

Improvement of Railway System in Jakarta Metropolitan Area

Tomoyoshi Hata

Introduction

Jakarta is the capital of the Republic of Indonesia but the socio-economic area is no longer limited to just Jakarta, and has grown to include the surrounding suburbs of Bogor, Tangerang and Bekasi, or 'Jabotabek' (a nickname derived from the first two letters of each place).

This area already had some railways dating from the 1910s when Indonesia was still a Dutch colony. The network remaining after WWII was mostly used

for long-distance train operations and little priority was given to further improvement due to the rapid growth of motor vehicle ownership seen in Jakarta like in other cities worldwide.

The early 1970s saw the gradual appearance of transport problems resulting from the government's long-term underinvestment in railways. The increasing pace of urbanization during the 1980s exacerbated the problems, causing serious road congestion and severe air pollution from vehicle exhaust emissions.

The government soon realized the need for a comprehensive railway system in Jabotabek, and decided in 1982 to build a modern commuter railway system that would fully integrate the existing network. The following 20 years have seen huge improvements, such as double-tracking, electrification, grade separation, improved signalling, better and more stations, new rolling stock, improved carriage depots and a workshop, etc., financed by the Indonesian government with overseas development aid from Japan and France.

Today, the railway in Jabotabek plays an important role in local transport, carrying more than 400,000 commuters each day with further development towards building a comprehensive railway system still in progress. This article outlines the improvement programme for the Jabotabek railway system, its progress, and the current conditions.

Area and population

Jabotabek consists of four local municipalities surrounding the city of Jakarta; the total area is about 6580 km² (Fig. 1). The population in 2000 is estimated to be about 21 million, consisting of 8.4 million in Jakarta and 12.6 million in Bogor, Tangerang and Bekasi (nicknamed Botabek). In the 1960s and 1970s, Jakarta experienced a remarkable annual population growth of 4% to 5%, but this high rate fell to 0.2% per annum between 1990 and 2000. On the other hand, Botabek has maintained a population growth rate of between 4.0% and 5.6% for the last 3 decades (1971–2000) and Tangerang and Bekasi (eastern and western sides) were even higher at 7.1% and 7.4%, respectively, from 1980 to 1990.

As a result, Jakarta's share of the total Jabotabek population has declined from 54.9% in 1971 to 39.9% in 2000, while the shares of Tangerang and Bekasi have increased from 12.8% to 19.6%, and

Figure 1 Location of Jabotabek Area



Table 1 Population of Jabotabek Area (1961–2000)

	1961			1971			1980			1990			2000				
	Population (1000)	Share (%)	Annual growth (%)	Population (1000)	Share (%)	Annual growth (%)	Population (1000)	Share (%)	Annual growth (%)	Population (1000)	Share (%)	Annual growth (%)	Population (1000)	Share (%)	Annual growth (%)	Area (km ²)	Density (person/km ²)
DKI Jakarta	2,973	49.7	-	4,579	54.9	4.9	6,503	54.6	4.2	8,210	48.4	2.4	8,364	39.9	0.2	655.7	12,756
Bogor	1,468	24.5	-	1,863	22.3	2.4	2,741	23.0	4.7	3,949	23.3	4.0	5,300	25.3	3.1	3,380.7	1,568
Tangerang	850	14.2	-	1,067	12.8	2.3	1,529	12.8	4.3	2,724	16.1	7.1	4,100	19.6	4.6	1,259.8	3,254
Bekasi	693	11.6	-	831	10.0	1.8	1,143	9.6	3.8	2,073	12.2	7.4	3,200	15.3	4.9	1,284.2	2,492
Botabek	3,011	50.3	-	3,761	45.1	2.3	5,413	45.4	4.4	8,746	51.6	5.6	12,600	60.1	4.0	5,924.7	2,127
Jabotabek	5,984	100	-	8,340	100	3.6	11,916	100	4.3	16,956	100	3.8	20,964	100	2.1	6,580.4	3,186
Indonesia	-	-	-	119,208	-	-	147,490	-	2.4	179,379	-	2.0	205,843	-	1.3	1890.8*	109

* x1000

Source: Statistics Indonesia

from 10.0% to 15.3%, respectively, during the same period (Table 1).

Economic growth

The annual growth in Indonesia's GDP (1993 constant prices) averaged 2.4% between 1995 and 2000 while annual per capita growth in GDP averaged about 1.1%. However, the figures would have been even higher discounting the massive double-figure drops in 1998 resulting from the 1997 Asian Financial Crisis (AFC).

Meanwhile, Jakarta's annual growth in GDP between 1995 and 2000 averaged about 1.6%, or 0.8% lower than the national average, reflecting the more serious impact of the AFC in the capital region. Jakarta's annual per capita growth in GDP averaged 2.8%, somewhat higher than the national average despite the negative impact of the AFC. As a result, in 2000, per capita GDP in Jakarta was IDR7.095 million (US\$1 = IDR10,000), or about 3.7 times the national average of IDR1.933 million.

Land use

The Jabotabek Metropolitan Development Plan (JMDP) was developed in the 1980s based on predictions that Jakarta would expand its administrative boundary outward and that the surrounding areas of Bogor, Tangerang and Bekasi would become part of urban Jakarta. The plan has three main points outlined below:

- Dispersion of population and urban activities to avoid centralization in Jakarta
- Restriction of development in the southern water catchment, especially around Bogor
- Promotion of development in Bekasi and Tangerang on the eastern and western sides

However, the JMDP underestimated the actual urban growth, necessitating a review. An updated plan was published as the Jabotabek Metropolitan Development Plan Review (JMDPR) in 1993. This revised plan called for large-scale housing and industrial estates, city development, etc., in the Jabotabek area but some recent developments have exceeded even the proposed JMDPR.

Road network

Jakarta's road network was mainly constructed in the 1960s. It is in the form of a ring road with other arterial roads radiating out. Some six-lane (or wider) arterial roads are connected directly by narrow local roads, but there are no collector roads between the arterial roads and local roads. Furthermore, although the road network is well developed in the north-south axis, the east-west axis is discontinuous. In this respect, the Jakarta road network is poorly organized. Construction of new arterial roads in Jakarta has been very limited during the

last 15 years due to difficulties caused by progressive urbanization. As a result, the emphasis on road development in Jakarta is shifting towards construction of overhead structures with the aim of improving interconnections.

The Botabek road network consists only of radial arterial roads and an expressway connecting Jakarta and other regions. Although a few new roads and flyovers have been built, the level of road development in Botabek is much lower than in Jakarta (Fig. 2).

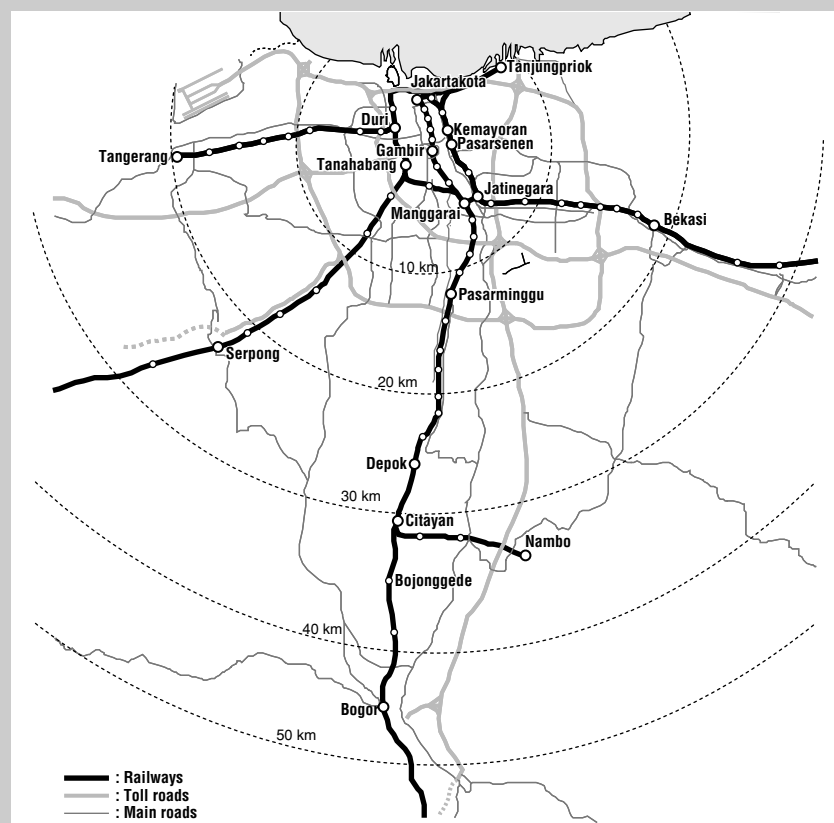
Buses

Four kinds of buses operate in Jabotabek: large (about 50 seats), medium (about 25 seats), small and public vehicles called Mobil Penumpang Umum (MPU). The larger buses are managed by the local government or private companies but most small buses are owned by small entrepreneurs.

Many buses are operated under a lease system in which the driver rents the bus from the operator and the revenue from operations is shared between the operator and driver.

Jakarta has a total of 517 bus routes, consisting of 279 routes for large buses, 105 for medium buses and 133 for small buses. The present bus services face many problems, such as low fleet availability, low service quality, complex schedules, frequent traffic violations, ignoring of schedules to ensure fully-loaded operations, etc. However, buses

Figure 2 Network of Railways and Roads in Jabotabek Area



year between 1993 and 2001. The annual growth rate of passenger cars and motorcycles was very high at 10.4% and 12.4%, respectively, and Jakarta now has almost half of all Indonesia's registered passenger cars and buses (Table 2).

Improvement of Jabotabek Railway System

Background

Jakarta's population increased rapidly in the 1970s in line with development of housing complexes and industrial estates, etc., resulting in worsening traffic congestion and air pollution and more traffic accidents. In addition, it was estimated that twice as many people would be using some form of transport within 20 years. From the viewpoints of road capacity, road construction cost, air pollution, energy conservation and losses caused by traffic accidents, further road development seemed an unlikely solution to the ever-increasing traffic volumes. As a result, there was clearly a need to develop a railway system in the Jabotabek area to solve the problems caused by over-dependence on road transport. The government started railway improvements in Jabotabek in 1976 with the implementation of the Jakarta Metropolitan Transportation (JMT) Intermediate Programme. The programme had very near targets so its contents were limited only to immediately required measures and did not include any major improvement works. Part of the JMT programme included introduction of rolling stock (electric and diesel railcars) and railway ridership increased steadily year-on-year. As a result of this favourable growth in railway usage, the government decided to implement full-scale improvements to the railway system in Jabotabek with the aim of establishing a modern mass transit system while utilizing the existing railway network. This Jabotabek Railway Project was formulated based on the 1981 Master Plan.

Table 2 Annual Growth of Vehicles in Indonesia and Jakarta (1993–2001)

		(%)								
	Vehicle	1994	1995	1996	1997	1998	1999	2000	2001	1993–2001
Jakarta	Passenger cars	22.0	12.8	13.8	13.2	1.1	1.6	10.0	8.7	10.4
	Buses	29.5	5.8	0.2	0.3	0.1	0.0	0.0	0.2	4.5
	Trucks	28.3	9.2	7.6	10.5	-0.3	0.2	4.4	4.8	8.1
	Motorcycles	35.7	14.6	15.2	15.8	1.1	0.7	5.8	10.6	12.4
	Growth	30.1	12.5	12.5	13.1	0.9	0.8	6.4	8.7	10.6
	Share	22.5	22.9	23.4	23.2	22.0	21.5	21.9	21.3	
Indonesia	Passenger cars	11.2	11.5	14.3	9.6	5.0	4.5	4.9	6.8	8.5
	Buses	14.6	5.7	-13.5	2.7	2.7	2.7	3.4	4.1	2.8
	Trucks	7.9	6.7	7.4	7.9	2.9	2.3	4.8	4.8	5.6
	Motorcycles	10.6	11.6	11.2	16.3	7.8	3.2	3.9	14.0	9.8
	Growth	10.6	10.7	10.0	13.8	6.7	3.3	4.1	11.7	8.9
	Share	100	100	100	100	100	100	100	100	

Source: Statistics Indonesia

do play an important role in people's daily lives and have about a 50% share of road transport in Jabotabek.

Number of vehicles

The total number of registered passenger cars, buses, trucks and motorcycles in Jakarta grew by about 10.6% year-on-



Various rolling stock by different manufactures for Jabotabek railways. From top left to right, rheostat type from Japan, VVVF type from Europe, VVVF type from Japan, used rheostat type from Japan and VVVF type manufactured in Indonesia. (Author)

Contents of 1981 Master Plan

As mentioned above, prior to the 1981 Master Plan, the JMP Intermediate Programme had implemented some slight improvements to the Jabotabek railway system but the railway facilities were still far behind those required by a modern commuter railway in terms of punctuality, frequency and safety (Table 3).

Many facilities in every field ranging from tracks, stations, electrification, signalling and telecommunications, to rolling stock, workshops, carriage depots, etc., all needed major renovations. To meet these needs, the 1981 Master Plan on how to improve the existing Jabotabek railway system was drawn up with technical assistance from the Japanese government. The plan clarified components required for improvement, such as double-tracking, station renovation, electrification, automatic signalling, grade separation, additional new rolling stock, improved workshops and depots, construction of new lines etc., with a targeted completion date of 2000.

Table 3 Conditions of Railways at Master Plan

Track	<ul style="list-style-type: none"> Many illegal squatters on the right of way Worn track Poor drainage Insufficient of level crossing facilities such as alarms and barriers
Stations, platform	<ul style="list-style-type: none"> Low height and narrow width Short clearance from track centre to platform No shelter on platforms at many stations Low height of passageway between platforms and station building Very limited plaza space at many stations
Electrical facilities	<ul style="list-style-type: none"> Worn facilities
Signal/telecommunication system	<ul style="list-style-type: none"> Low safety of blocking system because of out of date tokenless type or telecommunication type Worn signal equipment Worn interlocking device Worn turnout switching
Workshops/car depots and rolling stock	<ul style="list-style-type: none"> Shortage of rolling stock storage capacity at depot Shortage of inspection/repairing equipment at workshop and depot Low efficiency and availability of existing facilities because of remarkably deteriorated quality Prolonged maintenance period of rolling stock at workshop
Train operation	<ul style="list-style-type: none"> Low track capacity due to single track with long distance between stations and because of tokenless block system Low safety of train operation Turn-back train operation

Source: *Urban/Suburban Railway Transportation in Jabotabek*, JICA, 1981.

Furthermore, the project components were divided into the following three priority phases to ensure smooth and efficient implementation.

- Phase 1: Rehabilitation and improvement of existing facilities, including rehabilitation of track, improvement of carriage depots and



Very crowded passengers on commuter train

(Author)



Operations control centre for Jabotabek railway system

(Author)

workshops, improvement of level crossings, additional rolling stock, etc., to restore their functions and development of urgently required minimum railway facilities to normalize railway operations with targeted completion by 1987

- Phase 2: Improvement and development of facilities including double tracking, electrification, automatic signalling, grade separation, station renovation, additional rolling stock, etc., to strengthen transport capacity in both quantity and quality ensuring full commuter performance of Jabotabek railway network and to cope with rapid increases in future traffic demand with targeted completion by 1991
- Phase 3: Expansion of existing railway network, including construction of new stations and lines, expansion of carriage depots and workshops, additional rolling stock, etc., to meet newly generated demand with target completion by 2000

The 1981 Master Plan was authorized by presidential decree in 1982 and 1983 and then full-scale implementation was started as a national project to establish a

‘Modernized Commuter Railway System’ in the Jabotabek area with frequent, safer and more reliable train operations achieved mainly by improving existing railway facilities. The final objective at project completion was to achieve a railway market share for all transport modes in Jabotabek of about 20%.

Project implementation

At the beginning phase, the project progressed based on the formulated master plan in parallel with a feasibility study and the detailed design of each component. In the later phases, the project needed to be modified to: 1. respond to the changing circumstances, including early reinforcement of transport capacity to cope with rapidly worsening traffic congestion in Jakarta with minimum investment due to Indonesia’s tightened budget situation; 2. halve the implementation period based on the opinion that the original 20-year plan was too long.

To cope with the above requirements, the master plan was reviewed from the viewpoint of project efficiency. The first priority was given to project components leading directly to improving the function of the railway system or strengthening the transport capacity. This was similar to the basic concept of the master plan, but

the project target became the possibility of train operation during morning peak hours instead of progress with physical completion of the master plan. In other words, the target became completion to the point that would allow morning rush-hour operation at headways of 6 to 10 minutes by 1992. However, delays in the project implementation, as well as uncertainties over secured funding, inevitably forced a downgrading of headway targets to 12 to 20 minutes.

As a result, the project targets were revised once again to achieve three stages of headways during morning rush hours (12 to 20 minutes, 6 to 10 minutes and 3 to 6 minutes).

The first stage providing headways of 12 to 20 minutes was only regarded as a provisional arrangement because such long intervals between trains are inadequate for efficient commuter services but ended up being adopted due to the above-mentioned problems. The second stage providing headways of 6 to 10 minutes is sufficient for high-frequency commuter services and the third stage with headways of 3 to 6 minutes is anticipated when the railway achieves a market share of around 20%. A share of 20% is the maximum that can be expected until the network is

extended. The first stage was achieved in 1999 and there has been a gradual improvement in headways, which are now around 8 to 15 minutes. Achievement of the shorter headways envisaged in stages 2 and 3 has mostly been shelved for the time being due to funding problems and the need to completely review the 1981 Master Plan because present circumstances are very different from what was imagined 20 years ago.

Organization of project implementation

When the presidential decree was issued, the government organized a Steering Committee chaired by the Minister of Communications with members drawn from the relevant central and local government authorities to coordinate and consult on various issues extending over different government institutions.

In addition, a special project office was established in 1982 with responsibility for implementing and managing the project. Most of the projects have been tendered and contracted via this office.

Project effect

Although the project is still in progress towards the final target, there have been a number of interim effects.

The main effect has been a rapid increase in passenger volumes in parallel with the increase in the number of trains made possible by double-tracking, improved signalling and station facilities, larger fleet of EMUs, etc. In the last 10 years, the number of Jabotabek commuter trains (including commuter trains operating beyond the Jabotabek area) increased by 260% from 137 trains per day in 1992 to 356 trains in 2001. Meanwhile, the increase in daily passenger volumes from 130,000 passengers per day in 1992 to 410,000 in 2001 (+320%) exceeded the 260% increase in the number of trains. This is the result of both more trains and

transfer of potential demand (Fig. 3) from other modes to the railway due to its merits of speed, safety, economy, comfort, etc.

In addition, the effects can be seen in other regions, such as shorter travel times, reduced delays, better convenience and comfort, better train safety, greater possibility for expanding customer base through track-side housing developments, etc.

Future related programmes

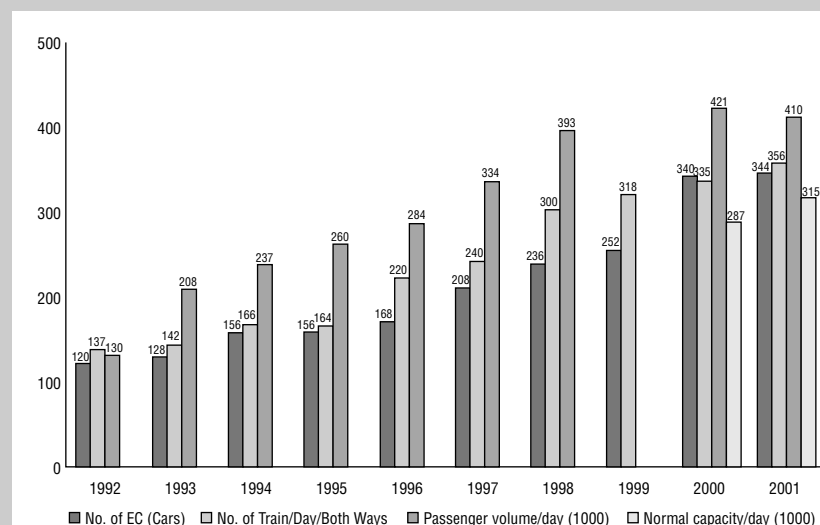
Since road traffic in Jabotabek is suffering from increasingly worse congestion, the area urgently requires a rapid mass transit system. Although the second and third stages of the 1981 Master Plan are suspended, there are some other projects that are directly or indirectly related to the Jabotabek railway system.

The first project, which is at the tendering stage, is to construct a new carriage yard and maintenance depot for EMUs. A second project, which is at the design stage, aims to separate commuter and

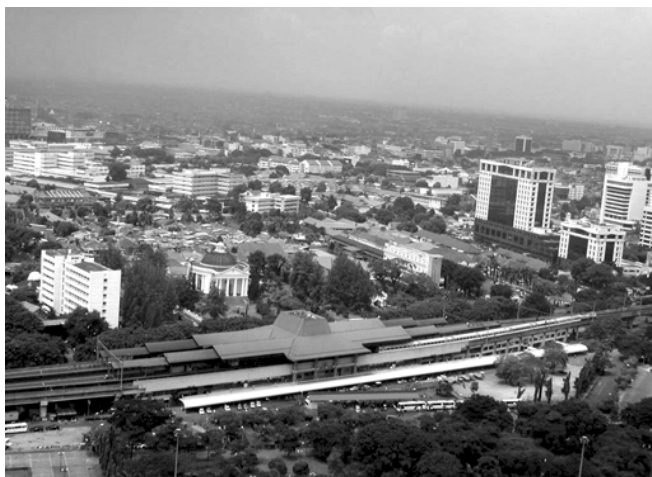
intercity trains that are now running over the same tracks. Part of this project aims to achieve the headways of 6 to 10 minutes of the second stage of the 1981 Master Plan. A third project, which is still in the financing stage, aims to procure additional EMUs using German development aid. This is directly related to the Jabotabek network where all operations use EMUs. A fourth project, which is at the design stage, aims to construct a new mass transit railway through a main north-south corridor in the centre of Jakarta. This new line will intersect the Jabotabek railway system at one location.

Furthermore, the Integrated Transportation Master Plan for Jabotabek (SITRAMP), which aims to establish a comprehensive road and railway system to alleviate land transport problems in Jabotabek, is now being implemented based on technical assistance from the Japanese government. The study has two phases: Phase I finished in 2002, and Phase II will finish in early 2004.

Figure 3 Increase in Daily Numbers of Trains and Passenger Volumes (1992–2001)

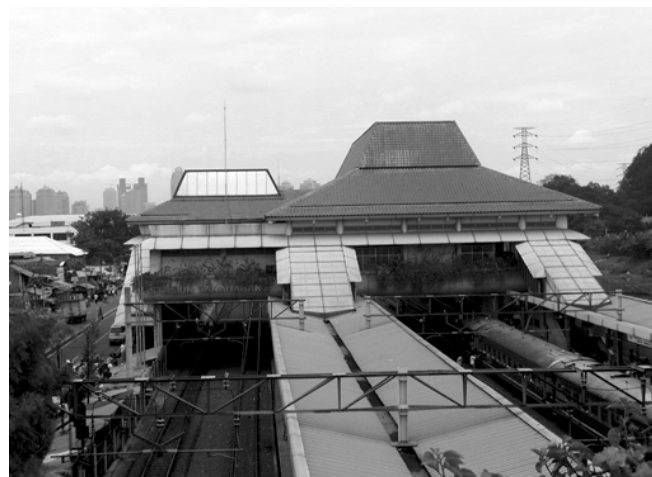


Note: Including trains being operated beyond the Jabotabek area, but excluding long/middle distance trains.



Gambir Station on elevated track

(Author)



Tanahabang station building

(Author)

Present Jabotabek Railways

Network, facilities and rolling stock

Since improvements to the Jabotabek railways have been implemented using the existing network, the total length is still 170.2 km. Most sections are now double-tracked and electrified to 1500 Vdc (Table 4).

Automated electronic block signalling is used on all lines except the Tanjungpriok Line. Furthermore, although the entire Jabotabek area has centralized traffic

control (CTC) and centralized traffic supervising (CTS) systems, neither is fully operational due to lack of operational preparations.

Facilities such as station buildings, platforms, track layouts, etc., have been improved but some stations still have low, narrow and short platforms. Moreover, passenger safety facilities are poor even though passengers have to cross many tracks in a station yard. Moreover, station fences are either broken down, missing or never installed so passengers and the general public have unfettered access to dangerous tracks and yards. EMUs form

the bulk of the rolling stock (352 carriages) but there are a few DMUs. Both DC and AC traction motors are used by the five kinds from various foreign builders. Some executive trains with air conditioning saw previous service on Tokyo's subways.

March 2003 saw the addition of two sets of eight-car EMUs manufactured by PT Inka, the state-owned carriage manufacturer although main components are imported. The sets are operated under a lease system but this is a first step in developing a domestic carriage building industry.

Table 4 Present Jabotabek Railways

	Length (km)	Double track	Single track	Electrified	Non- electrified
Central Line (Jakarta–Manggarai)	9.7	○		○	
Bogor Line (Manggarai–Bogor)	44.9	○		○	
Bekasi Line (Jatinegara–Bekasi)	14.6	○		○	
Eastern Line (Jakarta–Jatinegara) (via Pasarsenen)	11.4	○		○	
Western Line (Jakarta–Jatinegara) (via Tanahabang)	15.6	○		○	
Serpong Line (Tanahabang–Serpong)	23.2		○	○	
Tangerang Line (Duri–Tangerang)	19.3	○	○	○	
Tanjungpriok Line (Jakarta–Tanjungpriok) (Tanjungpriok–Kemayoran)	9.0 9.5	○		○ ○	
Nambo Line (Citayam–Nambo)	13.0		○		○
Total	170.2				

Management

At present, railways in Jabotabek and Indonesia as a whole have separate management of infrastructure and operations. The infrastructure other than station buildings and other offices is owned and maintained by the government as the railway operator, while train operations are managed by PT Keretaapi Indonesia (PT KAI), which owns and maintains the rolling stock and also maintains the infrastructure under commission from the government.

Furthermore, two different organizations are involved in Jabotabek railway operations. Jabotabek Division, which

was established in April 1999 solely to focus on commuter business, operates and manages Jabotabek commuter trains exclusively. Daop 1 Jakarta operates and manages long/middle-distance intercity trains.

Having two organizations managing different kinds of trains over the same tracks has caused some difficulties, resulting in the future management separation of Jabotabek railways from PT KAI.

Train operations

Both intercity and commuter trains operate over the same tracks. Most intercity trains run eastward along the Central, Eastern, Western and Bekasi lines

terminating at Jakartakota, Gambir, Pasarsenen, Tanahabang and Tanjungpriok. There are also a few westward intercity trains along the Western and Serpong lines terminating at Tanahabang or Jakartakota. Intercity services have two passenger classes—economy and commercial. Commercial-only trains are also divided into executive and business classes.

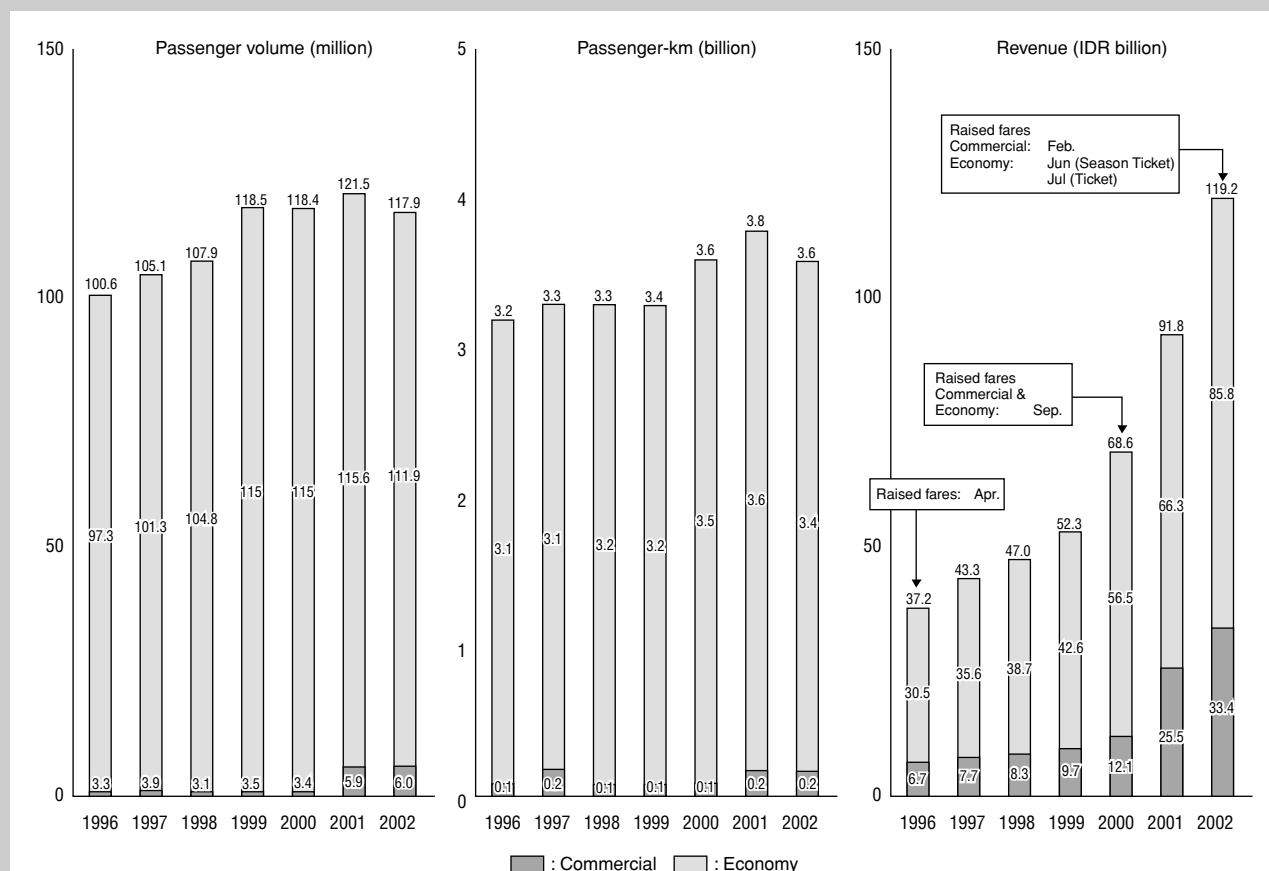
Commuter trains with economy, business and executive classes mainly operate as suburban services between suburban residential areas and the centre of Jakarta. Economy-class only train stops at every station, while executive- and business-class only trains run directly between the

origin and destination terminus stations. However, to provide better services to more passengers, some executive-class only trains stop at some intermediate stations.

Northbound trains for Jakartakota run through Bogor, Bonjonggede and Depok and then on the Central Line. Some trains take a detour on the Western Line through Manggarai. Trains from the east bound for Tanahabang and Jakartakota run through Bekasi and then on the Central, Eastern or Western lines.

In addition, trains hauled by diesel locomotive or diesel railcars operating between Jakarta City and cities to the east and west beyond the Jabotabek area run

Figure 4 Annual Passenger Volumes and Revenues of Jabotabek Railways (1996–2002)



over the same tracks (Bekasi, Eastern, Western and Serpong lines).

And there are also freight trains hauling containers, coals, steel, etc., on the Western, Eastern, Bekasi and Tanjungpriok lines.

In 2002, 471 trains ran each day in both directions in Jabotabek. They consisted of 272 Jabotabek commuter trains, 123 intercity trains, 48 trains to cities east and west beyond the Jabotabek area and 28 freight trains.

Jabotabek railways passenger volumes and revenue

In 2002, Jabotabek railways carried about 117.9 million passengers covering 3594 million passenger-km. Although this was a slight decrease compared to 2001 more journeys were made using executive-class only class trains due in part to the greater frequency of these services. Although Jabotabek railways account for only 3.7% of Indonesia's total railway network (4564 km in operation), they carried about 67% of total passenger numbers and 22% of passenger-km.

The passenger density of Jabotabek railways in 2002 was about 58,000 passengers/day/km, or about six times the figure for Indonesia as a whole (9900 passengers/day/km).

Jabotabek railway revenues totalled IDR119 billion in 2002, an increase of about 30% over 2001. Revenue from commercial-class only trains increased by about 3.1% for the reasons mentioned above. Jabotabek railways' share of PT KAI's total revenue was about 8.5% in 2002 (Fig. 4).

Fares and ticketing system

Fares for economy-class only trains are decided by the government while fares for commercial-class only trains (executive and business class) are set by PT KAI and only have to be reported to the government. The Jabotabek area is divided into six colour-coded fare zones.

Fares for economy trains were increased in July 2002 and February 2003; the minimum fare on a Jabotabek commuter train is IDR1000 for travel within one zone, increasing by IDR500 for each extra fare zone crossed up to a maximum of IDR2500.

There are also 1-month season tickets for economy trains with an average discount of about 34% but the sales period is limited to the first 4 days of each month. Fares for executive-class only trains were increased in February 2002, varying from a minimum of IDR3500 to a maximum of IDR8500. Season tickets offer a discount of 20% to 25%.

Flat-rate fares for buses, another important means of public transport in Jabotabek, were raised by an average of 20% in April 2003 ranging from IDR1100 to IDR1400. Since bus passengers usually have to change buses two or three times to reach their destination, buses are often more expensive than trains.

In addition to adopting fare zones for Jabotabek railways, the tickets themselves have been redesigned to prevent ticket fraud and facilitate easier ticket inspection. Although the new tickets are larger with a simple print layout and are colour-coded to match fare zones, there is still a great deal of ticket fraud and fare evasion on railways in Jabotabek.

Others

Recently, two women-only cars have been included in every eight-car economy train during the morning and evening rush hours to prevent sexual harassment. Furthermore, free parking

lots have been established on unused station land to increase convenience and railway demand.

The problem of riding on the carriage roof remains a major problem and a number of countermeasures have been tried, such as covering the roof with barbed wire, coating with oil, spraying dye on passengers on the roof, removing rain gutters from carriages. However, no completely satisfactory solution has been found yet.

Conclusion

The railway system in Jabotabek has seen remarkable developments in the last 10 years and Jabotabek railways have become an indispensable means of transport for Jakarta's commuters. However, there are still many problems requiring solutions. In addition, demand is expected to increase rapidly in the future, necessitating further strengthening of the system as soon as possible. ■

Further Reading

Statistical Year Book of Indonesia, 1996–2001.

Urban/Suburban Railway Transportation in Jabotabek, JICA, 1981.

Study on Integrated Transportation Master Plan in Jabotabek (Phase 1), JICA, 2002.



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Mr Hata is a consultant for Japan Railway Technical Service. He joined JNR in 1968 after graduating in civil engineering from Waseda University. He was posted to Indonesia as a JICA consultant while working for JR East, and continues to work on the Jabotabek railway project in Indonesia since retiring in 1997.