9 Train Operation Route-Alternative E

A part of the central Line trains will be assigned to the Western Line, so that large traffic demand between Tanahabang and Manggarai can be met, together with those Bekasi Line trains to be operated on the semi-loop line.

3) Alternative C
This is the alternative with closest similarity to the exising train operation system. Unlike any other alternatives, the Western Line trains will be operated solely on the Line alone.

4) Alternative D
Trains on the three systems of the Bekasi Line and on the two system of the Central Line are partly planned for assignment to the Western Line.

5) Alternative E
This plans for loop line operation. It is forecasted that in the year 2000 the Bekasi Line trains could still be operated on the Eastern Line. However, since the time interval of train operation, together with the loop line running trains, would be tightened to 4.5 minutes, it is anticipated that at the earliest time beyond the year 2000 it would become impossible for those Bekasi Line trains to be operated on the Eastern Line at rush hours.

3.1.4 Operation route of long-distance trains

(1) Present status

Medium and long distance trains take a vital part in the inter-city transport service. Number of trains operated (on both directions) in the month of January 1981, as shown in the following Table.

Line	Section	Long distance	Medium distance
Central Line	Jakarta – Gambir	12	–
	Gambir – Manggarai	14	–
Eastern Line	Jakarta – Pasarsenen	4	–
	Pasarsenen – Jatinegara	12	4
Bekasi Line	Jatinegara – Bekasi	36	10
Merak Line	Tanahabang – Serpong	–	4
	Jakarta – Tanahabang	–	2
Western Line	Tanahabang – Manggarai	–	2
	Manggarai – Jatinegara	24	6

The long-distance train is operated as the express train while the medium distance train is in service as the fast train. Trains operated on the Bekasi Line are apportioned to both of the Central Line and the Eastern Line within the city area. No. express trains are operated on the Merak Line and in the section between Manggarai and Bogor of the Central Line there is neither express train nor fast train available in operation.

The terminal stations for arrival and departure of medium and long distance trains are Jakarta Kota, Gambir, Pasarsenen, Manggarai and Tanahabang.

(2) Operation of medium and long distance trains

Since the medium and long distance trains are operated on the same track line with the short distance trains operated only within the JABOTABEK Area, it is necessary to ensure the operatingttime schedule so as to avoid mutual hindrance to operation of each other. Especially, it is important that all medium and long distance trains should be operated on time during rush hours with commuters, lest they should disturb the operation diagram of trains in the commuting service.

To comply with this need, full consideration must be given to the educational training of all the operators of such trains and the station service staff, improvement of ground facilities and maintenance of vehicles in good condition.

By 1987 as the target completion year of Phase I in the Master Plan and by 1989 as the scheduled completion year for conversion into the continuously elevated track system on the Central Line, the commuting service trains will be operated at a time interval of 15 minutes during the rush hours on the Bekasi Line.

Since it is planned that the electrification project, together with conversion into the automatic signalling system, will be completed by 1987 on the Bekasi Line, no difficulty

in particular is anticipated in an attempt to operate either medium or long distance train within a time interval of 15 minutes from one commuting train to the next. By the year 2000 the time interval of the commuting trains during rush hours will be reduced to 6 minutes between Manggarai and Depok of the Central Line and 6.5 minutes on the Bekasi Line. Because the ground facilities are designed so as to enable those trains to be operated at a time interval of 3 minutes, it can be assured that the medium and long distance trains could be put into operation even during the morning rush hours, provided that those medium and long distance trains should get to the JABOTABEK Area on time punctually as stated earlier. Otherwise, if those trains are delayed behind the time schedule of arrival, they would cause dislocation to the operation diagram of commuting service trains, thus diminishing the transport capacity as a whole over the line.

The train operation diagrams (for 1988, 1990 and 2000) covering both commuting and long-medium distance services during rush hours are shown in the APPENDIX Fig. 8.2∿8.4.
The diagram is formulated on assumption that the number of trains to be operated by the year 2000 would reach the twofold of that in 1979.

(3) Terminal stations for medium and long distance trains

Even at present, both Gambir and Pasarsenen Stations serve as the terminals of departure and arrival for a considerable number of medium and long distance trains. It is anticipated that both of those two stations will increase their significance with further growth of the business and commercial center in their vicinity. Manggarai Station serves merely as a terminal station for some fast trains at present. However, since it is situated at the pivot where the Central Line crosses the Western Line, it is most probable that the station will be developed to the terminal for medium and long distance trains, if progress is made in the development of the area around the existing station. It is also expected that the present Tanahabang Station will be the western gateway to the city of Jakarta as the terminal for the medium and long distance trains on the Merak Line.

All those things considered, it is most probable that future terminals for medium and long distance trains within the urban area of Jakarta will be Gambir, Pasarsenen, Manggarai and Tanahabang.

(4) Medium and long distance trains in the post-2000

In the Master Plan the Alternative D has been adopted as the future train operation route and, according to the plan, a part of trains on the Central and Bekasi Lines will be operated by way of the Western Line.
Therefore, the number of trains in operation within the urban area of the Central Line and on the Eastern Line is less than the number of trains in the suburb of the Central Line and on the Bekasi Line. However, in a long run after the year 2000, by fruitful effort for urban development and operational technology at high speed and density it is expected that the railway will become a contributing factor toward solution of the urban traffic problem with increasing demand in the city area and thereby with its

growing share in the total traffic.

In the period of long projection, it is further anticipated that the short-distance trains limited only within the urban area will be needed for daily operation, as the result of which train intervals for commuting service will be reduced more and more with increase in the number of trains to be operated on the urban lines, and those medium and long distance trains will be operated with increasing difficulty between the narrowed time intervals. It will therefore become necessary that some of those trains should depart from and arrive at the Manggarai station as the terminal.

To cope with this future development, the Master Plan envisages new construction of the passenger train depot in chipinang (to be completed by 2000) for accmmodation of passenger cars of medium and long distance trains leaving and arriving at the Manggarai Station as the terminal. It is also considered necessary that the track capacity should be increased in the future by quadrupling of the existing track line.

3.1.5 Comparison of alternatives on train operation routes

Table 3.1.6 summarized the result of comparison by advantage and disadvantage of each Alternative from A thru E as proposed in the preceding item of "urban/suburban train operation routes," Firstly, when each Alternative is compared by required number of cars, each of A and D required 584 vehicles, the most minimum as compared with 600 vehicles for B, 684 for E and 720 for C. In this comparison, Alternatives A and D are advantageous over any others.

Especially, Alternative A has its greatest advantage that the grade crossing between the Central and Western Lines within the station yard of Manggarai would not be required because all the Central Line trains would go into the Western Line. However, it is anticipated that the passenger trip from the suburb of the Central Line to Gambir of Jakarta Kota would become inconvenient and the trains proceeding to Bandung would have to be operated by via of the Central Line in the future. The problem involved in Alternative A lies in the fact that the planned operation routes are entirely different from the existing train operation routes.

Alternative D encompasses all the existing train operation routes in its entity, thought it would require the grade crossing at the Manggarai station. Although greater effort may be required for wide publicity of the completed operation routes to passengers, they would find it much more convenient than Alternative A to make trip to any destination of they can make a good selection of the train to be suited for their purpose. All those things considered, Alternative D may be recommendable as the best of all the alternative plans.

Table 3.1.6 Advantage/Disadvantage of Alternatives on Train Operation Routes

Alternative	Advantage	Disadvantage
A	(1) Dissolution of level crossing at Manggarai station (2) Convenient transfer of passengers from Bekasi to Duri and Tanahabang (3) Least requirement in total number of vehicles (584)	(1) Route change of the Central Line from the existing route (2) Inconvenient transfer of passengers from the Central Line to Gambir and Kota
B	(1) Convenient transfer of passengers from Bekasi to Duri and Tanahabang (2) Convenient transfer of passengers to east and west of the urban area by way of semi-loop line (3) Convenient transfer from the Central Line to Duri and Tanahabang (4) Relatively less requirement in total number of vehicles (600)	(1) Wide spreading of any train operation disturbance on the Western Line over the whole network (2) Necessity of publicity effort to passengers for clarification of operation routes because of their increasing diversity and complexity (3) Inconvenient transfer of passengers from the Bekasi Line to Jakarta Station
C	(1) Nearly same as the existing train operation routes (2) Simplified operation routes easily understandable to passengers	(1) Inconvenient transfer of passengers from the Central or Bekasi Line to Duri and Tanahabang (2) Increased number of electric railcars to be required (720)
D	(1) Convenient transfer of passengers from the entral and Bekasi Line to Duri and Tanahabang (2) Including of all present train operation routes (3) Reduced number of electric railcars to be required (584)	(1) Necessity of publicity effort to passengers for clarification of operation routes because of their increasing diversity and complexity
E	(1) Convenient transfer of passengers from Eastern Line to Western Line and its vice versa	(1) Necessity of constructing a short-circuit line between Eastern and Western Lines near Jatinegara (2) Formation of level-crossing at junction of both Eastern Line and short-circuit line near Jatinegara (3) Necessity of CTC installation because of switching operation for trains from Western Line and Bekasi Line at junction point as referred to above (4) No capacity for admittance of long-distance trains into the Eastern Line at rush hours (5) Increase number of electric railcars to be required (684)

3.2 Transport Plan

3.2.1 Assumptions

Prerequisite conditions are assumed as follows for drafting of the transport plan.

1) The plan should fully satisfy future demand increase as estimated in the preceding Chapter 2.
2) Cars to be required for one train-set should be increased to 4 and then to 8 on a step-by-step basis.
3) Until completion of railway electrification, diesel railcars should be increased to absorb future increase of demand.
4) The passenger load factor for both electric and diesel railcars is estimated at 200 %.

3.2.2 Train operation plan

Table 3.2.1 shows the estimated number of trains by lines and sections (in one-way operation to Jakarta Kota) and their headway at rush 2-hours in the year 2000. As noted from the Table, it is estimated that the number of trains to be operated for the Jakarta Kota – Manggarai and Kemayoran – Jatinegara Sections of Alternative C and the Kemayoran – Jatinegara Section of Alternative E would be too excessive to absorb traffic demand.

Table 3.2.1 No. of Trains in One Way during Peak 2 Hours and Operating Headways (in Year 2000)

Line	Section \ Alternative	No. of trains					Headway(Minutes)				
		A	B	C	D	E	A	B	C	D	E
Central Line	Jakarta ~ Manggarai	9	10	20	10	20	13	12	6	12	6
	Manggarai ~ Depok	20	20	20	20	20	6	6	6	6	6
	Depok ~ Bogor	11	11	11	11	11	11	11	11	11	11
Eastern & Bekasi Line	Kemayoran ~ Jatinegara	9	9	17	9	25	13	13	7	13	4.5
	Jatinegara ~ Bekasi	18	18	17	18	17	6.5	6.5	7.0	6.5	7.0
Western Line	Tanjungpriuk ~ Duri	36	36	37	36	18	3	3	3	3	6.5
	Duri ~ Tanahabang	38	37	37	37	37	3	3	3	3	3
	Tanahabang ~ Manggarai	20	19	19	19	19	6	6	6	6	6
	Manggarai ~ Jatinegara	9	9	9	9	–	13	13	13	13	–
Tangerang Line	Duri ~ Tangerang	10	10	10	10	10	12	12	12	12	12
Merak Line	Tanahabang ~ Serpong	18	18	18	18	18	6.5	6.5	6.5	6.5	6.5

Table 3.2.2 indicates the sectional traffic volume and transport capacity estimated for the year 2000, together with the ceiling limit of capacity in the event of utilizing the whole railway network to the fullest extent in the year 2000. The ceiling limit is calculated on assumption that a train-set would consist of 12 cars in the post-2000 period.

Table 3.2.2 Cross-sectional Link Load and Transport Capacity
(in year 2000)

(Unit: 1,000 passengers)

Line & section	Cross-sectional link load	Transport capacity in the year 2000					Ceiling limit of capacity
		A	B	C	D	E	
Central Line Manggarai ~ Depok	43.6	45.3	45.3	45.3	45.3	45.3	135.8
Bekasi Line Jatinegara ~ Bekasi	36.4	40.8	40.8	38.5	40.8	38.5	
Western Line Duri ~ Tanahabang	76.1	86.0	83.8	83.8	83.8	83.8	
Tangerang Line Duri ~ Tangerang	22.6	22.6	22.6	22.6	22.6	22.6	
Merak Line Tanahabang ~ Serpong	40.1	40.8	40.8	40.8	40.8	40.8	

Note: 1. Cross-sectional link load and transport capacity denote the figures estimated for rush 2-hours.
2. The ceiling limit of capacity is calculated on the basis of 12-car train-set.

3.2.3 No. of railcars required

(1) Electric railcars

Required number of electric railcars for the train operation routes, as compared by Alternatives, are as shown in Table 3.2.3. Comparison also includes three different cases, where the New Airport Line would be constructed, where bus service would be available to carry passengers from the airport terminal to Tangerang and where the new lines to the airport and Cibinong would be constructed. Note that the number of electric railcars includes those standby cars in reserved service and 100 vehicles to be increased under the Intermediate Program.

(2) Diesel railcars

Diesel railcars must be increased to meet increasing demand for same time until completion of electrification of Bekasi, Merak and Tangerang Lines. According to the study result confined to the JABOTABEK Area, it is estimated that the time on which diesel railcars will be required to their maximum may be immediately before completion of electrification on the Merak Line and a maximum increase of 48 railcars, excluding those required under the Intermediate Program, will be required by that time.

The desired bases as the diesel railcar depot must include Bukitduri, Tanahabang, Jatinegara and Bogor, which should require expansion and improvement for this purpose.

Table 3.2.3 No. of Electric Railcars Compared with Each Alternatives (2000 A.D.)

Alternative	Traffic network as planned in Fig. 3.1. 4	New lines		Total
		New Airport Ling	Passenger service on new line to Cibinong	
A	584	52	26	662
B	600	52	26	678
C	720	52	26	798
D	584	52	26	662
E	684	52	26	762

Note: 1. Total number of railcars includes extra standby vehicles.
2. Total number of railcars includes 100 vehicles proposed for increase under the Intermediate Program. Therefore, the net increase in the number of vehicles under the Master Plan equals to the balance after deduction of 100 from the total indicated in the above Table.

3.2.4 Passenger terminal

It can be said that the effect of contribution by both railway and road to the urban traffic would be increased to double, only if each of railway and road can be better coordinated with each own advantage demonstrated to the full extent.

In this sense, a terminal serves as the sole point of contact between railway and road. Therefore, the urban transport capacity may be affected greatly by either favorable or unfavorable conditions of terminal facilities. How to promote further growth of the urban area with the station terminal serving as the core of development is certainly a great future task for all the people concerned. In this regard, close study by joint effort of both railway and city planning authorities will be required so as to determine the site, content of facilities and timing for construction of the station terminal. When viewed on the railway side, it is advisable that terminals should be established by gradual sequence for the large stations with estimated number of daily passengers over 25,000 in the year 2000 serving as the stoppage and junction station for long-distance trains, for instance, such as Jakarta Kota, Gambir, Manggarai, Pasarsenen, Jatinegara, Tanjungpriuk, Duri and Tanahabang. It is believed that the urban traffic congestion will be eased by re-development of the urban area with construction of business, commercial, amusement and tourist centers to be concentrated to the vicinity around the station terminal, with the objective to minimize the daily flow of person trip into the city area by luring many people to the newly developed terminal area.

It is also necessary that a bus stop should be provided for each of such station terminals as one of the measures to smoothen the flow of mass transfer to and from the station.

Details on terminal facilities are given later.

3.2.5 Operation of freight train

Operation of freight trains must be well coordinated with that of passenger trains. It is planned that freight trains will be operated on the Western Line during the off-peak daytime, by avoidance from rush hours, or at night. However, in view of the fact that the increase rate of traffic demand on the Western Line is remarkably higher than any other urban lines, it is predictable that the time to affect the train operation on the Western Line will come some time in the future because of necessity to increase operating hours of electric trains and also to secure sufficient time interval for maintenance of track and trolley lines during night time. In such a case, it would be better to operate freight trains on the Eastern Line with less tightness in the time interval of trains as compared with the Western Line. However, if the new line is constructed exclusively for freight trains in the section between Tanjungpriuk and Cibinong, it would of course be advisable to operate all freight trains by way of the said New Line.

3.2.6 Construction of new stations

New stations must be constructed, wherever two stations are far apart over a long distance, in order to improve the service level for passengers, thus encouraging them actively to utilize the railway. For this purpose, new construction is planned to build 6 stations on the urban line and 5 stations outside the urban line but inside the D.K.I. Area. The proposed sections for construction of such new stations are as follows:

1) Urban Line
   i) Western Line
      a. Tanjungpriuk – Ancol
      b. Kampungbandan – Angke
      c. Duri – Tanahabang
      d. Tanahabang – Manggarai (3 stations)
2) Suburban Line
   ii) Central Line
      a. Durenkalibata – Pasarminggu
      b. Lentengagung – Pondokcina
   iii) Tangerang Line
      a. Pesing – Bojong Indah
   iv) Merak Line
      a. Pondokbitung – Jurangmanggu
      b. Sudimara – Rawabuntu

3.2.7 New lines

(1) New Airport Line

For the time being after opening of the new airport scheduled for 1984, it is planned that bus service will be made available for passenger transport through the expressway and to the Tangerang Line. Since the estimated demand generation by the year 2000 will reach 10.66 thousand passengers per day in the international service and 32.33

thousand passengers per day in the domestic service, there is growing possibility of new railway line construction for mass transit service of passengers increased to such a large number including those visitors to the airport to meet or see off such passengers. Further details on this plan must be studied for the future.

Upon completion of the New Airport Line, new demand for the railway traffic would be 10.36 thousand passengers at peak 2 hours. To meet such new demand, the new line of electrified single track will be constructed for about 10 km distance between the new airport and the Rawabuaya Station, in which trains of 8-car train-set for each will be operated by 15-minute headway during rush hours.

(2) Cibinong new freight line

Feasibility is now under study as to the envisaged plan for construction of the new freight line to connect Tanjungpriuk to the cement plant zone in Cibinong and the industrialized zone north of Cakung.

It is proposed that this new line should be made available, if constructed, for both freight and passenger transport, since the line will have the housing development areas in Cibinong and Pondok Gede within its station influence sphere.

Future demand generation by the year 2000 is estimated at 7.83 thousand passengers on this line. To meet such demand, the new line must be constructed for a distance of 14 km from the cement plant zone to the residential area in Cibinong for operation of trains of 4-car train-set each by 15-minute headway on the single electrified track.

CHAPTER 4. REAL STATE OF EXISTING RAILWAY FACILITIES AND THEIR IMPROVEMENTS

CHAPTER 4. REAL STATE OF EXISTING RAILWAY FACILITIES AND THEIR IMPROVEMENTS

4.1 Existing Facilities and Proposed Improvement

The present status of ground facilities including track and signals, along with their operational and maintenance problems, was clarified for full grasp by the site survey lately conducted and review was made to find the improvement measures. (Table 4.1.1)

All the disclosed points in this report are deemed as the fundamental problems relevant to improvement of the existing railway system and all of them should require improvement within the defined period under the Master Plan.

Table 4.1.1 as attached hereto makes full summary of the present condition, problem involved and measures for improvement with regard to track capacity, track construction, station, electrification, signal and telecommunication, rolling stock, workshop and car depot. Solution of those problems is the absolute 'must' toward improvement of the existing railway and all the possible measures for solution of those problems are planned to be carried out within the implementation period of the Master Plan.

4.2 Traffic Survey on Railway Crossing

4.2.1 Present situation of railway crossing of the city line

Although level crossings of the City Lines are often criticized as the road traffic flow increases rapidly in recent years, actually little data is available for analysing the present traffic situation. Consequently little improvement has so far been made for the crossings.

The latest survey was purposed to look into the traffic flow of motor-vehicles and pedestrian at the railway crossing and was conducted for the period of July 24 to August 11 to cover the following survey items.

i) Vehicle traffic volume passing over railway crossing
ii) Barrier time against vehicle traffic at railway crossing
iii) Retarding of vehicle traffic during morning rush hours

Because of limited time element and manpower, the survey was conducted by sampling after selection of suitable crossing points where there seem to be potential of relatively heavy vehicle traffic in the urban area. The survey points are indicated in Fig. 4.2.1

(1) Vehicle traffic volume at railway crossing

The survey continued for 12 hours from AM 7:00 to PM 7:00 by hourly measurement of the crossing traffic volume according to the traffic categories classified into pedestrians, bicycles, motor-cycles, tri-cycles, motor-cars, buses and trucks. The survey result is as shown in Table 4.2.1

Viewed from traffic volume fluctuations by hours, it was observed as a general tendency that there seem to be no fluctuations in the whole traffic. However, the motor-cycle alone was showing obvious increase at rush hours in both morning and evening, thus indicating its wide acceptability as the commuting transport means.

(2) Barrier time against vehicle traffic at railway crossing

This survey was to monitor the barrier time length required for each train passage at the crossing point.

All the crossing gates at survey points were of manually handled sliding type with a few exceptions of the lifting type gates at Jl. Mangga Besar, Jl. P. Jayakarta and Jl. Klender and the swing gate at Jl. Kramat Bundar.

The annunciator to alert the barrier operator against close approach of the train starts its sounding simultaneously in between the blocked stations. Because timing for opening or closing of the barrier is left entirely to human judgement of each operator, the barrier time at each crossing tends to be varied largely depending upon the operating manner of the barrier by each operator. Table 4.2.2 summarizes the survey result on the barrier time at each point of crossing.

(3) Survey result on retarding of motor-vehicle traffic

The survey was to measure the time length required until the retarded vehicles in stoppage before the barrier at the crossing could regain their normal traffic flow after passage of the train and the number of vehicles retarded under influence of the barrier time.

The survey result revealed that all the vehicles once retarded could regain their normal paces of running speed in about 2 or 3 minutes with exceptions at Jl. Klender now under reconstruction and at Jl. Kramat Burdar where the crossing road must be improve to sufficient width.

The survey result is shown in Table 4.2.3

Summarized as hereunder from the survey result are the factors causing reduced traffic capacity at the existing railway crossing.

1) Damage on paved surface of crossing lane

   Running speed of vehicles is reduced largely due to damaged surface of pavement on the crossing lane (especially, the boundary between rail and paved surface).

2) Boarding space for bus, oplet and bajai

   More than one traffic lane of the road is often occupied by concentrated omnibus vehicles, such as public bus, oplet and bajai, gathering in one place after passing over the railway crossing to pick up passengers.

3) Mixed pattern of vehicles

   Bajai and other similar vehicles of poor accelerating capacity are mixed among all the traffic vehicles being retarded during the barrier time. Because of this, the traffic vehicles of all types are dragged into slowdown of passing speed over the crossing.

4) Varrier time length

   Handling time of the barrier by each operator is varied largely into diversity at the time of train passage. As confirmed from the survey result, the barrier time is averaged normally at 85.4 seconds, much longer when compared with the expected time length of 55.8 seconds after introduction of the automatic barrier into practical

operation.

5) Necessity to enhance traffic moral of drivers

Because some vehicles try to pass over the crossing farcibly without stoppage even when the barrier is about to close, the train is often forced to reduce its normal running speed and the barrier time is prolonged accordingly.

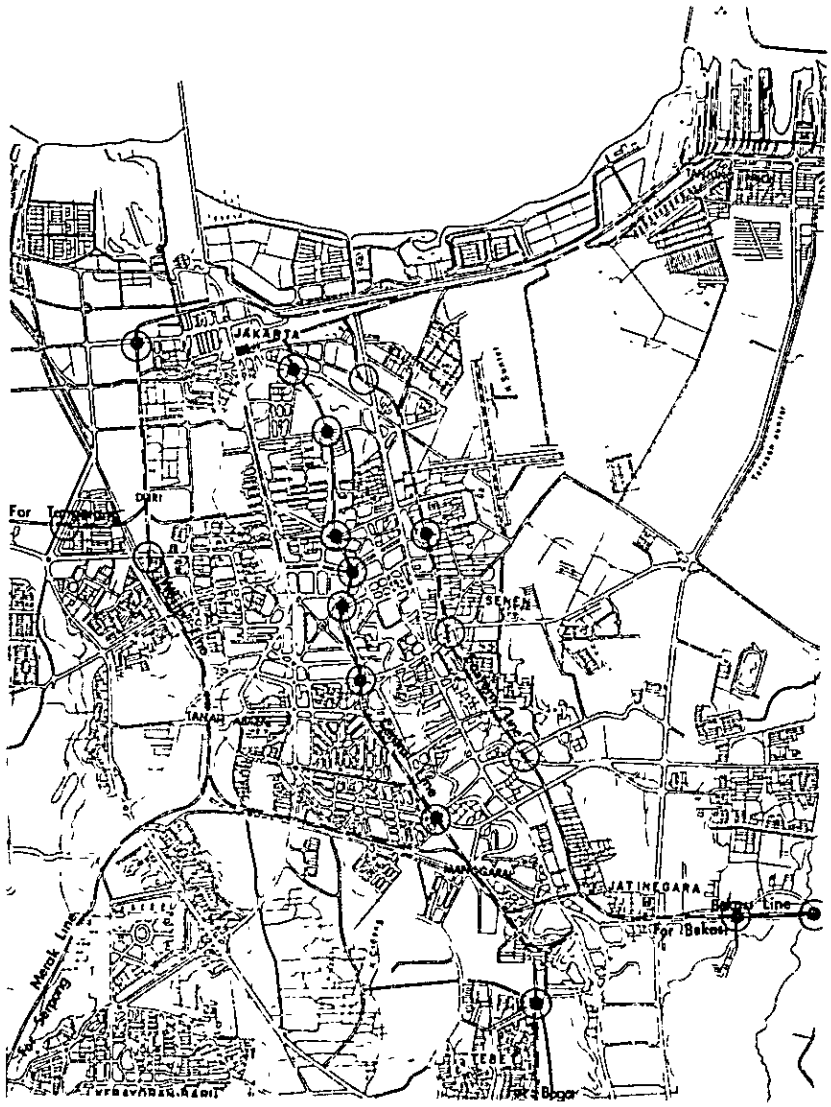


Fig. 4.2.1

The Map of the Crossing Survey Point

Legend

○ Survey for Barrier Time

◉ Survey for Traffic and Barrier Time

JABOTABEK Area Railway Transportation Study

Table 4.1.1 Status of Railway Facilities and Problems

Item	Problem	Status	Countermeasures
Line capacity	Low track capacity of Central Line (Manggarai ~ Bogor)	a) Now being operated on the line are 7 electric-car trains for Jakarta and 1 passenger train for Bogor in rush 2 hours. The track capacity is close to its ceiling limit because the track is of single construction with a long distance between stations and the block system is of tokenless type.	a) In anticipation of rapid increase of traffic demand with growth of housing development in the wayside area, prompt steps must be taken for double-tracking and introduction of automatic signal.
	Low track capacity of Merak Line	a) Stations with side track for crossover of two trains are long distanced apart from each other. The section is of single track and of block system with telecommunication.	a) Double-tracking, introduction of automatic signal and electrification should be required to cope with future demand increase.
	Low track capacity of Tangerang Line	a) None of stations existing in this section is provided with side track. The section is of single track and of block system with telecommunication.	a) Double-tracking, introduction of automatic signal and electrification should be required to cope with future demand increase.
Electrification	Bekasi Line, not yet electrified	a) Bekasi Line (Jatinegara ~ Bekasi) is of double-track construction without electrification. b) Large demand increase is forecasted for this section due to brick housing development.	a) Electrification and introduction of automatic signal system between Jatinegara and Bekasi. b) Although additional operation of diesel railcars may be sufficient, for the time being, to absorb increasing traffic demand because of doubling in track construction for this section, it is still desirable that the whole section should be electrified at the earliest possible time.
Level crossing	Level crossing with the station yard of Manggarai	a) Level crossing between Central Line and Western Line trains within the Manggarai Station yard. b) No operation problem at present because of a few limited number of trains running on Western Line. However, in anticipation of future increase of train operation on both Lines, it may be predictable that difficulty should arise in composition and control of the operation diagram.	a) Grade separation will be required at the time of future increase in the number of trains resulting from probable increase in traffic demand.
Turn-back operation	Turn-back operation of Western Line trains at Kampungbandan Station	a) At present, the Western Line trains are operated to arrive at Jakarta Kota station after turning-back at Kampungbandan (and its vice versa in opposite direction). This means that there is level-crossing of train routes. b) With future increase of trains running on Western Line, level-crossing would result in difficulty in making up a train diagram there on. c) As the result of shortening in the train headway, required number of train-set would increase by increased frequency of turn-back.	a) Operation of the Western Line trains should be extended to Tanjungpriuk by abolition of turn-back. b) Appropriate measures should be taken separately for transport of passengers from Western Line to Jakarta Kota.

Item	Problem	Status	Countermeasures
Car depot	Shortage of line capacity for railcars at the Bukitduri depot	a) The Bukitduri depot is assigned diesel locomotives (DL), diesel cars (DC) and electric cars (EC). The depot has line capability for only about 70 electric cars, even though all diesel locomotives and cars may be transferred to any other depot.	a) The Jakarta Kota car depot should be provided with storage track for electric cars at the earliest possible time. b) Construction of a new car depot. c) Bukitduri depot will be assinged only diesel railcars.
	Shortage of line capacity for railcars at Jakarta Kota depot	a) Line capacity for passenger cars will run short if the number of long-distance trains increases in the future. b) A passenger-car depot must be provided near Manggarai, if the existing Manggarai station serves as the terminal for a part of long-distance trains in the future.	a) A new passenger-car depot must be constructed near Jatinegara.
Track facilities	(1) Illegal trans-passers into the right of way by way-side inhabit-ants	a) This becomes a cause of subgrade damage and track irregularity. b) This abstructs high speed and safe passage of trains.	a) Fence must be provided for protection particularly of the urban route, the section over several km distance from Tanahabang on the Merak Line and the section over several km distance from Duri on the Tangerang Line.
	(2) Time-worn facilities	a) Ties and ballast are time-worn with poor maintenance care as a whole though partially kept in good condition. b) Slip-out of rail spike, insufficient tight-ening, loose joint-bolt, improper joint gap, insufficiency of ballast and corro-sion of rail. c) The urban line will be improved (except turnouts) under the Intermediate Pro-gram.	a) The turnouts on the urban lines and all the existing track on the suburban lines must be improved with good mainte-nance care.
	(3) Poor drainage system	a) The spouting phenomenon of silt is ob-served at many points, apparently be-cause of retarding water in the roadbed, which would result in deterioration of roadbed quality.	a) The cut section and the station yard should be complete with drain systems.
	(4) Insufficient of crossing facilities	a) Alarm and barrier systems are generally not complete. b) They are partly being improved under the Intermediate Program.	a) Some crossings on the urban lines and part of the suburban lines should be provided with alarm annunciators and barri-ers.
Station facilities	(1) Insufficient of station facilities	a) Platform 1. Insufficient height at low elevation (43 cm partly but 18 cm for all the rest). 2. Short clearance from track center to platform, endangering safety of pas-sengers. 3. Narrow width of platform b) Many of the existing stations have no shelters for passengers. c) Passages between platforms and between platform and station building are low at the same level as the track. d) Station buildings are time-worn at many intermediate stations.	a) Raising-up of platform eleva-tion and broadening of its width for security of passen-gers' safety b) Construction of cabins or shelters for passengers. c) Construction of overbridge for each platform. d) Reconstruction of station main building.

Item	Problem	Status	Countermeasures
Station facilities	(1) Insufficient of station facilities	e) Because of loose control in incoming or outgoing from the station, along with unristrictive passage even within the station premises, it is difficult to check those illegal riders without ticket. It also impedes operational modes toward high density and high speed.	e) Control must be intensified by installation of the screen fence to keep intruders out of the station yard.
		f) Ticket windows and barriers are provided relatively in small number at large stations as compared with greater number of passengers. No clear division is made between ticket sales and checks.	f) Increase in the number of ticket windows and barriers.
		g) Commercial shops and stalls are arranged in disorder within the yard of many stations.	g) Strengthening of station yard control.
		h) Many stations have only limited space of station front area.	h) Expansion and improvement of station front area.
Others	Securement of right-of-way	a) As observed many after along the wayside of the urban line, the right-of-way is infringed by free access or occupancy of inhabitants.	a) Installation of fence to intensify control for protection of the right-of-way.
Electrical facilities	(1) Time-worn facilities	a) Rectifiers and contact wire are being replaced for renewal.	a) Improvement of security facilities such as arresters and breaking circuits
		b) Deterioration by aging of high-voltage distribution system.	b) Repair and replacement of high-voltage distribution system.
		c) Slip-out of rail pond and electrolytic corrosion of rail.	c) Re-adjustment of contact wire elevation and deflection.
			d) Rehabilitation of return circuit.
Signal and telecommunication system	(1) Low safety of blocking system	a) Tokenless type is used for Central and Eastern Lines and telecommunication type for the rest lines.	a) Introduction of automatic signal system.
	(2) Time-worn signaling equipment	a) Because the signal system is of semaphore type, much manpower is required for maintenance and especially for hanging the oil lamp at night.	a) Introduction of automatic block system
		b) Many distant signals do not work well because of deterioration in quality by aging.	
		c) A single starting signal is used commonly plural number of departure track lines.	
		d) Signal indication at night is hard to identify.	
	(3) Time-worn interlocking device	a) Interlocking between the signal and the switch is operated by mechanical interlocking unit.	a) Introduction of relay interlocking system.
		b) Much maintenance care is required because of quality detrioration.	
		c) False operation may occur due to abrasion of the locking lever.	
	(4) Time-worn switch	a) There exist many stations without installation of locking device. This endangers operational safety.	a) Installation of power point machine
		b) The switch requires great physical strength for each handling and much manpower for maintenance.	

Item	Problem	Status	Countermeasures
Signal and telecommunication system	(5) Telecommunication system	a) Improvement is being progressed under the Intermediate Program for cable conversion of transmission route and for installation of PCM carrier, dispatching telecommunication, facsimile equipment and train radio system.	
Rolling stock, workshop and rolling stock depot	Insufficient of maintenance care for electric and diesel railcars	a) Shortage of test and repair apparatus and equipment in workshop and rolling stock depot. b) Low efficiency and availability of existing facilities because of remarkably deteriorated quality. c) Prolonged repair period of rolling stock inside workshop (because of shortage of material supplies and unskilled experience) d) For electric railcars, annual inspection began in 1978 and bi-annual inspection started in 1980.	a) Inspection and test apparatus for rolling stock maintenance, especially for electric railcars, must be improved urgently. b) Well-planned training program for technicians (especially, for electricians) c) Improvement of material inventory control for repair and maintenance.
Others	(1) Administrative organization	a) The railway system in the JABOTABEK Area is under administrative control of PJKA's West Java Region and Inspection 1. Inspection 1 is the organ subordinated to West Java Region.	
	(2) Personnel education and training	PJKA provides the following facilities for education and training of its employees. a) Railway Engineering College (for education of middle-class supervisory personnel during its 3-year educational course) and Training Center (for training of senior management during 3-month course) in Bandung. b) Training Center in Yogyakarta (for training of train operators and maintenance workers during 2 or 3 month course)	

Table 4.2.1. Result of Traffic Volume Survey (7:00 - 19:00)

		Pedestrian	Bicyle	Motor-Cycle	Tri-Cycle	Motor-Car	Bus	Truck	Total
Central Line	Jl. P.Jaya Karta	5.043	3.974	11.887	8.083	7.493	151	4.008	40.639
	Jl. Mangga Besar	4.968	4.391	20.104	14.032	12.493	478	3.317	59.783
	Jl. H. Samanhudi(Sawah Besar)	6.233	2.738	24.956	12.424	26.786	309	5.429	78.875
	Jl. Veteran & Jl. Juanda	5.048	1.698	30.709	15.968	40.616	3.639	5.893	103.571
	Jl. Perwira	2.871	715	25.167	9.222	39.328	910	6.325	84.538
	Jl. Samratulangi & Jl. Cut Mutiah	2.958	1.012	8.926	6.790	21.712	722	2.051	44.171
	Jl. Diponegoro	3.110	1.043	14.013	2.221	28.938	1.715	2.503	53.543
	Jl. Pahlawan (Kalibata)	2.859	567	6.559	154	9.468	881	2.739	23.227
Western Line	Jl. Bandengan (Grogol)	6.451	8.046	19.300	10.172	12.687	410	11.545	68.611
	Jl. K.H. Hasyim Ashari	-	-	22.689	-	31.744	6.118	10.162	70.713*2
	*1 Jl. Prof. Dr. Latumenten	-	-	10.270	-	17.151	4.411	7.638	39.470*3
Eastern Line	Jl. Gn. Sahari Ancol	-	-	10.204	-	12.208	520	3.643	26.575*4
	Jl. Garuda	3.078	2.380	16.151	9.299	12.272	1.118	3.072	47.350
	Jl. Kramat Bundar	-	-	22.082	-	23.805	3.272	5.439	54.598*5
	Jl. Pramuka	-	-	20.312	-	36.154	2.082	5.541	64.089*6
	Jl. Bekasi Timur	1.799	1.268	10.309	2.237	10.269	1.927	4.009	31.818
	Jl. Klender	29.973	2.038	9.139	1.203	2.694	852	1.441	47.340

*1 Tangerang Line
*2-6 Data of Source : Traffic Survey by BINA MARGA May, 1980
(Tri-Cycle is included in Motor-Car)

Table 4.2.2. Result of Closing Barrier Time Survey

	Name of Street / Barrier Factor		Time for Gate Closing (Sec)	Time for Train come into the Closing (Sec)	Time for Train Passing (Sec)	Total (Sec)	No. of Train in bound	No. of Train out bound
Central Line	Jl. P. Jayakarta	A	13.4	35.4	21.0	69.8	35	32
		L	26.0 (10:06	105.0 (7:47)	146.0* (15:15			
		S	4.0 (17:53	5.0 (17:36)	5.0 (16:17			
	Jl. Mangga Besar	A	15.0	50.7	20.8	86.5	32	30
		L	71.0 (17:03	133.0 (14:25)	88.0* (8:27			
		S	7.0 (17:20	6.0 (17:03)	3.0 (16:05			
	Jl. Samanhudi (Sawah Besar)	A	16.9	37.9	24.5	79.3	36	35
		L	104.0 (10:25	137.0 (15:59)	124.0* (16:50			
		S	11.0 (9:11	1.0 (10:15)	5.0 (8:46			
	Jl. Veteran & Jl. Juanda	A	20.0	38.3	20.3	78.6	34	33
		L	128.0 (7:30	317.0 (8:26)	132.0* (13:15			
		S	11.0 (14:15	7.0 (15:49)	5.0 (14:15			
	Jl. Perwira	A	18.1	18.6	27.7	58.4	33	36
		L	67.0 (10:12	50.0 (15:55)	56.0 (17:20			
		S	3.0 (13:05	5.0 (13:30)	8.0 (16:12			
	Jl. Samratulangi & Jl. Cut Mutiah	A	13.7	26.1	15.5	55.3	36	37
		L	84.0 (9:06	75.0 (13:27)	86.0* (7:55			
		S	10.0 (11:34	15.0 (17:50)	2.0 (8:32			
	Jl. Diponegoro	A	16.1	47.0	14.0	77.1	37	35
		L	35.0 (11:00	92.0 (15:26)	69*0 (9:47			
		S	10.0 (7:26	15.0 (7:23)	3.0 (14:48			
	Jl. Pahlawan (Kalibata)	A	14.4	36.5	8.8	59.8	18	18
		L	64.0 (12:45	130.0 (12:45)	21.0 (12:45			
		S	9.0 (7:50	3.0 (16:53)	5.0 (11:36			
Western Line	Jl. Bandengan (Grogol)	A	13.3	31.4	15.8	60.3	12	16
		L	22.0 (7:33	133.0 (8:14)	45.0 (7:05			
		S	8.0 (8:20	5.0 (11:32)	6.0 (16:29			
	Jl. K. H. Hasyim Ashari	A	15.7	21.9	10.4	48.0	10	10
		L	25.0 (7:54	50.0 (17:22)	26.0 (11:08			
		S	7.0 (14:53	6.0 (7:43)	5.0 (17:44			
	Jl. Prof. Dr.** Latumenten	A	26.7	30.0	22.9	79.6	3	6
		L	46.0 (8:17	49.0 (16:32)	76.0* (14:00			
		S	14.0 (11:17	11.0 (11:17)	10.0 (9:34			
Eastern Line	Jl. Gn. Sahari Ancol	A	11.4	24.6	11.8	47.8	13	11
		L	20.0 (7:25	93.0 (12:43)	34.0 (12:43			
		S	5.0 (14:15	10.0 (13:00)	5.0 (11:41			
	Jl. Garuda	A	17.5	43.6	30.9	91.9	20	21
		L	35.0 (16:04	86.0 (13:44)	238.0 (10:26			
		S	9.0 (14:05	10.0 (17:28)	5.0 (18:25			
	Jl. Kramat Bundar	A	54.3	67.3	32.0	153.6	27	20
		L	181.0 (15:45	208.0 (16:37)	128.0* (16:00			
		S	20.0 (9:51	18.0 (7:32)	9.0 (11:36			
	Jl. Pramuka	A	18.0	46.3	28.1	92.6	23	19
		L	25.0 (11:55	152.0 (13:23)	231.0* (8:09			
		S	11.0 (9:48	12.0 (14:36)	5.0 (10:04			
	Jl. Bekasi Timur	A	18.4	36.4	26.0	80.8	25	28
		L	102.0 (7:36	108.0 (8:23)	140.0 (12:10			
		S	5.0 (17:26	13.0 (14:09)	8.0 (17:50			
	Jl. Klender	A	32.0	142.0	57.1	232.0	26	26
		L	169.0 (16:56	342.0 (14:27)	390.0 (9:57			
		S	5.0 (13:27	96.0 (17:20)	17.0 (18:30			

Note : A: Average L: Maximum Time S: Minimum Time
*Two direction trains come into the same crossing.
** Tangrang Line

Table 4.2.3. Result of Traffic Congestion Survey

	Name of Street	Direction	1	2	3	4	5	6	7
Central Line	Jl. P. Jayakarta	Jakarta Kota → Jl. Gn. Sahari Ancol	25	31	36	32	116*		
			0.22	0.33	0.42	0.48	3.37		
		Jl. Gn. Sahari Ancol → Jakarta Kota	20	25	29	51	277*		
			0.33	0.22	0.30	0.55	3.45		
	Jl. Mangga Besar	Jl. Gajah Mada → Jl. Gn. Sahari Ancol	24	55	38	38	31	43	
			0.45	1.33	1.01	1.16	0.51	1.06	
		Jl. Gn. Sahari Ancol → Jakarta Kota	41	28	42	38	30	59	
			1.20	0.50	1.01	1.11	0.54	1.11	
	Jl. H. Samanhudi (Sawah Besar)	Jl. Gajah Mada → Jl. Gunung Sahari	7	12	10	62	28	32	
			0.24	0.42	0.22	1.29	0.47	0.59	
		Jl. Gunung Sahari → Jl. Gajah Mada	35	96	17	144	103	167	
			0.40	2.05	0.25	3.08	2.15	3.43	
	Jl. Veteran & Jl. Juanda	Jl. Gajah Mada → Jl. Gunung Sahari	25	31	36	32	116*	51	
			0.22	0.33	0.42	0.48	3.37	0.54	
		Jl. Gunung Sahari → Jl. Gajah Mada	20	25	29	51	277*	28	
			0.33	0.33	0.30	0.55	3.45	0.35	
	Jl. Perwira	Istana Negara → Pertamina	19	45	45	45	49	66	
			0.38	1.22	0.42	0.59	1.31	2.11	
		Pertamina → Istana Negara	9	13	21	18	60	92	
			0.10	0.10	0.16	0.16	0.44	0.55	
	Jl. Samratulangi & Jl. Cut Mutiah	Jl. M.H. Thamrin → Jl. Menteng Raya	5	9	9	14	16	35*	
			0.23	0.43	0.38	0.59	1.14	2.29	
		Jl. Menteng Raya → Jl. M.H. Thamrin	2	33	5	21	53	108*	
			0.05	0.40	0.10	0.25	1.07	2.35	
	Jl. Diponegoro	Jl.M.H. Thamrin → Jl. Salemba Raya	34*	28	25	39*			
			2.24	1.37	0.49	1.35			
		Jl. Salemba Raya → Jl. M.H. Thamrin	37*	19	33	38			
			3.00	0.45	1.00	2.15			
	Jl. Pahlawan (Kalibata)	Kalibata → Jl. Dewi Sartika	21	6	11	1			
			0.40	0.29	0.27	0.09			
		Jl. Dewi Sartika → Kalibata	18	16	16	5			
			0.35	0.21	0.30	0.13			
Western Line	Jl. Bandengan (Grogol)	Banjir Kanal → Jakarta Kota	48	44	45				
			1.23	0.54	0.55				
		Jakarta Kota → Banjir Kanal	57	62	74				
			2.07	1.30	1.47				
Eastern Line	Jl. Garuda	Jl. Gunung Sahari → Kemayoran	14	9	17	7	31	10	35
			0.21	0.17	0.28	0.19	1.06	0.26	1.03
		Kemayoran → Jl. Gunung Sahari	25	28	43	51	99	40	83
			0.38	0.54	1.09	1.30	1.35	1.03	2.04
	Jl. Kramat Bundar	Jl. Menteng Raya → Jl. Jend. A. Yani	148	212	80				
			2.51	3.57	1.46				
		Jl. Jend. A. Yani → Jl. Menteng Raya	229	272	256	Natural Conjestion			
			5.57	7.15	5.12				
	Jl. Pramuka	Jl. Salemba Raya → Jl. Jend. A. Yani	145	162	135	172	196	122	165
			1.58	2.25	1.56	2.10	2.48	1.41	2.15
		Jl. Jend. A. Yani → Jl. Salemba Raya	71	161	44	113	63	63	76
			1.18	3.09	0.46	2.06	1.11	1.13	1.14
	Jl. Bekasi Timur	Kel. Cipinang Besar→ Kel. Jatinegara Kaum	21	12	27	10	13	41	
			0.43	1.11	1.21	0.53	52	0.15	
		Kel. Jatinegara Kaum →Kel. Cipinang Besar	30	20	18	20	18	17	
			1.25	1.20	0.35	0.50	1.20	0.25	
	Jl. Klender	Kel. Cipinang Besar→ Kel. Jatinegara Kaum	36	36	41	28			
			6.40	6.30	6.15	5.32	Natural Conjestion		
		Kel. Jatinegara Kaum →Kel. Cipinang Besar	31	29	39	23			
			6.40	6.30	6.15	5.32			

Note: Upper Column shows the No. of Cars.
Lower Column shows the time for clear off (Minute, Sec.).
*Two direction train come into the same crossing.