(2) Highway system

Jakarta metropolitan area is developed under a low density development policy substantiated by a high portion of transportation investment into road sector. Within DKI, Jakarta, the total length of road is 3038 km (1982) consisting of 472 km of arterial road and 495 km, 1085 km, 986 km of collector, local and rural roads respectively (Table 3.1.2.1).

Table 3.1.2.1 Road Length by Type in DKI, Jakarta, 1982

Road Type	Length (km)
Arterial	472
Collector	495
Local Road	1085
Rural Road	986
Total	3038

Source: DKI, Jakarta Master Plan 2001.

Arterial network pattern in Jakarta metropolitan area is rather irregular but a "loop and radial" pattern has been proposed with major projects including Outer Ring Road (about 22 km in diameter) and Jakarta-Cikampek Toll Road (to East); Jagoraw: Toll Road to Bogor (and (South) and Jakarta-Merak Toll Road (to West) have been completed in 1979 and 1984 respectively. (Fig. 3.1.2.3)

The average arterial road spacing in the area is about 2.5 km (North-south corridor) and 3.5 km (East-west corridor) which was regarded sufficient in 1978 (Colin Buchanan and Partners et. al., 1982) but predicted that it will be increasingly less sufficient towards the year 2003 in which a desirable set of spacing is set at around 1 km.

Arterial Road Systems Development Study (ARSDS, 1987) also pointed out the lack of arterial road capacity particularly in East-west corridor where major suburban development is being directed.

Street system within DKI Jakarta, in general, is also rather sparse with the estimated street ratio of 2.0%. Sufficient road density is observed only in limited areas such as Kebayoran Baru, Banteng and Menteng.

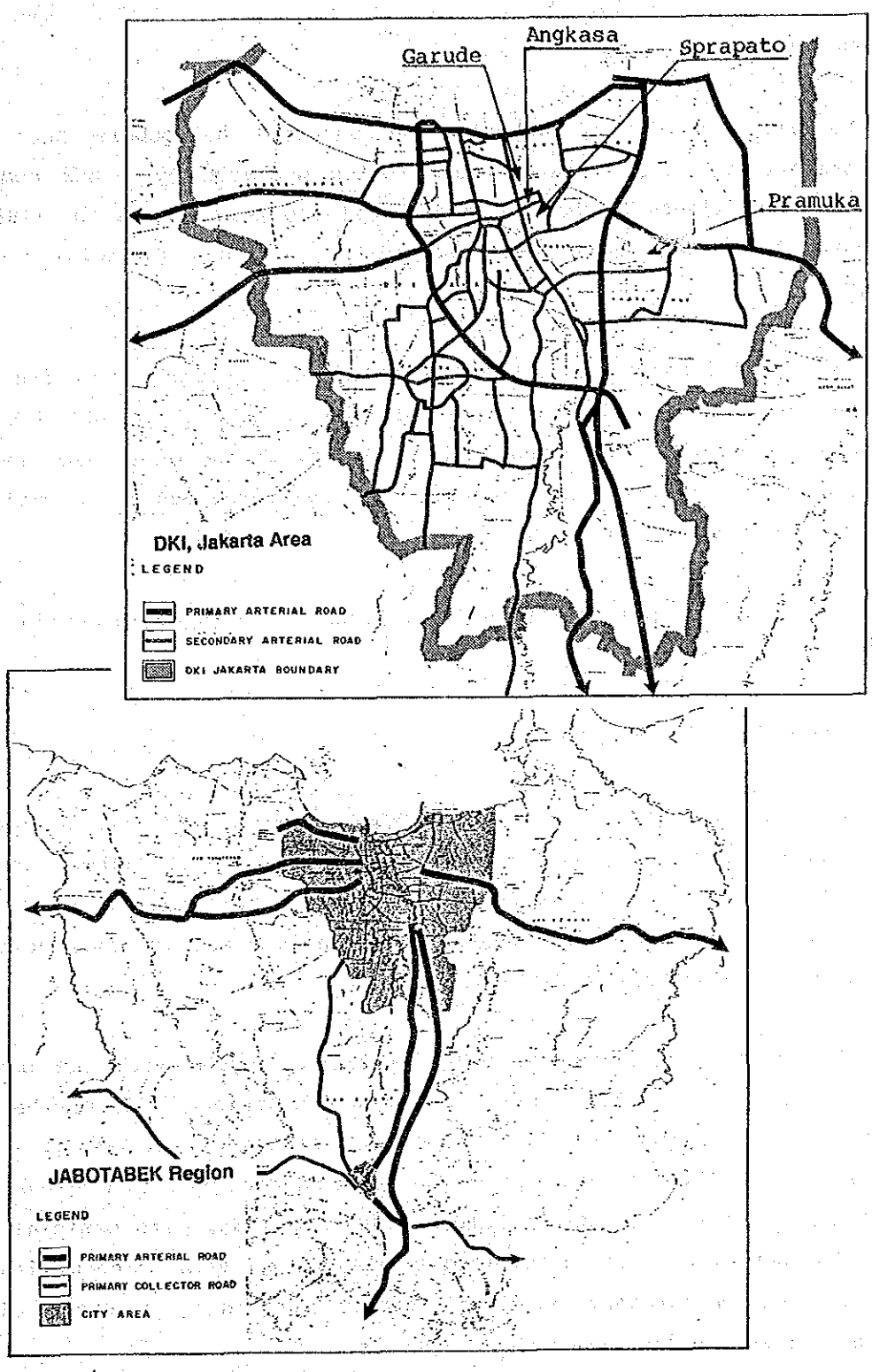


Fig. 3.1.2.3 Arterial Road Network in JABOTABEK Area

(3) Other modes of transportation

Bus Service

The bus services in Jakarta are operated by public and private enterprises. There are 373 bus routes operated by 8 bus companies. Total bus fleets officially registered are over 11,000 in 1988, that carry an average daily passenger of 3.4 millions (official figure by DKI).

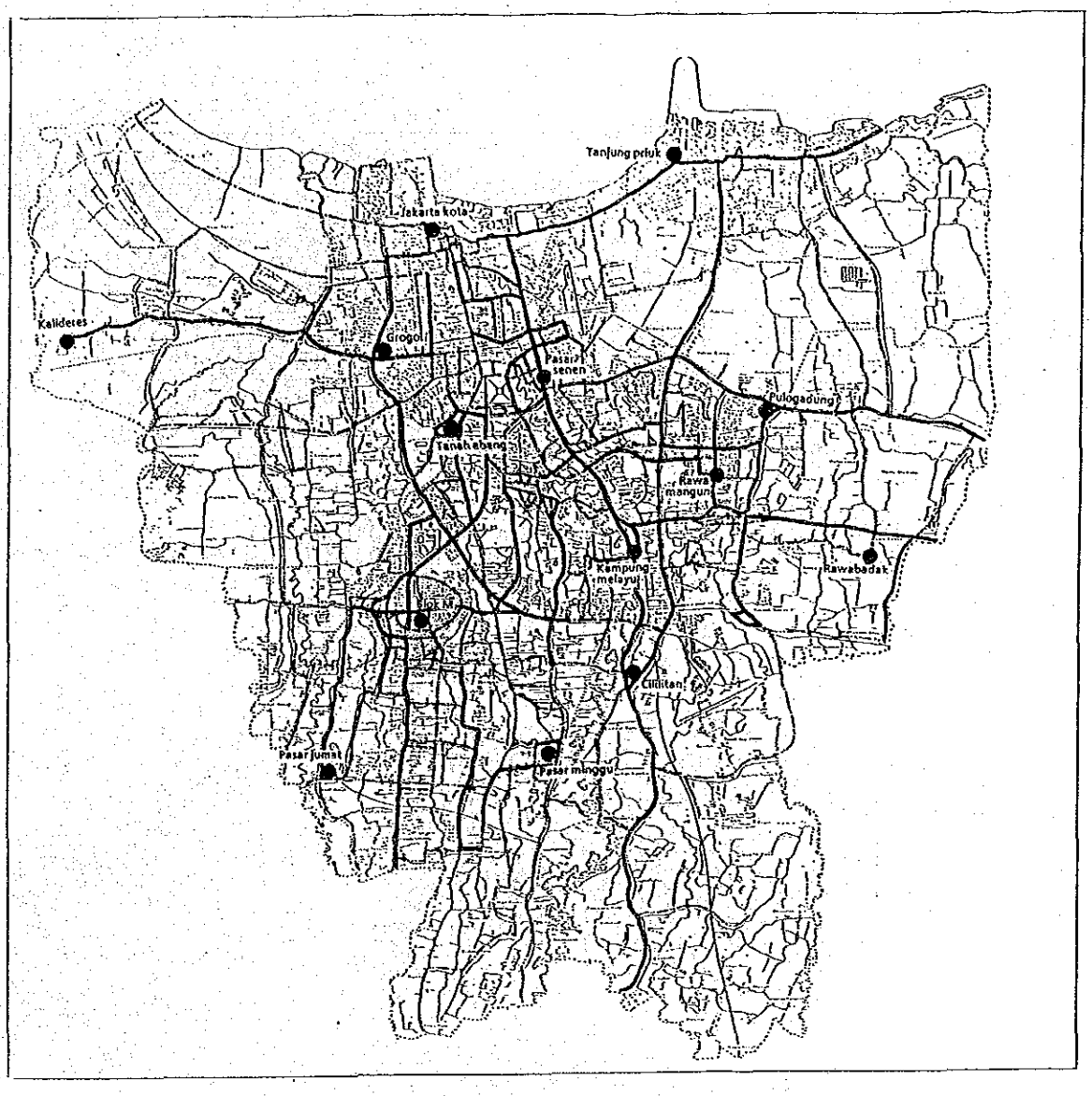
Fig. 3.1.2.4 shows the large and medium bus networks totaling 798 km route length. Additional 312 km at the peripheral of DKI Jakarta is covered by small bus routes. Fig. 3.1.2.5, on the other hand shows the Botabek bus network, and the number of registered bus fleets and routes are shown in Table 3.1.2.2.

The detailes of bus operation in JABOTABEK Area is explained in Section 3-3-1.

Other Modes of Transportation

There are a variety of other modes of motorized and nonmotorized transportation being used in Jakarta (Table 3.1.2.3). There are about 9,500 ordinary taxies, 14,600 three wheeler small taxies called Bajaj. Seizable number of other type of paratransit named as Bemo, Helicak or Mobet are shown in the Table 3.1.2.4.

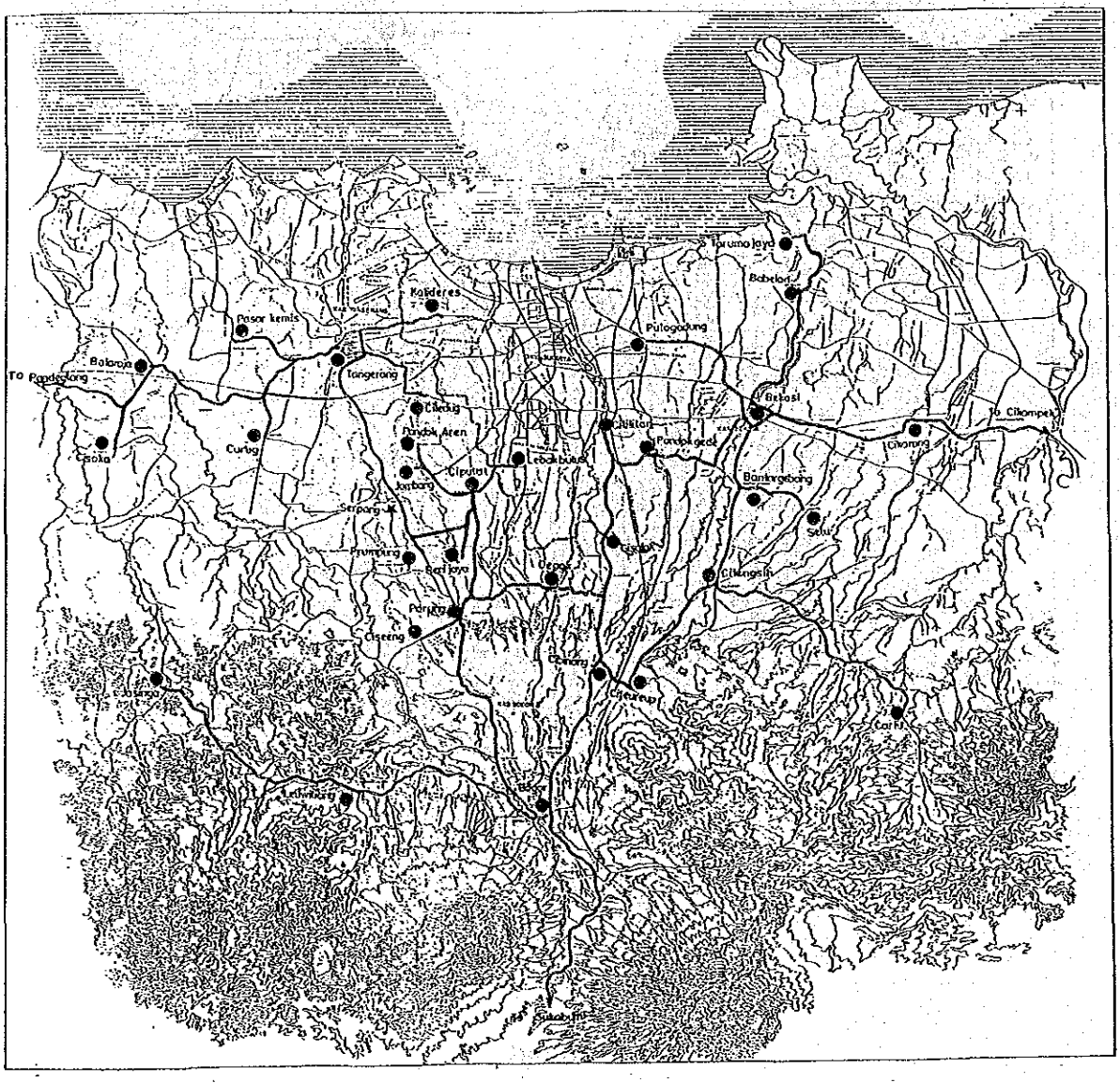
Well known Becak which is pedal powered tricycle with the passenger seats in front of the driver have been decreasing in its number since early 1970's when the city Government declared the war on removing Becak from Jakarta streets. The elimination policy removed 54,000 Becaks from Jakarta street between 1985 and 1988. Its official number is 22,800 in 1988 and prohibited to operate on main streets within the city but omnipresent in local streets providing a short distance carrier for public transportation users.



Legend:

- Large and Medium Buses
- Large Bus only
- Large Bus only
- Bus Terminals

Fig. 3.1.2.4 Bus Network in Jakarta, 1989 (Large and Medium Buses)



Legend:

Botabek Bus Network

Bus Terminal

D K I Boundary

Fig. 3.1.2.5 BOTABEK Inter-city Bus Network

Table 3.1.2.2 Number of Fixed Route Bus Fleets Licensed in DKI Jakarta, 1977-1989

Year/month	Bis Kota					BisMini	Mikrolet	Oplet	Bemo
	S/D	D/D	Patas	(AC)	Total				
1977/05	2,379	-	-		2379	380	-	2,595	1,093
1978/10	2,882	-	-		2882	949	-	3,005	1,093
1979/10	2,942	-	-		2942	1,099	-	2,978	1,085
1980/10	3,253	-	-		3253	1,148	60	2,945	1,085
1981/10	3,317	58	-		3375	1,997	1,829	1,196	1,085
1982/10	3,069	162	-		3231	2,404	2,909	246	1,074
1983/10	3,041	200	-		3241	2,462	3,003	175	1,904
1984/01	3,041	215	-		3256	2,479	3,034	104	1,904
1985/10	1,552	391	397		2340	2,935	3,633	-	1,096
1986/10	1,519	406	397		2322	3,562	4,146	-	1,096
1987/10	1,561	406	397		2364	3,462	4,113	-	1,096
1988/10	1,568	438	708	(10)	2724	3,918	4,445	-	-
1989/01	1,476	386	744	(30)	2636	4,034	4,449	-	-

Note: Figures in brackets are the number of air conditioned fleets in Patas service.

Source: Quartery booklet published by DLLAJR, DKI Jakarta.

Table 3.1.2.3 Characteristics of Other Public Transportation in Jakarta, 1988

Service Name	Licenced Number 1988	Vehicle Characteristics				Fare System			Registration Requirement
		Type	Engine Size (cc)	Fuel Type	Seating Capacity	Type	First 1km (Rp)	Additional	
Taxi	9,460	Passeger Car	1600-1800	Gasoline	4	Meter	600 1)	20Rp/100m	Required
Bajaj/ Minicar	14,612	Small Three Wheeler	250	Mixture	2	Negotiation	500	Lower than Taxi	Required
Bemo	Small	Three Wheeler Covered Pickup	300	Mixture	4-5	Negotiation	200	100Rp/km	Required
Helicak/ Mobet	Small	Motorized Tricycle	125	Gasoline	1-2	Negotiation	400	200Rp/km	Required
Becak	22,856 2)	Pedal Powered	n.a.	n.a.	1-2	Negotiation	300	200Rp/km	Banned 3)

Note: n.a. (not applicable)
1) This rate is for air conditioned taxi. One for without start from Rp 500.
2) Official figure from DKI Jakarta (Biro Ketertiban).
3) Becak are officially banned in Jakarta (Elimination policy removed 54,000 Becak between 1985-88).

Table 3.1.2.4 Number of Other Public Transportation Fleets in DKI Jakarta, 1977-1989

Year/month	Taxi	Bajaj	Helicak	Minicar	Mebea	Mobet	Becak 1) (spotted)
1977/05	4,598	3,696	1,055	5,088	446	45	-
1978/10	5,607	6,945	539	2,489	279	10	-
1979/10	5,898	9,212	936	1,390	145	27	-
1980/10	6,071	10,956	936	739	127	27	-
1981/10	6,471	12,183	936	639	101	27	-
1982/10	7,865	12,842	739	272	88	12	-
1983/10	7,898	12,868	-	272	88	-	-
1984/01	7,898	12,937	-	272	-	-	6,750
1985/10	7,949	13,541	-	-	-	-	19,422
1986/10	8,234	14,496	-	-	-	-	33,522
1987/10	8,548	14,496	-	-	-	-	18,686
1988/10	9,460	14,612	-	-	-	-	22,856
1989/01	9,785	14,612	-	-	-	-	-

Note: (-) indicates that figures are not available.
1) Number of Becaks are tabulated by Office of Security (Biro Ketertiban), DKI Jakarta based on reports from district offices but a larger number of Becak are believed to exist in Jakarta.

Source: Other figures are from quartery booklet published by DLLAJR, DKI Jakarta.

3-1-3 Transit Ridership and Modal Share

(1) Spatial distribution of transit patronage

ARSDS conducted railway passenger survey in 1986 and tabulated the number of passengers at each railway station and section. Table 3.1.3.1 shows the list of railway stations with more than 5,000 passengers per day. Jakarta Kota and Gambir handle nearly 20,000 passengers per day, whereas Bogor exceeds 17,000. Depok, Pasar Minggu, Jatinegara and Manggarai range at around 10,000, and the rest below 7,000.

Table 3.1.3.1 Railway Stations with More Than 5,000 Passengers/Day

Station Name	Number of Passengers
Jakarta Kota	21,646
Gambir	19,491
Bogor	17,567
Depok	11,685
Pasar Minggu	11,212
Jatinegara	9,305
Manggarai	9,274
Pasar Senen	6,963
Depok Baru	6,584
Cikini	5,771
Tanah Abang	5,434
Tebet	5,251
Lenteng Agung	5,089
Sawah besar	5,026

Source: ARSDS, 1986

Fig. 3.1.3.1 shows the train passengers by railway section. The major concentration of passengers takes place on Central Line indicating the line is well used by suburban commuters.

The survey shows that during the peak hours (6:00 - 9:00 am) Central Line carries 8,000 (62% of total inflows at traffic cordons) of Botabek commuters into DKI Jakarta.

Spatial distribution of bus and rail passengers are diagrammatically shown in Fig. 3.1.3.2 which characterizes the current role of railway (particularly Central Line) as suburban commuter railway and buses as urban as well as suburban transportation systems.

Most frequent trip lengths of bus and railway trips were 6.5 km and 51 km respectively indicating the substantially longer trips for railway users.

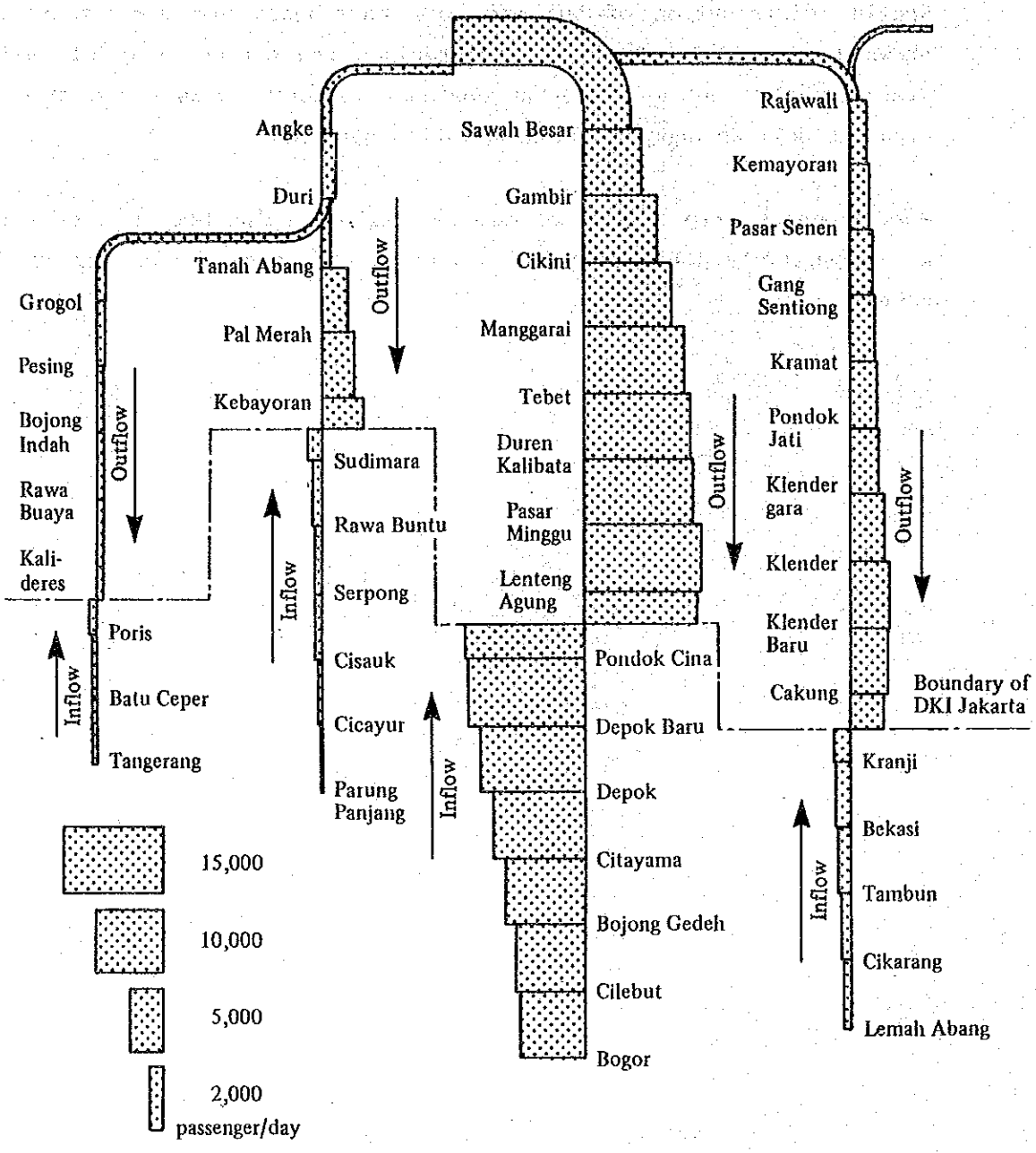
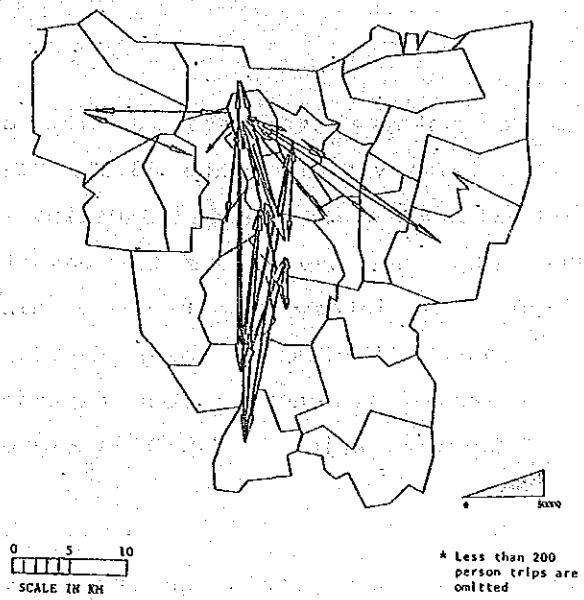


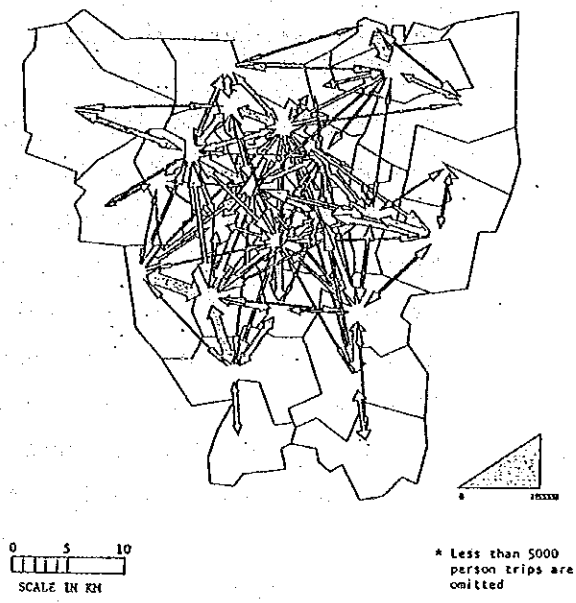
Fig. 3.1.3.1 Number of JABOTABEK Train Passengers by Section

Source: ARSDS Railway Survey, 1986

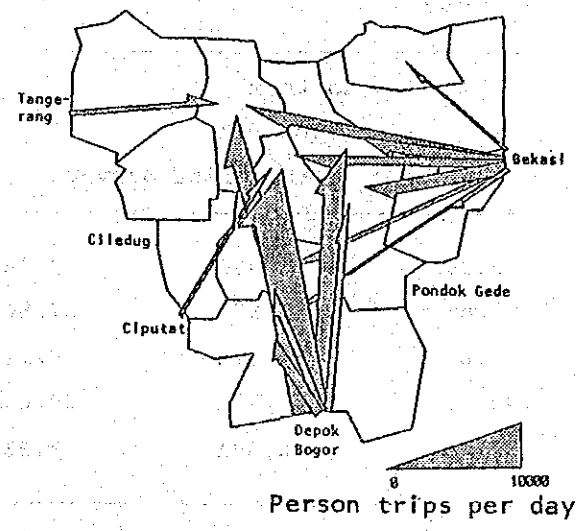
a. Internal Movement - Railway



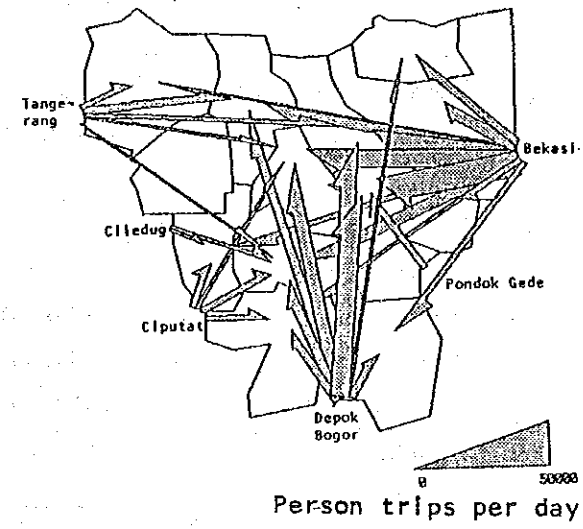
b. Internal Movement - Buses



c. Inbound Flows by Railway



d. Inbound Flows by Bus



Source: ARSDS, 1987

Fig. 3.1.3.2 Person Trip Movements by Bus and Rail

(2) Modal shares

Modal shares of Jakarta-related person trips estimated by ARSDS study in 1985 are shown in Table 3.1.3.2.

The railway share of person trips by Jakarta residents is 0.3% as compared to bus share of 52.6% and private vehicle share 43.3%. The share of railway in terms of Jakarta-Botabek trips, which is estimated by a Cordon Line Survey, is higher (8%) than the figure for Jakarta residents, but the equivalent figure for inter-city buses is also higher (57.9%) but the share of private vehicles is lower (30.8%). Original study also tabulated the share of railway in long distance travels -- Jakarta and outside the JABOTABEK, which is 10.6%, a higher value than Jakarta-Botabek travel share.

This indicates that the current role of railway within the urban area is rather limited but a more important role is played in inter-city travels.

Table 3.1.3.2 Transportation Mode Shares of Jakarta-Related Person Trips, 1985 (trips/day)

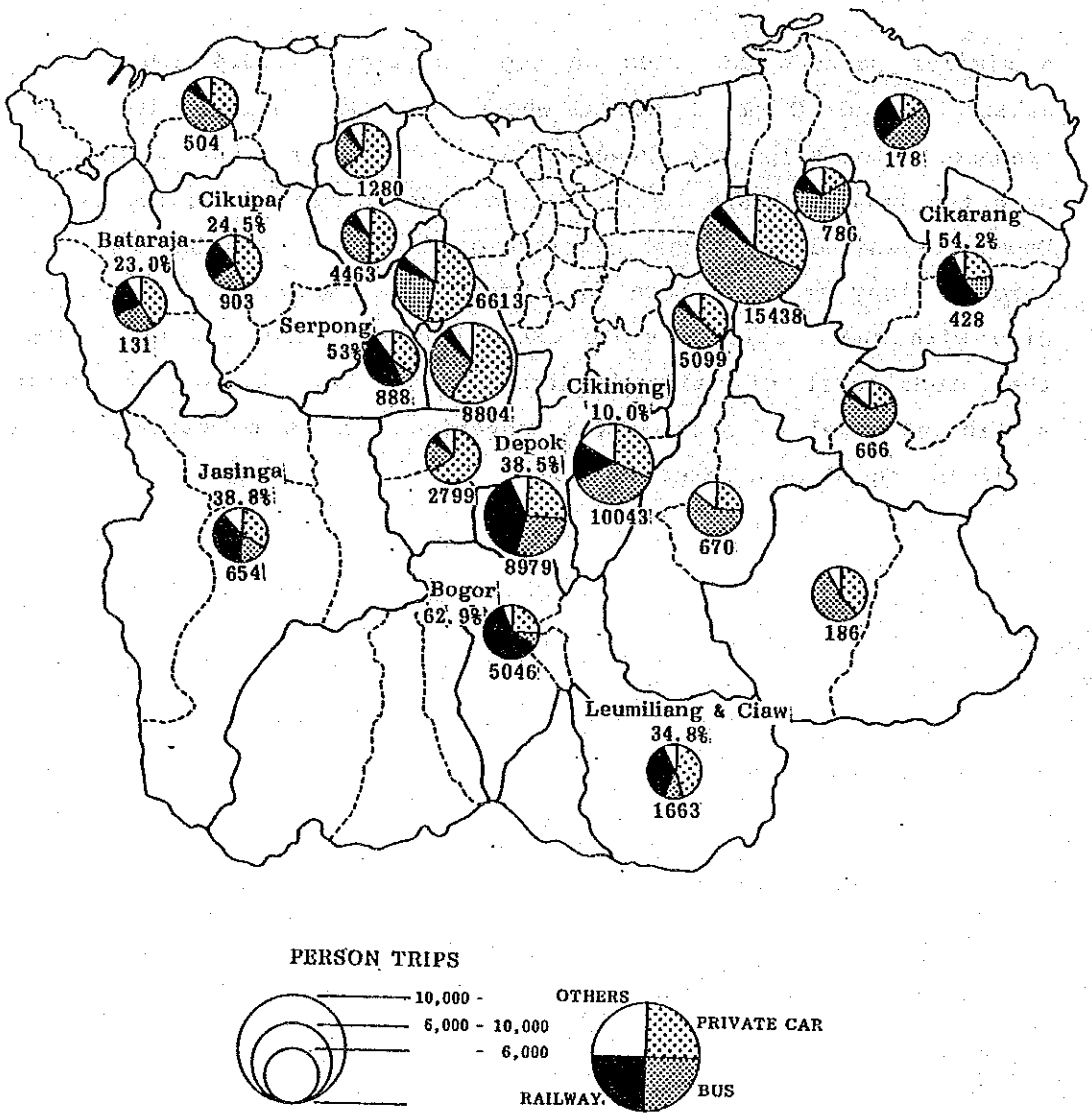
Mode	Jakarta[2] Residents	%	To/From[3] Botabek (Cordon Line Survey)	%
Railway	21,237	0.3%	53,960	8.0%
Bus	3,428,139	52.6%	392,901	57.9%
Taxi	67,833	1.0%	676	0.1%
Private Vehicles 1)	2,819,768	43.3%	208,794	30.8%
Trucks	175,695	2.7%	22,391	3.3%
Total	6,512,672	100.0%	678,722	100.0%

Source: ARSDS, 1985

Note: 1) Private vehicles include motorcycles.
2) ARSDS Home Interview Survey
3) ARSDS Cordon Line Survey

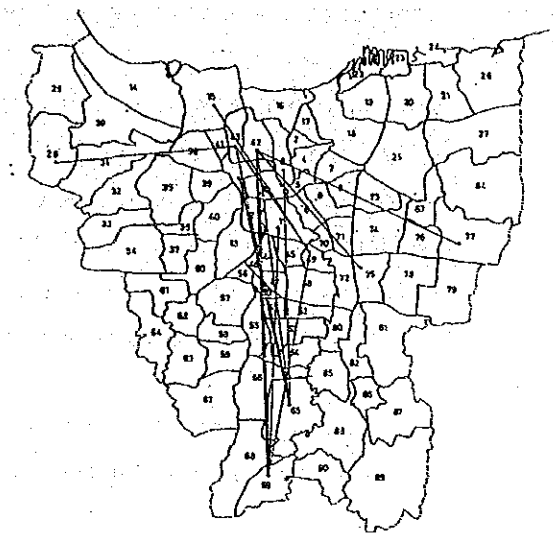
Modal shares of Botabek-generated work trips are shown in Fig. 3.1.3.3. Railways share is particularly high in zones along Central Line (Bogor 62.9%, Depok 38.5% and Leuwiliang & Ciawi 34.8%) and a part of zones along Tangerang Line (Cikupa 24.5% and Balaraja 23.0%) and Cikarang on Bekasi Line are also high (54.2%).

A similar pattern can also be seen in Fig. 3.1.3.4 indicating the Jakarta based O & D pairs whose railway shares within public transportation trips are exceeding 50%. The diagram was constructed to show the railway share (against total public transportation trips) of Depok originated trips destined within DKI Jakarta zones. Zones around major railway stations such as Jakarta Kota, Gambir and Manggarai was high with their railway share exceeding more than 80% which implies that high level of railway patronage can be attained by providing sufficient level of service and convenient access to railway stations as it is argued in a later section.



Note: Figures are the number of work trips

Fig. 3.1.3.3 Modal Split of Work Trips in BOTABEK Zones



Note: O & D pairs indicated in this figure shows that the railway trips exceed 50% of total public transport trips. Data based an ARSDS, 1986.

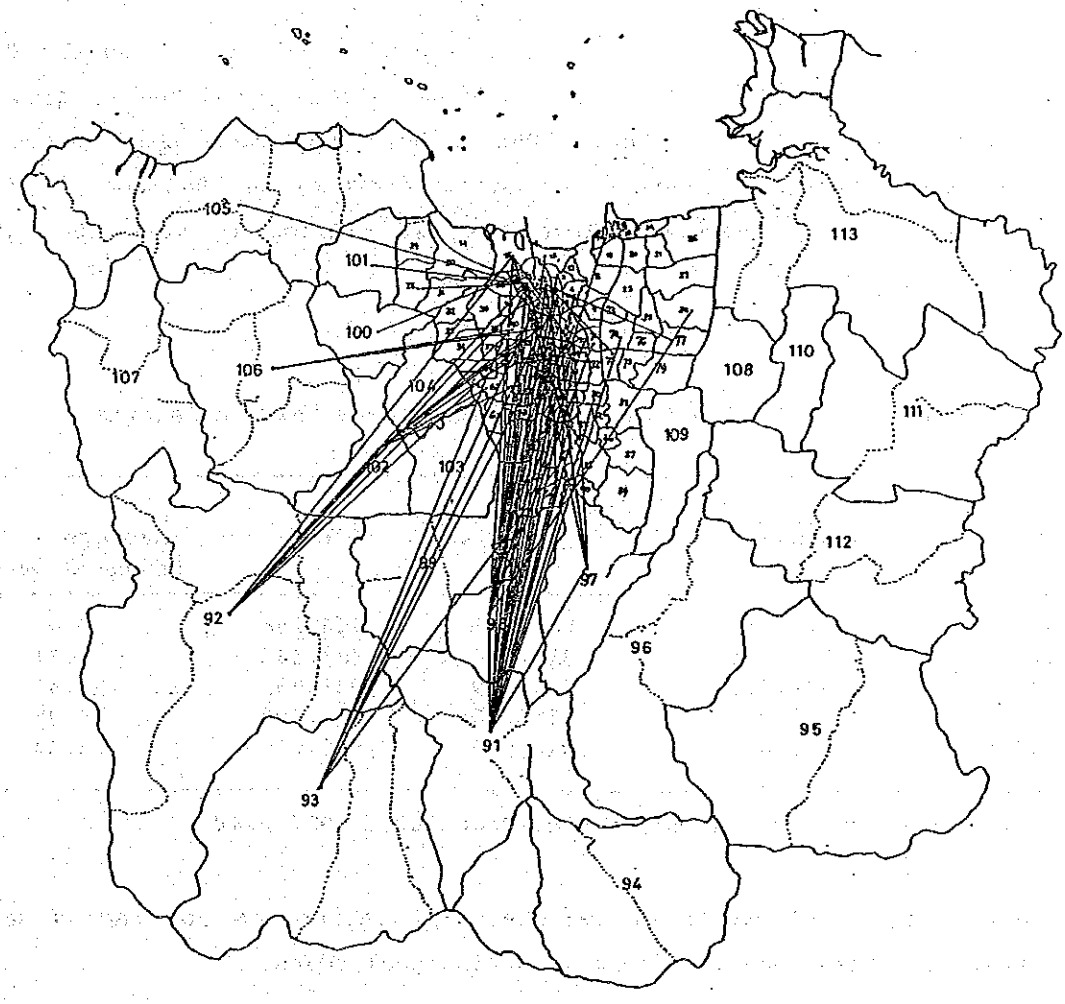


Fig. 3.1.3.4 Rail Advantaged O.D. Pairs

3-1-4 Transportation Policies in JABOTABEK Area

Traffic congestion and deteriorating efficiency in carrying people and goods are the widely held concern of the transportation planning authorities in JABOTABEK Area. This section summarizes the transportation goals and policies of major planning agencies based on a review of the latest official planning documents made available to this study. Two reports reviewed are:

- DKI, Master Plan 2005 (Section 4.8 "Transportation"); and
- REPELITA V (Chapter 13 "Transport and Tourism").

(1) DKI, Master Plan

Private vehicles in Jakarta has increased about 11.4% annualy during the period of 1975 - 1985, and the ownership is predicted to grow at a rate of 4% to 5% p.a. until 2005. There were more than one million private vehicles (passenger car and motorcycle) in 1985 and the figure is expected to reach the level of two million in year 2005 (Table 3.1.4.1).

Table 3.1.4.1 Trend of Motor Vehicle Ownership in Jakarta

Year	Type of Vehicle		TOTAL	(Average Annual Growth)
	Passenger Car	Motorcycle		
1972	115,635	188,583	304,218	-
1975	170,265	313,580	483,845	19.7%
1985	339,812	696,389	1,036,201	11.4%
1995 1)	597,000	955,200	1,552,200	5.0%
2005 1)	918,000	1,242,000	2,160,000	3.9%

Note: 1) Prediction made in DKI, Master Plan 2005, 1987 p.40

With this rapid growth of carownership, Jakarta is now facing serious traffic congestions particularly during peak hours.

Because it is indisputable that the urban space is limited and impossible to provide highway capacity to fully meet the expected demand of private traffic in the city area, an investigation of a high capacity mass transit corridor as well as the improvement of heavy railway systems in the area become a growing concern among policy makers in Jakarta metropolitan area.

Although a total of 626 km of arterial road is planned to be constructed by the year 2005, the capacity of road network is expected to fall short of the demand. The limitation of private transportation gives rise to the improvement of public transportation.

The major transportation policies of DKI up to the year 2005 include:
- The optimization of available road space to private cars and buses;
- Provision of an integrated public transportation system including railway and buses;
- Integration of land use and transportation planning; and
- Limitation of traffic in the city center.

These policy goals are achieved by the following specific measures:
- Provision of bus priority measures including bus lanes.
- Provision of bus connections as a railway feeder system.
- Provision of park and ride facilities at suburban railway stations.
- Stimulates development of commercial activities in the vicinity of railway stations.

(2) REPELITA V

REPELITA V pointed out that annual increase of 6.3% in passenger kilometer was achieved during Repelita IV, and maintain that the further improvement of railway transportation is necessary to provide 'cheap, safe and economical' transportation service that should be developed in conjunction with road as well as sea transportation. It proposes the rehabilitations and construction of 1835 km of railway during the Repelita V period. The plan stresses the continued role of railway as a major mode of inter-city transportation. The improvements of JABOTABEK railway require a coordinated development of the system as city or suburban railway system at the same time.

3-2 Railway

3-2-1 Train Operation

(1) Train operation routes

1) JABOTABEK trains

In the JABOTABEK Area, electric car trains, diesel car trains and diesel locomotive hauled passenger car trains are operated as commuter trains. By the line, they are as follows.

a) Central line (Jakarta-Manggarai-Bogor) (Fig. 3.2.1.1 (1))
The commuter service is comprised mainly of electric car trains, and some diesel car trains are operated for the students attending the universities. The frequency of operations is the greatest in the section between Jakarta-Bogor, and a small number of trains are operated between Jakarta-Depok and Manggarai-Bogor.
The diesel car trains are operated between Jakarta-Pondokcina. The section between Manggarai-Depok has the additional track installation completed but not the electrification, and so this section is tentatively in use of electric cars and diesel cars, each along a single track.

b) Eastern line and Western line (Jakarta-Pasarsenen-Jatinegara and Jakarta-Tanahabang-Manggarai-Jatinegara) (Fig. 3.2.1.1 (2))
Along the Eastern and Western Lines, a loop operation is made with electric car trains. Presently, however, the loop operation is not a complete one on account of the facilities, and the trains are turned back at the Jakarta and Kampung Bandan Stations.
Further, beyond Jatinegara, the railway is not yet electrified, and so diesel car trains are operated for commutation service from Bakasi, Krawang and Cikampek along the Eastern Line to Jakarta.

c) Serpong line (Tanahabang-Serpong) (Fig. 3.2.1.1 (3))

The Serpong Line is not electrified, and thus diesel car trains and diesel locomotive hauled passenger car trains are operated. The operation section is Tanahabang-Parungpanjang and Rangkasbitung. At present, the Western Line has not much operation of trains, and many of these trains are operated via the Western Line to Jakarta or Angke.

d) Tangerang line (Duri-Tangerang) (Fig. 3.2.1.1 (3))

The Tangerang Line has one train in shuttle operation, and many other trains are operated, as in the Serpong Line, to Jakarta or Angke via the Western Line.

e) Tanjungpriok line

The Tanjungpriok Line had once electric cars operated, but not presently.

2) Medium and long distance passenger trains (Fig. 3.2.1.1 (5))

The medium and long distance passenger trains coming to and going out of the JABOTABEK Area are generally those connecting the Area to the eastern region of the JAWA Island (Surabaya, Jogyakarta, Bandung, etc.). Except these trains, there are only 4 shuttle trains to Merak. The trains traveling beyond Bogor along the Central Line are all starting from and terminating at Bogor.

The medium and long distance passenger trains are all diesel locomotive hauled passenger car trains, comprised of 7 to 11 passenger cars, except 2 trains between Jakarta and Cirebon which are of 4 car composition.

The trains connecting JABOTABEK with the eastern region are operated via the Eastern or Central Line and are departing from and arriving at Jakarta, Pasarsenen, Gambir or Tanjungpriok.

3) Freight trains (Fig. 3.2.1.1 (6))

The freight trains from the eastern region of the JAWA Island are connected to Jakarta or Tanjungpriok via the Eastern Line or to Tanahabang via the Western Line, and those from the direction of Merak connected to Jakarta Gudang via the Western Line or to Bakasi (coal transportation trains) via the Western Line.

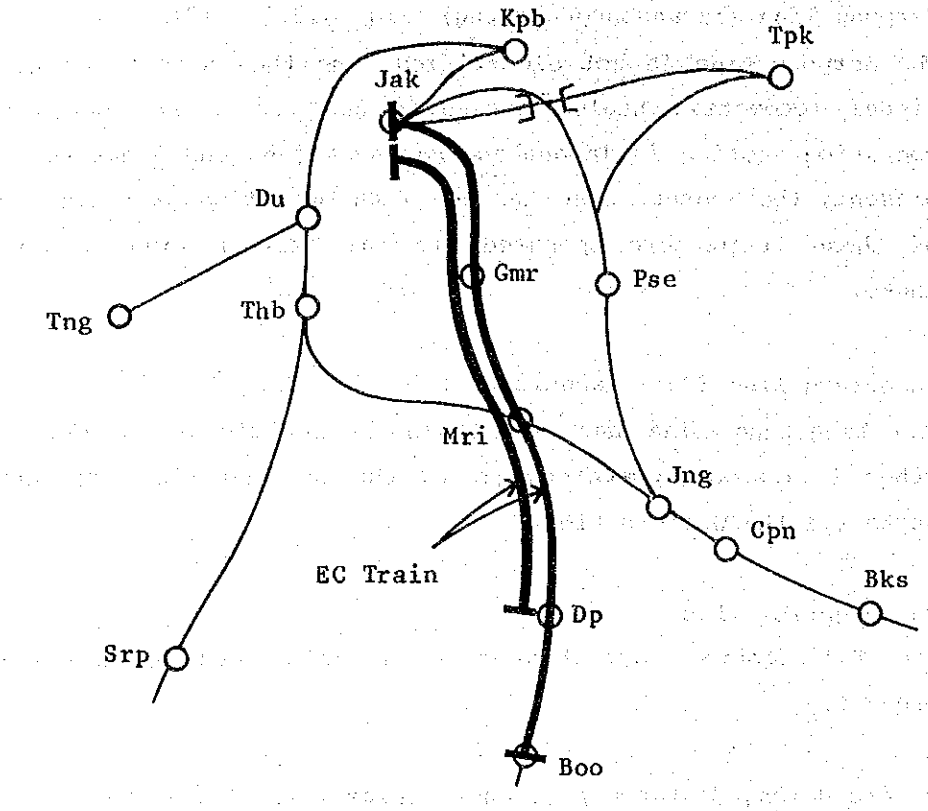


Fig. 3.2.1.1 (1) Train Operation Route of Central Line

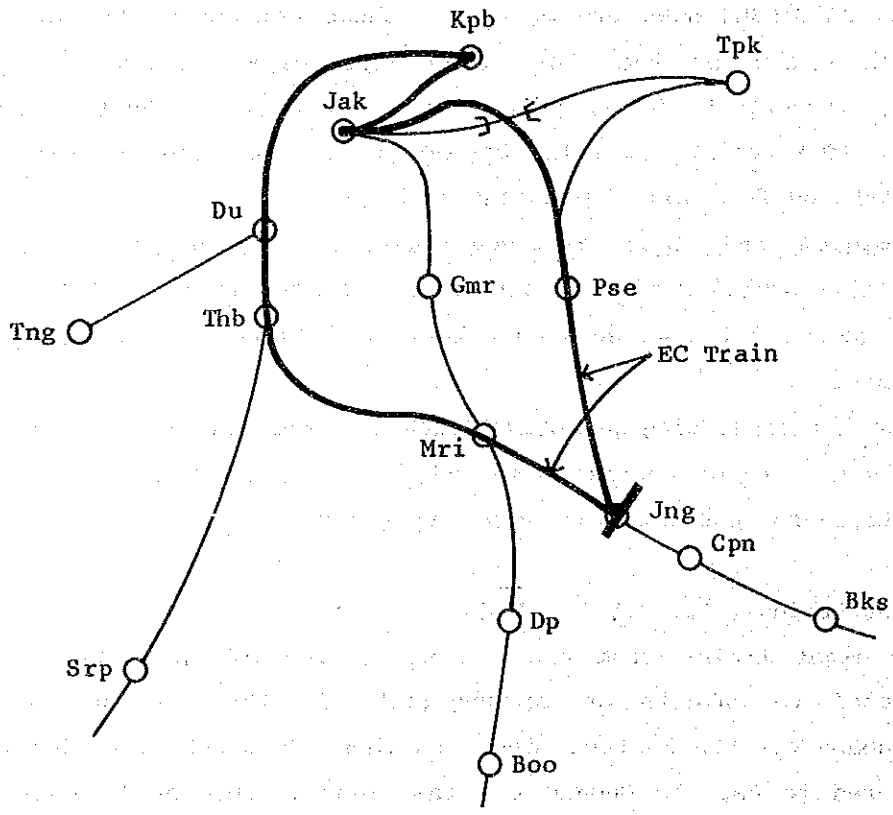


Fig. 3.2.1.1 (2) Eastern Line and Western Line

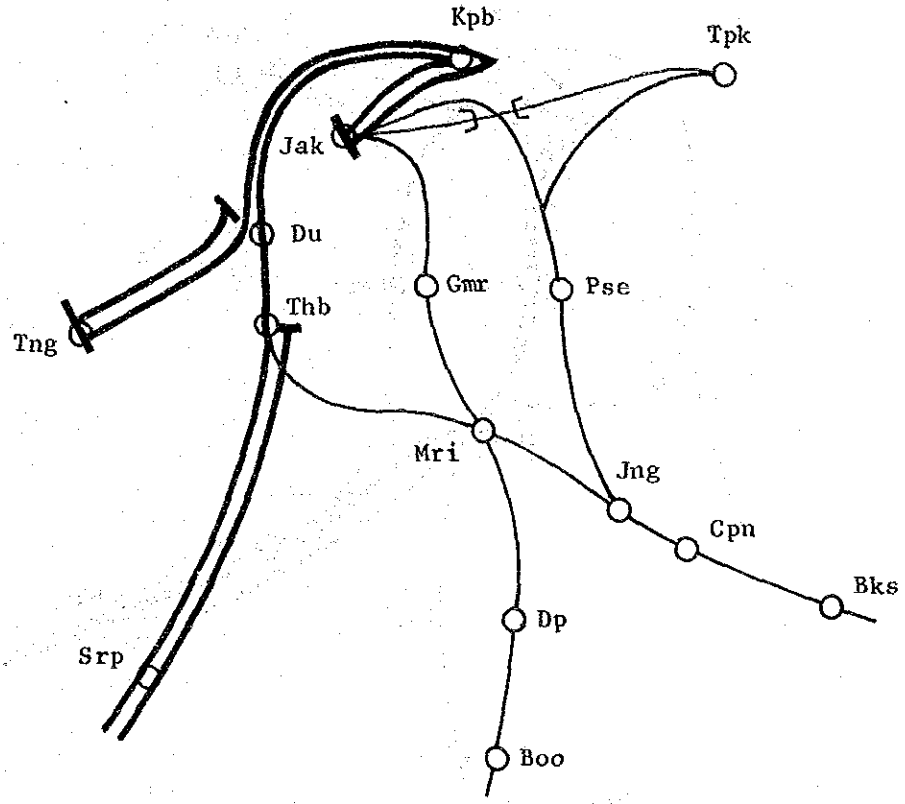


Fig. 3.2.1.1 (3) Serpong Line and Tangerang Line
(Diesel Railcar and Passenger Car Train)

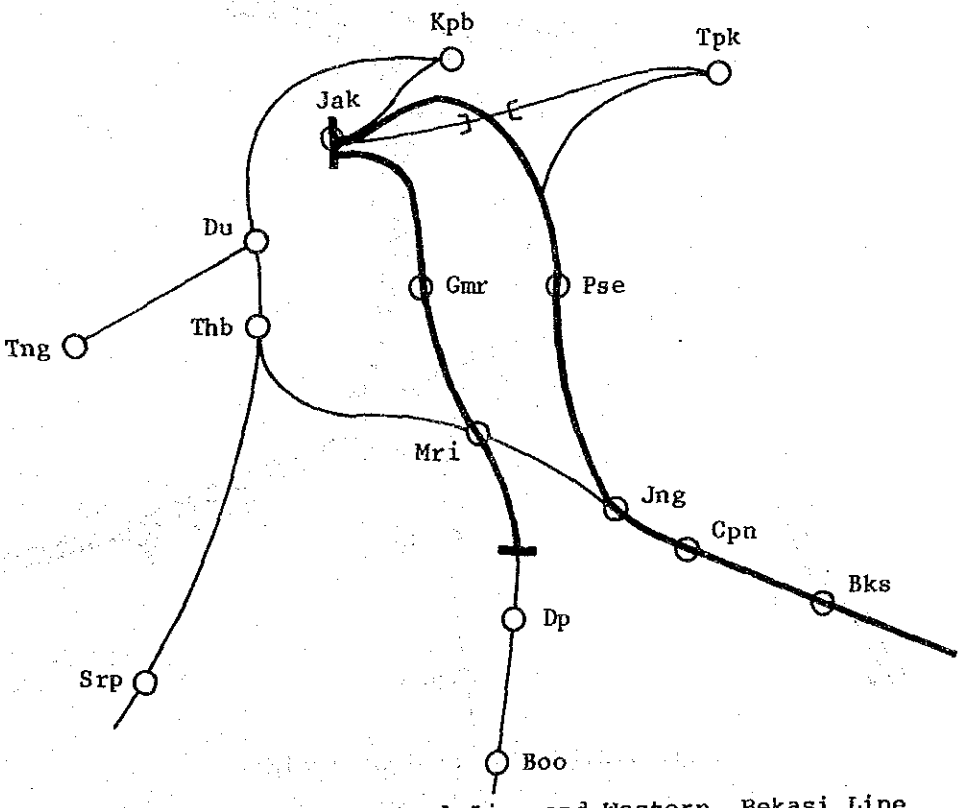


Fig. 3.2.1.1 (4) Central Line and Western, Bekasi Line
(Commuter Diesel Railcar Train)

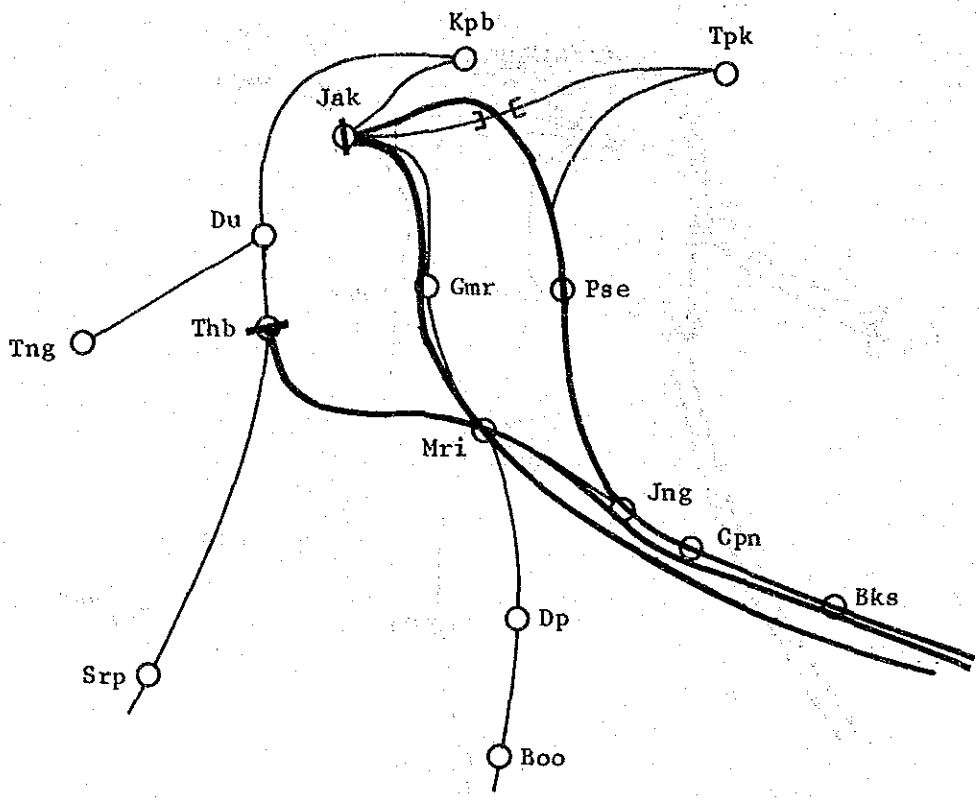


Fig. 3.2.1.1 (5) Middle and Long Distance Passenger Train

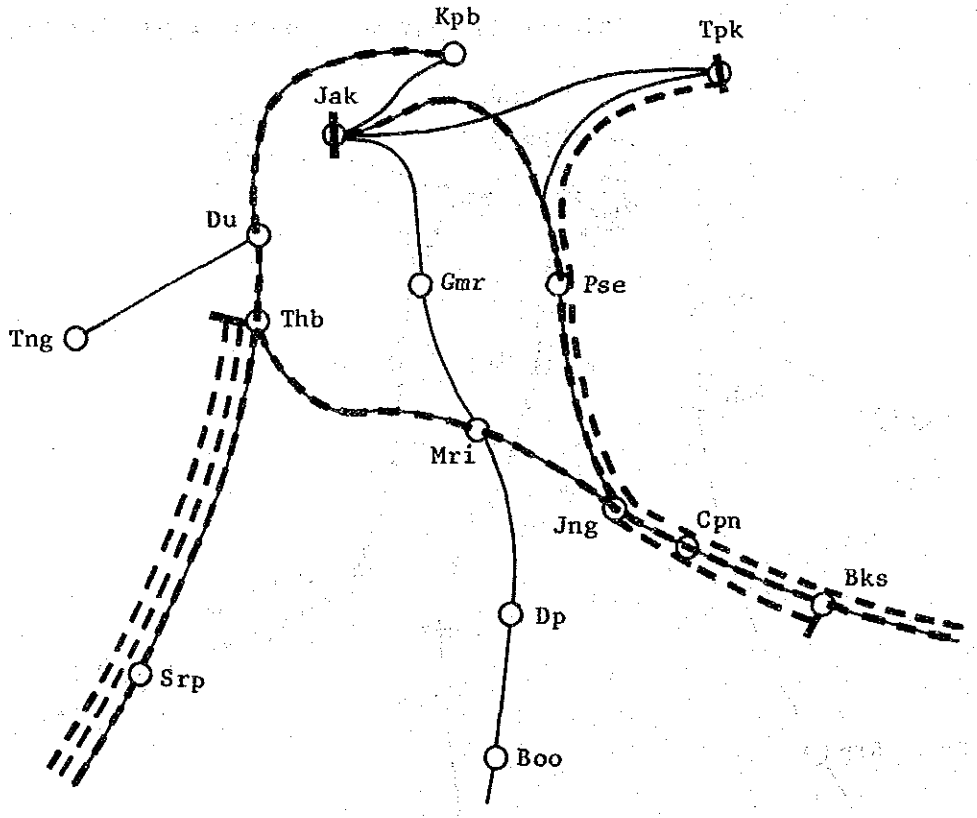


Fig. 3.2.1.1 (6) Freight Train

(2) Train operations

According to the train diagram revised September 5th, 1987, the number of trains, arrival times, schedule speeds and operation heads in the JABOTABEK Area are presently as follows.

1) Number of trains

The number of trains per day and in both directions is shown by section and by type of train in Table 3.2.1.1.

The number of the trains along the Central Line is the largest in both JABOTABEK trains and medium and long distance trains.

2) Operation heads

Table 3.2.1.2 shows the operation heads by time zone of the JABOTABEK trains and medium and long distance trains. With 06:00-09:00 hours having the largest number of trains taken as the commutation time zone in the morning, the mean operation heads of the trains directed to Jakarta are shown. For the commutation time zone in the evening, 14:00-17:00 hours was taken, and the mean operation heads of the trains directed opposite to Jakarta are shown; and for the daytime time zone, 09:00-14:00 hours was taken, and the mean operation heads of the trains in both directions are shown.

As shown in the table, the shortest operation head is that in the morning commutation time zone of the Central Line, and yet it is 22.5 minutes, and so it is hardly said that as a large city commutation railway, a satisfactorily frequent service is provided. In the Central and Eastern Lines, a number of medium and long distance passenger trains are operated during the congested time zones in the morning and evening. Presently, they poses no problem on account of the longer operation heads of the JABOTABEK trains. But, when the operation heads of the JABOTABEK trains will have to be reduced in the future, how to handle the medium and long distance passenger trains will be a problem.

3) Arrival times and schedule speeds

Table 3.2.1.3 shows the arrival times and schedule speeds by section. The schedule speed of the Central Line electric cars having a relatively long station-to-station distance and that between Jakarta and Cikampek along the Bekasi Line are in excess of 30 km/h, but the others are less than 30 km/h. The electric cars of the Eastern and Western Lines are particularly low at about 21 km/h. The lower schedule speeds are due to switch back at the Kampungbandan Station, crossings, longer stoppage time and lower maximum speed.

Table 3.2.1.1 Number of Trains (per day, both directions)

Train types \ Sections	Central Line (Gambir)	Eastern Line (Pasarsenen)	Western Line (Tanahabang)	Serpong Line (Tanahabang)	Tangerang Line (Duri)	Tanjungpriok - Rajawari (Tanjungpriok)
Electric car	57	26	31	0	0	0
Diesel car	9	16	2	12	10	0
Passenger car	41	29	4	14	0	7
Freight	0	7	20	23	0	6
Total	107	78	57	49	10	13

Note 1. The number of trains is given per day in both direction at the station shown in parentheses under the respective sections.

2. The number of trains includes unscheduled trains but not the trains for construction work and out-of-service trains.

Source: PJKA Train Diagram (Sep. 1987)

Table 3.2.1.2 Operation Heads

(Unit: Minute)

Trains \ Lines / Time Zone		Central Line (Gambir)	Eastern Line (Pasarsenen)	Western Line (Tanahabang)	Serpong Line (Tanahabang)	Tangerang Line (Duri)
Electric and Diesel Cars	Morning	22.5	36.0	30.0	45.0	180.0
	Evening	25.7	36.0	45.0	60.0	180.0
	Daytime	30.0	40.0	50.0	150.0	180.0
Medium and Long Distance	Morning	25.7	45.0	--	--	--
	Evening	30.0	90.0	--	180.0	--
	Daytime	54.5	300.0	600.0	200.0	--

Note: The time zones and mean heads are as given below.

Morning - 06:00-09:00 hours (180 mins ÷ Number of trains to Jakarta)

Evening - 14:00-17:00 hours (180 mins ÷ Number of trains opposite to Jakarta)

Daytime - 09:00-14:00 hours (600 mins ÷ Number of trains in both directions)

The number of trains is that at the station noted in parentheses under the respective lines.

Source: PJKA Train Diagram (Sep. 1987)

Table 3.2.1.3 Arrival Times and Schedule Speeds of JABOTABEK Trains

Lines	Type of Car	Operation Section	Section Distance (km)	Stopover Stations	Mean Sta-to-Sta Distance (km)	Arrival Time (min)	Schedule Speed (km/h)
Central Line	Electric Car	Jakarta - Bogor	54.674	14	3.64	107	30.7
	Diesel Car	Jakarta - Pondokcina	28.259	6	4.04	58	29.2
Eastern and Bekasi Lines	Electric Car	Jakarta - Jatinegara	12.489	6	1.784	35	21.4
	Diesel Car	Jakarta - Bekasi	26.379	10	2.40	62	25.5
	Diesel Car	Jakarta - CiKampek	84.028	19	4.20	147	34.3
Western Line	Electric Car	Jakarta - Jatinegara	19.006	8	2.11	53	21.5
Serpong Line	Electric Car	Jakarta - Rang-Kasbitung	83.097	19	4.15	193	25.8
	Diesel Car	Jakarta - Sudimara	27.647	7	3.46	76	21.8
Tangerang Line	Diesel Car	Jakarta - Tangerang	25.993	10	2.36	72	21.7

Note 1. The mean station-to-station distance was calculated by Section distance/(Number of stopover stations + 1)
Because, there are stations not in use.

2. The arrival time represents the mean of all trains.

Source: PJKA Train Diagram (Sep. 1987)

(3) Car depots and storage tracks

1) Number of cars, according to type

Car depots in the JABOTABEK Area and the numbers of cars located in each depot according to type are shown in Table 3.2.1.4.

Electric and diesel cars used in JABOTABEK and the surrounding suburban area are kept in the Bukitduri Depot.

The diesel locomotive depots are in Jatinegara and Tanahabang. The Jatinegara Depot is used for medium and long distance trains which run between Jakarta and the eastern part of Jawa Island. The Tanahabang Depot is for medium and long distance trains pulled by diesel locomotives along the Merak Line, and for locomotives used for shunting at stations in the JABOTABEK Area.

The Jakarta Kota Depot houses passenger cars used for medium and long distance special express, as well as express and rapid trains running between Jakarta and the eastern part of Jawa Island and along the Merak Line.

Near the JABOTABEK Area there are diesel locomotive and passenger car depots, in Cirebon and Bandung.

The number of cars has increased every year since their use began in 1976 year. The electric cars are used only in the JABOTABEK Area, while diesel cars are used in JABOTABEK and other area including Surabaya.

2) Storage tracks

Daily and monthly checks of the electric and diesel cars are, of present, only carried out at the depot located in Bukitduri. It is very wasteful to deadhead the cars at this depot for the sole purpose of checking them. Storage tracks should, therefore, be installed at or near the starting stations so that daily checks can be made on location. This will considerably improve the operating efficiency of the cars. To this end, a plan is now being considered to install storage tracks at the Jakarta Kota Depot, as well as Bekasi, Bogor and Tanjung Priok Stations.

Table 3.2.1.4 Number of Cars in Depots in the JABOTABEK Area

Depot	Type of Car	Locomotive Type, Engine HP	Number of Cars	Section of Use
Bukitduri	Electric car		120	Central, Eastern and Western Lines
	Diesel car		28	Serpong, Jak-Pwk, Central and Tangerang Lines
Jatinegara	Diesel locomotive	CC201 (1,500)	20	
Tanahabang	Diesel locomotive	BC303 (1,500)	11	
		BB304 (1,500)	10	
		BB306 (875)	8	
		BB300 (680)	4	
		C300 (350)	20	
Jakarta Kota	Passenger car		152	Jakarta-Cirebon-Surabaya Jakarta-Bandang Jakarta-Merak

3) Actual use of electric and diesel cars

Table 3.2.1.5 shows the results of use of the electric and diesel cars located in Bukitduri Depot. The average number of kilometers run per used car per day is 272.8 km for electric cars and 306.4 km for the diesel cars. Also, per car assigned, the electric car is 181.8 km, and the diesel car is 262.6 km, the diesel car running 1.45 times as far as the electric car.

This is due partly to the operation of diesel cars over longer distances that is greater average station-to-station distances, however it is due mainly to a very low ratio of electric cars actually in use about 67%.

This low rate of use is accounted for by greater numbers of cars damaged in accidents and by a greater number of days spent in the repair depot.

(4) Operating personnel

1) Power car crew

Diesel locomotives, electric cars and diesel cars, each have one driver and one assistant assigned to them. Table 3.2.1.6 shows the number of power car crew at each of the depots in JABOTABEK.

The required number of drivers and assistants for alternate duties at Bukitduri is 116 for electric cars and 38 for diesel cars, for a total of 154. When an allowance for absence due to disease, etc. is taken into account, the present number is not sufficient. There is a particularly great shortage of assistants.

2) Car maintenance personnel

The number of the car maintenance personnel at Bukitduri Depot is 46 for electric cars and 39 for diesel cars. Per car assigned, that is 0.4 for electric cars and 1.4 for diesel cars.

3) Station personnel

Between Jakarta and Bogor along the Central Line, the number of station personnel at the major stations i.e.
Jakarta, Gambir, Manggarai and Bogor is 100-130, and at the other smaller stations, about 10 per station.

Table 3.2.1.5 Use of Electric Cars and Diesel Cars

Cars	Lines	Train kilometerage (per day, km)	Car kilometerage (per day, km)	Number of cars		Car use kelometerage (per day, km)	
				Cars used	Cars assigned	Per car used	Per car assigned
Electric	Central Line	2,776.922	20,465.808	80	120	272.8	181.8
	Eastern Line, Western Line	338.818	1,355.272				
Diesel	Bks Line, Srp Line, Tng Line	1,460.962	7,354.198	24	28	306.4	262.6

Source: EC and DC utilization plan of Bukitduri Depot (Sep. 1988)

Table 3.2.1.6 Power Car Crew

(persons)

Depot	Cars	Driver	Assistant	Total
BuKitduri	EC, DC	117	23	140
Jatinegara	DL	50	47	97
Tanahabang	DL	48	40	88
Bogor	DL, DC	8	11	19

Note: 1. EC --- Electric Railcar
DC --- Diesel Railcar
DL --- Diesel Locomotive

Source: PJKA West Regional Office (Feb. 1989)

The total number of station personnel for the Central Line is 557. Breaking this down there are 80 (14% of the total) for ticket booking and clipping, 107 (19%) for conducting, 153 (27%) for operation (train handling, signalling and shunting) and 18 (3%) for crossing.

4) Conductors

Each trains has in two conductors who are assigned to a particular station. In JABOTABEK, there are four stations which the conductors are assigned to. They are: Tanah Abang, Jatinegara, Manggarai and Bogor. A total of 191 conductors are assigned to these stations.

(5) Power consumptions of electric and diesel cars

Power consumption of electric cars averaged 5.84 kwh/train km from April to July 1988, while the fuel consumption of diesel cars averaged 0.56 l/car km.

(6) Train dispatch

Train dispatch in Inspection I is in a compound in the Jakarta Kota Station, and through radio communication with the stations, information is gathered on train delays.

(7) Problems in train operation

1) Too many operating accidents

Table 3.2.1.7 shows the number of operating accidents by year in West Jawa (EBT) from 1985 to 1987.

Of these operating accidents, those that are particularly serious are the train collisions, derailments and fires. These three are called train accidents, and there were 23 train accidents in EBT in 1985, 32 in 1986 and 15 cases in 1987.

On Jawa Island as a whole, there were 85 train accidents in 1987 and the total train kilometerage for this year was 17.754 million. Therefore the train accidents occurred at a rate of 4.79 per million train kilometers, a very large figure. For example, the average number of train accidents per million train kilometers per year for what was formerly the Japanese National Railway, during the 10 year period starting in 1975 was 0.074.

2) Greater train delay

Table 3.2.1.8 shows the average delay time of trains. The largest delays were on the medium and long distance trains headed toward Jakarta, sometime exceeding 100 minutes. The Parahyangan trains, experienced the least amount of delay averaging less than 10 minutes.

When the headway of JABOTABEK trains is reduced in the future, considerable delay of medium and long distance trains will disturb the operation of all JABOTABEK trains.

3) Lower scheduled speed of JABOTABEK trains

Table 3.2.1.9 shows the presently scheduled speeds for trains in JABOTABEK. Only those trains on the Central Line and the Bekasi Line (Jakarta - Cikampek) have schedules speeds over 30 km/h. Most lines have a scheduled speed below 22 km/h.

This is due to: Presence of single track sections;
Longer stopping times;
Manual signalling;
Slowing down at crossings; and
Lower running speeds over turnouts.

4) Train dispatch not functioning satisfactorily

Presently, the Train Dispatch is concerned mainly with determining the operating condition of trains. It is not well adapted for immediately contacting personnel in track maintenance, electric power, signalling and business in the event of an accident.

Table 3.2.1.7 Number of Operating Accidents by Year (West Java)

Code	Type of operation accident	Year		
		1985	1986	1987
a	Train collisions (between stations)			1
b	Train collisions (Within station yard excluding shunting)	3		
c	Train derailment (within station)	11	10	10
d	Train derailment (within station yard, excluding shunting)	8	19	4
e	Train fire	1	3	
f	Vehicles collision during shunting	1	1	
g1	Vehicles derailment (during shunting) passenger car	1	7	3
g2	Vehicle derailment freight car	4	7	4
g3	Vehicle derailment locomotive	4	12	9
h	Railway crossing accident	24	44	14
i	Bodily injury	26	106	65
j	Animal injury			1
k1	Broken wheel tire (locomotive)		1	
k2	Broken wheel axle (locomotive)			
k3	Broken coupler (locomotive)			
k4	Broken spring (locomotive)			
k5	Broken wheel tire (passenger and freight car)		1	
k6	Broken wheel axle (passenger and freight car)			
k7	Broken coupler (passenger and freight car)		1	3
k8	Broken spring (passenger and freight car)			
k9	Other vehicle problems	35	53	104
n	Trouble in electric system of DL	63	69	68
o	Trouble in mechanical system of DL	21	7	11
p	Trouble in motive power transmission of DL			
q	Electric facilities (Substation, Transmission-line, etc.)			
r	Trouble in signal facilities			
s	Broken rails or other structures		1	
t	Landslide, flood, others	2	3	3
u	Ignoring of signal	2	4	11
v1	Other problems attributable to PJKA employees	16	10	98
v2	Other problem attributable to persons other than PJKA employees	75	112	
	Total	297	471	412

Source: PJKA Head Office

Table 3.2.1.8 Train Delay Time

Trains	Stations checked time	Mean delay times (minute)
Central Line electric cars	Jakarta	17.2
	Bogor	12.6
Loop operation cars (Eastern Line, Western Line)	Jakarta	18.4
Merak line trains	Jakarta	40.1
	Rangkasbitung	39.6
Medium and long distance passenger trains (except Parahiyangan trains)	Jakarta	109.6
	Cikampek	29.3
Parahiyangan trains	Jakarta	6.7
	Cikampek	6.8

Source: PJKA Inspection 1

Table 3.2.1.9 Schedule speeds of JABOTABEK Trains

Lines	Section	Mean station-to-station distances (km)	Scheduled speeds (km/h)
Central Line	Jakarta - Bogor	3.64	30.7
Bakasi Line	Jakarta - Pasarsenen - CiKampek	6.00	34.3
Eastern Line	Jakarta - Pasarsenen - Jatinegara	1.79	21.4
Western Line	Jakarta - Tanah Abang - Jatinegara	2.11	21.5
Serpong Line	Jakarta - RangKasbitung	7.55	25.8
Tangerang Line	Jakarta - Tangerang	2.60	21.7

Source: PJKA Train Operation Diagram (Jul. 1988)

3-2-2 Facilities

(1) Stations

1) General

The railway network in the JABOTABEK Area is comprised of the Central line running through the area from south to north, Eastern and Western Lines circulating around the central part of Jakarta, and Tangerang, Serpong, Bekasi and Tanjung Priok Lines extending radially therefrom, for a total of 7 lines, with 3 lines designed exclusively for freight (Fig. 3.2.2.1).

The total line length is 168.5 km, and compromises 48 passenger stations, 3 freight stations, 5 passenger and freight stations and 2 signal stations for a total of 58 station and 2 car depots, Jakarta/ Depot and Bukitduri Depot (Table 3.2.2.1). Of these, the Tanjung Priok Line and the freight line connecting KampungBandan and Tanjung Priok Gudang, totaling 14.2 km, have had their operation temporarily suspended.

2) Station track layout

As for track layout, many stations use double slip switch (DSS) turnouts in addition to simple turnouts. In the Jakarta Station which is a dead-end station there are 12 tracks used for departure and arrival of the Eastern, Western, Central and Tanjung Priok Lines, and 17 pairs of DSS turnouts, which allow entry into any of the vacant tracks, thus the track layout is convenient for shuttling (Fig. 3.2.2.2). So long as the number of trains remains stable, there will be no problem. But, if the number of trains is increased in the future, crossing lines will cause bottlenecks, and it will be difficult to comply with the increasing demand.

The DSS turnout is advantageous as it allow change of the route in a relatively short section, but it imposes a great restriction of the speed of the train.

Further, it has an intricate structure, and requires a great deal of labor for maintenance.

A study should be made to reduce the number of turnouts to help with train scheduling, increase riding comfort and reduce costs associated with maintenance.

Therefore, it is desirable to limit the use of the DSS turnout to cases where the yard space is limited, and has a structure such as a crossing or bridge either before or after; or there is a restriction in the level alignment. It will also be necessary to consider simplification of the routes connecting stations with one another, incoming routes and shuttle operations to reduce the time necessary to configure a train for operation.

The stations in the JABOTABEK Area do not have well developed pass-by and refuge facilities, thus once a train is delayed, subsequent trains are also delayed, making punctual operation virtually impossible and further reducing track capacity.

The Tangerang and Serpong Lines are particularly susceptible as they are both single tracks lines, and improvement is urgently required.

The Pasar Senen Station has a high volume crossing located near the end of the platform which causes considerable traffic congestion. As a tentative measure, while the grade separation of railway and road is being completed, it will be necessary to consider relocation of the station taking into consideration the surrounding conditions.

3) Platform

Although improvement works are being made, the platforms of almost all stations are of a concrete construction with a separation of only 10 cm between themselves and the end of the sleeper and a height of not more than 43 cm above the rail surface.

The platforms are generally of a narrow width, usually less than 3 m and are not sufficiently separated from the center of the track, interfering with the rolling stock gauge. Passengers standing near the edge of the platform are in danger of coming into contact with incoming trains. Further, the distance between platforms is only 2.0 m thus it is difficult to replace sleepers, or compact or drain the roadbed which results in mud-pumping.

The platforms should be modified so that they are of sufficient width for the safe flow of passengers, are outside the rolling stock gauge and provided for improved drainage of the roadbed. Also, the height over the rail surface should be corrected, to ensure the safety of the passengers and to reduce the time passengers spend getting on and off the train taking into consideration the type of train and load factor, the height of platforms should be 0.95 m above the rail surface for commuter trains and 0.80 m above the rail surface for medium and long distance trains. Very few stations having a roof over the platform and in those which do, it is not of sufficient length thus the riding time in rainy weather is adversely affected. It is therefore necessary to install roofs with lengths of one half the train composition length.

4) Connecting passages

There are only three stations which have passages which run either above or underneath the platform. They are, Dukuh where the station is above the track, Depok Baru which is a ground station with an overbridge, and Pasar Senen which has an underground passage. Connections between platforms are level except in Jakarta Kota and Tanjung Priok which are a dead-end stations. Depok Baru is a modern station, but the stairs to the passages are closed and passengers are forced to use level crossings.

Under the Central Line elevation project now being executed, the stations between Kota and Manggarai are being constructed under elevated track and Manggarai Station will be built with passages overhead. Other stations will continue to be of the level crossing type.

As the number of trains increases, maintaining passages safety and on-time operation becomes difficult. Construction of passages either above or below track level is necessary to resolve this problem.

5) Main station building and station plaza

The main buildings of the principal stations such as Kota, Gambir, Manggarai, and Pasar Senen, have both passenger facilities such as booking and clipping facilities, and a waiting room, and operation facilities such as station office.

But, the other smaller stations have only a booking and clipping facilities in a building on the platform as in Kramat and Pondok Jati, a small covered waiting room on the platform as in Mampang and Karet, or an unattend building as in Batuceper and Poris. For improvement of passenger services to meet increasing demand, it will be necessary to improve the station buildings and arrange facilities to simplify passenger flows. Further, passengers have free access to the track and are able to get on or off the train without passing through a gate. For example, the Dukuh Station is an overtrack bridge station and has the gate equipment on the bridge, however passengers can access the track from the ground, and bypass the gate. Free access to the track site, increases the number of non-paying passengers and makes it difficult to secure the revenue necessary for operation. Moreover, it is apt to disturb the ballast, resulting in the cost of maintenance. It will also make increasing the number of trains in the future difficult because it threatens on time operation. It is imperative that a fence preventing free access be constructed.

The station plaza must be centrally located and have the necessary space and facilities so that it can easily be accessed by pedestrians, buses, taxis and private cars. In the JABOTABEK Area, there is no station which can function in this way, for example, the Kota and Tanjung Priok stations have station fronts but their station fronts are part of the small traffic circle, allowing little access.

The Tanah Aban and Jatinegara stations directly face a road a with high traffic volume and virtually NO parking ability while the Angke, Duri and Tebet have only a narrow entrance road precluding access by automobiles. The Depok Baru and Pasar Senen stations have plazas but, buses have no access to them. (Fig. 3.2.2.3).

At present, the improvement works of some station buildings and station plazas are being carried out under the railway improvement project which is targeted for completion in 1992. These plans however are insufficient and further improvement will be necessary to increase railway utilization, by development and improvement of the station buildings, station plazas with consideration given to large-scale housing and industrial development in the vicinity of the station.

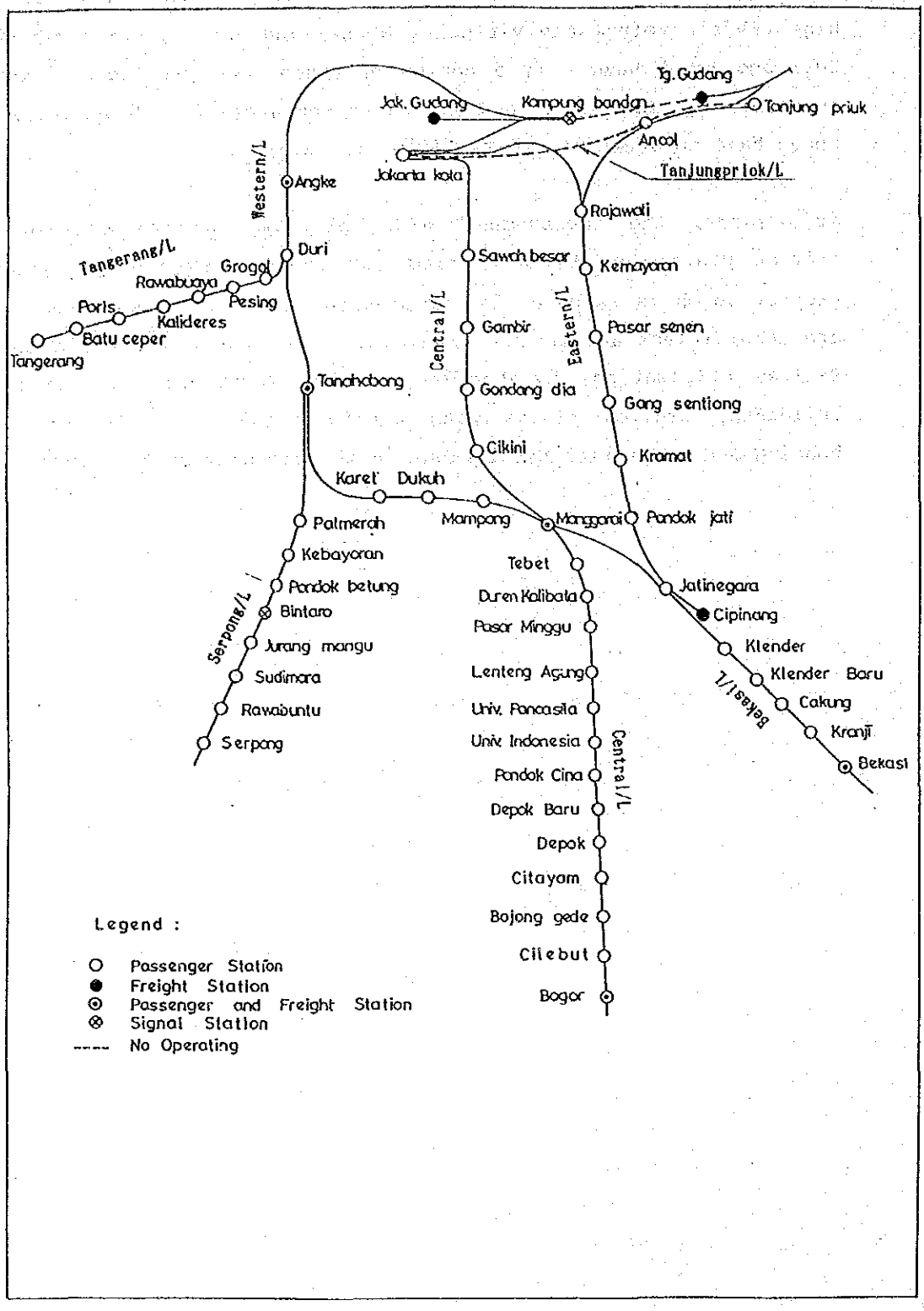


Fig. 3.2.2.1 Situation of Existing Stations

Table 3.2.2.1 Stations in the JABOTABEK Area

Name of Line	Station to Station	Km	Number of Station					Remarks
			Passenger	Goods	Passenger and Goods	Signal	Total	
Central/L	Jak — Boo	54.7	17	—	2	—	19	
Eastern/L	Jak —(Pse) —Jng	12.4	7	—	—	—	7	
	Tpk —Kmo	8.6	2	—	—	—	2	No operating
	Total	21.0	9	—	—	—	9	
Western/L	Jak —(Thb) —Jng	19.0	4	—	2	1	7	
Bekasi/L	Jng —Bks	14.7	4	—	1	—	5	
Tanjungpriok/L	Jak —Tpk	8.1	—	—	—	—	—	No operating
Serpong/L	Thb —Srp	23.3	7	—	—	1	8	
Tangerang/L	Du —Tng	19.3	7	—	—	—	7	
Goods/L	Kpb —Tpkg	6.1	—	1	—	—	1	No operating
	Jak —Jakg	0.7	—	1	—	—	1	
	Jng —Cpn	1.6	—	1	—	—	1	
	Total	8.4	—	3	—	—	3	
Total		168.5	48	3	5	2	58	

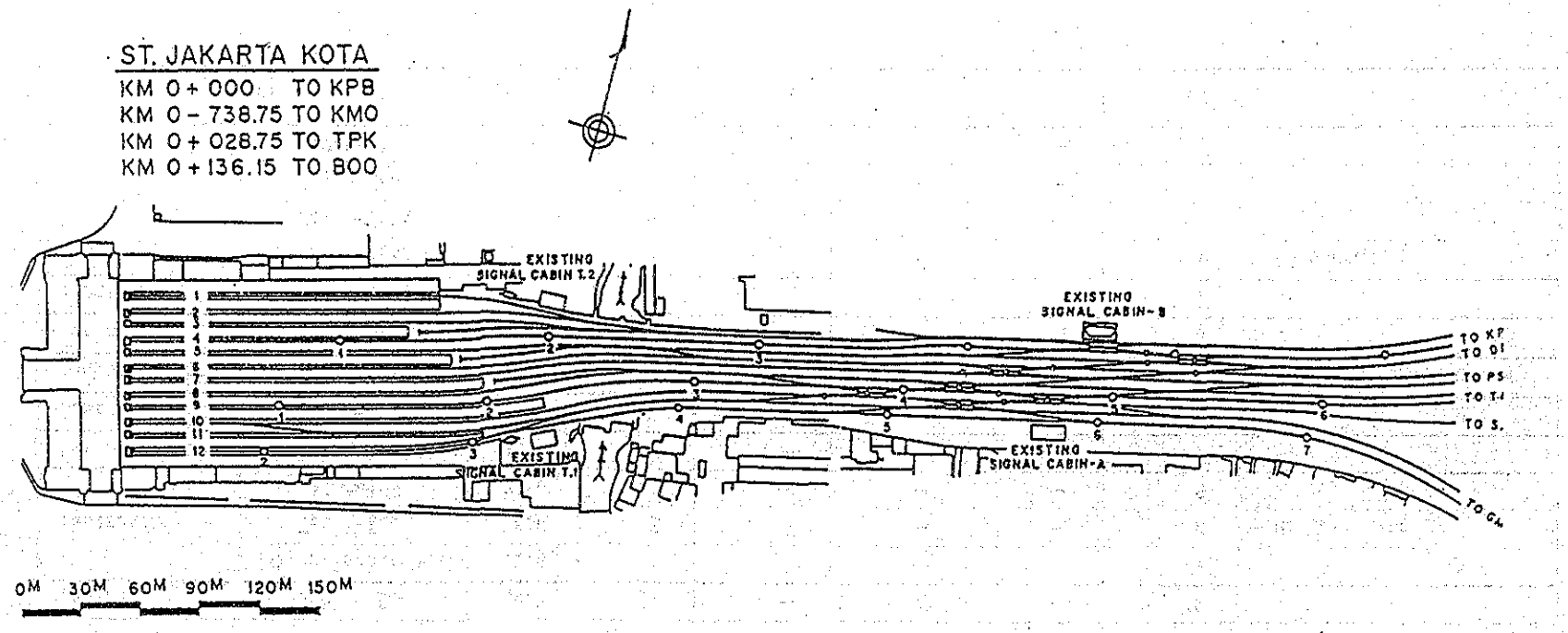


Fig. 3.2.2.2 Present Situation of Jakarta Kota Station

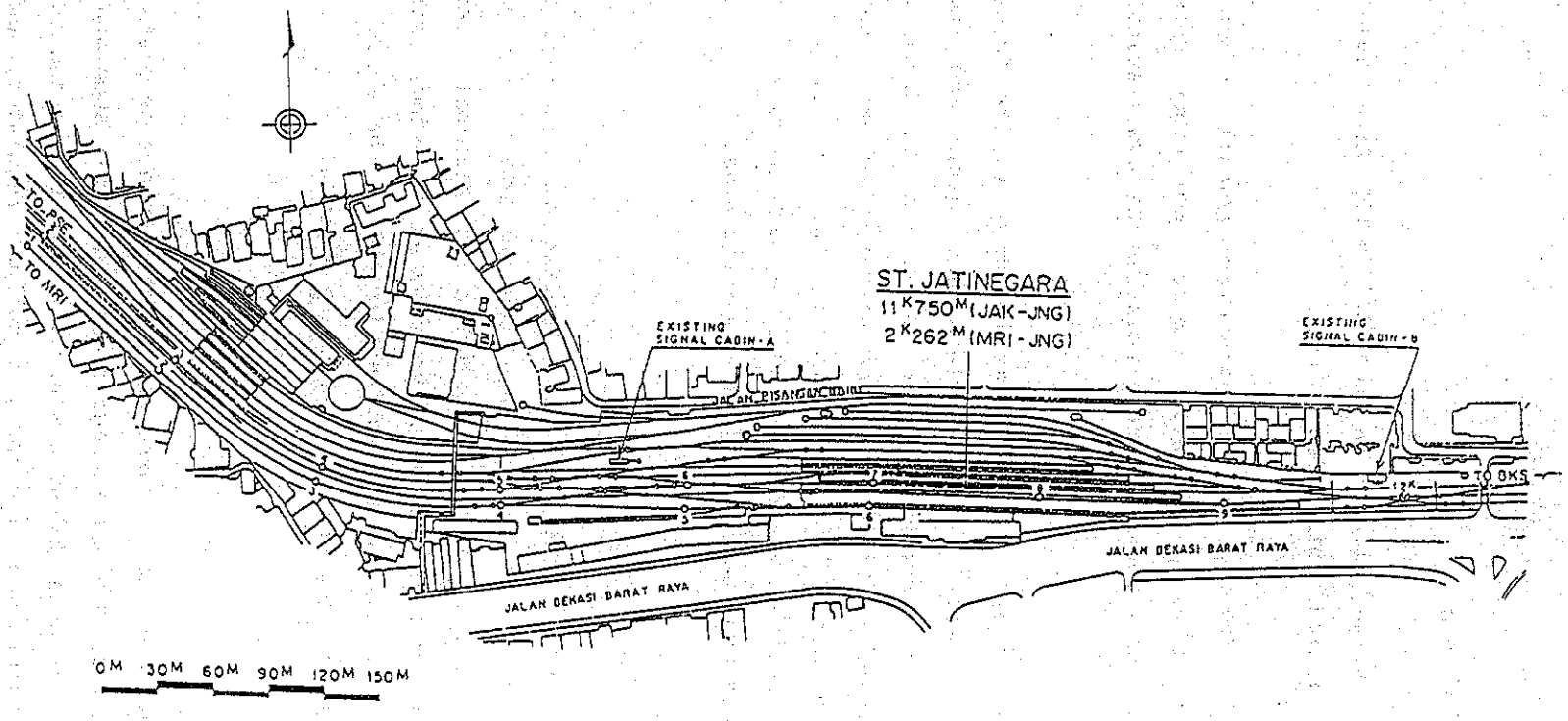


Fig. 3.2.2.3 Present Situation of Jatinegara Station

(2) Tracks and structures

1) Present conditions of tracks

Some of the seven railway lines in the JABOTABEK Area have a strengthened track structure, while some do not.

For example, on the Central Line (Jakarta-Manggarai) a grade separation is constructing which will improve operating speed, strengthen tracks, and lead to maintenance works being systematically carried out.

For the reduction of headway (to 3-10 mins headway) in the future, crushed stones must be added to the Western Line (Duri and Angke Stations), the rails must be changed on the Eastern Line to change the rails in the (Rajawali-Jatinegara) and (Kemayoran-Pasar Senen) sections, the bed and curves must be improved, and the bridge (at Tanahabang) must be repaired on the Serpong line, and heavier weight rails, and new sleepers must be used on the Tangerang Line.

2) Crossing facilities

With the increasing number of motor cars, traffic at crossings has increased. Some crossings have more than 100,000 motor cars pass through a day. It is, therefore, desirable to eliminate level crossings through elevation or flyover. So long as crossings exist, particularly careful maintenance is required to reduce the amount of track irregularity and to keep train vibration to minimum.

3) Maintenance depot

Presently, in the JABOTABEK Area, there are no maintenance depots with the necessary facilities, such as storage tracks, a repair shop and or a track for training, Jakarta Gudang now has tracks for training three M.T.T. large track maintenance machines, a ballast regulator, and a ballast compactor. However, in order for the maintenance work to be carried out with the efficient use of these facilities and machines, the construction of maintenance is necessary.

These maintenance depots should be constructed with consideration for the frequency of maintenance and the area to be maintained, but at an interval of about 30 km should generally be used as a standard.

Intermediately positioned maintenance depots should be constructed to serve as bases, to save time loss in deadheading to and from the maintenance depots, thus improving work efficiency and, at the same time, providing refuge in the event of machinery failure.
These intermediate bases should be constructed with an interval of about 5 km as a standard.
It will also be necessary to conduct emergency training using these base facilities.

4) Security equipment

In order to prevent derailment, it is necessary to install guard rails at places where derailment is likely to occur or where accidents resulting from derailment are apt to occur, so that serious accidents will not result from derailment. The guard rails to be used will include derailment preventive guard rails, safety rails, bridge guard rails and crossing guard rails.

For sections, such as Sudimara-Serpong along the Serpong Line and Duri-Tangerang along the Tangerang Line where there are sharp curves, derailment preventive rails or guards should be installed.

On lines with bridges such as the Serpong Line, bridge guard rails should be installed to prevent the cars from derailing or over turning.

Installation of car stops which prevent trains or cars from overrunning is also required. Operation of maintenance cars and work trains and handling of the works accompanying track blocking should be specified for the purpose of preventing serious accidents.

Also, in order to ensure safe train operation and maintenance, it is desirable that rain gauges and anemometers be installed, permitting remote measurement at the necessary places.

5) Miscellaneous (safety equipment, protective fence and real property)

In order to ensure the safety of workers, a safety fence with a height of at least 1.0 m should be installed on each side of the track in elevated or bridge sections. A maintenance train approach alarm should also be designed for placement in sections where visibility is obstructed or where there is an inspection scaffold on an abutment or pier of a bridge.

Also, for security of operation, a protective fence should be installed along the track to prevent entry into the railway. It is also necessary to erect property posts to clearly identify boundarys between private land or the road and railway land.

(3) Signalling and telecommunications

1) Signalling

Signalling systems in JABOTABEK railways consist mainly of mechanical interlocking devices, semaphore signals and mechanical points, many of which are superannuated and take much time and labor to operate. They are also inadequate in securing train operation safety.

The existing signalling systems are shown in Fig. 3.2.2.4.

a) Block System

Most stations are provided with S & H's tokenless block systems using hand generators and some stations are equipped with communication block systems using Morse telegraph. Bigger stations have treadles to detect trains, many of which are out of order.
Some bigger stations have plural signal cabins with respective local block systems.

b) Interlocking Device

Mechanical interlocking devices are provided for interlocking semaphore signals and mechanical points. The signals and points are operated with levers centralized in signal cabins. The levers are connected with the signals and points through a pair of iron wires.

c) Level Crossing Protection Device

Automatically controlled barriers are provided at 41 level crossings, manually operated barriers with automatic alarms at 38 and manually operated barriers without automatic alarms at 31. In many level crossings in the Bekasi line, Serpong line, Bogor line and Tangerang line, automatically controlled barriers and alarms are under construction.

In the level crossings with manually operated barriers without automatic alarms, notification of train departure to level crossing watchmen between stations is made with hand generators by station staff.

The status of the existing level crossing protection devices is shown in Table 3.2.2.2.

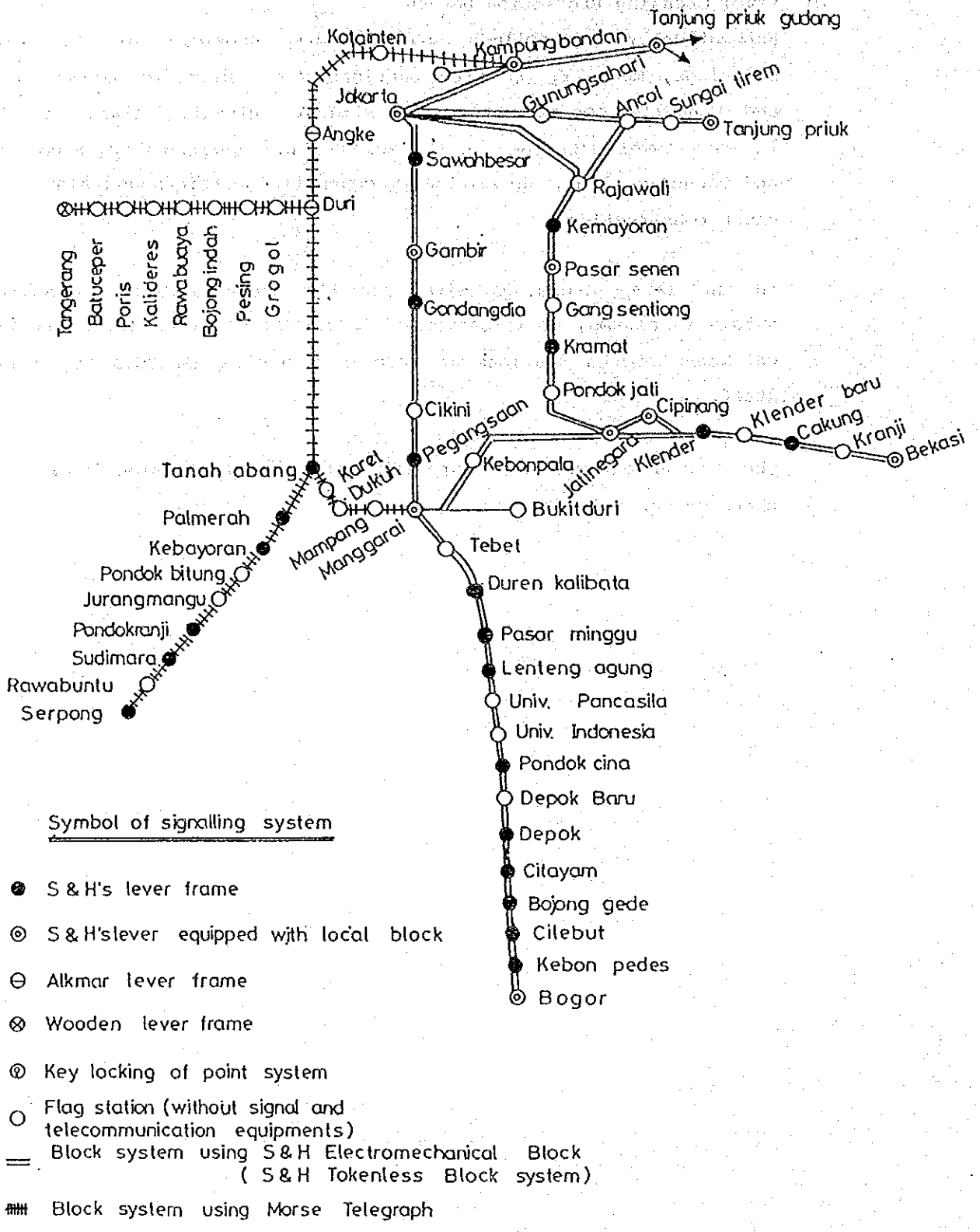


Fig. 3.2.2.4 Signalling System in the JABOTABEK Area (as of 1988)

Table 3.2.2.2 The Existing Level Crossing Protection Devices

L I N E	With Barrier			Without Barrier		Total
	Automatically Controlled Barrier	Manually Operated Barrier		With automatic Alarm	Others	
		With Automatic Alarm	Others			
Central Line (Jak to Nri)	15	4	1	0	0	20
Western Line (Jak, Kpb to Jng)	10	0	0	0	1	11
Eastern Line (Jak to Jng)	12	2	1	0	0	15
Bekasi Line (Jng to Bks)	0	8	0	0	0	8
Serpong Line (Tnb to Srp)	0	6	8	-	-	14
Bogor Line (Nri to Boo)	0	11	13	-	-	24
Tangerang Line (Ou to Tng)	0	6	8	-	-	14
Tg. Priok Line (Jak to Tpk) (Kpb to Tpkg)	3	1	0	0	1	5
Ancol Line (Rjw to Ac)	1	0	0	0	0	1
Total	41	38	31	0	3	112

2) Telecommunications

a) Transmission lines

The UHF radio link systems, the VHF radio utility systems and the optical fiber cables are used for long distance communications as basic telecomunications lines. The overhead cables and the overhead bare wires are used for short distance communications.

These networks are used for dispatching among the dispatcher centers, trains and stations, for internal automatic exchanger telephones, for teleprinters, etc. The outlines of telecommunication lines are shown in Fig. 3.2.2.5.

- The UHF radio link systems

The UHF radio link systems are installed between Depok and Manggarai, Depok and Bekasi, Depok and Bogor, and Depok and Parung Panjung. The systems have the frequencies of 1.7 - 2.1 GHS and a maximum capacity of 132 CH.

- The VHF utility radio systems

The VHF utility radio systems on 150 MHz are installed with 3 meter base stations and 18 fixed stations. The systems have 2 CH per area, 8 CH in total.

- Optical fiber cables

Along the Western Line (Jak to Mri), the optical fiber cables (4-GI-SS) are installed with a maximum capacity of 120 CH and with a transmission speed of 2 M bit/S.

- Overhead cables

Some sections of the Western, Bogor, Bekasi, Serpong and Tangerang Lines are equipped with overhead cables of 10 pairs, 20 pairs, and 30 pairs.

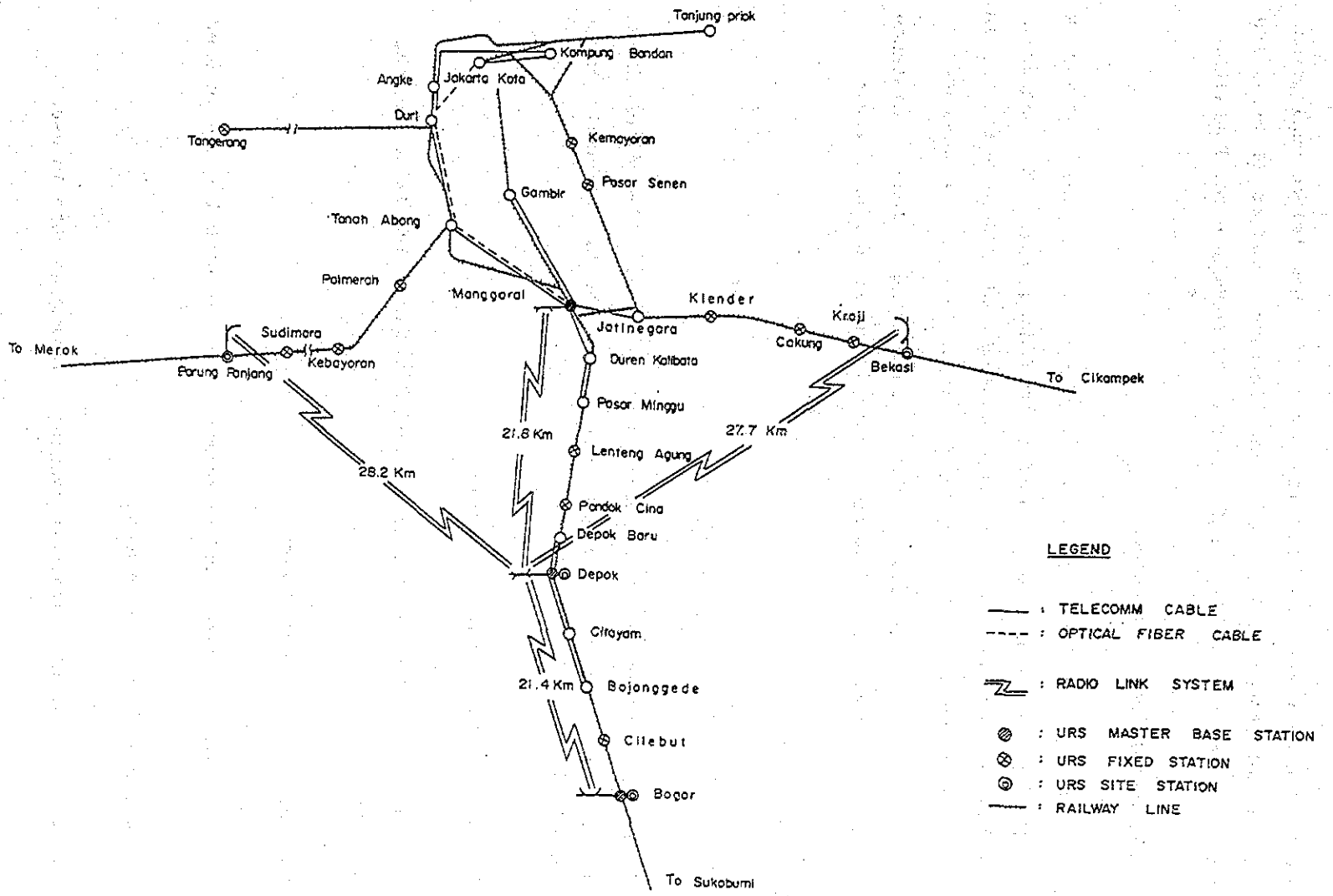


Fig. 3.2.2.5 Network of Radio Link System and Utility Radio System

- Overhead bare wires

Overhead bare wires are used for short distance telecommunications such as telegraphs or telephones for blocking. Two to 24 wires are installed for the railways and 4 to 8 wires somewhere for PERUMTEL.

b) Automatic telephone exchangers

The electronic telephone exchangers with a maximum capacity of 132 CH and 216 CH are installed in Jakarta and Manggarai. The automatic telephone exchangers with a maximum capacity of 50CH are located in Bogor, Jatinegara, Tanah Abang and Cikampek. Arepeating exchanger is installed in Manggarai for reapeating long distance telecommunications. The diagram of them is shown in Fig. 3.2.2.6

c) Terminal equipment

- Dispatching direct telephones

Inspection dispatcher are located in Jakarta. The dispatchers, stations and trains are linked with dispatcher's telephones using UHF/VHF systems, etc.

- Substation dispatching telephones

The telephones for dispatching substations are installed in the 7 terminals.

- The VHF radio utility system

Ten portable telephones and 12 terminals for automobiles are in use.

- Automatic exchenger telephones

As mentioned in b), automatic exchenger telephones are in use.

- Teleprinters and Facsimiles

These are also used.

- Telegraphs

As to Morse Telegraph, T type Morse telegraph is used for signalling block systems, A type Morse telegraph for connection of main stations, and B type Morse telegraph for connection of some neighboring stations. The existing Morse telegraph network is shown in Fig. 3.2.2.7.

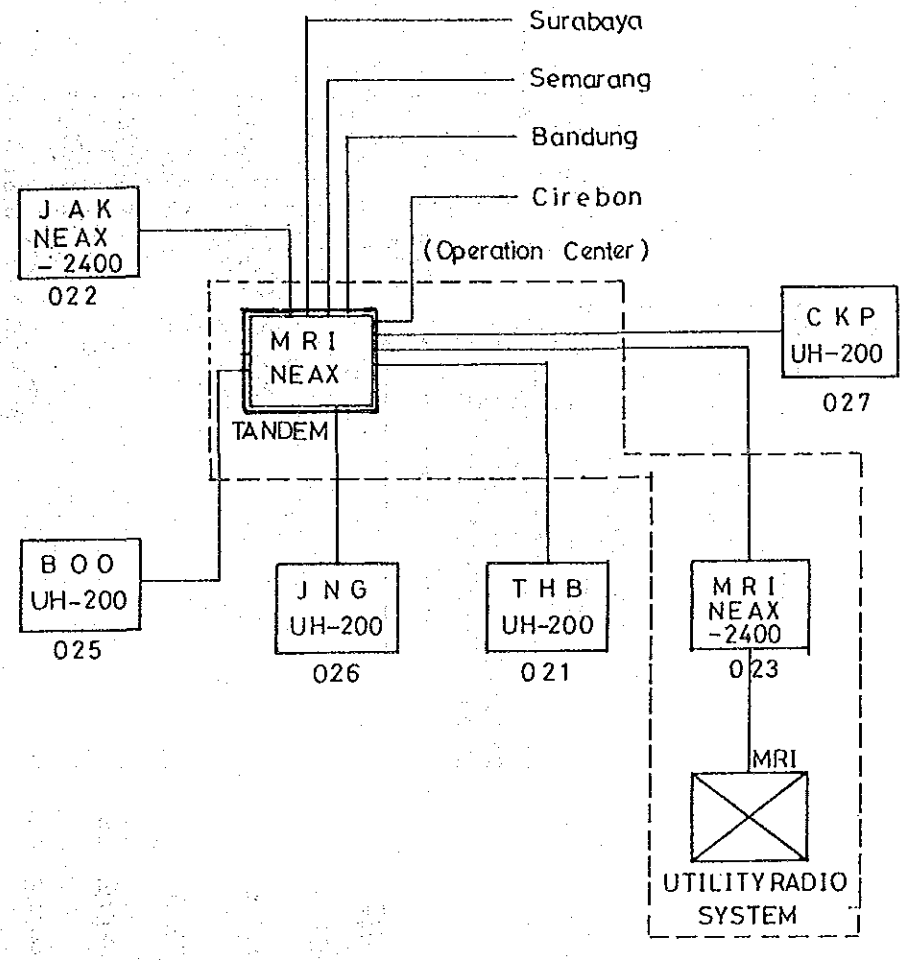


Fig. 3.2.2.6 Automatic Exchange Telephone Networks System in Jabotabek

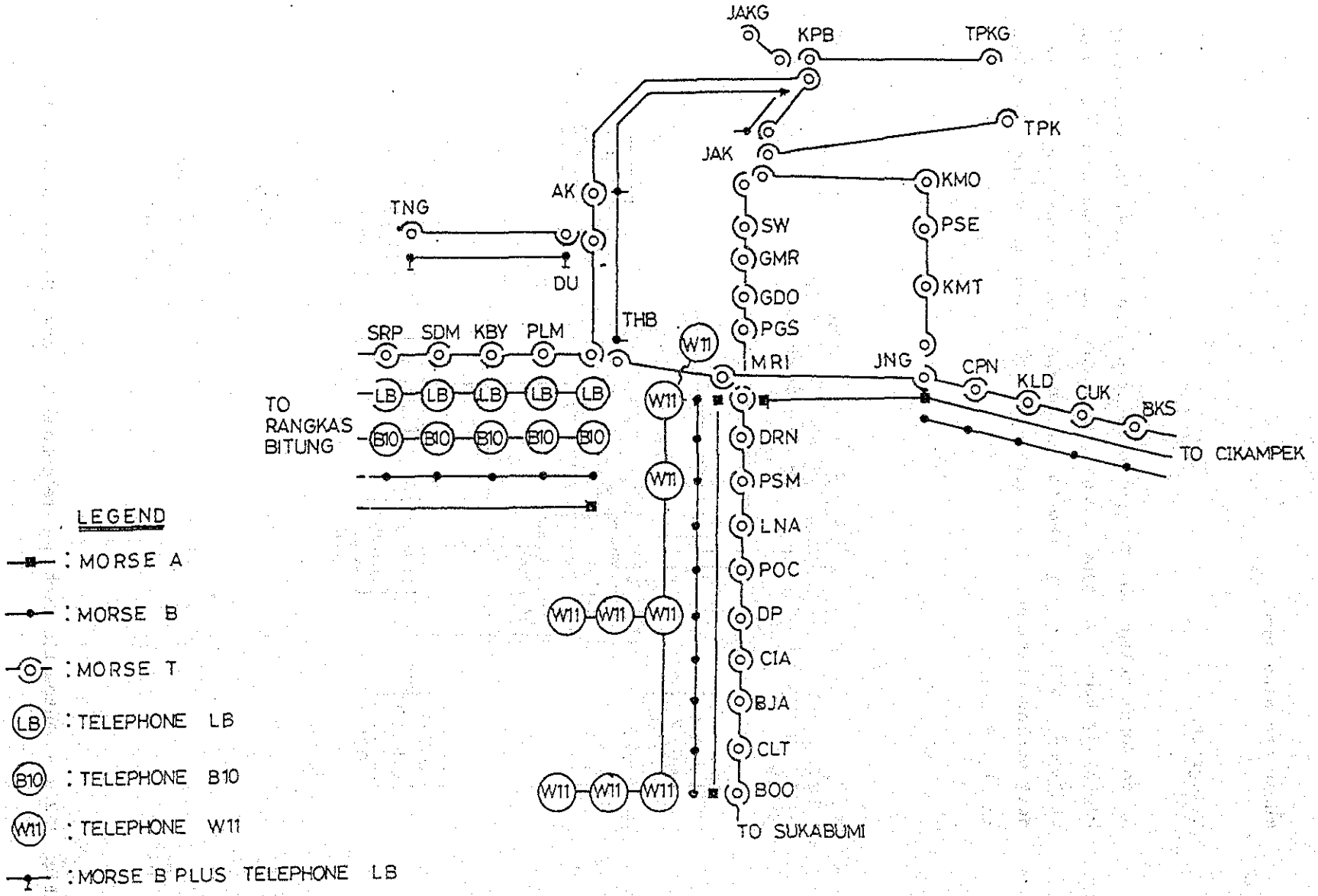


Fig. 3.2.2.7 Existing Telephone and Morse Telegraph Network

(4) Electricity

1) Equipment

For the electrified track in JABOTABEK, there are ten substations which distribute electricity (DC 1500 V) to the overhead contact system.

This overhead contact system extends for about 90 km, on both the Western Line which was completed in April 1987 and the previously electrified Central and Eastern Lines. The Central and Eastern Lines contact system has double contact wires, while the Western Lines contact system uses a simple catenary with a feeder wire.

Table 3.2.2.3 Present Substation Capacities

Unit: KW

Central Line					
Jakarta	Gambir	Pasarminggu	Depok	Bojonggede	Kebonpedes
3000	2500	3000	2500	3000	2500

Western Line		Eastern Line	Tanjung Priok Line
Duri	Karet	Jatinegara	Ancol
1500	1500	3000	1500

For automatic signalling in the future, installation of a high voltage distribution line system is planned, but the work has not yet been carried out. Any obstacles which prevent the elevation of the Central Line will be relocated.

2) Maintenance

The organization for maintenance of the substations and overhead contact system is under the direction of the Transportation Section of Inspection 1. The organization has three field sections, each comprised of two groups, a substation group and a contact system group. The total number of maintenance personnel is 66.

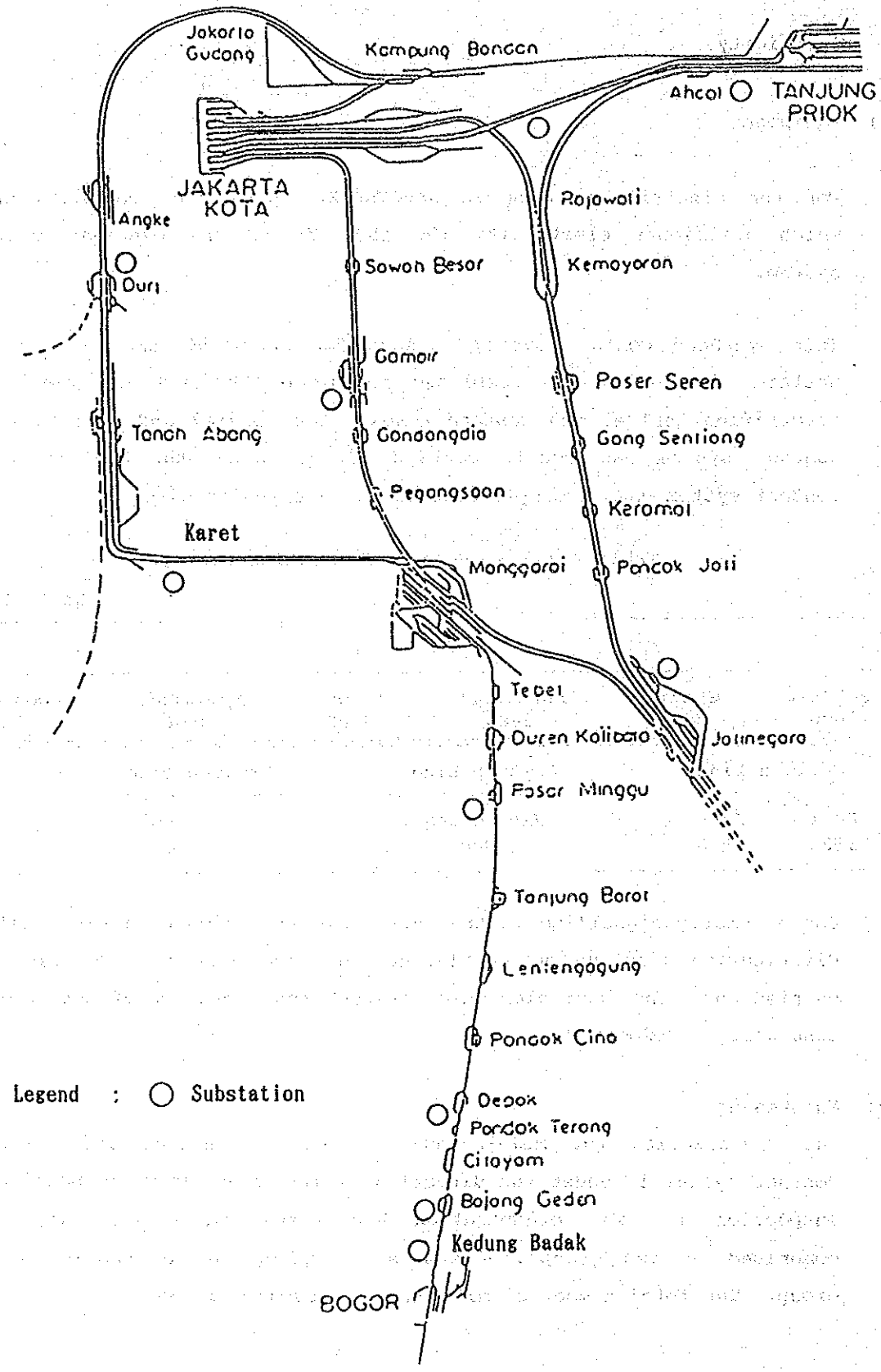


Fig. 3.2.2.8 Electrified Area

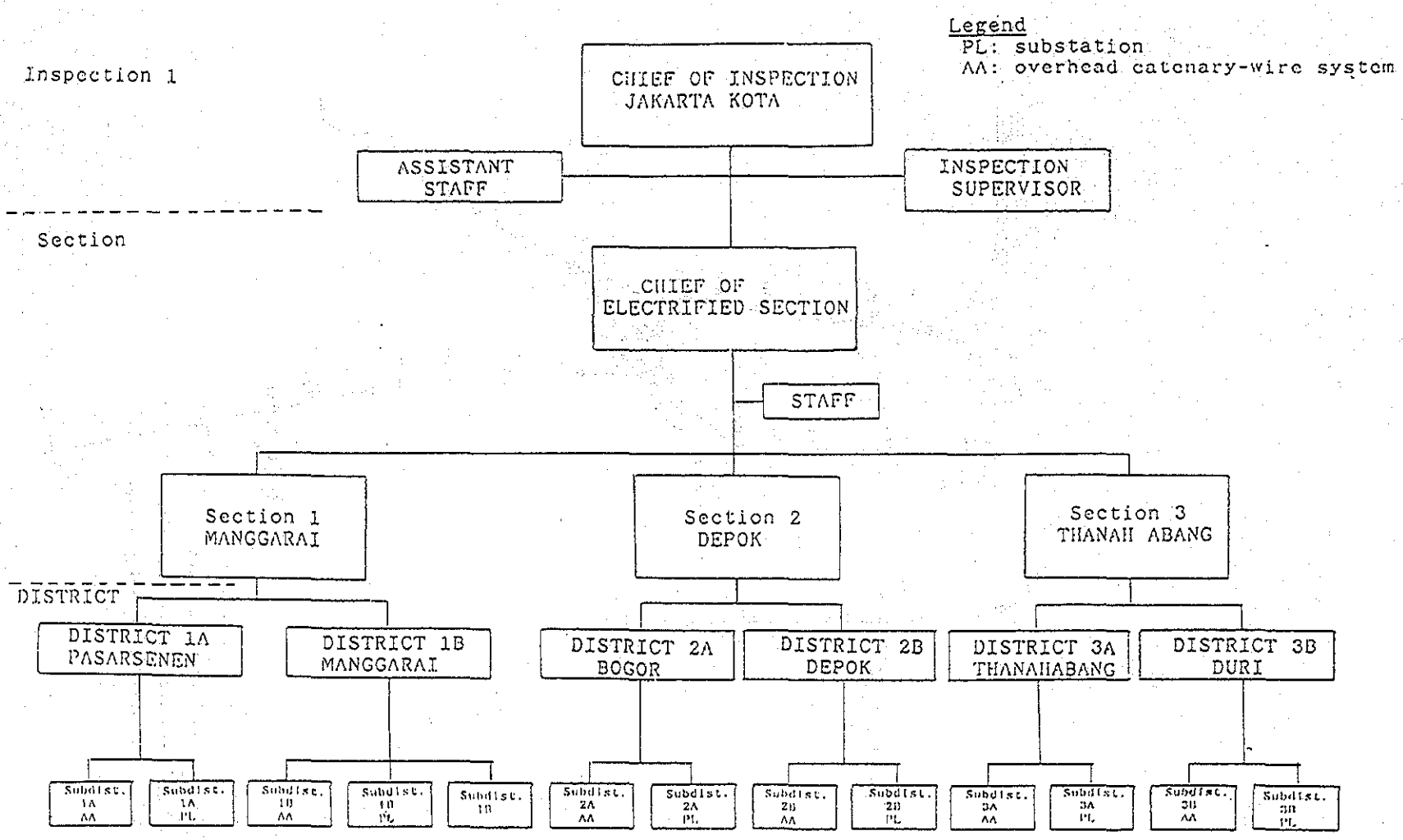


Fig. 3.2.2.9 Organization for the Maintenance of the Substations

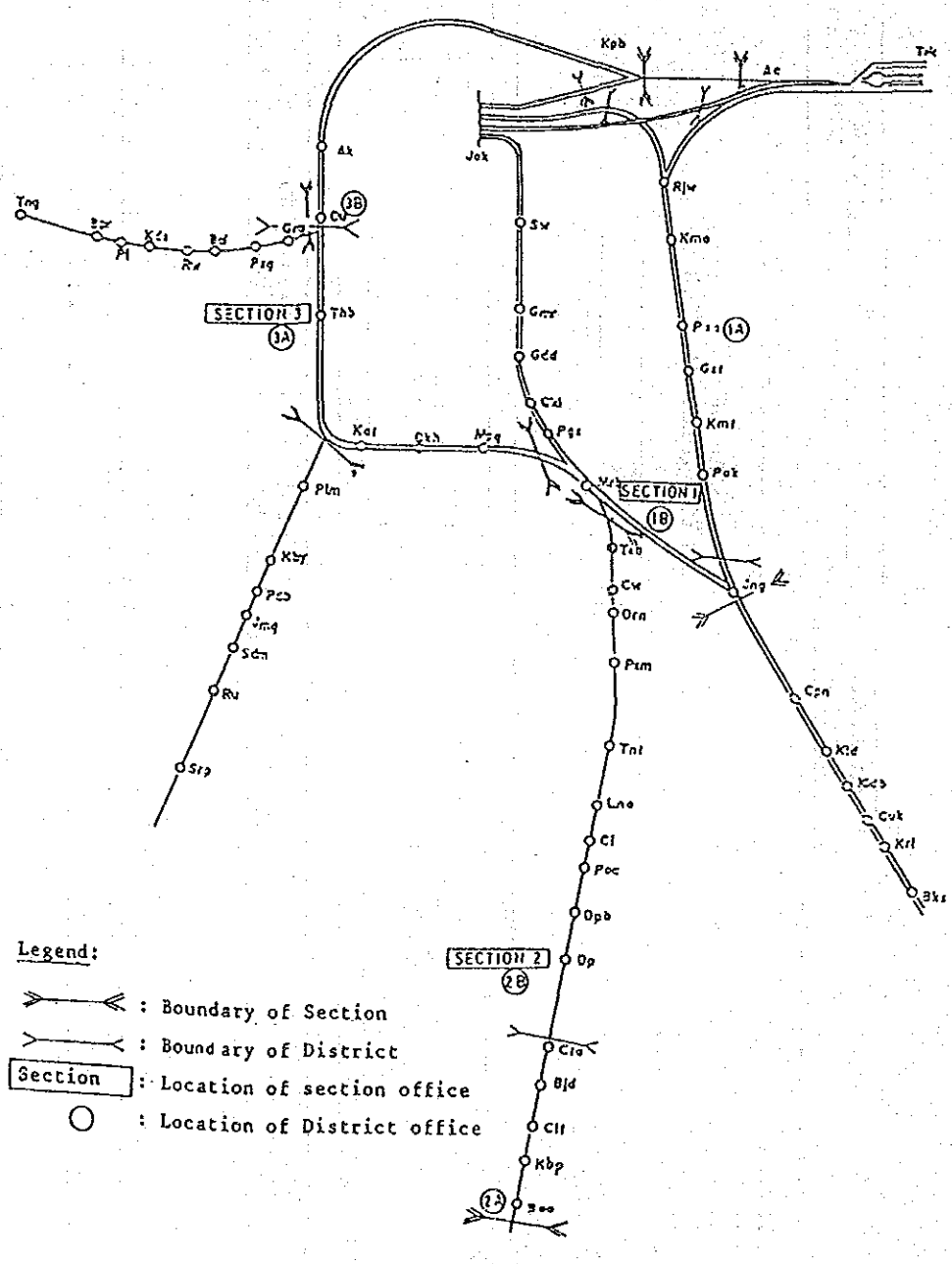


Fig. 3.2.2.10 The Maintenance Area of the Substations

(5) Rolling stock

1) Outline of rolling stock

The existing rolling stock for transportation within JOBOTABEK, including the adjoining areas, consists of electric railcars (ECs) and diesel railcars (DCs). For middle- and long-distance trips, with JOBOTABEK as the starting point, diesel locomotives (DLs), passenger coaches (PCs), and freight cars (FCs) are mainly used.

Of the just mentioned rolling stock (excluding DCs), there have been no serious defects as of this time. However, most of the DCs are now out of service due to engine trouble.

Therefore, there is a plan to implement a DC restoration project with the goal of rehabilitating these DCs in a few years.

Many parts of these railcars, such as the windshields of driver's cabs, hand straps, blades of electric fans, passenger seats, seem to get damaged.

In the past, there were repeated improvements of these parts, such as size and kind of material, and it will be necessary to do this again. Furthermore, the necessity of the parts themselves and the method of publicizing to reach a larger segment of society will have to be studied comprehensively.

2) Car maintenance

At present, the maintenance for the increasing railcar fleet is not showing sufficient results due to a lack of capacity and quality.

To make up for this, work to improve the car maintenance facilities is now under way.

Assuming that this work can be done, it is necessary to implement improvements in the various car maintenance systems and to establish better maintenance systems.

3-2-3 Management

(1) Management form

PJKA (Indonesian State Railways, Perusahan Jawatan Kereta APi) is operated as a government-owned enterprise in compliance with the Governmental Decree Nr. 61 year 1971. Although PJKA is under the authority and control of the Minister of Communications, the Chief Director of PJKA is completely responsible for its operations. (Refer to Fig. 3.2.3.1.)

(2) Organization of PJKA

PJKA owns 6,458 km of railway (total extension) and employed 48,224 people as of 1987. (See Table 3.2.3.1) The organization which operates and manages PJKA consists of a Head Office and regional offices (Wilayah usaha or exploatasi), with sub regional offices (daerah operasi) and technical executing units of operation.

Table 3.2.3.1 Trends of Transportation Volume, Number of Workers and Business Kilometers

		1982/83	1983/84	1984/85	1985/86	1986/87
Passenger (Except ferry)	(1,000 persons)	44,637	46,082	44,646	47,761	49,379
[Including JABOTABEK Area]	(1,000 persons)	[16,205]	[16,945]	[16,277]	[16,910]	[16,980]
	(1,000,000 perons/km)	6,105	6,150	6,316	6,881	7,535
[Including JABOTABEK Area]	(1,000,000 perons/km)	[721]	[630]	[614]	[603]	[585]
Freight = (Except ferry)	(1,000 tons)	4,353	5,104	6,410	6,545	7,743
	(1,000,000 tons/km)	880	929	1,248	1,305	1,576
Number of Workers	(persons)	52,684	51,399	50,826	50,247	48,224
Business kilometers	(km)	6,411	6,411	6,411	6,458	6,458
[Including JABOTABEK Area]	(km)	[168.5]	[162.4]	[162.4]	[162.4]	[154.3]

Source: PJKA

1) Head office

As Fig. 3.2.3.2 shows, the Head Office consists of a Directorate of Finance, a Directorate of Technic, a Directorate of Operation, a Directorate of Marketing, a Directorate of Personnel and an Inspectorate. There is also a Centre of Planning, a Centre of Research and Development, as well as a Centre of Education and Training.

2) Regional offices (Wilayah usaha or exploatasi)

PJKA has 4 regional offices (1 in Java Island and 3 in Sumatra Island).

Name	Location
Wilayah Usaha Jawa	Semarang
Exsploatasi Sumatra Selatan	Plaembang
Exsploatasi Sumatra Utara	Medang
Exsploatasi Sumatra Barat	Padang

The organization of Java Regional Office (Wilayah Usaha Jawa) is shown in Fig. 3.2.3.3.

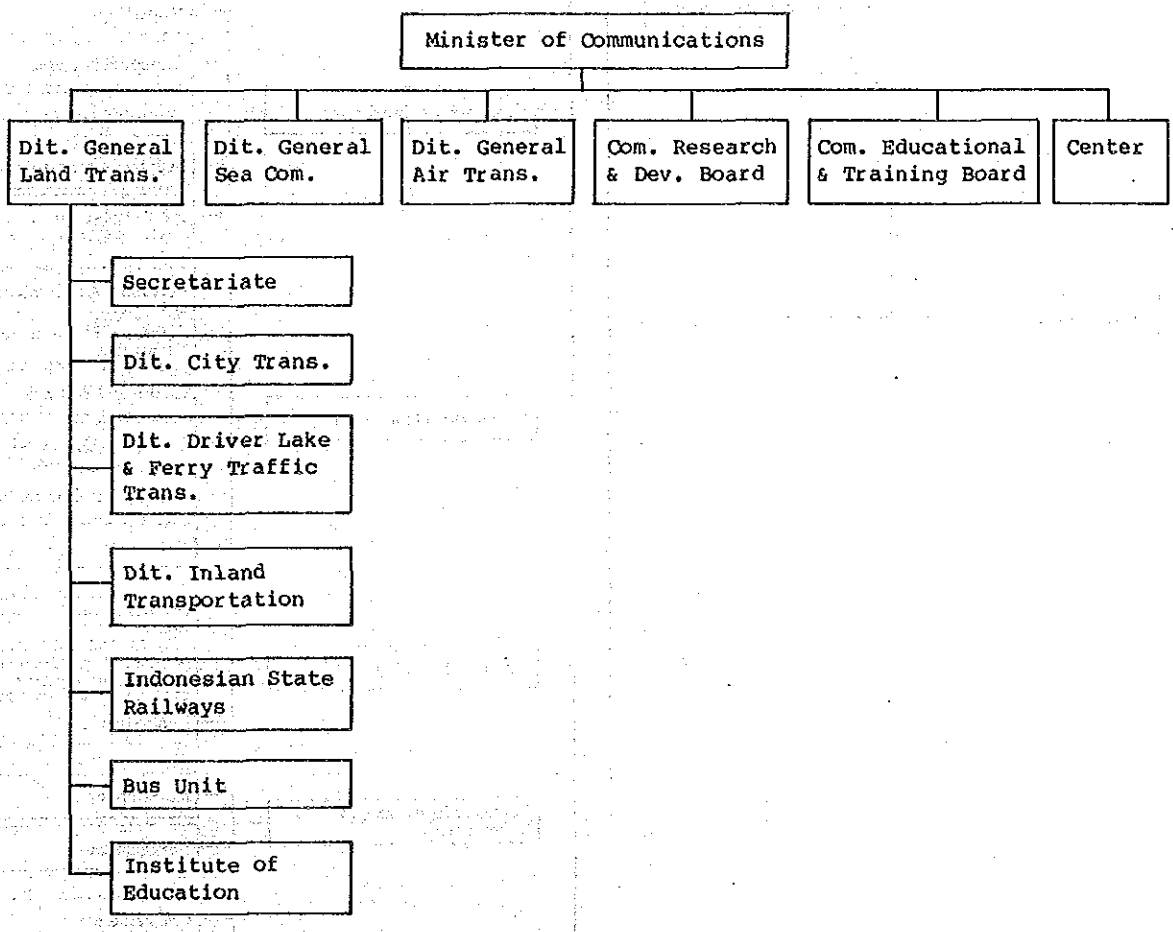


Fig. 3.2.3.1 Organization Chart of Minister of Communication

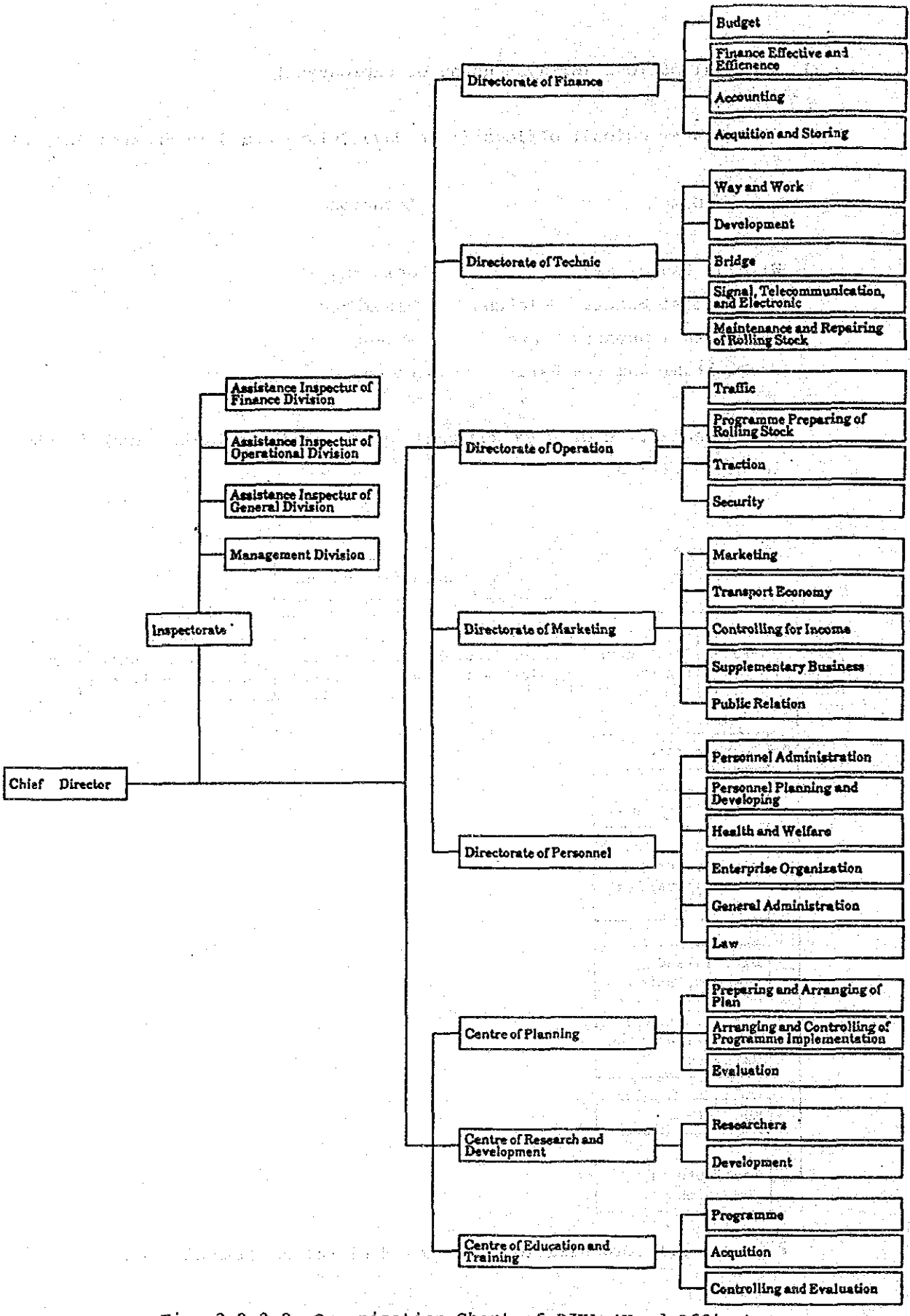


Fig. 3.2.3.2 Organization Chart of PJKA (Head Office)

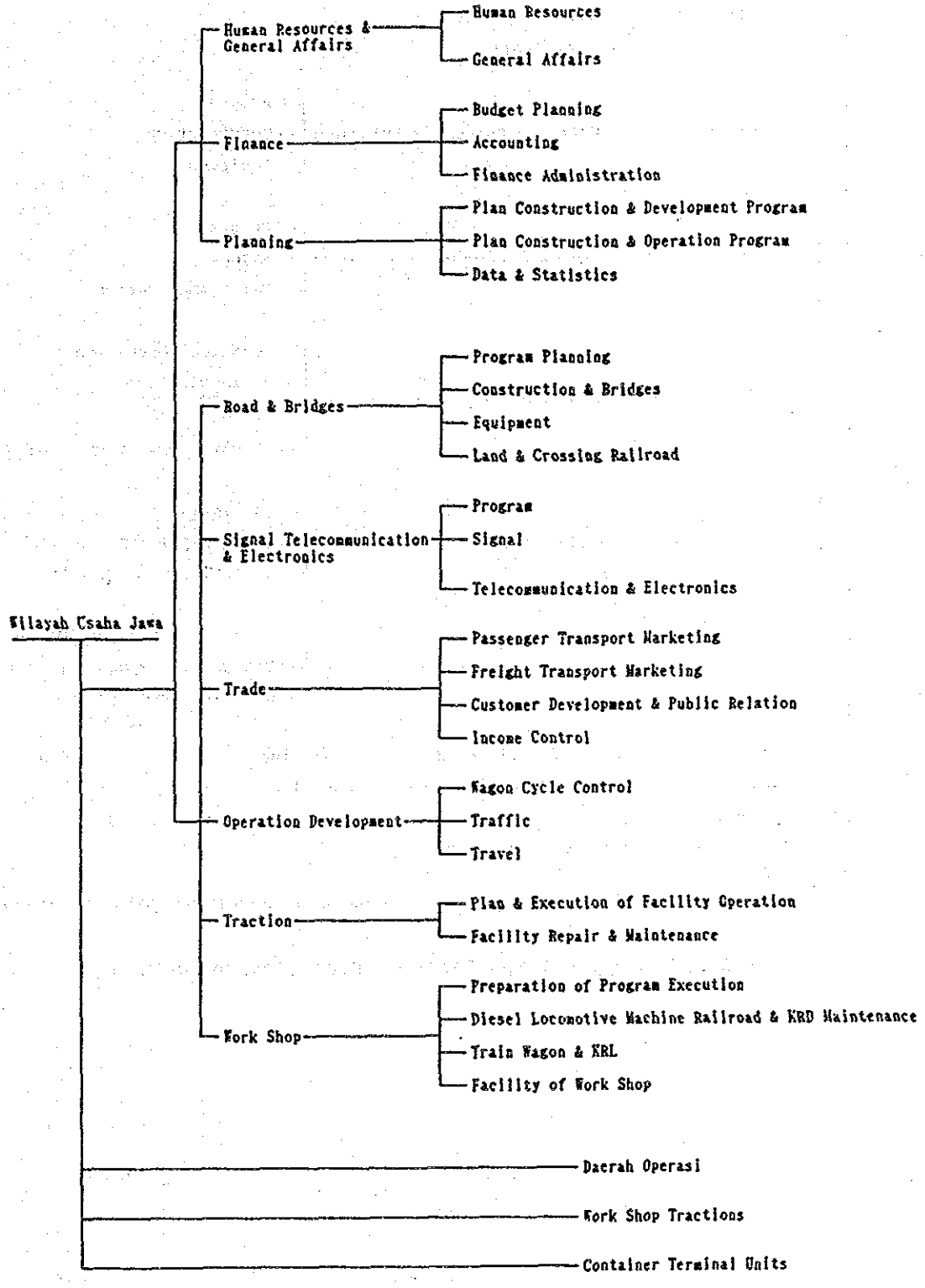


Fig. 3.2.3.3 Organization Chart of PJKA (Weilayah Usaha Jawa)

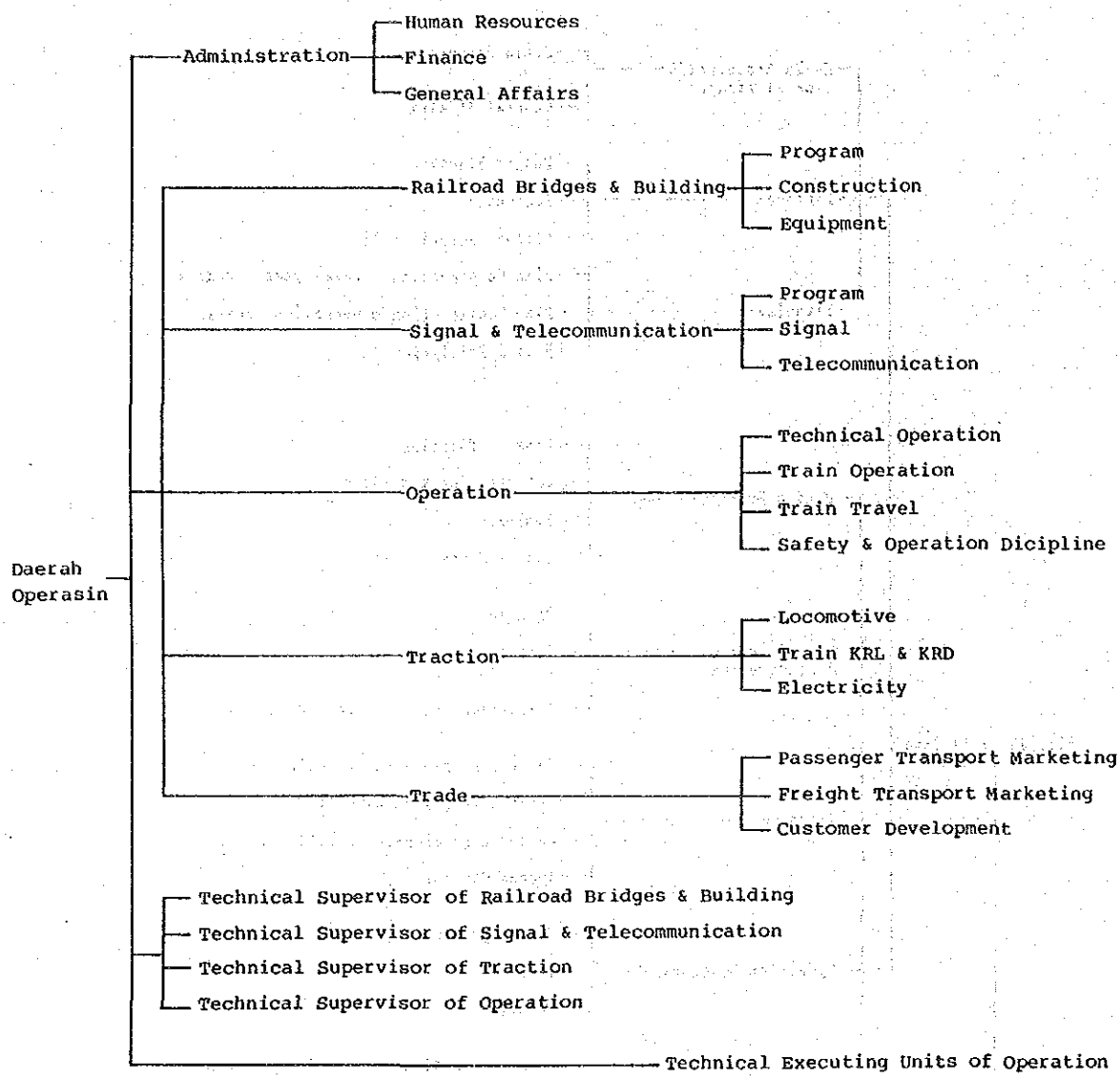


Fig. 3.2.3.4 Organization Chart of PJKA (Daerah Operasi)

3) Sub regional offices (Daerah Operasi)

There are 9 sub regional offices as the subordinate organizations to Java Regional Office (Location: Jakarta, Bandung, Cirebon, Purwokerto, Semarang, Jogyakarta, Madiun, Surabaya, Jember). The sub regional offices supervise and guide the technical executing units of operation. There is no sub regional office in Sumatra Island, where each regional office directly supervise and guide the technical executing units of operation.

The organization of each sub regional office (Daerah Operasi) is shown in Fig. 3.2.3.4.

(3) Financial state

1) Principles of operation

The government-owned enterprises in Indonesia are operated in one of the following three ways.

a) Perusahaan Jawatan (PERJAN) - A public utility enterprise
= An enterprise which fully undertakes the Government's mission. The Government grants the funds for capital and subsidizes any losses incurred during operation.

b) Perusahaan Umum (PERUM) - A public corporation
= This form of enterprise still has the Government mission, but also has a profit motive. The Government gives only funds for capital. The enterprise attempts to overcome its operational expenses and strives to make a profit.

c) Perusahaan Terbatas (PERSERO) - A (limited) holding company.
= An enterprise in which the Government is the only shareholder.

The legal status of Indonesian State Railways (PJKA) is PERJAN at present. The Government provides investment funds for PJKA's

facilities and vehicles and subsidizes business operations.

At present, discussions are being made among PJKA, the Ministry of Communications and other authorities concerned to change the legal status of PJKA from PERJAN to PERUM.

PJKA's operating expenditure has been exceeding its operating income, with deficits financed through Government subsidies. The following figures show the amount of Government subsidies PJKA has received over the past 5 years. (Unit: million rupiahs)

1982/83	30,679
1983/84	29,608
1984/85	29,183
1985/86	34,780
1986/87	34,300

The government's subsidies for covering operating losses and providing investment funds for facilities and vehicles are reflected in the yearly increases in government equity on PJKA's balance sheet. (See Table 3.2.3.2.)

2) Financial state of PJKA as a whole

Table 3.2.3.3 shows the loss and profit accounts of PJKA over the past 5 years (the fiscal year of 1982 - the fiscal year of 1986*).
[*Fiscal year of PJKA is from April 1st, every year, to March 31st, next year.]

It shows that the total revenue covers only about 60% of total expenses. The total revenue covers only about 70 to 80% of the working expenses, which include neither depreciation, nor interest payments.

Passengers fares and freight charges account for about 85% of total revenue. "Others" include ferry charges, ancillary services, station charges, door to door service charges and train attendance charges.

The staff cost accounts for the largest part (about 35%) of expenses, although its percentage has been decreasing yearly. The staff cost accounts for about 45% of working expenses and slightly more than 60% of revenue.

The railway is a highly labor-intensive business. There is a tendency for the staff cost accounts to be the largest part of total expenses regardless of the country. Therefore, labor saving measures are an important part of business, management. However, it must be pointed out that the labor saving possibilities are limited because safety must always be the highest priority.

PJKA's staff cost as a percentage of both total expenses and working expenses is rather small when compared with the large private railway companies in Japan. (For further details, please see the latter paragraph (5) Problems with Commercial Service in PJKA as Compared with Japanese Railway Enterprises)

However, the fact that the ratio of the staff cost to the revenue is 50 to 60% indicates that more efforts will have to be made to save labor (or to increase the income).

The Minister of Communications has the authority to determine the railway fare tariff and the Chief Director of PJKA has the authority to make discounts of not more than 10% of the determined fare tariff.

Table 3.2.3.4 and Fig. 3.2.3.5 show the recent trends in short distance fare tariffs (1 km to 80 km).

3) Financial state in the JABOTABEK Area

The financial state in the JABOTABEK Area is not very clear because of a lack of sufficient materials. The related materials should be improved quickly, in view of their importance in making administrative decisions for the JABOTABEK Area.

The quarterly reports on revenues and expenses which are submitted by General Affairs Manager of West Java Region Office to PJKA's Head

Office, are the only currently available materials on the financial state of the JABOTABEK Area. Table 3.2.3.5 shows the loss and profit accounts for the JABOTABEK Area over the past 4 years (fiscal year 1984 - fiscal year 1987) which were made using data from the quarterly reports. They are overlapped with the loss and profit accounts of the entire PJKA for three terms (fiscal year 1984 - fiscal year 1986). The following statements can be made when the balance in the JABOTABEK Area is compared with that of entire PJKA over these 3 terms.

The revenue in JABOTABEK Area accounts for 3 to 3.5% of the total revenue of PJKA, and yet its expenses account for 4 to 4.5% of the total expenses of PJKA. As for the loss and profit before depreciation, the loss in JABOTABEK Area accounts for 7 to 11% of the total loss of PJKA. These figures indicate that the railway business activities in JABOTABEK Area do not contribute to the operation of the entire PJKA.

Therefore, efforts must be made to increase revenues and to decrease expenses in the JABOTABEK Area.

Table 3.2.3.2 Balance Sheet of PJKA 1983 - 1987

(in million rupiahs)

	1983/3/31	1984/3/31	1985/3/31	1986/3/31	1987/3/31
Assets					
Fixed Assets	309,541	513,681	611,053	752,312	887,665
less Depreciation	59,948	70,768	89,405	111,478	135,829
Fixed Assets(net)	249,593	442,913	521,648	640,834	751,836
Current Assets	60,246	72,665	191,803	181,750	203,077
(Inventories)	(18,544)	(24,186)	(125,133)	(105,884)	(104,206)
Total Assets	309,839	515,578	713,451	822,584	954,913
Liabilities & Equities					
Current Liabilities	20,594	24,396	30,345	30,674	55,207
Government Equity	289,245	491,182	683,106	791,910	899,706
Total Liabilities & Equity	309,839	515,578	713,451	822,584	954,913

Source: PJKA

Table 3.2.3.3 Loss and Profit Account of PJKA 1982/83 - 1986/87

(In million rupiahs)

	1982/83 (% of rev.) [% of exp.]	1983/84 (% of rev.) [% o exp.]	1984/85 (% of rev.) [% of exp.]	1985/86 (% of rev.) [% of exp.]	1986/87 (% of rev.) [% of exp.]
Operating Revenue					
Passenger	42,413 (61) [35]	52,724 (62) [36]	65,676 (60) [40]	73,973 (60) [37]	79,915 (59) [38]
Freight	15,669 (23) [13]	19,947 (23) [14]	26,961 (25) [16]	31,538 (26) [16]	36,067 (27) [17]
Others	11,097 (16) [9]	12,919 (15) [9]	15,837 (15) [10]	16,727 (14) [9]	18,204 (14) [8]
Total Operating Revenue	69,179 (100) [59]	85,590 (100) [59]	108,474 (100) [66]	122,238 (100) [62]	134,186 (100) [63]
Working Expenses					
Wages,Salaries	37,134 (54) [31]	43,727 (51) [30]	46,425 (43) [29]	55,982 (46) [28]	56,974 (42) [27]
Rice	5,554 (8) [5]	8,089 (10) [6]	8,658 (8) [5]	9,206 (8) [5]	8,943 (7) [4]
Uniform,Health and Education	2,491 (3) [2]	2,941 (3) [2]	3,544 (3) [2]	3,836 (3) [2]	4,202 (3) [2]
Total Staff Cost	45,179 (65) [38]	54,757 (64) [38]	58,627 (54) [36]	69,024 (57) [35]	70,119 (52) [33]
Fuel	12,407 (18) [10]	16,559 (19) [11]	20,300 (19) [12]	22,407 (18) [11]	21,199 (16) [10]
Maintenance	28,645 (42) [24]	32,727 (38) [22]	28,852 (26) [18]	35,534 (29) [18]	40,141 (30) [19]
Accident repairs	928 (1) [1]	735 (1) [1]	913 (1) [1]	1,264 (1) [1]	832 (1) [0]
Miscellaneous	18,883 (27) [15]	21,788 (26) [15]	25,010 (23) [15]	27,744 (23) [14]	32,258 (24) [15]
Total Working Expenses	106,042 (153) [88]	126,566 (148) [87]	133,702 (123) [82]	155,973 (128) [79]	164,549 (123) [77]
Profit before Depreciation	△36,863	△40,976	△25,228	△33,735	△30,363
Depreciation	6,060 (9) [5]	11,109 (13) [8]	16,011 (15) [10]	22,095 (18) [11]	25,097 (18) [12]
Interest	8,274 (12) [7]	8,044 (9) [5]	14,013 (13) [8]	19,403 (16) [10]	22,481 (17) [11]
Total Expenses	120,376 (174) [100]	145,719 (170) [100]	163,726 (151) [100]	197,471 (162) [100]	212,127 (158) [100]
Net Profit	△51,197	△60,129	△55,252	△75,233	△77,941

Source: PJKA

Table 3.2.3.4 Change of Passenger Fare Tariff of PJKA

Distance(km)	Passenger Fares (Rp)				The rising rate a year for 1980-1987 (%)
	1980.11.1	1983..2.1	1984.4.1	1987.2.8	
1 - 10	50	100	150	150	17.0%
11 - 20	75	100	150	200	15.0
21 - 30	100	150	200	250	14.0
31 - 40	125	150	250	300	13.3
41 - 50	150	250	250	350	12.9
51 - 60	175	250	300	400	12.5
61 - 70	200	250	350	450	12.3
71 - 80	200	300	400	500	14.0
					Simple average = 13.9
					Weighting average = 13.6

Source: PJKA

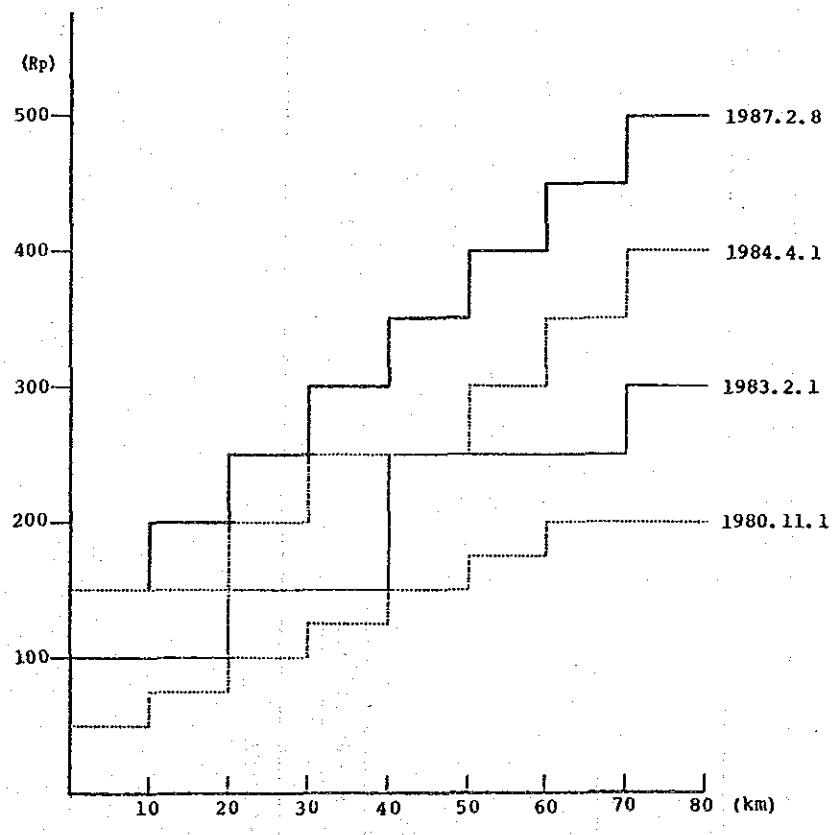


Fig. 3.2.3.5 Change of Passenger Fare Tariff of PJKA

Table 3.2.3.5 Loss and Profit Account of JABOTABEK KA 1984/85 - 1987/88

(in million rupiahs)

	1984/85	(% of rev.)	[% of exp.]	<% of PJKA>	1985/86	(% of rev.)	[% of exp.]	<% of PJKA>	1986/87	(% of rev.	[% of exp.]	<% of PJKA>	1987/88	(% of rev.)	[% of exp.]
Total Revenue	3,997	(100)	[67]	<3.68>	4,011	(100)	[63]	<3.28>	3,984	(100)	[53]	<2.97>	4,531	(100)	[65]
Total Expenses	5,809	(145)	[100]	<4.34>	6,340	(158)	[100]	<4.06>	7,458	(187)	[100]	<4.53>	7,018	(155)	[100]
(Breakdown of Expenses)															
Staff Cost	3,136	(78)	[54]		3,472	(87)	[55]		4,025	(101)	[54]		3,668	(81)	[52]
Fuel	1,860	(47)	[32]		1,878	(47)	[30]		1,927	(48)	[26]		2,285	(50)	[33]
Materials	515	(13)	[9]		664	(16)	[10]		613	(15)	[8]		660	(15)	[9]
Others	298	(7)	[5]		326	(8)	[5]		893	(23)	[12]		405	(9)	[6]
Profit before Depreciation	△1,812			<7.18>	△2,329			<6.90>	△3,474			<11.44>	△2,487		

Source: PJKA

(4) Characteristics of Railway Enterprises
(Especially in Comparison with Road Enterprises)

1) The characteristics of a railway (its restrictions and potential) as a means of transport are based on the technical feature that the railway uses routes meant for its exclusive use. In other modes of transport, motor vehicles for example, vehicles of various types owned by various persons or organizations use public routes called roads, with the owners of the vehicles and roads being clearly different.

On the other hand, the railway usually owns both its routes and rolling stock. In Japan, however, the Railway Enterprise Law, which was passed in 1986 along with the privatization of the Japanese National Railways, officially opened the way for railways that only want to operate trains and not construct track and for railways that want to only construct tracks and transfer or lease that track to other companies. That is to say, there are now three types of railway enterprises. However, most railways in Japan still operate using their own track.

2) In view of the above, the restrictions and potential of railways as enterprises are considered to be as follows.

a) Generally, enterprises that must have their own fixed facilities entail economies of scale. It is easily understood that the economies of scale of a railway (economic advantages due to vehicle and facility size) are larger than that of road carriers (buses, taxes, truckers, etc.), which generally can operate without owing their own routes.

For a railway, a single-track line is necessary even for the operation of one round-trip train per day. It is also necessary to invest in double tracking when transport slightly exceeds the capacity of the single-track line, even when the excess demand occurs only during a few specific hours a day. When confronted with

such odd transport demand, a railway can not display its advantages concerning costs, resulting in its service becoming expensive.

On the other hand, in large-volume transport, as in the case of a highly utilized double-tracked railway, the service cost can be much smaller than that of road carriers. This is because although investment for double-track construction is two times that for single track, in view of land procurement and material costs, the transport capacity of the double-tracked railway is more than several times that of the single-tracked. That is to say, a highly utilized double-tracked railway can achieve larger scales of economy in terms of operational efficiency than road carriers.

The characteristic of intense use can be commonly seen in all means of public transport. Although the quality of transport inevitably decreases when transport demand exceeds seating capacity, carriers can collect their fares from passengers since the passengers attain their major objective of reaching their destinations. Transport enterprises (especially railways) have the inherent characteristic that they can only make profits via congested transport. In this respect, public transport enterprises differ from enterprises where a single service can be sold to a single person.

When railway traffic is less than its capacity, that is to say, when some part of the moving space remains unsold, the unconsumed portion cannot be maintained as stock.

b) Since railways run on exclusive corridors, it is inevitable that their commercial routes (courses of transport) are inflexible. As a result, the locational superiority or inferiority of commercial routes greatly influences business performance.

Therefore, it is most important for railway management to set up routes in regions having large and continuous transport demand. Some Japanese private railway companies implement policies that attract large numbers of people and create their own large transport demand.

They do this by constructing tracks in regions with no residents and then build housing areas along the line, setting up such facilities as terminal department stores, supermarkets, and sport/leisure facilities. In such cases, the railway is a means for carrying out large-scale housing development. That is to say, railways promote various businesses resulting in an entity related to regional development, that can be called a regionally comprehensive industry.

In some Japanese private railways profits from the railway sector, despite the fact that this is their main line of business, account for only a little more than 30% of total company profits. (Refer to Table 3.2.3.6, Revenues and Expenses of Major Private Railways in Japan, 1987).

Road carriers, on the other hand, can easily change commercial routes and, therefore, have an advantage in flexibility. However, it is easily understandable that, since railways use exclusive routes, they are superior to road carriers in the aspects of high-speed, accuracy, safety, and large capacity*1 in transport*2.

*1 Railways have, as one of their transport characteristics, the capacity to deal with large-volume transport demand. The maximum transport capacity of a railway is about 80,000 persons per hour one way. On the other hand, many experts have commented that the above capacity of buses is 5,000 to 10,000 persons per hour one way on ordinary roads and 20,000 persons per hour one way on exclusive roads.

*2 This only means that railways have such characteristics (potential or prospect). Needless to say, appropriate strengthening of hardware (construction and maintenance of railway facilities including rolling stock) and software (operational control systems) are necessary to have such characteristics materialize.

(5) Problems with Commercial Service in PJKA as Compared with Japanese Railway Enterprises

1) When a railway is considered as a commercial enterprise, the main points that must receive emphasis are as follows.

a) Attraction of new passengers

b) Promotion of baggage and freight transport

c) Establishment of appropriate fares

d) Efficient execution of work in station yards

e) Work rationalization via labor savings

When roughly classified, a) to d) are measures for increasing revenues and d) and e) measures for curtailing expenses.

2) The revenues of PJKA have so far been smaller than expenses, and deficits have been supplemented by subsidies from the government. However, in view of the fact that discussions are under way on changing the legal status of PJKA from a PERJAN (a government-owned enterprise where the government does all the investment and compensates for all operational losses) to a PERUM (a government-owned enterprise where the government does all the investment but does not compensate for operational losses), it is considered urgently necessary to at least keep a balance between revenues and expenses, as well as to study and implement measures to attain this objective.

Accordingly, we would like here to provide some advice on which of the two (increasing revenues and curtailing expenses) should receive emphasis and what concrete measures should be taken when PJKA operates the railway in the future as a commercial enterprise. For this purpose, we have made comparisons of the present status of PJKA and railways in Japan (major private railways and JR) and conducted some analyses.

Please refer to Table 3.2.3.7 (Railway-Related Revenues and Expenses of PJKA and major Private Railways in Japan, 1987), Table 3.2.3.8 (Railway-Related Revenues and Expenses of PJKA and JR Companies, 1987), Table 3.2.3.9 (Businesss Indicators for PJKA and Major Private Railways in Japan 1987), and Table 3.2.3.10 (Business Indicators for PJKA and JR Companies, 1987)

In Tables 3.2.3.9 and 3.2.3.10, items 8 to 13 indicate the financial ratios. Among these figures, items 8, 9, 10[*3], and 13 concern revenues, and items 10, 11, and 12 concern expenses. As for expenses, the ratio of each expense item (personnel expense, maintenance expense, etc.) to the total expense is as shown in Tables 3.2.3.7 and 3.2.3.8, and can be used as indicators.

3) First, comparisons will be made between PJKA and Japanese private railways and JR in terms of expense indicators. As for the ratio of each expense item to total expense, there is no special problem in PJKA's ratios when compared with those of Japanese private railways and JR. Also, the number of employees per route kilometer in PJKA is not inferior to that in Japanese companies.[*4]

The turnover of fixed assets in PJKA is a little lower than those of Japanese private railways and JR. However, viewing the comparison in terms of the ratio of fixed assets against the number of employees, the cause of the lower turnover is due to smaller PJKA revenues rather than to excessive expenses (investment) for fixed assets. That is to say, this is a problem of revenues and not a problem of expenses. (Although the turnover of fixed assets in PJKA is 1/4 to 1/2 of those in Japanese private railways and JR, the fixed-assets/number of employees ratio in PJKA is 1/24 to 1/15. In this respect,

*3 Item 10 denotes Revenue (sales)/Fixed assets. When this turnover is large, it shows that the relationship between fixed assets and expenses (investment) is in a favorable condition. On the other hand, when the turnover is small, it shows that the utilization of the fixed assets is insufficient to increase revenues or that expenses (investment) for fixed assets is excessive. In enterprises such as railways, where large fixed assets (facilities) are necessary for business, the turnover is generally small. However, this varies with the individual railway enterprise.

*4 Major private railways in Japan mainly operate commuter trains in urban areas. Although their route length is short, employees are densely assigned to deal with the large volume of passenger transport demand under extremely heavy congestion. This is the reason why the number of employees per route length in railways in Japan is larger than that of PJKA.

it is necessary to strengthen facilities by increasing expenses (investment) to fixed assets.

4) Next, their railways will be compared from a revenue standpoint.

Regarding revenue per person-kilometer from fares, PJKA's is 1/15 to 1/8 of that for Japanese private railways and JR, and an extremely low 1/243 to 1/117 for passenger revenue per route kilometer. In addition, despite PJKA having a smaller number of employees per route kilometer than average value of that in Japanese counterparts, the revenue per employee of PJKA is 1/50 of that in Japanese private railways and JR. Although PJKA has a fairly appropriate fare rate, there just is not enough revenue coming in.

Therefore, of the five points mentioned previously in managing a railway, implementing number (1), i.e., increasing revenue by attracting new passengers, is probably the most important for PJKA at present.

5) As stated before, PJKA should do something to attract as many new passengers as possible. However, the important thing in corporate strategy for increasing revenue for a company (including a railway company) is how to handle services (products), pricing, and marketing. In this regard, concrete suggestions for PJKA are set out below.

The services offered to customers by railways should consist of fulfilling the functions of punctuality, frequent service, short travel time, and comfort, as well as realizing said functions with an appropriate fare. To attract more passengers, a market study that includes analysis and forecasting (including a study on competing modes of transport such as cars) should be carried out and a strategy formulated to promote business.

In the case of PJKA, the biggest reason for its small passenger demand is that the above functions are not being sufficiently fulfilled. In other words, the present state of the Indonesian

railways cannot be said to be attractive to potential users.

According to the questionnaire for railway users drawn up by the survey team, the thing in demand most is for trains to run according to schedule, with shorter train headway being next in priority. (Refer to Table 3.4.1.1 Railway Users Comments on Railway Services.) Also, since the highly experienced survey team is of the opinion that one of the important things demanded of a railway, especially an urban one, is to have frequent and punctual service, it can be said that the results of the questionnaire are valid.

Regarding the railway in the JABOTABEK area, even if punctual high frequency service is established, it will be difficult to raise the railway's level of use as long as the functions of road and rail are not integrated in a plan to improve station accessibility.

Therefore, if improved feeder service and punctual high frequency operation are not carried out, it will be hard to constantly secure a passenger volume that can bring about an increase in income based on the advantages of railway transport in the JABOTABEK area. To put it another way, the quick implementation of these improvements will produce greater demand and more revenue, as well as lower prices for services. This should be of the highest priority from a management viewpoint for the railways in the JABOTABEK area.

Table 3.2.3.6 Total Revenues and Expenses of Major Private Railways in Japan
(Fiscal 1987)

(Unit : Million Rp. , Conversion rate : 1 ¥ = 11.9 Rp.)

	Tokyu	Keisei	Kintetsu	Hanshin	Nishitetsu
Railway operating revenue	907,496	444,682	1,845,942	283,668	272,954
Railway operating expense	772,540	343,115	1,568,220	254,009	241,418
Railway operating profit	134,956	101,567	277,722	29,659	31,536
Non-railway operating revenue	1,736,484	371,335	458,159	273,534	1,236,310
Non-railway operating expense	1,517,896	319,492	353,935	216,082	1,179,240
Non-railway operating profit	218,588	51,843	104,224	57,452	57,070
Total operating profit [profit ratio of railway enterprise, %]	353,544 [38%]	153,410 [66%]	381,946 [73%]	87,111 [52%]	88,606 [36%]
Non-operating revenue	139,517	29,736	96,098	18,433	18,028
Non-operating expense	362,151	121,326	307,471	51,162	51,612
Non-operating profit	-222,634	-91,590	-211,373	-32,729	-33,584
Total general profit	130,910	61,820	170,573	54,382	55,022
Special profit	72,875	17,165	131,842	12,120	22,795
Special loss	75,447	84,208	119,645	9,931	25,456
Net special profit	-2,572	-67,043	12,197	2,189	-2,661
Profit before deduction of tax	128,338	-5,223	182,770	56,571	52,361
Corporate tax	61,999	955	81,515	34,082	28,881
Total profit	66,339	-6,178	101,255	22,489	23,480

Source : "Annual Railway Statistics, 1987" compiled by the Ministry of Transport

Table 3.2.3.7 Railway-Related Revenues and Expenses of PJKA and Major Japanese Private Railways (Fiscal 1987)

Unit: Million Rp., Conversion rate 1¥ = 11.3 Rp.)

	PJKA (% of total revenue) [% of total expense]	Tokyu	Keisei	Kintetsu	Hanshin	Nishitetsu
Revenue						
Passengers	94,105 (58) [43]	805,225 (87) [91]	393,081 (88) [95]	1,506,980 (82)[86]	255,862 (90) [86]	258,432 (94) [101]
Other fares	48,481 (30) [22]	0	0	1,238 (0)[0]	0	71 (0) [0]
Miscellaneous	18,506 (12) [8]	121,844 (13) [14]	51,991 (12) [12]	341,066 (18)[20]	27,870 (10) [10]	15,422 (6) [6]
Total	161,092 (100) [73]	927,069 (100) [105]	445,072 (100) [107]	1,849,284 (100)[106]	283,732 (100) [105]	273,925 (100) [107]
Expense						
Personnel	69,898 (43) [32]	318,480 (34) [36]	168,575 (38) [41]	742,727 (40)[43]	124,926 (44) [46]	109,504 (40) [42]
Maintenance (Repair)	37,798 (23) [17]	90,738 (10) [10]	43,435 (10) [10]	189,115 (10)[11]	29,595 (10) [11]	30,202 (11) [12]
Fuel	24,767 (15) [11]					
Others	33,155 (21) [15]	214,176 (23) [24]	73,209 (16) [18]	405,195 (22)[23]	61,321 (22) [23]	56,299 (21) [22]
Depreciation	28,406 (18) [13]	162,625 (17) [19]	57,453 (13) [14]	231,943 (13)[13]	37,783 (13) [14]	45,898 (17) [18]
Interest	25,362 (16) [12]	98,294 (11) [11]	71,531 (16) [17]	171,574 (9)[10]	17,005 (6) [6]	14,661 (5) [6]
Total	219,386 (136) [100]	884,313 (95) [100]	414,203 (93) [100]	1,740,554 (94)[100]	270,630 (95) [100]	256,564 (94) [100]
Profit	- 58,294	42,756	30,869	108,730	13,102	17,361

Sources : PJKA, "Profile of Major Private Railways" by Japan Non-Government Railways Association

Table 3.2.3.8 Railway-Related Revenues and Expenses of PJKA and JR Companies (Fiscal 1987)

Unit: Million Rp. Conversion rate 1¥ = 11.3 Rp.)

		JR Group					
	PJKA (% of total revenue) [% of total expense]	Hokkaido	East Japan	Central Japan	West Japan	Shikoku	Kyushu
Revenue							
Passengers	94,105 (58) [43]	741,394 (86) [50]	16,686,192(92)[102]	9,824,283(95)[104]	8,086,764 (91)[94]	315,136 (87) [60]	1,272,324(84)[70]
Other fares	48,481 (30) [22]	0	0	0		0	0
Miscellaneous	18,506 (12) [8]	122,784 (14) [8]	1,446,812(8)[9]	508,915(5)[5]	802,893 (9)[9]	46,684 (13) [9]	234,692(16)[13]
Total	161,092 (100) [73]	864,178 (100) [58]	18,132,804(100)[111]	10,333,198(100)[109]	8,889,657 (100)[103]	361,820 (100) [69]	1,507,016(100)[83]
Expense							
Personnel	69,898 (43) [32]	759,970 (88) [51]	5,085,310(28)[31]	1,367,370(13)[14]	3,113,623 (35)[36]	233,323 (64) [44]	883,313(59)[48]
Maintenance (Repair)	37,798 (23) [17]	300,487 (35) [20]	1,675,544(9)[10]	872,508(8)[9]	1,059,338 (12)[12]	129,698 (36) [25]	245,735(16)[13]
Fuel	24,767 (15) [11]	36,842 (4) [3]	588,253(3)[4]	394,568(4)[4]	460,768 (5)[5]	11,067 (3) [2]	85,323(6)[5]
Others	33,155 (21) [15]	179,976 (21) [12]	4,210,315(23)[26]	6,044,974(59)[64]	2,321,714 (26)[27]	56,430 (16) [11]	322,930(21)[18]
Depreciation	28,406 (18) [13]	209,035 (24) [14]	2,785,992(16)[17]	638,399(6)[7]	993,221 (11)[12]	94,165 (26) [18]	283,898(19)[18]
Interest (Note 1)	25,362 (16) [12]	12 (0) [0]	1,931,715(11)[12]	183,320(2)[2]	652,763 (8)[8]	0	881(0)[0]
Total	219,386 (136) [100]	1,486,322 (172)[100]	16,277,129(90)[100]	9,501,139(92)[100]	8,601,427 (97)[109]	524,683 (145) [100]	1,822,080(121)[100]
Profit	-58,294	-622,144	1,855,675	832,059	288,230	-162,863	-315,064

(Note 1)

$$\text{Interest payment for railway-related sector} = \text{Interest payment total} \times \frac{\text{fixed assets in railway-related sector}}{\text{total fixed assets}}$$

Source : PJKA , "JR Gazette"

Table 3.2.3.9 Business Indicators for PJKA and Major Japanese Private Railways
(Fiscal 1987)

(Conversion rate ¥ = 11.9 Rp.)

	PJKA	Tokyu	Keisei	Kintetsu	Hanshin	Nishitetsu	Average of 14 major private railways
1) No. of passengers carried (Note 1) (million persons)	50	895	245	751	218	150	513
2) Passenger-km (million passenger-km)	7,744	8,199	3,244	14,138	2,234	2,094	7,280
3) No. of personnel (persons) (Note 2)	45,059	3,659	2,247	10,750	1,553	1,157	3,907
4) Fixed asset (mil. Rp.)	795,137	1,846,059	1,349,365	4,012,954	369,102	456,282	1,659,661
5) Route length (km)	8,491	100.7	89.5	595.2	40.1	133.8	201.6
6) Average travelling distance per passenger (km) (Note 3)	155	9	13	19	10	14	14
7) 6) / 5)	0.024	0.09	0.15	0.03	0.25	0.10	0.07
8) Fare revenue per passenger per km (Rp.) (Note 4)	12	98	121	107	115	123	94
9) Revenue per employee (mil. Rp.) (Note 5)	4	253	198	172	183	237	197
10) Turnover of fixed asset (times/year) (Note 6)	0.20	0.50	0.33	0.46	0.77	0.60	0.46
11) Personnel -fixed asset ratio (mil. Rp.) (Note 7)	18	505	601	373	238	394	425
12) No. of employees per route km (persons) (Note 8)	7	36	25	18	39	9	19
13) Passenger revenue per route km (mil. Rp.) (Note 9)	14	7,996	4,392	2,532	6,381	1,931	3,403

Note1 : PJKA : excluding ferries
Note2 : Japanese private railways : railway-related sector only
Note3 : 2) / 1)
Note4 : Passenger revenue 2)
Note5 : revenue/3)
Note6 : revenue/4)
Note7 : 4) / 3)
Note8 : 3)/ 5)
Note9 : Passenger revenue /5)

Source: PJKA, "Profile of Major Private Railways " by Japan Non-Government Railways Association

Table 3.2.3.10 Business Indicators for PJKA and JR Companies (Fiscal 1987)

(Conversion rate 1¥ = 11.9 Rp.)

	PJKA	JR Group					
		Hokkaido	East Japan	Central Japan	West Japan	Shikoku	Kyushu
1) No. of passengers carried (Note 1) (million persons)	50	96	5,068	392	1,496	55	248
2) Passenger-km (million passenger-km)	7,744	3,920	104,491	41,148	45,782	1,674	7,664
3) No. of personnel (persons) (Note 2)	45,059	12,111	80,796	20,231	49,881	3,768	13,636
4) Fixed asset (mil. Rp.)	795,137	2,430,944	31,689,890	4,365,408	11,808,775	1,156,751	3,486,462
5) Route length (km)	6,491	3,193	7,573	1,984	5,208	881	2,350
6) Average travelling distance per passenger (km) (Note 3)	155	41	21	105	31	30	31
7) 6) / 5)	0.024	0.013	0.003	0.053	0.006	0.034	0.013
8) Fare revenue per passenger per km (Rp.) (Note 4)	12	189	160	239	177	188	166
9) Revenue per employee (mil. Rp.) (Note 5)	4	71	224	511	178	96	111
10) Turnover of fixed asset (times/year) (Note 6)	0.20	0.36	0.57	2.37	0.75	0.31	0.43
11) Personnel -fixed asset ratio (mil. Rp.) (Note 7)	18	201	392	216	237	307	256
12) No. of employees per route km (persons) (Note 8)	7	4	11	10	10	4	6
13) Passenger revenue per route km (mil. Rp.) (Note 9)	14	232	2,203	4,952	1,553	358	541

Note1 : PJKA : excluding ferries
Note2 : Japanese private railways : railway-related sector only
Note3 : 2) / 1)
Note4 : Passenger revenue 2)
Note5 : revenue/3)
Note6 : revenue/4)
Note7 : 4) / 3)
Note8 : 3)/ 5)
Note9 : Passenger revenue /5)

Source: PJKA, "JR Gazette"

3-3 Road Based Transportation Systems

3-3-1 Bus System

(1) Type of buses and service characteristics

There are basically three types of services in Jakarta: Bis Kota (means city bus, large bus with 50 to 85 seating capacity), Bis Mini (medium size bus with about 30 seats) and Mikrolet (small bus with about 9 seats) -- these are standard local name for the services but there are a variety of names depending on bus companies. Bis Kota have licensed routes and fixed stops. Bis Mini and Mikrolet also have licensed routes but no fixed stops.

There are over 23,000 bus fleets and 600 bus routes in Jakarta, Bogor, Tangerang and Bekasi Municipal area, and additional 4,500 buses (on 1400 routes) are operating in inter-city services based on or passing through Jakarta and Botabek region. (Table 3.3.1.1 and 3.3.1.2)

Table 3.3.1.1 Registered Bus Fleets (Routes) in JABOTABEK

Bus Size	Jakarta 1)	Bogor 2)	Tangerang 3)	Bekasi 4)
Large	2,606 (149)	973 (47)	3,124 (21)	18 (5)
Medium	3,869 (105)	177 (10)	184 (16)	31 (4)
Small	7,792 (120)	4,882 (45)	3,101 (79)	- (-)
Total	14,267 (373)	6,032 (102)	3,409 (116)	49 (9)

Note: Figures in bracket are number of bus routes.

Source: 1) Dinas LLAJR, DKI Jakarta, 1988
2) Dinas LLAJR, Bogor, December 1988
3) Dinas LLAJR, Tangerang January 1989
4) Dinas LLAJR, Bekasi, October 1988

Table 3.3.1.2 Inter-City Bus Operators in JABOTABEK

Registration Site	Operators	Fleet Size	Number of Routes
Within Jakarta	State Enterprise 1) (Perum Damri)	1226	1109
	Private Companies 2)	1088	307
Outside Jakarta	Private Companies 3)	2142	(figure not available)

Note: 1) Figures include Damri's city bus services in Medan, Surabaya, Semarang and Bandung.
(Source: Perum Damri) February 1989.

2) Registered in LLAJR, DJPD which include services outside JABOTABEK.
(Source: LLAJR, DJPD) February 1987.

3) Figure includes buses registered outside Jakarta but part of their operations take place within Jakarta.
(Source: Dinas LLAJR, DKI Jakarta) November 1988.

Most of the buses charge flat fare of Rp. 200 (in 1989) with student discount of 50%. (Table 3.3.1.3). There are no fixed schedule therefore the bus passengers learn only by experience how frequent the particular buses on particular route is running in a given time of the day.

Regardless of its year-round hot climate, air conditioned buses are limited. In January 1989, there are 30 air conditioned fleets registered in Jakarta, which is about 0.3% of total bus fleets. The service name is called 'Patas AC' and is an express service between major bus terminals within the metropolitan area. This service charges Rp. 750 which is 3.75 times more expensive than ordinary buses with targeted passengers of medium to high income earners. Fleets of Patas AC is usually newer than ordinally buses (average 7 to 8 years) and fitted with reclining seats.

An average running speed of large buses throughout the city throughout the day is about 21 km/h but the cruising speed in the main street during peak hours drops bellow 5 km/h. Table 3.3.1.4 shows the declining bus speed in Jakarta between 1982 - 1989. City buses passing through central area decreased their speed from 23.2 km/h to 20.0 km/h (about 14% slower). It is suspected that the peak hour running speed of buses declined in a higher degree.

Table 3.3.1.3 Characteristics of Fixed Route Bus Services in Jakarta, 1988

Service name	Vehicle Type	Typical Setting Capacity	Total Capacity 1)	Bus Stop	Schedule	Fare		Student Discount
						System	Amount	
Bis Kota	Large Bus:							
	Double Decker	85	120	Fixed	Not Exist	Flat	Rp 200	50%
	Single Deck	50	90	Fixed	Not Exist	Flat	Rp 200	50%
Bis Patas	Large Bus:							
	Standard Express	50	90	Fixed	Not Exist	Flat	Rp 350	-
	+ Air Condition	50	90	Fixed	Exist 2)	Flat	Rp 750	-
Bis Mini	Medium Bus	30	45	Not Fixed	Not Exist	Flat	Rp 200	50%
Mikrolet	Small Bus	9	15	Not Fixed	Not Exist	Flat 3)	Rp 200	50%

Note: 1) Total capacity includes standing passengers as well.
2) Schedule exists but the operator claims the difficulty of keeping up due to various reasons such as traffic congestion and crew failure.
3) It can be negociated.

Table 3.3.1.4 Change of PPD Bus Speeds in Jakarta, 1982 - 1989

(km/h)

Year	No. Route	All Buses		Without Express	
		DKI	Central	DKI	Central
1982	52	23.7	23.4	23.7	23.2
1989	86	22.1	21.1	21.2	20.0

Source: Study team's analysis on bus route (length, time) data provided by PPD.

City buses are suffering not only from the deteriorating traffic congestion but also from inefficient supply of bus capacity parcitularly during the peak hours. Bus-passenger counting survey conducted by the study team on major corridor connecting Jakarta and BOTABEK recorded a high level of loading factors on inbound buses on those corridors. Table 3.3.1.5 shows the hourly fluctuation of loading factors in Daan Magot, Gaja Mada, Sudirman and Srengseng Sawah. Buses on most of the streets recorded more than 100% of loading factor or close to its full seating capacities. Daan Magot in the hour of 8:00 a.m. showed its highest 156.7% but it is reported by the surveyors that many of the buses passed fully occupied without stopping because of their inability to pick up extra passengers.

(2) Bus routes and service area

Three types of bus services in Jakarta are supposed to perform complementary functions; large buses as line haul carrier on major corridors converging into city center; medium bus as shorter distance carrier on collector roads and circumferential demand of bus trips; and small buses at the fringe of DKI Jakarta by catering for sparsely developed suburban and rural area. (cf. Fig. 3.3.1.1, 3.3.1.2 and 3.3.1.3)

Table 3.3.1.5 Load Factors of Inbound Buses in Daan Mogot, Gaja Mada, Sudirman and Srengseng Sawah

	Hours Starting	Daan Mogot	Gaja Mada	Sudirman	Srengseng Sawah
Morning peak start	6 :00	21.2	87.4	123.3	91.6
	7 :00	98.3	107.4	108.7	93.4
	8 :00	156.7	108.3	92.9	88.2
Morning peak end	9 :00	94.8	88.3	95.5	68.0
	10 :00	113.0	97.9	81.8	85.4
	11 :00	125.8	89.4	79.4	70.8
	12 :00	149.3	94.5	86.2	88.4
	13 :00	140.7	93.0	69.7	73.8
	14 :00	63.7	84.9	85.2	69.3
Afternoon peak start	15 :00	94.5	73.4	77.6	73.2
	16 :00	96.0	90.9	100.5	103.2
	17 :00	150.0	75.5	102.4	56.4
Afternoon peak end	18 :00	106.6	80.9	93.6	59.3
	19 :00	67.6	75.7	72.6	120.0
	20 :00	-	51.3	66.1	12.0
	21 :00	94.0	54.3	44.1	-
AVERAGE		98.5	88.7	89.5	82.5

Note: Single deck large buses only. Seating capacity of 50 is assumed.
Source: Bus passenger count by study team, December 1988.

The policy of differenciating functions of the three types of bus services is well conceived but difficult to put it into effect. The licensing agency (Dinas LLAJR) is not well equipped with implementing the above policy. As a result they regret that the overlapping routes frequently occur and create unnecessary competition among bus drivers. Table 3.3.1.6 is constructed based on the three bus network figures shown in the above three figures. It shows minimum of 32% and maximum of 62% among three types of services overlap. PPD alone claims that 17 routes out of 85 routes (in 1988) overlapped completely (i.e. 100%) with the routes provided by other private bus companies. Certain degree of competition may be required but the licensing process clearly demands a more systematic approach.

Table 3.3.1.6 Degree of Network Overlap Among Bus Categories

Bus Type	Service Name	Network Length 1)	Overlap with the Network of ... Large Bus	Medium Bus	Small Bus
Large Bus	Bis Kota Patas	339 km	-	62%	32%
Medium Bus	Metro Mini Kopaja	459 km	46%	-	37%
Small Bus	Mikrolet A.P.K.	312 km	35%	54%	-

Note: Measurement is made by first constructing networks for each category of buses by ignoring the route overlap within the same category. Then, their lengths are measured on photo-reduced map scaled to about 1: 1,200,000 to sum up the total length.

(3) Bus related facilities

Buses in Jakarta usually operate between major bus terminals. There are 14 bus terminals in Jakarta -- 11 city terminals and 3 inter-city terminals (Cililitan, Pulo Gadung and Kali Deres).

Number of buses and routes operate in these terminals along with the number of bus users carried by these services are shown in Table 3.3.1.7. BOTABEK municipalities also have bus terminals inside the city centers or at the fringe of the cities.

Fixed furniture at bus stops are called 'bus shelters' in Jakarta, which is operated and maintained by Dinas LLAJR but planned by Bappeda, DKI and constructed by Dinas PU. Other bus related facilities and their responsible agencies are shown in Table 3.3.1.8.

Bus lanes do not exist in Jakarta as of April 1989, but total of 84.8 kilometers along major bus corridors are proposed by JUTP study and now under a detailed designing stage. Location of planned bus lanes are shown in Section 3.3.2.

(4) Institutional aspects

Bus Operators and Operation Practice

There are 8 bus operating units in Jakarta: 1 state enterprise; 4 private companies; 1 cooperatives; 2 associations (Table 3.3.1.9). Perum PPD and PT. Mayasari Bakti operates large buses. Some of their services are express services called PATAS. PT. Metro Mini and Kopaja operate medium size buses and the rest small buses.

Most of the private operating units except PT. Mayasari Bakti are owned by a number of individuals. Each individual owns one to several vehicles that are often rented other individual drivers who pay the owners a fixed amount of money at the end of the day. The driver employs the conductor and pays for fuel out of the fares collected. This is practiced by most of the bus operating units including the state owned PPD. This system provides the vehicle owners an assured turnover per vehicle but it puts the drivers in a highly competitive situation to pick up extra passengers thus degrading the driving moral and unnecessary long waiting at the bus terminals. The practice which is not always welcomed by bus passengers.

Bus operation as a business is profitable for most of the private companies but not so for the PPD. The state owned company is projected to lose 1.8 billion Rupiah in the fiscal year 1989 (POS KOTA, 27 Februari, 89); the revenue account for only 50% of the direct cost of operating buses.

Their relative inefficiency may be illustrated by calculating some efficiency indices as shown in Table 3.3.1.10. PPD hold 12.9 personnel (including crews) per bus operating while the equivalent figures are well below (4 to 7) for the private companies. PPD, however, is in the process of improving the organizational efficiency, and the efficiency indices from 1985 to 1986 are improving as it is shown in the table.

Related Agencies - Dinas LLAJR

Dinas LLAJR (Traffic and Highway Transportation Department) DKI-Jakarta is responsible for regulating the city bus operation. Their major functions are, among many others:

- to issue licenses to city buses, inter city buses (taxis and Bajaj as well).
- to advise and approve bus routes (new introduction and modification of existing bus routes).
- to inspect registered buses (trucks and taxies as well).
- to provice training to public transportation drivers.
- to operate and maintain bus terminals and shelters.
- to plan for bus lanes and other bus priority measures.

The division responsible for issuing of route license is currently overloaded and introduction of efficient and rational route allocation system with better performance monitoring method is needed.