Chapter 4 Analyses on Present Railway Facility and Operation

4.1 Present Condition of Railway System in Central Java Region

4.1.1 Railway Infrastructure

(1) Railway Network

The network layout is shown in the map below consists of the following segments:

- North Line (Jakarta - Semarang - Surabaya)
- South Line (Bandung - Yogyakarta - Surabaya)
- Kroya - Cirebon Line
- Solo - Gundih - Semarang Line
- Solo - Wonogiri Line

Source: Based on Each DAOP Report

Figure 4.1.1 Railway Network in Java Island

The operated network (shown in Figure 4.1.2) is 894 km (58.9%) and non-operated network (also shown in Figure 4.1.2) is 624 km (41.1%).

(2) Operating Route and Railway Station

There are a total of 127 stations in the Central Java Region, of which 16 are large stations (class 1) and 7 (class 2). They are controlled and maintained by three Railway Management Bureaus, or DAOP (or *Daerah Operasi*), which are under the control of PT. Kerata Api (Persero).

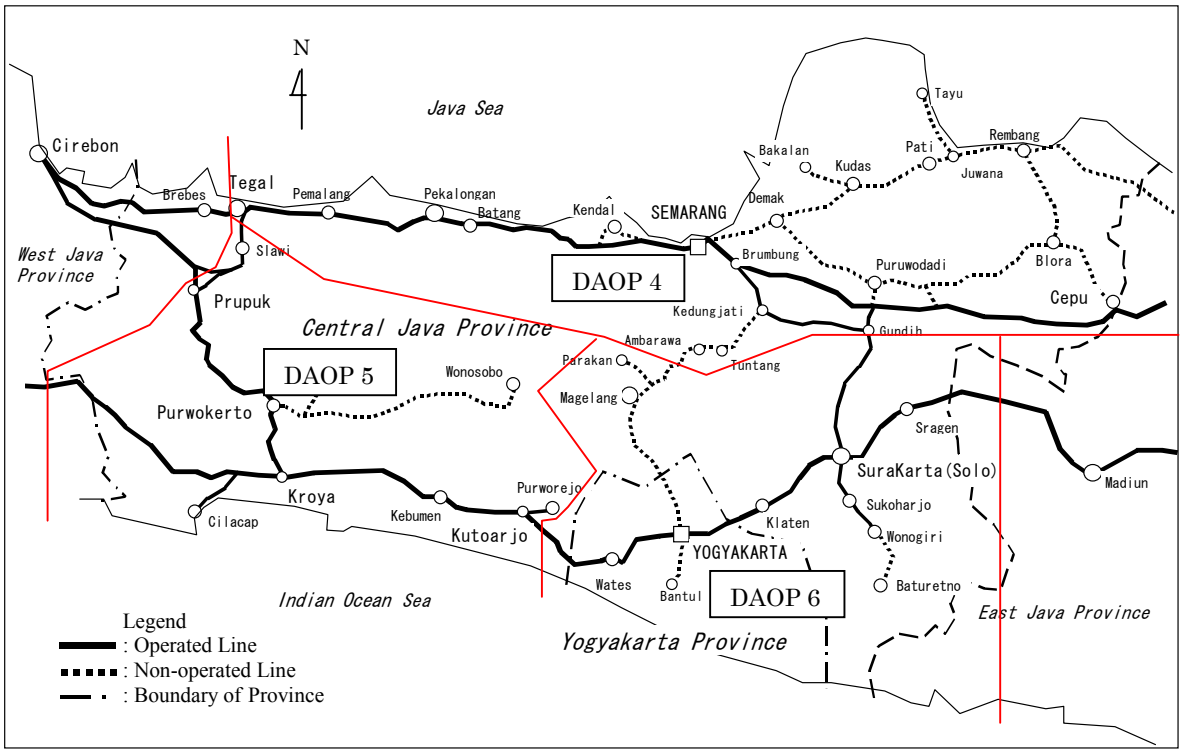


Figure 4.1.2 Segmentation of DAOP Regions

(3) Track

1) Rail

There are seven types of rails depending on its unit weight (54 kg, 50.4 kg, 42.59 kg, 41.5 9 kg, 38kg, 33.4 kg, 25.7 kg). DAOP VI knows clearly the circumstances of rail conditions, mainly due to recent implementation of double-tracking project.

Table 4.1.1 Types of Rail by DAOP 2006

Unit:(%)

District	54 kg/m	50 kg/m	41-42 kg/m	33-38 kg/m	25 kg/m
DAOP IV	31	24	40	5	-
DAOP V	41	-	43	13	3
DAOP VI	69	3	13	5	10

Source: DAOP IV, V and VI

2) Sleeper

Types of sleepers utilized on the railway network in the region are concrete, steel and wood. DAOP VI again clearly knows the profiles of sleepers.

Table 4.1.2 Types of Sleepers by DAOP 2006

Unit: (%)

District	CONCRETE	STEEL	WOOD
DAOP IV	50	5	45
DAOP V	38	35	27
DAOP VI	86	4	10

Source: DAOP IV, V and VI

3) Fastener

There are five types of fasteners: Pandrol, F. Type, De. Clip, Rigid and Ka Crip.

Table 4.1.3 Types of Fasteners by DAOP 2006

Unit: (%)

District	PANDROL	F.TYPE	DE.CLIP	RIGID	KA CRIP
DAOP IV	43	19	10	13	15
DAOP V	53	-	8	30	9
DAOP VI	43	-	1	10	46

Source: DAOP IV, V and VI

(4) Bridges

Long-span bridges are made of steel, whereas short-span bridges are made of concrete. Class 1 is defined as a span length over 10 meters.

Table 4.1.4 Types of Bridges by DAOP 2006

District	CLASS 1 (STEEL)		CLASS 2 (CONCRETE)	
	(UNIT)	(kg)	(UNIT)	(m3)
DAOP IV	546	9,128,655	65	398,000
DAOP V	508	9,133,758	168	1,240,616
DAOP VI	257	6,413,759	92	822,373

Source: DAOP IV, V and VI

(5) Railway Crossing

Number of crossings in Central Java Province and Yogyakarta Special Province (DIY) is 1,655, of which 293 (17.7%) are guarded and 1,358 (82.3%) are unguarded. Illegal crossings are observed in the regions, the number of which is estimated within the range of 5% to 10% of the legal crossings.

Table 4.1.5 Railway Crossings by DAOP 2006

District	WITH GUARD	WITHOUT GUARD	TOTAL
DAOP IV	90	607	697
DAOP V	90	346	436
DAOP VI	113	405	518
Total	293	1,358	1,655

Source: DAOP IV, V and VI

4.1.2 Rolling Stock

(1) Number of Trains in Operation

The number of trains in the Central Java Region is 424 or 39% of the total number of passenger trains operated in Indonesia. Two-thirds of the total national freight trains or 6,550 coaches are allocated to Java Island.

(2) Types of Rolling Stock

Long distance and business class coaches are trailed by diesel locomotives, while local trains are operated by diesel cars. Diesel locomotives in operation are either DEL (Diesel Electric Locomotive) or DHL (Diesel Hydraulic Locomotive). Passenger cars are classified into three classes, executive, business and economy. Executive class coaches have AC (Air Conditioning) system and power for AC is supplied by engine and generator set equipped in the power source car, while other classes do not have AC system.

Diesel trains are composed with two to four diesel cars. There are three doors on one side and seat layout is a mixture of transverse and longitudinal seating. Most of the diesel cars are decrepit and speedometer is defective or missing. Some of the diesel engines were dismantled and trail the diesel locomotive as passenger coach.

Yogyakarta - Solo section is served by Prameks express trains, which are newly procured and owned by DAOP VI, Yogyakarta.

Prameks is the symbolic train of this region. Vehicles are specially produced for this train.

One end of train is motor car equipped with power unit motor bogie. Front half of motor car has a machine room, and engine and generator are installed. Other four cars are trailer cars and they have better riding performance without noise and vibration of the engine. Longitudinal seat is installed. Air condition system is not installed but interior is still clean and it is accepted by the passengers.

This suggests that frequent service with clean vehicles will induce passengers.

For the freight trains, tank car and container carry wagon are bogie car; however, most freight wagons are 2 axle car. The operation still works on the low axle burden with the high traffic number, which is not efficient for transporting cement and fertilizer.

(3) Operating Rate

Operating rate of rolling stock appears to be low from the site reconnaissance of several maintenance facilities. This is mainly due to: 1) many varieties of rolling stock were procured from various international donors, which causes difficulties in learning skills for adequate maintenance and procuring spare parts, and 2) maintenance is not conducted periodically but only on a corrective basis; repair works can rarely be undertaken once a critical disorder occurs.

(4) Localization of Rolling Stock Manufacturing

Electric diesel trains (KRDE) are used for Prambanan Ekspres. This was manufactured by Indonesian Company, PT. Inka that developed electric trains with only 30% components made abroad while the remaining 70% are made by themselves.

4.1.3 Maintenance Facilities

(1) List of Maintenance Facilities

Locations, functions and number of rolling stocks maintained in each maintenance facility are summarized in Table 4.1.6 and Figure 4.1.3.

Table 4.1.6 List of Maintenance Facilities in the Central Java Region

Depot/Workshop	Location	DAOP	Kind of Rolling Stock	Number of Cars in Operation
Depot	1.Tegal	4	Locomotive Diesel Railcar	Shunting Loco (D-301)=4 KD2 = 7
	2. Semarang Poncol	4	Locomotive Diesel Railcar	Loco (CC 201/203)=1 KD3=11 , KD2=7
	3. Semarang Poncol	4	Passenger Car	126
	1 Purwokerto	5	Locomotive	BB 201=2, CC 201=23
	2. Purwokerto	5	Passenger Car	112
	1. Solo	6	Locomotive Diesel Railcar	BB. 300 =2 KD2=8, KD3=5
	2. Solo	6	Passenger Car	KDE=10 (2 sets) 80
	3. Yogyakarta	6	Locomotive	Loco (CC 201/203/204)=24
	4. Yogyakarta	6	Passenger Car	104
Workshop	Tegal	4	Passenger Car Freight Car	Production Car: Passenger Car=123/Year Bogie Only =51/year Freight Car = 720/Year Unschedule Maintenance=45 PC/Year
	Yogyakarta	6	Locomotive Diesel Railcar	DE Loco = 98/Year DH Loco K DIE = 20/Year Unscheduled Maintenance =120 PC/Year

Source: Based on various reports and site surveys

Figure 4.1.3 Maintenance Facilities in Java Island

Table 4.1.7 shows the condition of machines and Table 4.1.8 shows age of machines in Yogyakarta workshop.

Table 4.1.7 Activities of Machine in Yogyakarta Workshop

Active	Breakdown	No Renewal Parts	Broken	Total
498	45	17	11	571
87 %	8%	3 %	2 %	-

Source: PT. KA Yogyakarta Workshop

Table 4.1.8 Property of Lasting Machine based on Acquisition Year in Yogyakarta Workshop

1900-1920	1921-1940	1941-1960	1961-1980	1981-2000	2001-2007	Uncertainly	Total
56	53	118	73	147	120	4	571
10 %	9 %	20 %	13 %	26 %	21 %	1 %	-

Source: PT. KA Yogyakarta Workshop

4.1.4 Train Control System

(1) Signaling and Telecommunication

- Installation of automatic signaling system covers limited route sections, i.e. Cirebon - Tegal - Semarang – Brumbung section and Cirebon - Prupuk - Kroya – Yogyakarta section
- Signaling control of the other sections is manual. Blocking sections on each side of stations are made through telephone communications by each station master.
- Signaling facilities from overseas has caused maintenance problems. Spare parts for repair works are often not available when required and skill development is hard to achieve due to too many types of signaling systems.
- Improvement of signaling system in this region will significantly contribute to train control

capabilities, to allow safe and reliable operation as well as reduction of required number of staff for the operation.

- A train radio system is provided for diesel locomotives and a train dispatching system for the middle/long distance train operation. The system consists of a base station at Operation Center, Wayside (WS) radio at each station and Locomotive (L) radio for each locomotive driver. VHF dedicated band for railway operation is used.
- The radio relay system makes radio network using 2GHz band (UHF), providing channels for the automatic Telephone, centralized clock system, ticketing system, remote control management system and other communication channels. Now 2 GHz band is changing to 8 GHz band because 2 GHz band is assigned to general Telecommunications Carriers.

(2) Centralized Train Control (CTC) Center

- CTC at Semarang, Yogyakarta, and Purwokerto supervise signaling control at each station. However each station master administers the works in practice.
- To meet the basic needs of centralized train control in the region, two issues are of concern with regard to facilities: 1) Introduction of CTC system in Tegal - Jerakah section to achieve the train operation in safe and efficient manner, and 2) Integration of CTC system between Semarang Poncol and Semarang Tawang stations.
- In line with the facility upgrade, it is also mandated to provide sufficient staff training.

Table 4.1.9 Signaling system in the Central Java Region (1)

North Line

Station Name / Signal System	**TEGAL**	2 St.	PEMALANG	2 St.	PEKARONGAN	5 St.	WELERI	KALIBODRI	(KENDAL)	KALIWUNGU	Mangkang	Jerakah	Smarangponcol	**SEMARANGTAWANG**	Semaranggudung	Alastuwa	BRUMBUNG	14 St.	**CEPU**	
Tokenless block system with electromechanical interlocking device (S&H)																v	v	v	v	v
Automatic block system with relay interlocking device (MIS 801*1)													v	v	v					
Automatic block system with computerized interlocking device (VPI Alstom)	v	v	v	v	v	v	v	v		v	v	v								
CTC													v	v	v					
CTC center														v						

Table 4.1.10 Signaling system in the Central Java Region (2)

South Line

Station Name	**CIREBON**	16 St.	PURWOKERUTO	3 St.	KROYA	13 St.	KUTOARJO	8 St.	**YOGYAKARTA**	Lempuyangan	Maguo	8 St.	Purwosari	**SOLOBALAPAN**	Solojebres	3 St.	**SRAGEN**	
Tokenless block system with electromechanical interlocking device (S&H)											v	v	v	v	v	v	v	v
Automatic block system with relay interlocking device (MIS 801, DRS-60(NX))										v				v				
Automatic block system with computerized interlocking device (Westrace Austrarlia)	v	v	v	v	v	v	v	v	v									
CTC	v	v	v	v	v	v	v	v	v	v								
CTC center			v						v									

Semarang - Solobalapan

Station Name / Signal System	**SEMARANGTAWANG**	Semaranggudung	Alastuwa	**BRUMBUNG**	Tanggung	KEDUNGJATI	Padas	Telawa	Karangsono	GUNDIH	Goprak	Sumberlawang	Salem	Kalioso	**SOLOBALAPAN**	
Token block system with mechanical interlocking device (Alkmar)										v	v					
Token block system with electromechanical interlocking device (S&H)						v	v	v	v			v	v			
Tokenless block system with electromechanical interlocking device (S&H)			v	v	v									v	v	
Automatic block system with relay interlocking device (MIS 801*1)	v	v														
Automatic block system with computerized interlocking device																
CTC	v	v														
CTC center																

Source: Based on Preliminary Study of Railway System in Central Region of Java (2007)

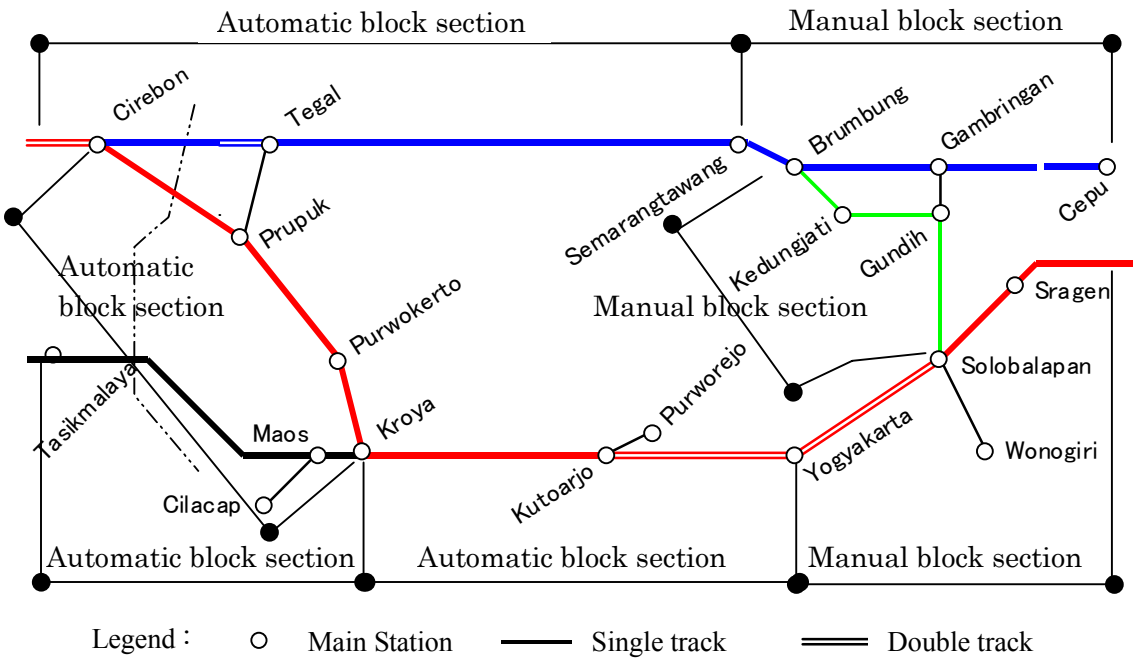


Figure 4.1.4 Block Sections in the Central Java Region

4.1.5 Present Conditions of Major Sections and Stations

(1) General

- There are three major stations in Central Java Province and Yogyakarta Special Province: Semarang, Solo and Yogyakarta.
- To ease operation of different types of trains, the stations for long-distance and local trains in three cities are separately located but adjacent to each other.

Table 4.1.10 Long Distance and Local Train Stations in Each Regional Core

Stations	DAOP	Province	Middle/Long Distance Train	Local Train
Semarang	DAOP IV	Central Java	Semarang Tawang	Semarang Poncol
Solo	DAOP VI	Central Java	Solo Balapan	Solo Jebres
Yogyakarta	DAOP VI	Yogyakarta	Yogyakarta (Tugu)	Lempuyangan

Source: CJRR Study Team

- Double tracking is progressing in some regions. Very recently a double-track railway link between Kutoarjo in Purworejo district and Yogyakarta was commissioned. The 64-km double railway track from Kutoarjo to Yogyakarta was constructed from 2004 to 2007.
- The Government is considering to covert Tegal - Semarang line into double track lines, i.e. Krengseng - Ujungnegoro Line (29.2 km), Batang - Sragi (19.1 km), Pemalang - Surodadi Line (12.4

km)

Table 4.1.11 Progress of Double Tracking in the Central Java Region

Section		Distance	Track
1	Tegal – Semarang Tawang	149.8 km	Single track (Bridges rehabilitated by 2003)
2	Semarang Poncol – Solo Balapan	110.5 km	Single track
3	Yogyakarta – Solo Balapan	59.3 km	Double track (from 2006)
4	Solo Balapan – Solo Jebres	2.1 km	Single track
5	Tegal - Purpuk	38.5 km	Single track
6	Cirebon - Kroya	64.2 km	Single track
7	Petuguran - Purwokerto	25.0 km	Double track
8	Kroya - Kutoarjo	76.1 km	Single track (to be double tracked under Japanese ODA loan)
9	Kutoarjo - Yogyakarta	63.6 km	Double track
10	Kroya - Bandung	86.9 km	Single track
11	Maos - Cilacap	20.6 km	Single track

Source: Based on Preliminary Study of Railway System in Central Region of Java (2007)

(2) Semarang Station

- The two Semarang Stations now face chronic water logging problem in their station tracks and buildings. Despite major efforts, such as raising platform level and construction of drainage and pumping system, these stations sometimes cancel partial operations in rainy seasons. Freight handling station cannot be operated due to the same problem on spur lines. Solutions such as construction of elevated railways or relocation of these stations should be undertaken to solve the problem.

- Passenger coaches and locomotive depots are separately located in the yard of Semarang Poncol station, and an abandoned freight handling yard is sandwiched in-between. Providing better maintenance facilities is the key to reduce sending their rolling stock to the nearest workshop wherever service is available among Tegal, Surabaya, Yogyakarta and Bandung.

(3) Semarang – Solo Section

- Aged rails have been heavily ground and buckled in many sections, which causes shaking of the train coaches and even derailment by horizontal force. Sleepers are made of either wood (91.65%), concrete (1.23%) or steel (7.12%). Most of wooden sleepers are rotten, steel sleepers are rusted, and concrete sleepers are in poor condition since they were manufactured with unused materials of trunk lines.

- Rolling stock operated on the Semarang - Solo section as local trains are KDR type, which mainly care about riding comfort. As a consequence, inadequate coach interiors as well as insufficiently maintained tracks have lost the market's interest. In addition, characteristics of rail users (such as

hawkers) deteriorate service grade and accelerate the free-riding environment.

(4) Yogyakarta Station

- Yogyakarta (Tugu) station is located in the center of Yogyakarta city, close to traditional and modern shopping centers. It only takes a little time to reach tourist hotels and it is close to some tourism objects. This station could have tourism potential because of its hundred-year old building style.

(5) Solo – Yogyakarta Section

- Track and alignment conditions are particularly good in this section after double tracking project was completed.
- Most of the sections use R54 rails (except Srowot - Klaten) and can serve trains with speeds of over 100 km/h, yet manual signaling system is bottlenecked to fully reach the capability of this double tracked section.
- Rail Link Company is currently renovating the line and has relocated Maguwa Station to serve the Adisutjipto (Yogyakarta) Airport Rail Link.
- Prameks express trains operate seven round trips per day in this section.

(6) Kroya – Yogyakarta Section

- Double tracked Kutoarjo - Yogyakarta Section (63.7 km) has been commissioned and is commencing operations in a phased manner. Kroya - Kutoarjo Section (76 km) is to be implemented continuously, with 5.4 km average station distance, 0.5% maximum gradient, and 400 m minimum curve radius. The existing track conditions encompass R54 or R42 rail, 20 cm ballast thickness, and 60 cm intervals between sleepers.

4.2 Tourism Train in Central Java

4.2.1 Tourist Loco in Blora Regency

Perum Perhutani, the Indonesian Forestry Commission has a railway line in the northeast part of the Central Java Region, between Cepu and Blora. It was originally used for hauling teak logs from the forest to the factories at Cepu. These days most of the haulage is done by trucks; thus the railway is at present used for tourists.

4.2.2 Railway Museum and Tourist Loco in Semarang Prefecture (Ambarawa - Bedono)

The 9-km railway between Ambarawa and Bedono is still operated on the last section of the past route between Semarang – Ambarawa – Magelang - Yogyakarta. The railway was never commercially significant and the mountain section from Ambarawa to Magelang was closed in 1976.

However, the remaining section has been operated between Ambarawa and Bedono. There exists very high gradient and rack rail system was installed. Four steam locomotives including three rack locomotive are still active with small collection of four-wheel timber coaches. These are now used to operate a tourist service on the line. The Ambarawa Station is used as a railway museum, where 21 steam locomotives are now displayed.

4.3 Present Passenger Train Operation in Central java Region

4.3.1 Passenger Transport

(1) Operational Indicators

Operational indicators in each DAOP are shown in Table 4.3.1.

Table 4.3.1 Operational Indicators by DAOP 2006

District	Regional Centre	Annual Passengers	Railway Line Length (km)	
			Operated	Not Operated
DAOP IV	Semarang	3,060,435	417,137	537,075
DAOP V	Purwokerto	2,756,108	330,721	96,950
DAOP VI	Yogyakarta	3,693,857	360,358	258,649
Total		9,510,400	1,108,216	892,674

Source: DAOP IV, V and VI

(2) Major Regional Train Services

Major regional train services in the Central Java Region are listed in Table 4.3.2.

Table 4.3.2 Major Train Services in the Central Java Region 2007

Name of Train	Section	Distance (km)	No. of Trains (2ways /day)	Operating Period	Ave. Travel Time (hour)	Scheduled Speed (km/h)	Train Composition
Kaligung Business	Tegal - Semarang	148.1	4	4:54-19:41	2.40	55.5	5KRD
Kaligung Economy	Tegal - Semarang	148.1	4	6:05 - 19:36	2.47	53.3	4KRD
Pandan –wangi	Semarang - Solo	109.6	4	5:00 - 20:22	3.17	33.4	2KRD
Prambanan Express	Yogyakarta - Solo	59.3	19	5:45 - 19:45	1.00	59.0	3KRDE

Source: DAOP IV, V and VI

(3) Maximum Travel Speed

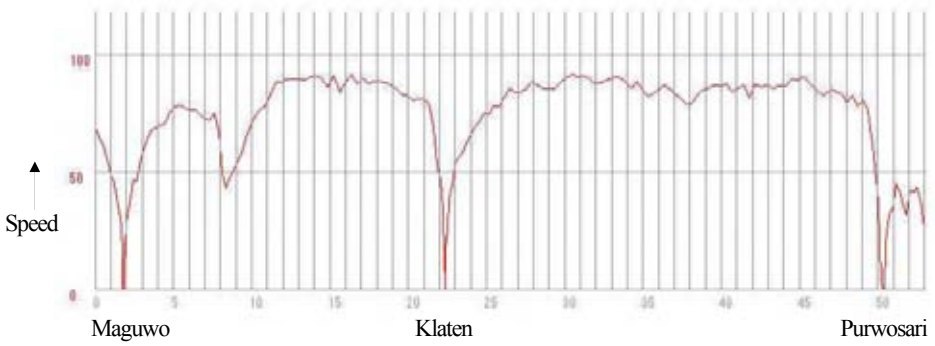
Maximum travel speed in each section is summarized in Table 4.3.3.

Table 4.3.3 Maximum Travel Speed in Each Section

Tegal - Semarang (km/h)		Semarang - Solo (km/h)		Yogyakarta - Solo (km/h)	
1. Tegal – Surodadi	95	1. Semarang - Alastuwa	70	1.Yogyakarta – Solo Balapan	100
2. Surodadi – Kuripan	95	2. Alastuwa - Brumbung	85	2. Solo Balapan – Solo Jebres	80
3. Kuripan – Krengseng	70	3. Brumbung - Kedungjati	50		
4. Krengseng – Semarang Poncol	95	4. Kedungjati-Gundih	40		
5. Semarang Poncol – Semarang Tawang	50	5. Gundih-Solo Balapan	65		

Source: DAOP IV, V and VI

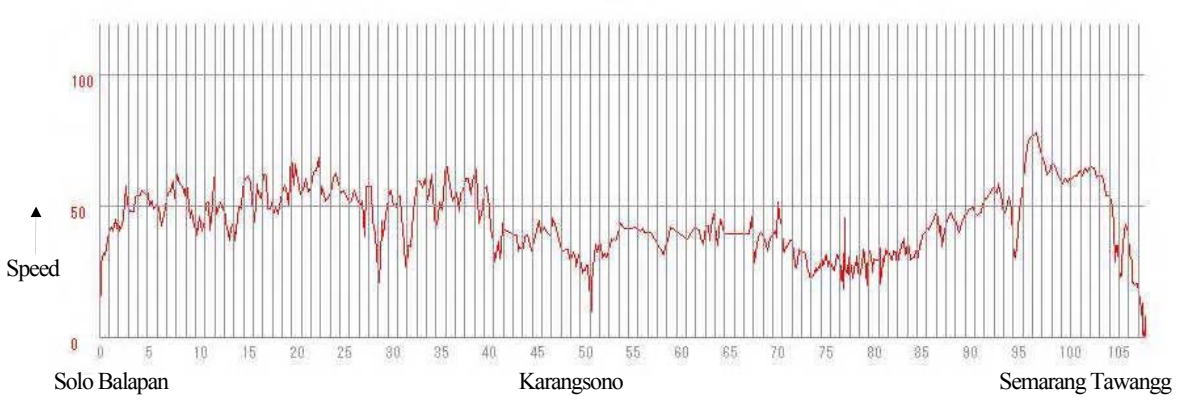
Figure 4.3.1 is a sample of actual run curve of the train. According to this data acceleration is about 0.5 to 1 km/h/s and deceleration is about 1 km/h/s.



(KA 762 July 16 2008, 4 car consist of diesel car scanned by GPS)

Figure 4.3.1 Actual Run Curve of the Train (1)

Figure 4.3.2 shows another sample of run curve. Speed is restricted to very low due to track condition.



(KA 477 February 16 2008, scanned by GPS)

Figure 4.3.2 Actual Run Curve of the Train (2)

4.3.2 Railway Service Quality

There are a variety of factors affecting service quality of passenger trains. According to survey result of bus passenger OD survey, comfort, speed, safety, price, frequency and easy access to stations are major factors (See Chapter 3 Section 3.1.4). In this section, current condition of service quality of passenger trains will be discussed.

(1) Line Capacity

- The operating frequency in the Central Java Region has been kept relatively high, especially by North Line. For some lines, like Tegal, capacity has been exceeded. Double tracking works solve capacity bottlenecks like Yogyakarta-Solo Balapan.

Table 4.3.4 Line Capacity 2007

	Line	Capacity	No. of Train	Allowance
DAOP 4	Semarng Tawang-Tegal	66	64	2
	Semarang Tawang-Bojonegoro	70	28	42
	Semarang Tawang-Gundih	43	12	31
DAOP 5	Kutoarjo-Kroya	66	58	8
	Kroya-Purpuk	49	42	7
	Kroya-Banjar	40	40	0
DAOP 6	Yogyakarta –Kutoarjo (Double Track)	260	50	210
	Yogyakarta-Solo Balapan (Double Track)	260	66	194
	Solo Balapan-Walikukun	79	38	41
	Solo Jebres-Gundih	63	18	45
	Purwosari-Wonogiri	25	2	23

Source: DAOP IV, V, VI and Diagram as of 22 June 2007.

(2) Safety and Level of Railway Accident

- Number of accidents in Indonesia range between 100 and 200 per year, types of which vary: collisions, accidents on a level crossing gate, derailment, floods etc. Major factors of these accidents are poor conditions of track, insufficient and inadequately maintained rolling stocks and disorder of signaling systems.
- To reduce the accident risk in 2002, the railway company established a policy to introduce speed limits. Maximum speed on heavily used lines are restricted to as low as 20-30 km/hour.

Table 4.3.5 Railway Accidents

	2000	2001	2002	2003	2004	2005	2006	2007
Collision	4	10	4	1	7	9	5	3
Level crossing	28	42	48	57	26	10	20	13
Derailment	79	40	47	83	76	99	75	116
Flood, Landslide	7	10	10	7	4	3	3	6
The others	9	32	71	70	35	29	12	11
Total	127	134	180	218	148	150	115	149
Victim								
Death	89	128	76	72	78	35	45	29
Sever injury	71	156	114	104	87	85	71	102
Tiny injury	93	114	60	122	33	109	51	155
Toatal	253	398	250	298	198	229	167	286

Source: -PT. KAI Head Office -Pusat Keselamatan -Divisi Sarana

(3) Punctuality

Some indicators of time punctuality of the railways are:

- Average delay of departure time of passenger trains in Java = 6 minutes
- Average delay of arrival time of passenger trains in Java = 47 minutes

To improve the punctuality to an acceptable level, it is required to improve rolling stock, infrastructure reliability, signal and telecommunication system, manpower and train operational management system.

Table 4.3.6 Passenger Train Operation Record in 2007

DAOP/ EKSP.	Punctual Train Operation (%)		Average Delay Time compared to Timetable (min.)		Average Net Delay Time of Travel Time (min.)	
	Departure	Arrival	Departure	Arrival	In	Out
1 JAK	48	5	10	56	25	17
2 BD	87	19	2	39	15	16
3 CN	81	18	4	24	1	5
4 SM	86	21	4	32	9	13
5 PWT	77	10	15	76	30	41
6 YK	85	18	5	69	5	29
7 MN	94	40	2	47	6	13
8 SB	72	33	9	50	5	14
9 JR	92	53	1	35	10	7
Average of JAWA	80	24	6	47	12	17
DIV. I SU	71	28	6	22	-	-
DIV. II SB	-	-	-	-	-	-
DIV. III SS	76	20	10	69	-	-
Average of SUMT	74	24	8	45	-	-
Average of PT. KAI	77	24	7	46	-	-

Source: PT. KA

(4) Comfort

Cleanliness, noise, temperature and lack of air circulation, shaking and unsteadiness (vertical/horizontal)

provides riding discomfort in several sections. Especially the Solo - Semarang Section faces chronic problems in this regard.

Air conditioners are installed to executive class train and a few economy class trains in Jabodetabek. Although the air conditioner requires additional cost to install, it not only increases comfort of the coach, but also encourages passengers to close doors and windows. This will increase security of passengers and prevent illegal vendors to enter a passenger coach.

A lighting apparatus is installed to trains, but it is not well maintained especially that of local trains. Considering comfort and security, it should be maintained frequently.

Source: CJRR, 2008

Figure 4.3.2 Coach Condition of Intercity train (Pandanwangi, 2008)

Lack of steps, cleanliness, noise and vendors also provide discomfort at stations. Most stations in the Central Java Region do not have sufficient height for passengers to board smoothly while only a few stations have high platforms and slopes (See Figure 4.3.3 and Figure 4.3.4). Portable steps are provided at some stations, but the number is not enough. From a barrier free point of view, a high-raised platform is demanded.

While beggars and musicians were observed in a station and a railway coach in Jabodetabek, they are not common in the Central Java Region. A number of vendors are, however, rushing to greet an arriving train. Not only excluding these vendors, but improving the service level and internalization of these benefits are important.

Source: CJRR, 2008

Figure 4.3.3 Boarding Passengers at Kutoarjo Station

Source: CJRR, 2008

Figure 4.3.4 Slope Facility at Yogyakarta (Tugu)Station

(5) Security

As indicated in section 4.1.1 (5), surveillance along the railway line and improving fencing arrangements are demanded. Also restricting some illegal buildings along the railroad and illegal level crossings will improve security.

Some trains leave their windows broken. Since broken window may pose bad impression of railway itself, repair is recommended to be done frequently. Children were observed throwing stones at trains on the bank of a trenched section. This act has to be stopped in cooperation with local authorities.

(6) Frequency of Train

Even one of the most frequently operated sections in the Central Java Region, Yogyakarta – Solo, intercity train called Prameks is operating 10 trains from Lempuyangan to Solo Balapan per day. In Semarang, the most frequently operated intercity train, Kaligung, has 4 trains from Semarang Poncol to Tegal station. This may not satisfy passengers and may decrease competitiveness of railway.

(7) Operator-Oriented Train Operation

PT. KA's railway diagram provides much information on PT. KA's policy on railway operation, namely, "operator-oriented" train operation. These examples will be discussed as follows:

1) Long distance oriented

Current train operation targets long-distance passenger transport. Historically too much attention has been given to long-distance passenger transport, while little attention has been paid to local and regional railway services.

2) Executive, business and economy class

PT. KA operates trains mostly by class. Executive trains consists of merely executive train coaches; some trains often consist of either business class or economy class cabins, although some trains are comprised of business and economy train cars. This composition of single class train cars results in longer frequency for certain class train cars.

Stations are also divided by class in major cities such as Semarang, Solo and Yogyakarta in the Central Java Region. This makes it difficult for passengers to transfer from executive class long distance train to local trains.

3) Ignorance of intermediate stations

Train operation serves the travel demand directly from an origin station to a destination station. Other travel demand with travel patterns from an origin to intermediate stations of the train line are not regarded as potentials for passenger demand. Many trains are operated only between major big cities such as Jakarta, Bandung, Semarang, Yogyakarta, Solo, Surabaya and Malang.

For instance, 6 trains stop at Losari station per day for both directions (as of May 2008) and 5 trains stop at Brambanan station per day for both directions (as of May 2008). This will not fulfill all the needs of potential daily railway users.

4) Ignorance of transfer passengers

As mentioned in section 3.2.1, approximately 95% of passengers do not transfer when they use trains. This may be partly because the timetable is not targeting transfer passengers. With smooth connection of long distance trains and local trains with minimum waiting time, railway travel distance for one trip will increase. For instance, passengers from Wonogiri branch line have to wait approximately 1 hour to get the economy train to Jakarta at Purwosari station.

5) Others

Track numbers: In addition to delay of trains, the track is often changed in case of train delays. Passengers have to go back and are forced to carry baggage between tracks.

Timetable renewal: Timetables are suddenly revised without advance notice.

(8) Ticket Sales

Long distance train tickets are sold at major PT. KA stations, travel agencies and telephone centers. Although telephone reservation system enables users to reserve railway ticket on the phone anytime during 24 hours and to pay by bank transfer, there are some limitations. Only one bank is available for transferring fare funds and the user has to pay for the ticket within 3 hours after telephone reservation.

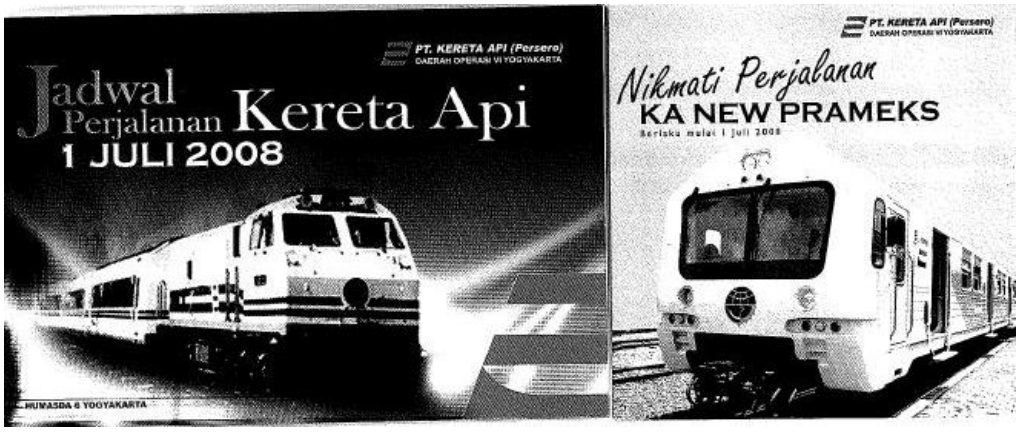
Tickets of short and middle distance trains are available only at stations by cash and IC cards are not allowed. Since installation cost for internet services and IC cards are decreasing, application of these technologies may attract passengers.

(9) Information Services

While railway information has to be provided when and where users need it for convenient use of railway, almost all railway information needs to include all major railway stations.

1) Paper based information

While some portable timetables are provided at major stations (see the following figure), they are usually not available at hotels and shopping centers close to railway stations. Nation wide, island wide and region wide timetables are needed for frequent railway users. These timetables are recommended to be sold at major bookstores and stations.



Source: PT. Kereta Api (Persero), 2008

Figure 4.3.5 Examples of Portable Timetables Delivered at Stations

2) Internet

While railway information including timetables of long distance trains, railway fare and railway line maps are available on PT. KA's web site (see the following figure), there is delay in updating information. Timetables of all stations and trains, train-delay information and transit route search system are not available.

Source: PT. Kereta Api (Persero), 2008

Figure 4.3.6 Image of PT. KA Web Site

3) Announce at a station

While train delay and track number are announced at stations in Indonesian, detail information such as expected delay time and reasons for delay are not frequently announced. Since track is often changed in case of train delay, misleading announcement causes confusion of passengers.

4) Tourist information

Some tourist spots are close to railway stations in the Central Java Region such as Yogyakarta Sultan's palace, Prambanan temple and Solo Sultan's palace. Since information and guide sings are insufficient, it is difficult for tourists, especially foreigners, to reach such destinations.

(10) Integration with Other Mode of Transportation

In contrast with Jabodetabek, a wide station plaza is available at most stations in the Central Java Region (see the following figure). Parking-and-ride and kiss-and-ride facilities are also available for both cars and motorcycles. A car usually pays for parking at major stations. While access roads to local and intermediate stations are sometimes too narrow for large cars, major stations can usually be accessed by cars.

Feeder services are also available at stations such as *Angkutan Kota* (*Angkot* or intra-city bus), taxi, *Ojek* (motorcycle taxi), and *Becak* (cycle rickshaw).

Source: CJRR, 2008

Figure 4.3.7 Station Plaza of Tegal Station (Left) and Brambanan Station (Right)

Since attention has been paid for integration with other modes of transportation in Indonesia, Maguwo station was relocated adjacent to Yogyakarta Adisucipto (Yogyakarta) Airport in September 2008. Simultaneously, TransJogja, intra-city bus system in Yogyakarta city, established a busstop close to them. On the other hand, there is no railway station to Ahmad Yani Airport in Semarang although the railway

track is close to the airport terminal.

While a variety of choices are available for intra-city transportation, inter-city bus services are not connecting to railway stations due to government regulatios on using bus terminals which are usually located outskirt of cities.

4.4 Present Freight Train Operation in Central Java Region

4.4.1 Freight Transport

Freight train operations are scheduled between passenger trains in daytime and nighttime.

Table 4.4.1 Number of Freight Trains Operated in Each Section

Yogyakarta – Solo	10 trains /day
Jakarta - Semarang – Surabaya	7 trains /day
Others	4 - 6 trains /day

Source: PT. Kereta Api (Persero), DAOP IV, V and VI

4.4.2 Railway Service Quality

(1) Punctuality

Freight trains have bigger delay time than of passenger trains to give priority to recovery of the delay of passenger trains. Some indicators of time punctuality of the railways are:

- Average delay of departure time of freight trains in Java = 82 minutes
- Average delay of arrival time of freight trains in Java = 124 minutes

To improve the punctuality to an acceptable level, it is required to improve rolling stock, infrastructure reliability, signal and telecommunication system, manpower and train operational management system.

Table 4.4.2 Freight Train Operation Record in 2007

DAOP/ EKSP.	Punctual Train Operation (%)		Average Delay Time compared to Timetable (min.)		Average Net Delay Time of Travel Time (min.)	
	Departure	Arrival	Departure	Arrival	In	Out
1 JAK	23	0	8	33	17	9
2 BD	6	1	39	176	16	55
3 CN	-	-	-	-	5	-
4 SM	10	12	79	93	13	38
5 PWT	41	45	39	48	41	64
6 YK	23	21	178	193	29	151
7 MN	8	13	168	166	13	105
8 SB	29	20	64	160	14	68
9 JR	-	-	-	-	7	-
Averageof JAWA	20	16	82	124	17	67
DIV. I SU	21	12	38	56	-	-
DIV. II SB	28	28	32	32	-	-
DIV. III SS	21	22	148	177	-	-
Average of SUMT	23	21	73	88	-	-
Averageof PT. KAI	21	18	77	106	-	-

Source: PT. Kereta Api (Persero)

(2) Travel Time

In addition to the delay of departure / arrival of freight train, even scheduled travel time for freight trains is more than that of a passenger train due to PT. KA's policy to put high priority on a passenger train. Some freight trains have to stop almost at all stations for passenger trains in the same direction to overtake and for those of opposite direction to pass in a single track section.

For instance, transporting steel from Ciregon, west end Java Island, to Surabaya, eastern city of Java Island, takes roughly one week for one way trip (ca. 850 km railway track). On the other hand, it usually takes 10 hours from Jakarta, located western area of Java Island, to Surabaya by Argo Bromo Anggrek (ca. 730 km railway track). Another example is cement train from Cilacap to Solo (ca. 220 km railway track). It usually takes 2 – 3 days for round trip.

(3) Integration with Other Mode of Transport

Since railway is usually a part of a freight trip from an origin station to a destination station, integration with other mode of transport such as maritime transport and road transport is essential. While there were several branch railway lines within Semarang Tanjung Emas Port, all these lines were abandoned. The following pictures are abandoned branch lines to fertilizer plant and container terminal in Tanjung Emas port. According to Semarang Container Terminal (TPKS), double handling cost, train schedule and small quantity of containers are major reasons for truck use instead of railway.

Source: CJRR Study Team, 2008

Figure 4.4.1 Abandoned Railway Branch Lines to Container Terminal (Left) and Fertilizer Plant (Right) in Tanjung Emas Port, Semarang

Dry Ports with custom office also can play an important role connecting maritime transport, railway and road transport. While there are only a few dry ports with railway facilities in Indonesia, Gude Bage dry port, located outskirt of Bandung city, is an example. Gude Bage dry port is utilized to transport containers from / to Tanjung, Priok Port in Jakarta via Pasoso station near the port, although there are some problems such as double handling from Pasoso Station to Tanjung Port and competition with a toll road. There was a dry port adjacent to Solo Jebres Station and containers were transported from / to Semarang Gudang station; it is, however, not in use at this moment. Cooperation with a railway company, a port authority and a freight forwarder is highly expected for smooth freight transportation.

While PT. KA is focusing on station to station service for cargo transportation, door to door service in association with trucking companies is also demanded.

Source: CJRR Study Team, 2008

Figure 4.4.2 Gede Bage Dry Port

(4) Business Promotion and Marketing

PT. KA's revenue share of freight service in Java Island was comparatively smaller than passenger service while there was annual demand from regular customers mainly ex-national enterprises such as PT. Pertamina, PT. Pusri and PT. Krakatau Steel. It could be said that PT. KA's business promotion was relatively passive compared with other private companies in this regard. For instance, limited information is accessible for freight forwarders and manufacturing companies through internet.

Human resources for marketing was 858 persons in 2005 totaling approximately 3% of whole employees of PT. KA. The number is expected to decrease due to retirement according to PT. KA company profile.

According to interview survey with potential customers including steel, fertilize and cement companies by CJRR, there is potential demand for railway use. There would be possibility to attract more customers by positive marketing and user-oriented fright train operation.

4.5 Review of Current Railway Administration

Prior to 2007, PT Kereta Api (PT. KA) was the only organization authorized for the operation and administration of railway services in Indonesia. PT. Kereta Api is a wholly state-owned company (Persero) with shares owned by the Ministry of State Owned Enterprises. PT. KA owns its own rolling stock and locomotives though it generates insufficient funds to meet renewal needs. The railway network of the country is operated and controlled by PT. KA, maintaining infrastructure under ministerial supervision (MOT), with ownership remaining with MOT. There have been recent concerns regarding safety, outdated infrastructure, inefficiency, poor service quality and lack of line capacity that have prompted Government to provide for the participation of provincial and local governments as well as the private sector in the provision and operation of railways. This change in approach promises to bring about institutional reforms to the railway industry as well as the potential to attract capital investment from the private sector supplementing the available funding from government.

4.5.1 TAC, IMO and PSO

(1) Responsible Agency for Railway Infrastructure

The Ministry of Transport is responsible for the management of rail infrastructure. In theory, MOT is responsible for the ownership, maintenance and investments in the railway network (maintenance is performed by PT. KA, on behalf of MOT). Of the 25 or 30 railways around the world that have separated rail infrastructure from operations, Indonesia is the only country that allocated responsibility of rail infrastructure to a government ministry. Experience shows that specialist executive agencies or companies make more effective infrastructure managers. It would be more appropriate to transfer the infrastructure management functions from the Ministry to a Railway Network Agency, to manage the rail network on commercial principles. This Network Agency may choose to contract with PT. KA to undertake maintenance and renewal, though it should have the choice to use alternative contractors, if appropriate. The new Railway Law 23 of 2007 provides for the participation of companies other than PT. KA in the infrastructure construction, maintenance and operation.

In the draft government regulations of 2008[1], it is stated specifically in Chapter IV that a Business Concern can be granted a permit to undertake railway construction, operation, maintenance and management of railway infrastructure. This "business concern" can be a state-owned company, a provincial-owned company or an Indonesian legal entity. This "management" of railway infrastructure represents the concept of infrastructure management, important for coordinating and ensuring fair infrastructure charging

[1] *System for Organizing means of railway and railway infrastructure.*

in the future railway environment of Indonesia[2].

It is recommended that an infrastructure manager be appointed to manage the train path allocation and to collect track access charges on behalf of PT. KA. PT. KA could remain as the organization performing maintenance, but the administration of the train operation slots would be the infrastructure manager. In many European countries, the government owns the infrastructure, performs maintenance and manages the infrastructure (dispatching/allocating train paths), through separate government agencies.[3] In Indonesia, it might be easiest to keep PT. KA under their existing organization structure, rather than create a new government entity. However, as PT. KA maintains the infrastructure and is a train operator, they would possibly be biased when establishing train paths and administering track access charges. As the regional railway will operate in a small part of the national railway system, it is probably not prudent to create the infrastructure manager at this time. There will, however, need to be created within MOT an oversight unit to ensure train paths and track access charges are administered on a non-discriminatory basis between PT. KA trains and CRJ trains.

In addition to the infrastructure manager, a Rail Regulator should eventually be created to ensure fairness in the manner the infrastructure manager conducts business as well as to adjudicate and disputes between operators and the railway infrastructure manager. The level of track access charges would be calculated by the Rail Regulator, administered by the infrastructure manager and paid by rail operators. The Rail Regulator essentially looks after the interests of the rail users, promoting use and development of the rail network, efficiency and economy in railway services and promoting competition in the rail sector. The regulator issues licenses to railway operators and approves all access agreements.

However, in the initial stages of provincial/private railways in Indonesia, it is probably not necessary to create the rail regulator; in fact, in many European countries, the regulator is not an active participant; only in the case of disputes between operators and the infrastructure manager, does the regulator intervene.

These recommendations to establish an infrastructure manager and rail regulator are intended to be medium-term recommendations. While we have recommended the establishment of a regional railway organization as well as separate railway management companies to operate commuter services, these services can be integrated within existing PT. KA trains without difficulty. There will, however, have to be an agreement (possibly mediated by the provincial or central government) regarding the level of track

[2] In fact, this clause describing the functions permitted to be performed by the business concern is shown in many Articles of the draft legislation, including 478, 525, 529 and 557.

[3] ProRail, a Dutch government agency, is responsible for maintenance and rehabilitation of rail infrastructure; ProRail receives a subsidy from government and fees from operators. The owner of the infrastructure is NS Railinfratrust, Railinfratrust has under it a rail infrastructure management organization, a railway capacity allocation body and a traffic control organization.

access charges paid by the private operator as well as the priority of train movements between PT. KA trains and private trains.

(2) Annual Payments of TAC, IMO and PSO

As with many predominately passenger railways in the world, PT. KA cannot recover full costs from revenue. During 1999, a financial model was developed for PT. KA consisting of three financial flows: (i) reimbursement by Government to PT. KA for maintenance of infrastructure (IMO); (ii) track access charges owed by PT. KA to government for the use of the infrastructure (TAC); and (iii) financial compensation to PT. KA, essentially to cover the cost of operating economy passenger trains (PSO). Essentially this means that the amounts received by PT. KA are the PSO and IMO; PT. KA owes to the Government the TAC.

In theory, this system should have provided full compensation to PT. KA for operating economy passenger trains and each of the three items was to be independently calculated; however, each year, the actual amounts allocated to PT. KA are lower than the requested amounts and the shortfall in payments since the inception of this system in 2000 has been significant (cumulative shortage in allocation from 2000-2003 was 571.7 billion Rupiah). In fact, since 2006, the amounts of TAC and IMO have been set by the Ministry of Finance to be equal to each other; the net amount paid to PT. KA is essentially the PSO, equal to the amount that can be afforded by the Ministry of Finance. The following table shows amounts of IMO, TAC and PSO for 2006 and 2007.

Table 4.5.1 IMO, TAC and PSO for 2006-2007 (millions of Rupiah)

Year	IMO	TAC	PSO
2006	746.53	746.53	350.00
2007	824.38	824.38	425.00

Source: MOT

This system is not working as intended; amounts for each category are not calculated independently; actual amounts paid are dependent on allocations from the budget. There are no performance or efficiency incentives incorporated in the process. Since 2005, the TAC and IMO have been set at the identical amounts; but under this system, the quality of maintenance will never improve and the condition of the line will remain the same.

There are three possible ways to reduce the passenger subsidy:

- Identify priority and non – priority economy passenger trains and allocate PSO funds starting from the priority trains; those trains not funded when funds are extinguished will be recommended to be discontinued;

- Supplement the shortfall in PSO payments from central government with contributions from provincial or local governments;
- Increase the level of economy fares to reduce the difference between operating costs and revenue; alternatively, to reduce the number of economy trains and replace them with business class trains which do not attract a subsidy.

In addition, operating efficiencies could be encouraged if the PSO payment were linked to a performance contract, for example. The payment could be in two parts: a fixed amount for operating the defined services; a second variable part linked with the achievement of specified performance targets, such as on time operation, minimum number of passenger coaches available for service, ridership increases, etc. In addition, there could be a provision for encouraging PT. KA to increase their cost coverage for each service by reducing costs while maintaining service standards.

The costs and revenue for each service included in the PSO system should be calculated and critically **examined by PT. KA and Ministry of Transport officials** to determine if any cost savings could be achieved or if the service could be operated in a more cost – effective manner.

In addition, a performance – based subsidy system should be developed. There should be a link between the payment of the PSO and performance / incentive system. For example, the PSO payment could be established in two parts; (i) basic payment to operate the service and (ii) an incentive payment if PT. KA operates services in excess of specified performance standards. These could be on time performance standards, equipment availability, etc.

4.5.2 Review of New Railway Law No. 23/2007

(1) Provisions of the New Law

"***One important theme in these laws is the phasing out of the monopoly position of the SOEs in infrastructure services…...Wider opportunities will be open up for private investments in railways, harbors and airports and other sectors***"[4]

Generally, the new railway law provides legislation that ends the monopoly of PT. KA for the railway business in Indonesia. Railway Law number 23 enacted in 2007, provides for the operation of trains and construction, maintenance and management of infrastructure by entities other than PT. KA; these could be

[4] Policy Reform in Indonesia: Agenda and Challenges ; Mohamad Ikhsan Advisor to Coordinating Minister for Economic Affairs Republic of Indonesia and Senior Research Associate at the Institute for Economic and Social Research University of Indonesia Presented at the First OECD-Southeast Asia Regional Forum: Peer Review Mechanism for Policy Reform Hotel Nikko Jakarta, Indonesia 23-24 January 2007

legal entities established for this purpose or Provincial or City governments.

Consistency of the integration of the country's railway network is to be done by means of the development of railway master plans, at the national, regional, province and regent/city level. These plans should include volumes of cargo and passengers; current and projections, as well as needed infrastructure and facilities to support these future forecasts. These master plans should also be consistent with land use planning at the provincial and city level. However, the legislation does not specify which services would be candidates for private/government partnership operation. Candidate projects should be evaluated and included in a "short list" of potential projects, to be subjected to further detailed evaluation.

There is a wide range of potential areas for private sector participation that would improve the efficiency and performance of the country's railway industry. Privatization of maintenance can result in reduced total costs for maintenance as well as increase in the standard of maintenance, with oversight by PT. KA to ensure adherence to required standards and good engineering practices. In addition, the operation of some freight and passenger train services could also be candidates for operation by private companies. This has been found to result in increased efficiency of train operations in many countries.

The potential for private sector participation has been evaluated in the railway business through an examination of the existing rail services as well as the potential of services that are not now provided but could possibly be provided by private sector/regional cooperation. **The focus of these investigations** will be to identify those rail services or functions that could better be conducted by a partnership of private sector and provincial/local government in Yogyakarta and Central Java Province.

(2) Changing Roles and Issues of Local Governments

Up to the present time, responsibility for development and operation of railways has been centralized, with little autonomy granted to provinces. The new railway law No.23 of 2007 granted authority to local governments, also permitting cooperation with the private sector, to develop and operate railways. Private companies also are permitted this participation in the railway business.

With the increasing participation of regional governments in the transport sector, there is increased scope for regional governments to develop those transport services it considers most important. This can be done in three ways; i) the local government provides supplemental financial support specifically for increased regional rail services; ii) regional rail services are developed with an organizational structure more cost effective than the existing national rail network; or iii) contract with the private sector to operate specific services with the regional government providing oversight of quality and cost.

(3) Draft Government Regulations Supporting Law 23

With the enactment of Railway Law 23 of 2007, important ground was broken to allow the establishment of a railway operator other than PT. KA in Indonesia. In addition, there is currently a draft of more detailed legislation necessary to implement the provisions of Law 23, this draft is entitled: "*Draft of Government Regulation Concerning System for Organizing Means of Railway and Railway Infrastructure*". The final version of this draft is expected to be enacted by the end of 2008. Chapter 6 is the most relevant part of this draft legislation covering the establishment and composition of railway management. The following is a brief outline of chapter 6:

Part One: Railway Infrastructure Construction

- General Matters
- Business Permit of Constructing Railway Infrastructure
- Agreement on Constructing the Railway Infrastructure
- Definition of the Alignment
- Construction Permit of Railway Infrastructure
- Train Operational Permit for the Railway Infrastructure
- Cooperation in Organizing the Railway Construction and Operations

Part Two: Rolling Stock

- General Matters
- Business Permit
- Operational Permit
- Cooperation

Part Three: Infrastructure and Rolling Stock

- General Matters
- Cooperation

Part Four: Infrastructure and Rolling Stock by Government or Provincial Government

- Railway Infrastructure

- Rolling Stock

There are specific procedures for the obtaining of a business permit for operating infrastructure; the legislation provides for a "Business Concern "*to be responsible for organizing the means of railway infrastructure"*. A business concern is defined in the legislation as "*state owned company, province owned company or Indonesian legal entity specially established for railway*"[5]. Within chapter 6 there is a distinction made between the need for a "*development permit for railway infrastructure*" and "*operations permit for railway infrastructure*". This distinction apparently is to separate the management of the infrastructure from the operations of the railway. The regulations do not preclude, however, that the development permit for infrastructure and operations permit cannot be held by the same organization.

Provision in the draft legislation also provide for railway concessions, as stated in Article 477: "*Business Concern may operate the railway infrastructure stipulated as provider of railway infrastructure shall be given concession right of operating railway infrastructure governed in the agreement on operating the railway infrastructure between government and Business Concern*".

While this draft legislation must still be enacted, it provides the legal means to establish a regional railway organization which can be a private sector entity or state owned enterprise "*responsible for the activities of construction, operation, maintenance and managing of railway lines*"[6].

[5] Chapter 1, General Provisions, Article 1

[6] Chapter IV, article 478, 525, 529 and 557

4.6 Problems and Countermeasures

4.6.1 Operational Problems and Countermeasures

Operational problems and their countermeasures are briefly summarized in the following table, which highlights that improvement of transport services is hard to achieve without upgrading existing facilities.

Table 4.6.1 Operational Problems and Countermeasures

	Problems	Countermeasures
Line capacity	* Insufficient line capacity (Tegal)	* Providing efficient and reliable train control system * Improving facilities in bottlenecked sections * Double tracking
Safety	* Frequent railway accidents (collisions, derailment, etc.)	* Controlling travelling speed at bottlenecked sections * Introducing efficient and reliable train control system * Improving deteriorated facilities
Time Punctuality	* Frequent delays of departure and arrival	* Improving facilities in bottlenecked sections * Introducing efficient and reliable train control system * Procuring rolling stocks in good condition * Optimizing train operation schedule and management
Travel Time of Freight Train	* Long travel time	* Increase line capacity * Change priority on freight train in rural section
Integration with Port, Dry port	* No railway in Tg. Emas port. * No dry port	* Installing railway line in Tg. Emas port and Solo dry port in cooperation with freight forwarders
Business Promotion	* Passive approach * Few resources for marketing	* In cooperation with private companies * Installing competition among railway operators
Comfort	* Dirty inside the train * Noise * Temperature and lack of air circulation * Shaking and unsteadiness * Lack of Air conditioner * Inadequate lighting apparatus * Large steps between train and platform * Vendors	* Renovating or replacing rolling stock * Improving track facilities * Installation of air conditioner * Frequent maintenance of lighting apparatus * Raising level of platform
Security	* Accidents due to illegal crossing and structures * Broken window	* Prohibiting illegal crossings and improving fencing * Frequent maintenance
Frequency	* Low frequency	* Installation of a train composed with 3 class coaches
Timetable	* Low service level for local trains * Classed service * Ignorance of intermediate stations * Ignorance of transfer passengers	* Improve line capacity * Stops all trains at terminal stations * Installation of a train composed with 3 class coaches * Timetable in consideration of transfer passengers
Ticket Sales	* A few outlets * Inconvenient telephone booking system	* Increase of travel agencies * Installation of internet booking system with variety of options of payment
Information Service	* Station-based information service	* Up to date information service with variety of media
Integration with other modes	* No integration with inter-city bus services	* Cooperation with local authorities to allow inter-city bus to enter station plazas

Source: CJRR Study Team

4.6.2 Facility Problems and Countermeasures

Existing general facility problems and bottlenecks are summarized below. As a next step, the focus for future actions needs to determined through a series of discussions with counterpart agencies as well as incorporating traffic survey outputs.

Table 4.6.2 Summary of Facility Problems and Countermeasures

	Problems/bottlenecks	Countermeasures
Track	* Insufficiently and inadequately maintained tracks * Aged or disordered tracks	* Introducing sufficient and adequate maintenance program * Rehabilitating aged or disordered tracks
Signal & Telecom.	* Disorder of signaling facilities due to inadequate and insufficient maintenance * Difficulties in procuring spare parts from overseas * Inefficient operation with manual-based signaling system	* Rehabilitating signaling facilities * Developing maintenance skill * Standardizing signaling system * Introducing automatic signaling system
CTC	* Absence of CTC system in Tegal – Jerakah * Different CTC system between two Semarang Stations	* Introducing CTC system * Standardizing CTC system
Level Crossing	* Unsecuritized illegal crossings * Dangerous crossings without surveillance	* Prohibiting illegal crossings * Providing surveillance at level crossings where accidents frequently occur
Bridge	* Constraints in travel speed when passing aged bridges	* Rehabilitating aged bridges
Station	* Waterlogging at Semarang Stations	* Introducing efficient drainage and pumping system * Elevating critical section of the line
Rolling Stock	* Slow travel speed (especially long distance trains and freight trains) * Frequent disorder (aged cars) and low operating rate * Insufficiency in number of rolling stock to provide frequent operation * Ground pollution and contamination due to leaked fuels and lubrication oils	* Reorganizing operation schedule * Introducing sufficient and adequate maintenance program * Procuring additional rolling stock * Optimizing train operation schedule * Cleaning up and renovating maintenance yards
Maintenance Facilities and Activities	* Aged or disordered maintenance equipment * Aged or disordered tracks in maintenance yards * Insufficiency of maintenance works (corrective maintenance as maintenance policy)	* Providing necessary maintenance equipment * Rehabilitating aged or disordered tracks * Introducing and developing a periodic maintenance environment
Structures	* Illegal structures invading structure gauge	* Prohibiting illegal structures
Integration with ports	* Abandoned spur lines	* Rehabilitating access lines (if required to be integrated)

Source: CJRR Study Team

4.6.3 Regulatory Problems and Countermeasures

Some regulatory problems that are being addressed through existing and new legislation, are described in the following section. In addition, it is recommended to implement a pro-rail transport policy by the Ministry of Transport. Suggestions for this policy are described in this section and would enable the Ministry to apply several additional measures that would help develop a stronger and more effective railway network in the country.

(1) Regulatory Problems

While there is the PSO system of compensation to PT. KA for operation of uneconomic passenger services by the central government, due to lack of financial resources the government is unable to fully compensate PT. KA for the losses incurred in operating these services. This shortfall must be compensated by cross – subsidy from other PT. KA services. The Study also found that many goods are moved long distances by road because of poor railway freight services, cited by several customers during interviews as long transit times, insufficient freight wagons and locomotives and outdated infrastructure that results in frequent delays. Many industries are paying higher transport prices for road transport, because of the absence of reliable and efficient rail freight service. The rail freight tariff is not controlled by government, though most of PT. KA's customers are parasitical organizations.

Transport regulatory reform is one way to improve this situation and to attract additional capital investments to railways and to permit more innovative railway management structures to more effectively deal with attracting freight traffic to the railways. Passage of Law 23 of 2007 and the subsequent draft enabling legislation is the first step towards developing a stronger railway system in the country and eliminate many of the economic distortions now present.

With regard to passenger services, there will continue to be the need to compensate operators for losses incurred in operating economy passenger trains, though additional funding is necessary as treasury can never pay the full amount owed for PSO. It is proposed that there should be a greater involvement of private sector railway operators/managers that would be responsible for operating some passenger services on regional railways. With a properly – structured performance and incentive contract (these contracts would be tied to the payment of a management fee), a private railway operator should be able to operate passenger services efficiently at minimum cost, and attracting the maximum number of passengers.

In fact, the participation of the private sector in operating passenger trains may result in increased financing sources for the passenger rail subsidy. One of the criteria for selecting the private railway manager/operator could be the level of operating subsidy required; the qualified bidder requiring the lowest level of subsidy may be selected. This technique could actually reduce the level of operating subsidy, by inviting private

sector operators to manage passenger services, with one of the criteria for selection the subsidy required. The qualified company requiring the lowest subsidy (consistent with service standards) may be selected.

(2) Implementation of a Pro-Rail Transport Policy

A pro – rail transport policy is recommended to be implemented by the Ministry of Transport to increase public awareness of the efficiencies of rail transport as well as to provide some financial incentives for companies to use rail transport to a greater extent. Suggestions for this policy are shown in the following diagram and would enable the Ministry to apply several additional measures that would help develop a stronger and more effective railway network in the country.

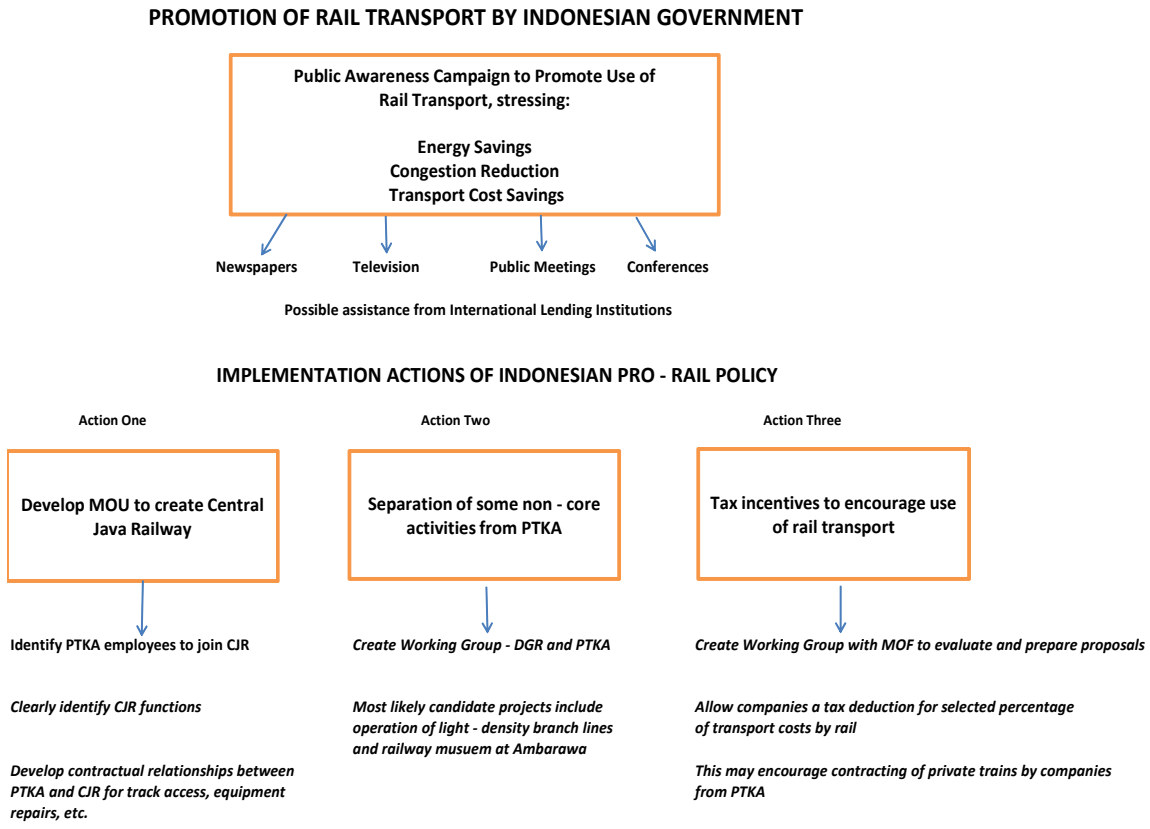


Figure 4.6.1 Promotion of Rail Transport by Indonesian Government

4.6.4 Summary of Problems and Countermeasures

Relationship between problem causes and impacts are illustrated in Figure 3.4.1. Based on the understanding of the problem structure of the railway system, it is suggested that the following items should be target for improvement:

- procurement of rolling stock
- maintenance of rolling stock
- double tracking
- improving rail track
- increase frequency

Addition of rolling stock and double tracking will lead to increasing frequency of train operation.

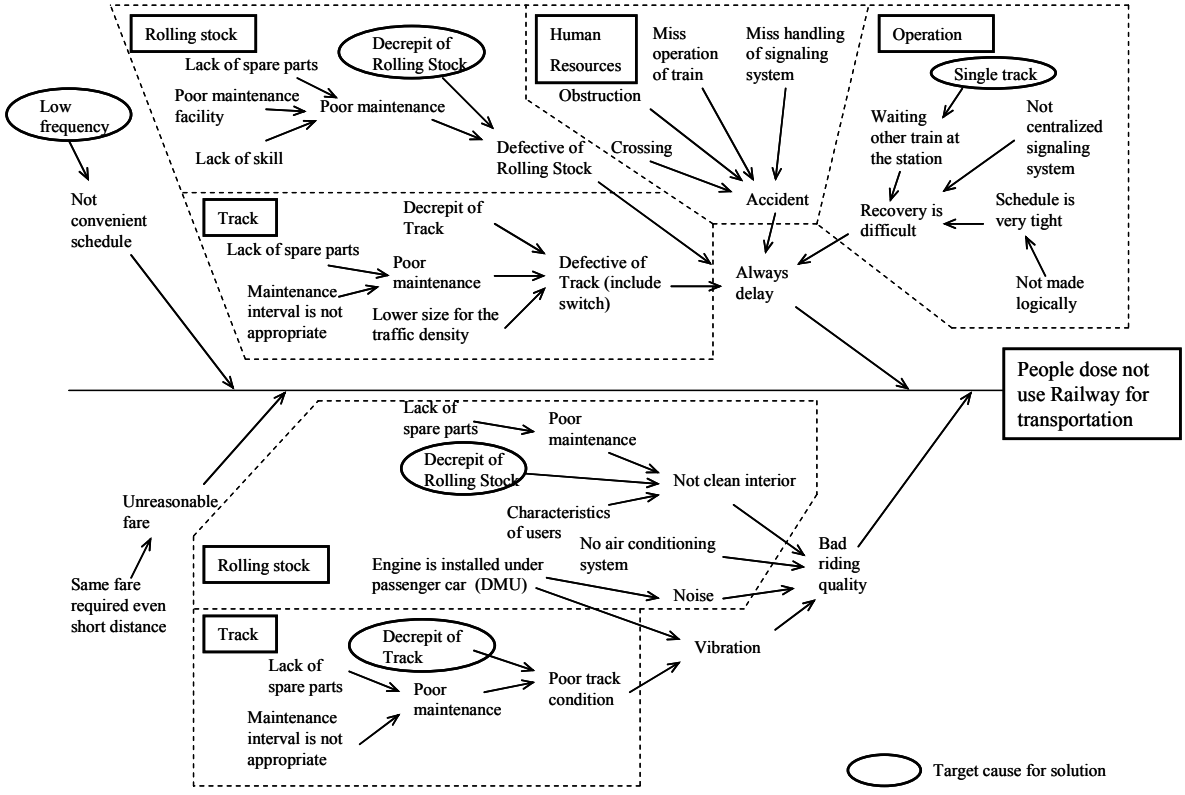


Figure 4.6.2 Problem Causes and Impacts Diagram for Railway System in the Central Java Region

Chapter 5 Perspective of Central Java Region

This chapter discusses the perspective of the Central Java region. As a basis for demand forecast, future socio-economic framework of the Central Java region in light of the whole nation is assumed. Then, growth of the metropolitan areas is discussed especially focusing on the population, GRDP, and land use. Existing transportation development plans and programs of each transport sector are also reviewed.

5.1 Socio-economic Framework

5.1.1 Population

According to the latest population census, total population of Indonesia as of 2000 is about 206 million, which is the third largest in Asia after China and India. Population growth rate nationwide registered 1.66% during 1990s which was down from 1.84% during the previous decade due to family planning encouraged by the government. It can be assumed that such historical trend of the gradual decline of the annual population growth rate would continue towards the future considering worldwide social phenomena of the decline of the birthrates presumably attributed to the progress of women's employment and high-level education.

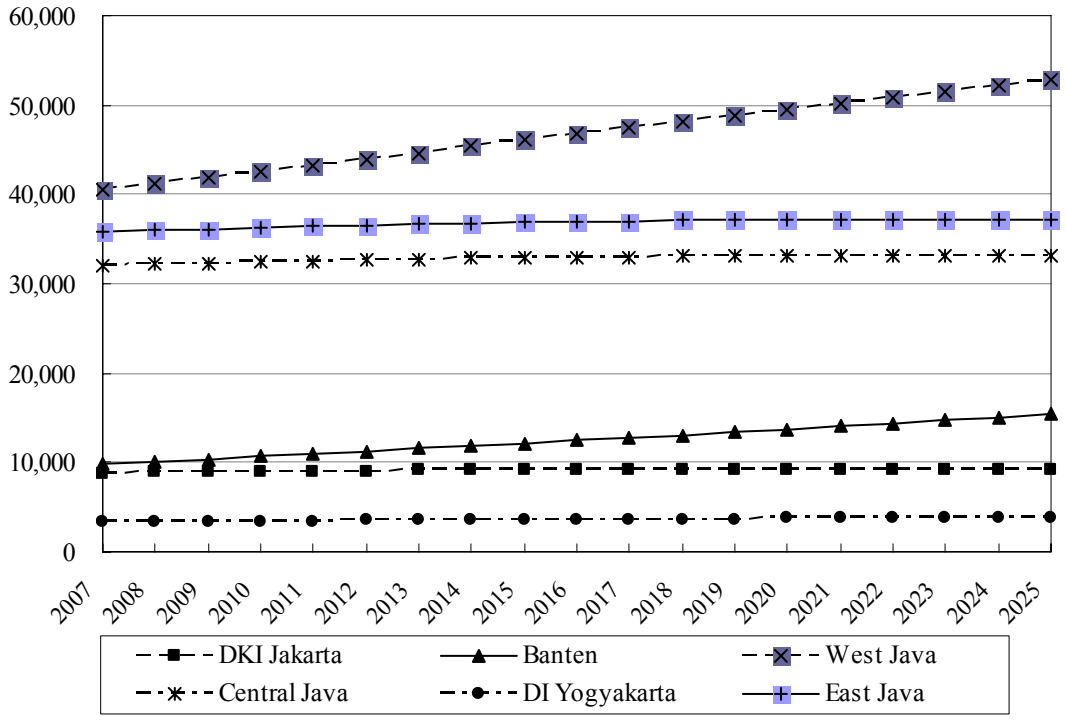
According to the World Bank's projection, the annual population growth rates in Indonesia will continue to decline, and will become 1.00% in 2015 and 0.90% after 2020, as shown in Table 5.1.1. Although the population growth rates will decline, total population in Indonesia will continue to grow and will reach 275 million people in 2025, which is 1.31 times larger than that in 2000. As for the period from 2026 to 2050, according to the World Population Prospects (2006 revision) made by the UN, the population growth rate will go as low as 0.36% per annum.

Table 5.1.1 Historical Trend and Projection of Population in Indonesia

Year	1980	1981-1990	1991-2000	2001-2005	2006-2015	2016-2020	2021-2025
Population	148,303	178,232	210,421	224,459	250,408	263,181	275,239
Annual Growth Rate		1.84%	1.66%	1.30%	1.10%	1.00%	0.90%

Source: World Development Indicators 2002, World Bank

The Statistical Bureau (*Badan Pusat Statistik*, BPS) estimates that the population in Central Java Province and Yogyakarta Special Province (DIY) is around 32.1 million and 3.3 million, respectively, totaling 35.4 million for the Central Java region. Future projection of population in each province of Java Island is presented in Figure 5.1.1. While the population growth in West Java is remarkable, the growth in the two provinces of the Central Java region is much lower, and nearly 0% growth is expected for 2020 and afterwards.



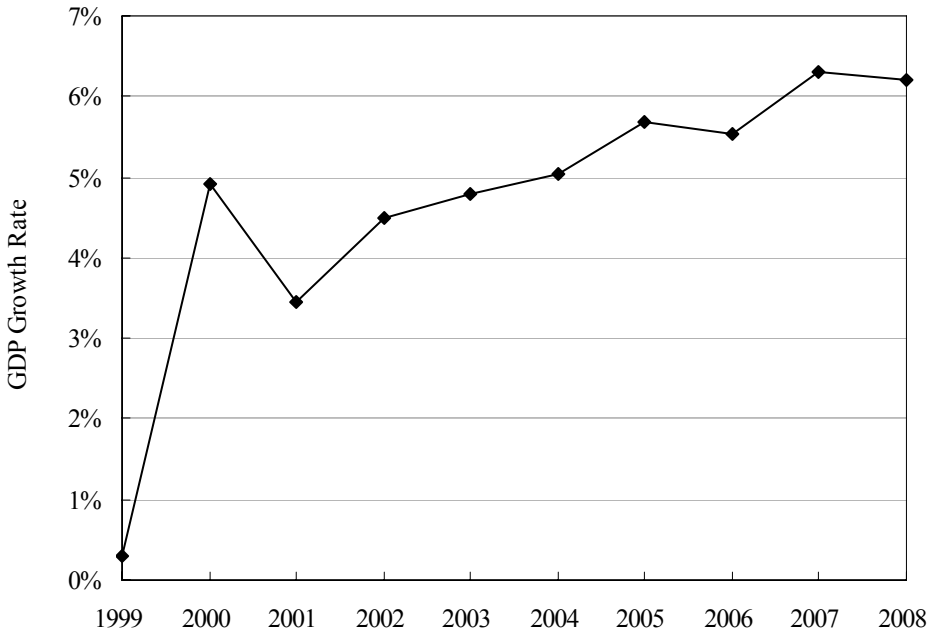
Source: BPS

Figure 5.1.1 Future Projection of Population in the Central Java Region

5.1.2 Gross Domestic Product

In late 1990s, in order to overcome the critical economic and financial situation after the 1997-98 Asian Economic Crisis, emergency countermeasures such as Social Safety Net Program were undertaken. Consequently, the crisis abated and the IMF program was completed in December 2003. At present, the Indonesian economy has recovered and gotten back on the track of the healthy economic growth. Although the Great Java Earthquake in December 2004 brought some negative effect to the country's economy in 2005, various international assistances minimized the damage to the Indonesian economy. However, slight economic recession was encountered in the third quarter of 2005 due to increases in commodity prices, interest rates, and so on triggered by the hike of oil prices.

As shown in the historical trend of the gross domestic product (GDP) growth rates in Figure 5.1.2, GDP has steadily grown and the recent annual GDP growth rates are around 5 – 6%, although they are still lower than the 7.2% average GDP growth that the country experienced in the period of 1990-96.



Note: Growth rate for 2008 is a predicted value.
Source: BPS

Figure 5.1.2 Historical Trend of GDP Growth Rates of Indonesia

As to the future growth of Indonesian economy, "Guidelines for National Development" (GBHN) and a five-year plan called PROPENAS, which was formerly called REPELITA before the economic crisis, together set out the basis for national development plan in Indonesia. Based on the latest GBHN (1999-2004) that is available, the "current" five-year plan, PROPENAS (2000-2004), was formulated by the National Development Planning Agency (BAPPENAS) although a new long-term plan covering 20 to 25 years is being currently examined.

According to the plan called REPETA, which is made annually based on the PROPENAS over its duration, GDP growth rates in the recent years were predicted as around 6%. Although this figure may seem to be rather challenging, 5 – 6% economic growth in the middle and long term appears to be an appropriate target if the following points are considered:

- Indonesia needs a sustained period of strong economic growth to provide employment opportunities to Indonesia's millions of unemployed and under-employed workers. Economists calculate that Indonesia's labor force is increasing by 2.2 – 2.7% a year, which is a growth rate equivalent to 2 – 2.5 million new jobseekers each year. BAPPENAS estimates that, for example, 4% GDP growth translates into an increase in the demand for labor of 2.4%, or 2.2 million new job opportunities per year. In order to re-employ large numbers of workers who lost their jobs during the economic crisis and to absorb new market entrants, Indonesia needs a sustained period of GDP growth well above 4%.

- According to "Indonesia: Economic and Social Update (2007)" by the World Bank, the main drivers of recent economic growth have been investment and net exports. Investment has been expanding at 7% – 8% per annum since 2006. This overall performance of investment is a particularly welcome development, as stronger investment has been a target of the government's economic policies for several years now. The ratio of investment to GDP (nominal) has increased from 19.4% in 2002 to over 24% estimated in 2007. Notwithstanding these sizable gains, much more is possible, noting that this ratio was near 30% just before the 1997-98 economic crisis. Net exports have also been increasing mainly due to merchandise exports, which have surged to record levels caused in part by the world commodity price boom. Among other components of GDP, private consumption and government spending have also picked up in recent years.

- Rapid and sustained GDP growth is the key to reducing Indonesia's debt/GDP ratio as well as to meeting the government's debt servicing burden. The World Bank report in May 2000 noted that Indonesia could reduce its debt/GDP ratio to approximately 50% with annual GDP growth rates of 6%.

Future GDP growth rates projected by the Study Team are presented in Table 5.1.2. It is assumed

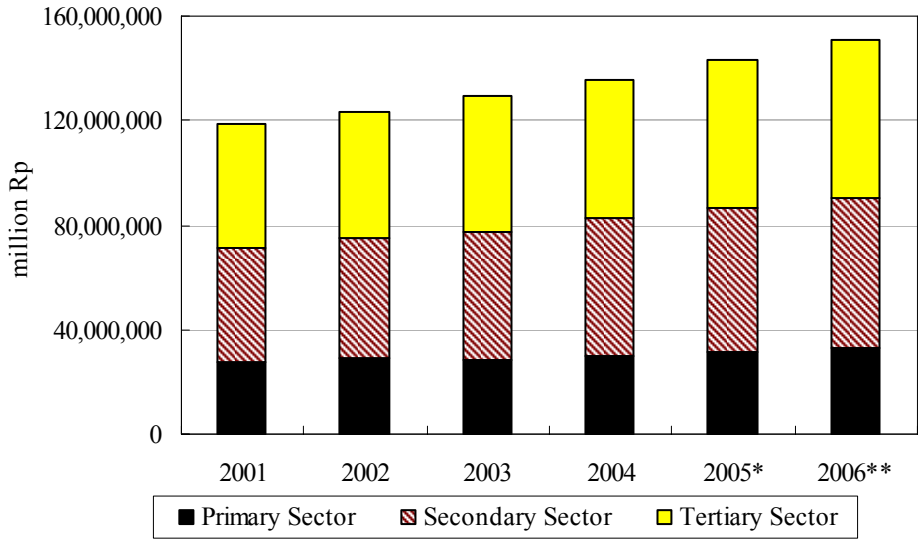
that the 6% growth rate that was realized in recent years will be maintained through 2012, and then will slightly decline because the population growth rate will continuously decrease as mentioned earlier.

Table 5.1.2 Recent Trend and Projection of GDP Growth in Indonesia

Year	2006	2007	2008	2009-2012	2013-2030
Annual GDP Growth Rate	5.53%	6.29%	6.20%	6.00%	5.00%

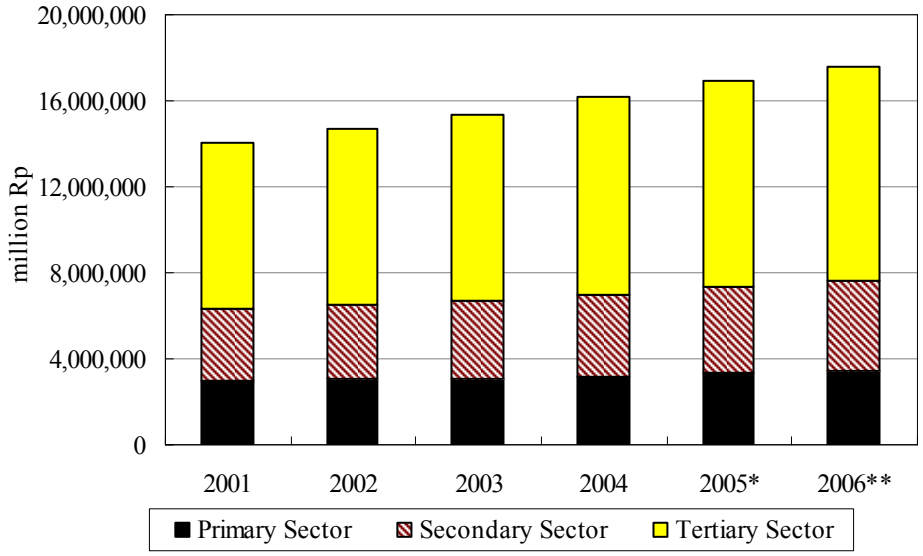
Source: BPS (for 2006-2008) and CJRR Study Team (for 2009 onwards)

Focusing on the Study area, recent trends of gross regional domestic product (GRDP) in Central Java Province and Yogyakarta Special Province (DIY) are presented by industrial sector in Figure 5.1.3 and Figure 5.1.4, respectively. The economic growth in recent years is stable and the rate is around 5% in both provinces. In fact, growth in the tertiary sector is the most remarkable. As compared to Central Java Province, the share of the tertiary sector is greater and that of the secondary sector is smaller in DIY.



Note: All figures in 2000 constant price.
* is the first preliminary figure and ** is the second preliminary figure.
Source: BPS

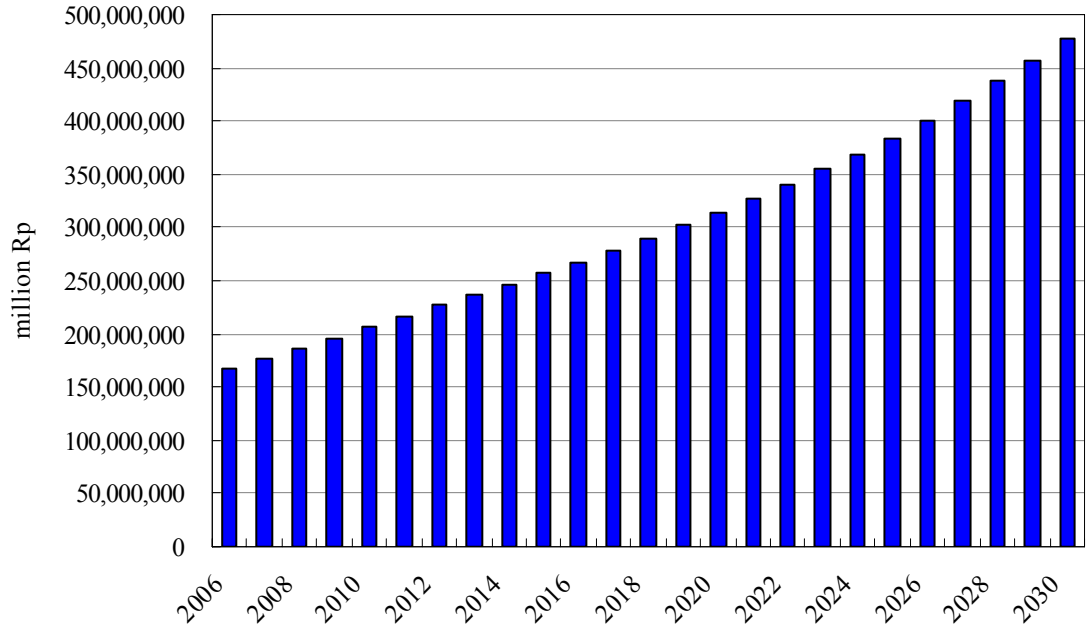
Figure 5.1.3 Recent Trend of GRDP in Central Java Province



Note: All figures in 2000 constant price.
* is the first preliminary figure and ** is the second preliminary figure.
Source: BPS

Figure 5.1.4 Recent Trend of GRDP in Yogyakarta Special Province

For future projection of GRDP in the Study area, the share of the Study area (i.e., Central Java Province and DIY) to the whole country was first calculated for future years in terms of population. The population share is forecasted to change from 15.9% in 2006 to 13.2% in 2030. Then, future change of this share was applied to the share of the Study area in terms of GRDP; that is, the GRDP share of the Central Java region will gradually decrease from 9.1% in 2006 to around 7.5% in 2030. Consequent future projection of GRDP in the Study area is presented in Figure 5.1.5. The annual GRDP growth ratio of the Study area is estimated as approximately 5.1% for the period of 2009 – 2012 and 4.1% for 2013 onwards.



Note: All figures in 2000 constant price.
Source: CJRR Study Team

Figure 5.1.5 Future Projection of GRDP in the Central Java Region

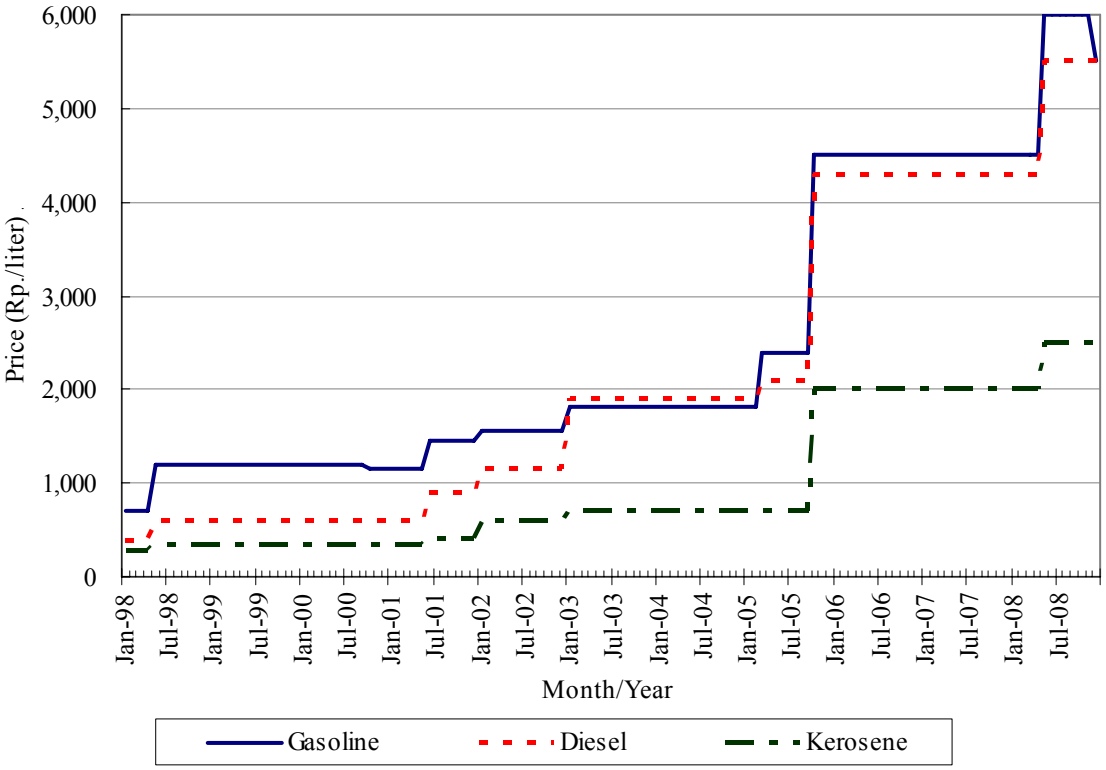
5.1.3 Increase in Fuel Prices

Historical trend of crude oil price (West Texas Intermediate, WTI, price) is presented in Figure 5.1.6. In recent years, the crude oil price kept rising, and, in January, 2008, the crude oil price exceeded US$100 per barrel. Rapid increase in fuel prices has greatly affected industrial and human activities. Major impacts in the transportation sector are: less frequent use of private vehicles, decrease in the air travel demand, increase in the logistics cost, and so on.

Note: WTI spot price (Cushing, Oklahoma), FOB (Free on board)
Source: U.S. Energy Information Administration

Figure 5.1.6 Historical Trend of Crude Oil Price

Although Indonesia was originally an oil-producing country, it has shifted to an oil-importing country due to the rapid increase in domestic consumption of oil and the flat production of oil. Therefore, Indonesia has also been suffering from the soaring fuel prices in the world. Historical trend of gasoline, diesel, and kerosene prices in Indonesia is presented in Figure 5.1.7. For the purpose of stabilizing the people's living, especially for the poor, Indonesia has kept the fuel prices (especially the kerosene price) lower than the market prices with subsidies. However, recent steep rise in the fuel prices in the world market cannot be absorbed by the government subsidization, and the fuel prices have dramatically increased in Indonesia. Current fuel prices (gasoline and diesel: Rp. 5,500 per liter, kerosene: Rp. 2,500 per liter) as of December, 2008 are nearly threefold as compared to three years ago.



Note: All subsidized prices.
Source: BPH Minyak dan Gas Bumi (November 2008)

Figure 5.1.7 Historical Trend of Gasoline, Diesel, and Kerosene Prices in Indonesia

Increase in the fuel prices has caused higher prices in many commodities and services, seriously affecting people's lives. However, since the soaring fuel prices discourage use of private vehicles and airplanes, railway travel which is supposed to be energy-efficient has a relative advantage over other travel modes. Similarly for freight transport, as the unit cost of transporting commodities by truck increases due to the higher fuel prices as well as the stricter regulation of overloading, railway is regarded as a more competitive mode of transport.

Furthermore, as oil prices increase, coal is becoming more and more important as alternative energy resources for Indonesia. As explained in Section 7.2.3, the volume of coal production has been rapidly growing due to construction of coal power plants, energy conversion from oil to coal industry, diffusion of coal briquettes in households, and so on. Since railway is essentially suitable for transporting bulky, heavy commodities such as coal for long distances, it is also a great opportunity for the railway to become the main mode for transporting coal.

5.2 Growth of Metropolitan Area

5.2.1 Population

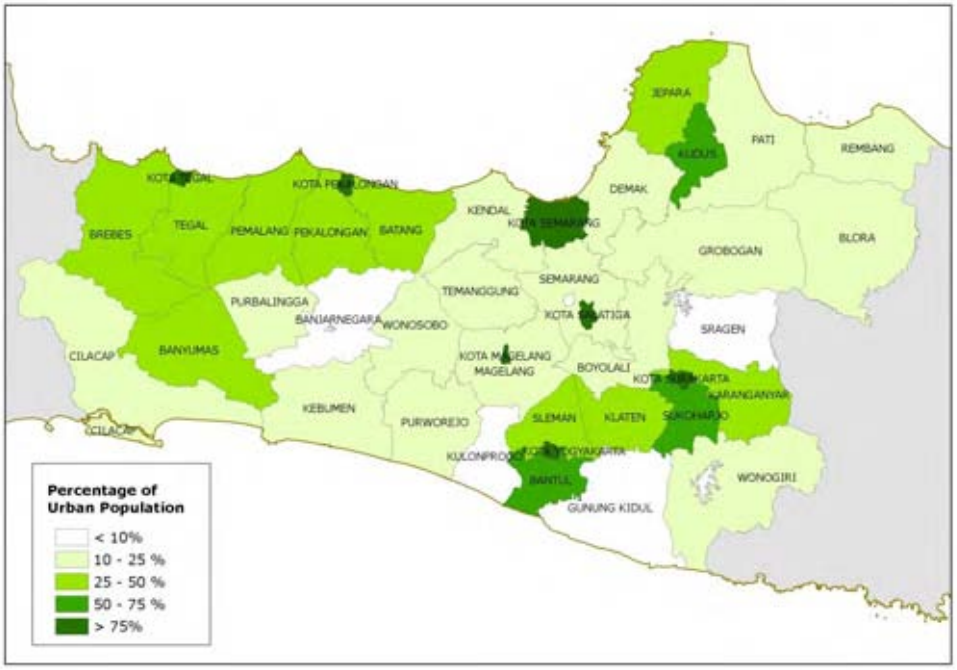
Urbanisation is one of phenomena associated with the globalisation. The study area reflects this. Population of three cities (or *kota*), Semarang, Solo and Yogyakarga, have been growing and gradually becoming high density. At the same time, other areas (regencies (or *kabupaten*) and kota) have been changing their demographics. Urban population has been increasing in the study area, notably, in kabupaten surrounding the kotas. Comparing the data of 1995 and 2005, urban population has increased remarkably in a decade. The growth of urban population in some kabupaten was over 5%, and the highest is more than 13%. The detailed data is shown in Table 5.2.1.

The demography, urban and rural population, changed between 1995 and 2005, especially, in northern coastal area and the triangle area linking Semarang, Solo and Yogyakarta. Ratio of urban population in each kabupaten/kota in 1995 and 2005 is shown in Figure 5.2.1 and Figure 5.2.2. Based on the past data, CJRR study team estimated future urban population in 2015 and 2030 (see Figure 5.2.3 and Figure 5.2.4).

Table 5.2.1 Urban and Rural Population by Kabupaten/ Kota, 1995 and 2005

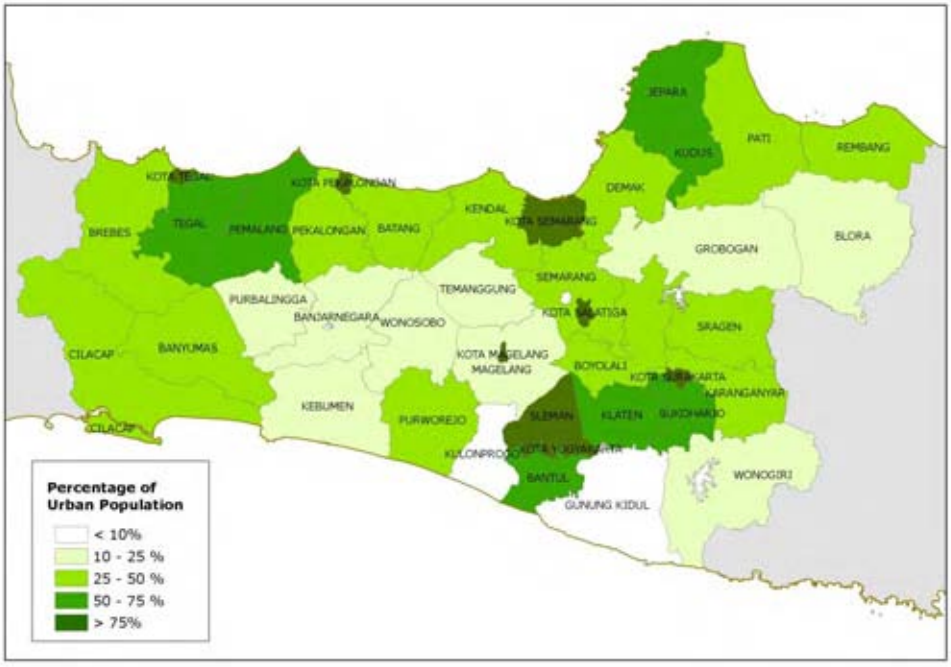
Kabupaten/ Kota	Year 1995			Year 2005			Population Growth 95-05		
	Urban	Rural	Total	Urban	Rural	Total	Urban	Rural	Total
Study Area	**10,809,788**	**21,997,743**	**32,807,531**	**14,877,522**	**20,355,687**	**35,233,209**	**3.25%**	**-0.77%**	**0.72%**
Central Java	**9,459,680**	**20,193,586**	**29,653,266**	**12,903,891**	**18,992,223**	31,896,114	**3.15%**	**-0.61%**	**0.73%**
Cilacap	344,955	1,187,683	1,532,638	455,244	1,161,678	1,616,922	2.81%	-0.22%	0.54%
Banyumas	516,410	863,736	1,380,146	665,026	815,549	1,480,575	2.56%	-0.57%	0.70%
Purbalingga	82,350	666,700	749,050	193,777	616,331	810,108	8.93%	-0.78%	0.79%
Banjarnegara	79,872	725,144	805,016	156,012	698,773	854,785	6.92%	-0.37%	0.60%
Kebumen	155,600	983,580	1,139,180	264,731	931,573	1,196,304	5.46%	-0.54%	0.49%
Purworejo	115,804	586,460	702,264	199,973	512,878	712,851	5.61%	-1.33%	0.15%
Wonosobo	77,749	606,816	684,565	121,813	626,171	747,984	4.59%	0.31%	0.89%
Magelang	205,318	828,855	1,034,173	282,304	855,634	1,137,938	3.24%	0.32%	0.96%
Boyolali	191,391	664,378	855,769	239,833	683,374	923,207	2.28%	0.28%	0.76%
Klaten	445,626	651,147	1,096,773	726,644	396,840	1,123,484	5.01%	-4.83%	0.24%
Sukoharjo	443,744	263,809	707,553	583,253	215,321	798,574	2.77%	-2.01%	1.22%
Wonogiri	165,244	804,861	970,105	163,085	814,386	977,471	-0.13%	0.12%	0.08%
Karanganyar	191,168	539,752	730,920	354,124	439,293	793,417	6.36%	-2.04%	0.82%
Sragen	73,746	765,000	838,746	259,227	595,524	854,751	13.40%	-2.47%	0.19%
Grobogan	186,150	1,007,666	1,193,816	194,938	1,114,408	1,309,346	0.46%	1.01%	0.93%
Blora	143,276	642,114	785,390	185,117	642,470	827,587	2.60%	0.01%	0.52%
Rembang	116,494	422,073	538,567	143,390	419,732	563,122	2.10%	-0.06%	0.45%
Pati	218,160	864,864	1,083,024	354,002	806,544	1,160,546	4.96%	-0.70%	0.69%
Kudus	457,815	210,714	668,529	513,338	240,845	754,183	1.15%	1.35%	1.21%
Jepara	328,716	548,418	877,134	535,264	506,096	1,041,360	5.00%	-0.80%	1.73%
Demak	151,515	735,581	887,096	264,142	744,680	1,008,822	5.72%	0.12%	1.29%
Semarang	199,644	607,744	807,388	293,047	585,231	878,278	3.91%	-0.38%	0.85%
Temanggung	79,632	554,496	634,128	165,628	522,273	687,901	7.60%	-0.60%	0.82%
Kendal	201,216	629,804	831,020	350,054	557,717	907,771	5.69%	-1.21%	0.89%
Batang	203,360	406,861	610,221	223,923	449,483	673,406	0.97%	1.00%	0.99%
Pekalongan	216,864	500,316	717,180	369,591	461,041	830,632	5.48%	-0.81%	1.48%
Pemalang	395,100	785,981	1,181,081	674,937	655,053	1,329,990	5.50%	-1.81%	1.19%
Tegal	616,502	666,705	1,283,207	761,167	639,421	1,400,588	2.13%	-0.42%	0.88%
Brebes	418,320	1,211,096	1,629,416	571,157	1,180,303	1,751,460	3.16%	-0.26%	0.72%
Kota Magelang	123,800	0	123,800	124,374	0	124,374	0.05%	-	0.05%
Kota Solo	516,594	0	516,594	506,397	0	506,397	-0.20%	-	-0.20%
Kota Salatiga	101,892	0	101,892	152,913	12,481	165,394	4.14%	-	4.96%
Kota Semarang	1,104,405	241,947	1,346,352	1,352,869	85,864	1,438,733	2.05%	-9.84%	0.67%
Kota Pekalongan	301,504	19,285	320,789	263,921	5,256	269,177	-1.32%	-12.19%	-1.74%
Kota Tegal	289,744	0	289,744	238,676	0	238,676	-1.92%	-	-1.92%
DIY	**1,350,108**	**1,804,157**	**3,154,265**	**1,973,631**	**1,363,464**	**3,337,095**	**3.87%**	**-2.76%**	**0.57%**
Bantul	439,354	301,182	740,536	618,122	241,846	859,968	3.47%	-2.17%	1.51%
Kulon Progo	34,208	394,422	428,630	71,058	302,699	373,757	7.58%	-2.61%	-1.36%
Sleman	382,841	411,260	794,101	816,283	171,994	988,277	7.87%	-8.35%	2.21%
Gunung Kidul	27,392	697,293	724,685	34,629	646,925	681,554	2.37%	-0.75%	-0.61%
Kota Yogyakarta	466,313	0	466,313	433,539	0	433,539	-0.73%	-	-0.73%

Source: BPS Central Java Province and DIY, SUPAS



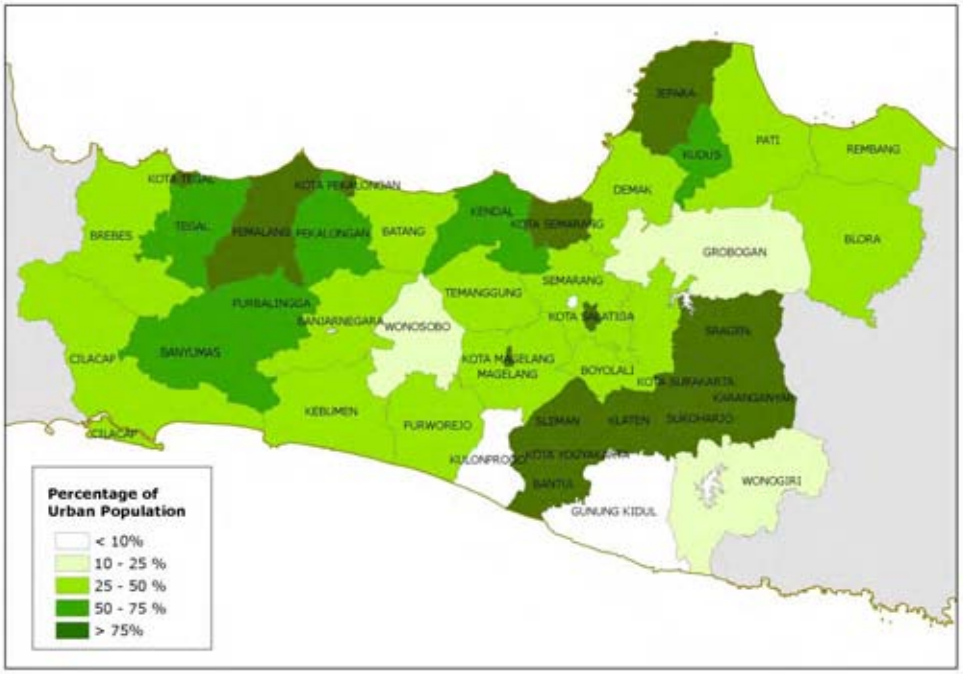
Source: CJRR Study Team based on BPS Central Java Province and DIY, SUPAS

Figure 5.2.1 Urban Population Ratio by Kabupaten/Kota in 1995



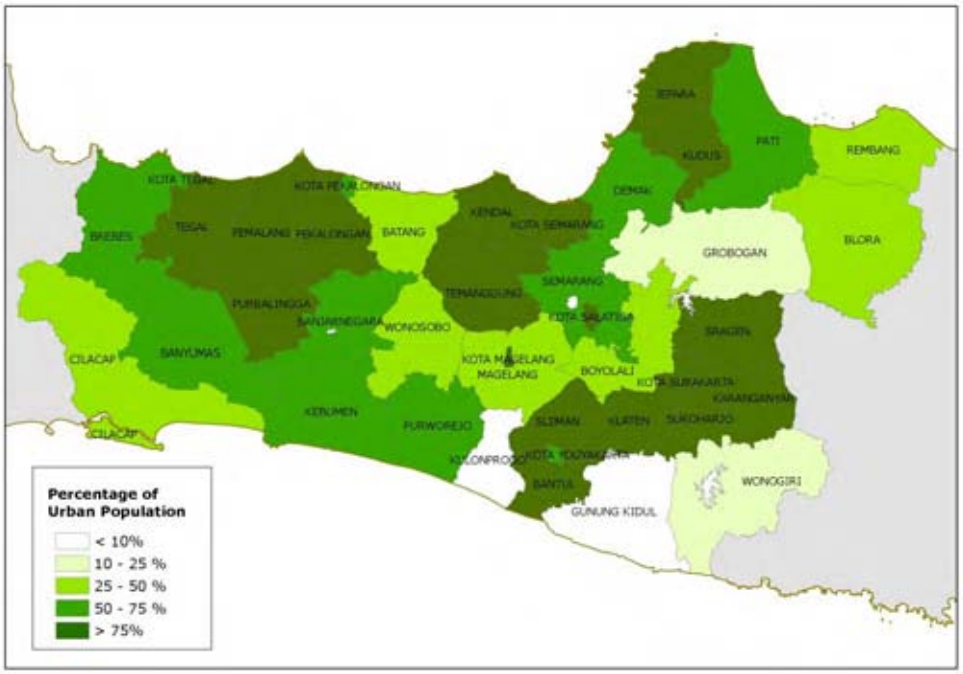
Source: CJRR Study Team based on BPS Central Java Province and DIY, SUPAS

Figure 5.2.2 Urban Population Ratio by Kabupaten/Kota in 2005



Source: CJRR Study Team

Figure 5.2.3 Estimation of Future Urban Population Ratio by Kabupaten/Kota in 2015

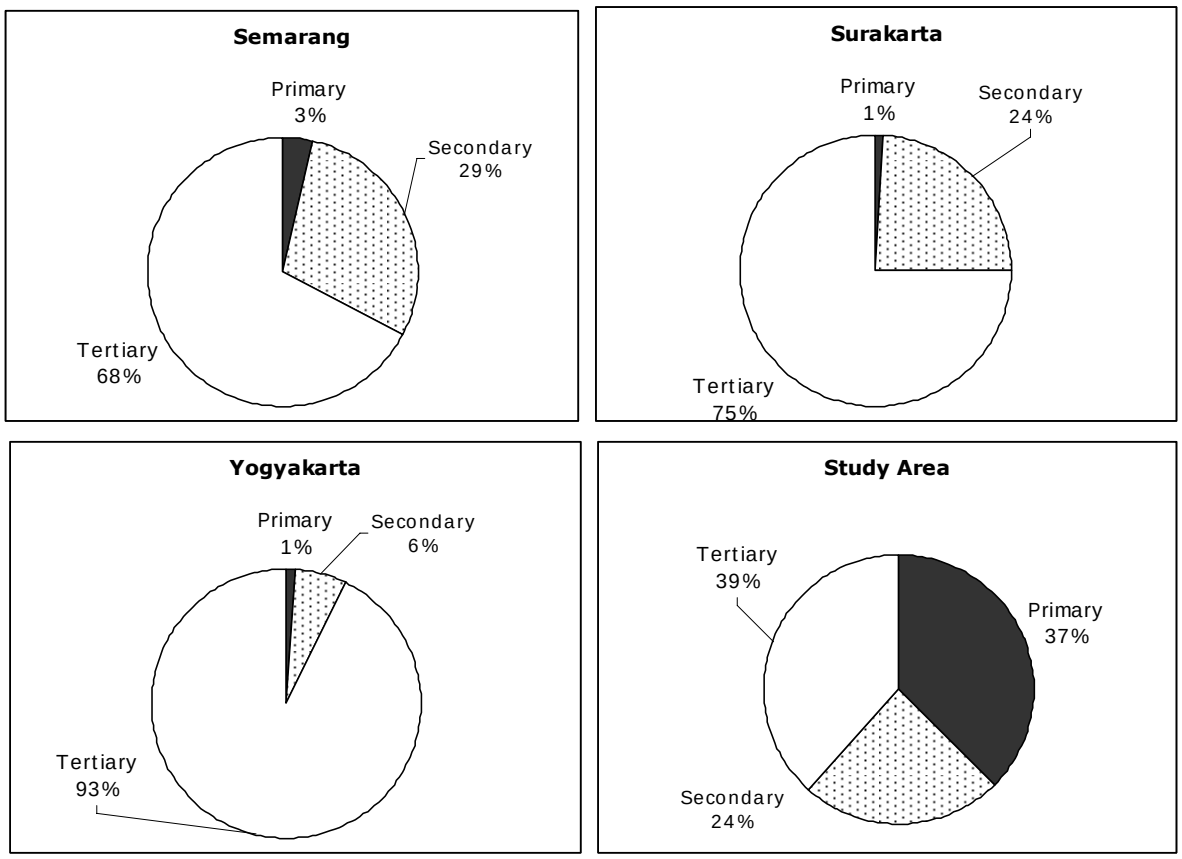


Source: CJRR Study Team

Figure 5.2.4 Estimation of Future Urban Population Ratio by Kabupaten/Kota in 2030

5.2.2 Gross Domestic Product

In Semarang, Solo and Yogyakarta, most businesses are tertiary sector industries, such as trade, service and manufacturing. Major industries in Semarang and Solo are trade, service, and commerce. Also, tourism related industries are dominant in Yogyakarta.



Source: BPS

Figure 5.2.5 Percentage of Industrial Sector, 2006

GRDP is expected to follow the trend of urban population growth, . In terms of pull factor, urbanisation could offer many people the opportunity to shift from primary to secondary and tertiary sector industries. On the other hand, in terms of push factor, improvement of agricultural, fishery and forestry skills such as introducing mechanise system might help to change in industrial structure, by decreasing population of the primary industrial sector.

In terms of GRDP per capita by the sector, the tertiary achieved high price compared to the primary and secondary. Increase of tertiary population might help to further economic growth in the urban area.

Table 5.2.2 GRDP by Sector in 2006 (constant price 2000)

Sector	GRDP (mil. Rp.)	GRDP per Capita ('000 Rp.)
Study Area	**168,218,008.68**	**9,903.63**
Central Java	**150,682,654.74**	**9,906.21**
Primary Sector	32,680,498.72	5,750.26
Secondary Sector	57,892,131.55	15,248.33
Tertiary Sector	60,110,024.47	10,509.92
DIY	**17,535,353.94**	**9,881.54**
Primary Sector	3,433,064.50	5,199.04
Secondary Sector	4,213,946.14	12,522.50
Tertiary Sector	9,888,343.30	13,043.36

Source: Dalam Angka 2007 Central Java Province, DIY

5.2.3 Land Use

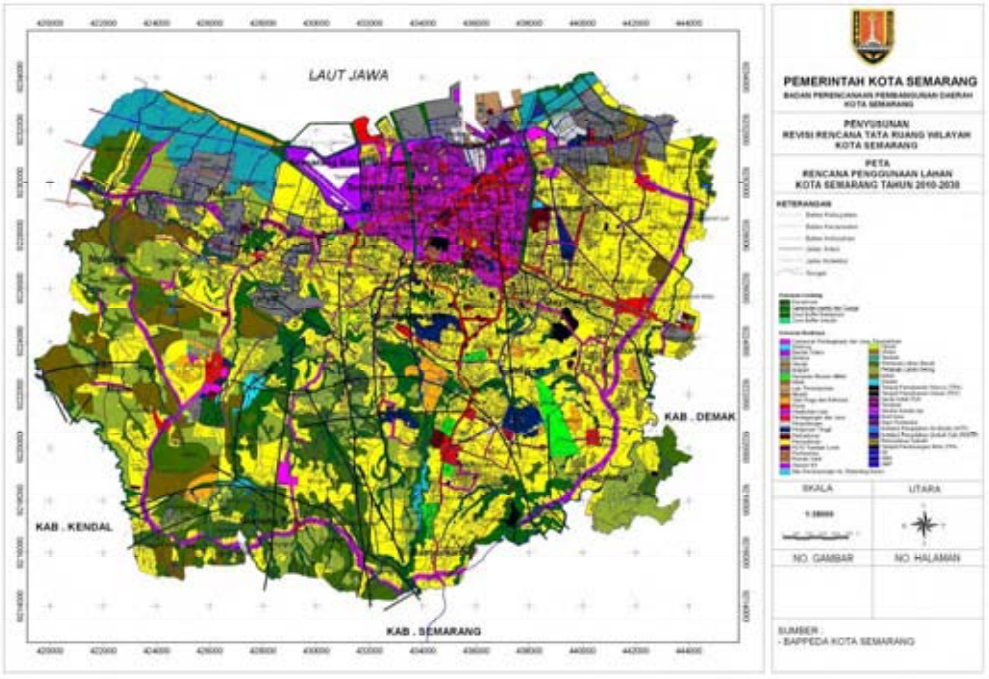
(1) Future Land Use Plan in Metropolitan Area

Urban land use needs to efficiently support urban functions and convenience in line with urban population growth and high density society. In addition, it should provide pleasant business environment that could attract business activities and encourage economic growth such as improvement of office space, transportation, and basic infrastructure including stable power supply, telecommunication and internet infrastructure.

Semarang has a large area and still plenty of room for new development. However, efficient land use, especially with clearly defined development and reserved areas,will be needed in order to support the population growth of 200,000 people over two decades estimated by Bappda Central Java Province. Organized land use will allow more efficient planning of infrastructure to support it. On the other hand, Solo and Yogyakarta have relatively small area and the is already high density population inside them. These two cities are expected to conduct land redevelopment and/or land adjustment in order to enhance urban functions including smooth transportation.

In order to take account of future dynamics from increasing urban population and economic growth, CJRR study team suggests to review the existing future land use plan periodically. In addition, an integrated land use plan of metropolitan area which covers not only kota (city) but also surrounding kabupaten will be needed depending upon the rate of urban population growth in future. The land use plans in these three cities are shown in Figure 5.2.6, Figure 5.2.7 and Figure 5.2.8. Bappeda Kota Yogyakarta is now developing their new regional spatial plan (*Rencana Tata Ruang Wilayah*, RTRW) to be completed within 2008. The Future Land Use map of Kota Yogyakarta (Figure

5.2.8) is already out of date.



Source: Bappeda Kota Semarang

Figure 5.2.6 Future Land Use Plan in Kota Semarang 2010 – 2030

Source: Bappeda Kota Solo (Surakarta)

Figure 5.2.7 Future Land Use Plan in Kota Solo 2007 - 2016

Source: Bappeda Kota Yogyakarta

Figure 5.2.8 Future Land Use Plan in Kota Yogyakarta

5.3 Review of Existing Transportation Development Plan and Program

5.3.1 Road

(1) Ordinary Road

In the north Java corridor (Brebes – Tegal – Pemalang – Pekalongan – Semarang – Demak – Kudus – Pati – Rembang), some road sections already have four lanes. By the end of 2008, the section between Semarang and Losari (western border of Central Java Province) is planned to be all four-lane roads and the work is currently underway. The remaining sections on the north corridor (i.e., Semarang – Kudus – eastern border of Central Java Province) are also planned to be widened in the near future, and will be four lanes or at least two lanes with 2 m hard shoulders. As for the central Java (Purwokerto – Banyumas – Banjarneraga – Temanggung – Salatiga – Magelang – Solo (Surakarta) – Sragen) and south Java (Cilacap – Kroya – Kebumen – Purworejo – Yogyakarta – Klaten – Boyolali – Wonogiri) corridors, there is no development program in near future (2008 and 2009).

In addition, a South-South Line Road (JLSS: *Jalan Lintas Selatan-Selatan*) (shown in Figure 5.3.1) will be developed as a primary arterial road for the purpose of diverting the trans-Java traffic that is currently concentrated on the north corridor. Total length of this trans-Java road is 1,556 km. Cooperation for the development of JLSS has been agreed among the five related provinces: namely, Banten, West Java, Central Java, DIY, and East Java; thus, the maximum benefit is expected of this project. JLSS is also expected to help to reduce the existing development gap between the northern and southern areas of the Central Java region. Construction of JLSS started in 2005. While in Central Java Province about 13 km of sections (including two bridges) have not been constructed yet, most of the sections in the Central Java region will be in service by 2009.

(2) Toll Road

In addition to the current toll roads in Semarang, there are plans for toll roads in the Central Java region as shown in Figure 5.3.1. Among others, the sections listed in Table 5.3.1 have been given high priority in an acceleration program made by the Ministry of Public Works. Some sections (No. 1 – 7 in the table) will constitute part of the Trans Java Toll Road. For the section of Semarang – Solo (total length: 75.7 km), in particular, construction of the toll road will be completed in 2012. Work of the first phase (Banyumanik – Ungaran) is expected to begin shortly.

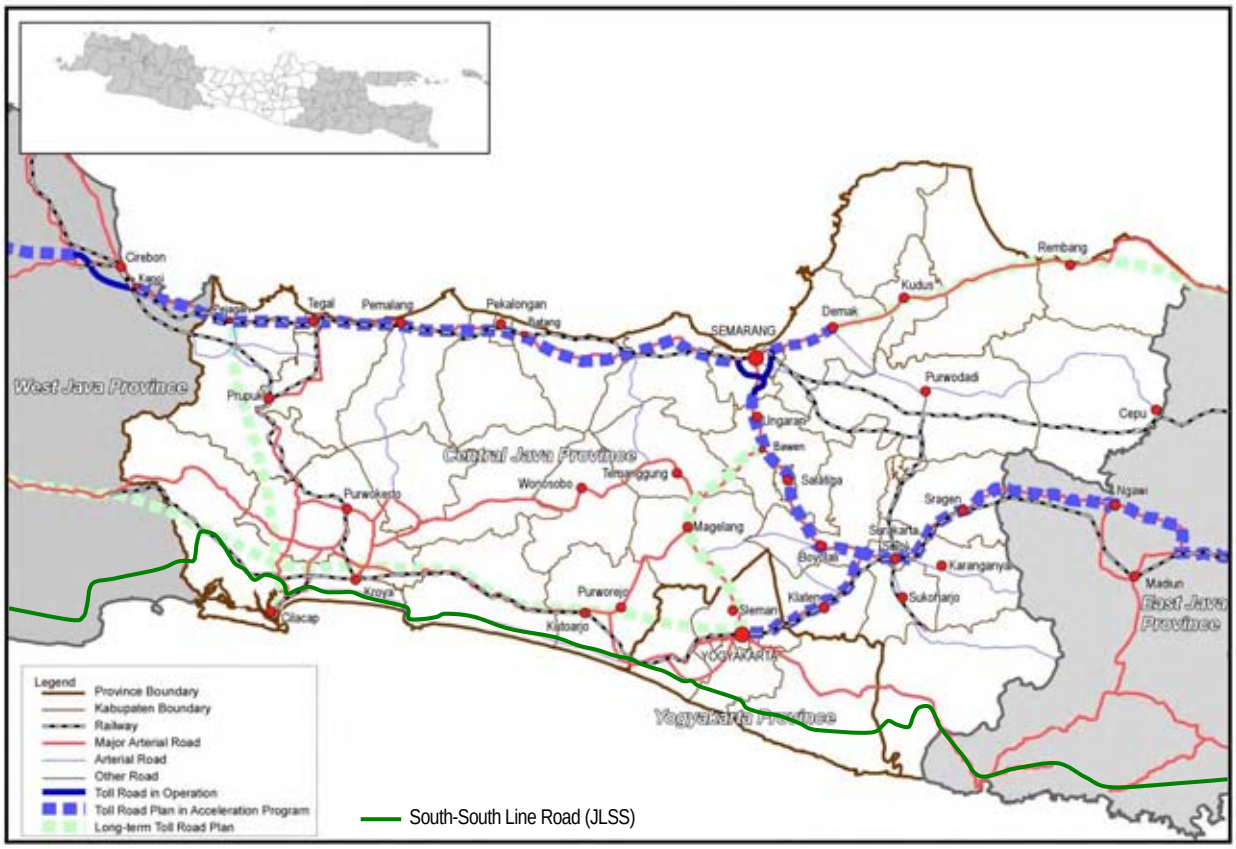


Figure 5.3.1 Planned Roads in the Central Java Region

Table 5.3.1 Prioritized Toll Roads in the Central Java Region

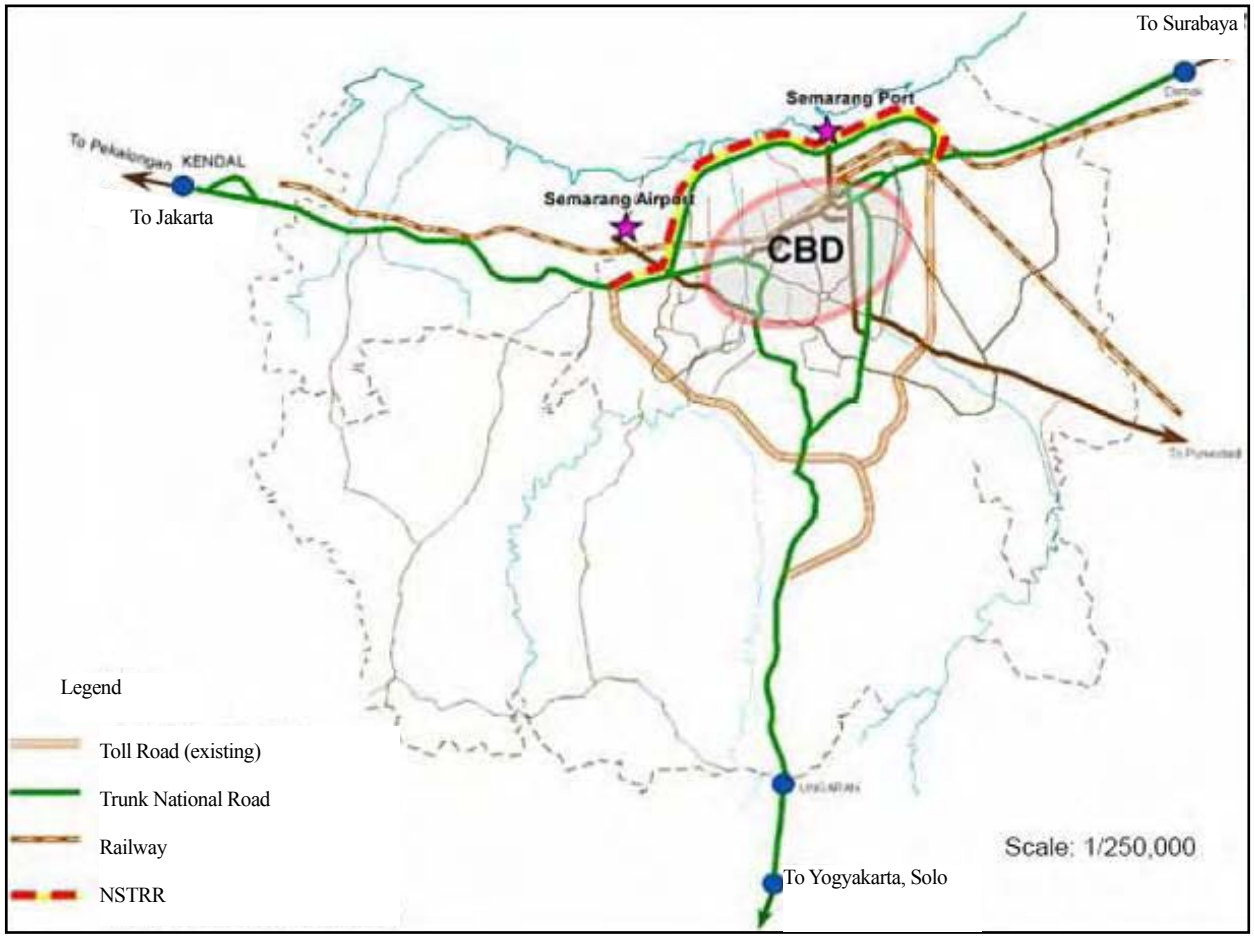
No.	Toll Road Section	Investor/Operator	Length (km)	Investment Cost (Billion Rp.)	Status
1	Kanci - Pejagan	PT. Semesta Marga Raya	34	2,095	Under construction
2	Pejagan - Pemalang	PT. Pejagan Pemalang Toll Road	57.5	3,236	Site surveying
3	Pemalang - Batang	PT. Pemalang Batang Toll Road	39	2,293	Site surveying
4	Semarang - Batang	PT. M Setiapuritama	75	3,635	Land acquisition
5	Semarang (Section A, B, C)	PT. Jasa Marga	24.75	-	In operation
6	Semarang - Solo	PT. Jasa Marga	75.7	6,135	Land acquisition
7	Solo - Ngawi	Theiss Contactors Indonesia	90.1	4,465	Site surveying
8	Semarang - Demak	-	25	2,960	Reviewing tender document
9	Yogyakarta - Solo	-	40.5	2,330	Document preparation

Source: Badan Pengatur Jalan Tol, Ministry of Public Works

Since the creation of such toll roads will greatly shorten the travel times of automobiles and buses, full attention must be paid to the toll road plans including their construction period when creating the railway development plan. For example, the travel time between Jakarta – Bandung is now only about two hours with the completion of the toll road to Bandung which is as short as the travel time by the fastest express train. With this toll road, passengers who had previously used trains have switched either to cars or buses using the toll road.

Besides the above-mentioned toll road plans, a feasibility study on North Semarang Toll Ring Road (NSTRR) was conducted as a part of the "Study of Economic Partnership Projects in Developing Countries in FY2006" by JETRO (Japan External Trade Organization). NSTRR, which is planned to traverse the northern area of Kota Semarang, aims at improving accessibility to the two main international and intercity terminals: namely, Ahmad Yani Airport and Tanjung Emas port (Tg. Emas port). These two terminals assume a very important role for the regional economy including Semarang. It is hoped that construction of NSTRR will reinvigorate the movement of people and goods.

As shown in Figure 5.3.2, NSTRR is planned to pass by the airport and the port, and its total length is about 12 km. NSTRR is also planned to connect to the existing toll roads to form a full ring road, which will function as a bypass for the through traffic in Semarang. Thus, it is expected to improve the traffic situation in the central business district (CBD) by reducing the total traffic volume.



Source: "Study of Economic Partnership Projects in Developing Countries in FY2006" (JETRO)

Figure 5.3.2 Location of North Semarang Toll Ring Road

(3) Regulation against Overloading

At present, in order to reduce the road damage caused by overloaded trucks, regulation against overloading is being enforced in accordance with the phased schedule instructed by the central government as shown in Table 5.3.2. At each weighbridge, overloaded trucks within the designated maximum percentage are still allowed to go by paying retribution; however, overloaded trucks over the maximum percentage are given a CPPPL (*catatan pemeriksaan perkara pelanggaran lalu lintas*, or note of traffic offense case) and are forced either to reduce the load on the spot or to return to the origin place. Thus, control of overloading is gradually being tightened, and no overloading (i.e., 0% overloading) will be allowed in 2009.

Table 5.3.2 Enforcement Schedule for Regulation of Overloading

Phase	Effective Period	Maximum Allowable Overload
I	February 1, 2008 – April 30, 2008	50%
II	May 1, 2008 – July 31, 2008	40%
III	August 1, 2008 – September 30, 2008	30%
IV	October 1, 2008 – December 31, 2008	20%

Source: Dinas Perhubungan, Kantor Pengendalian Muatan Barang (Central Java Province, DIY)

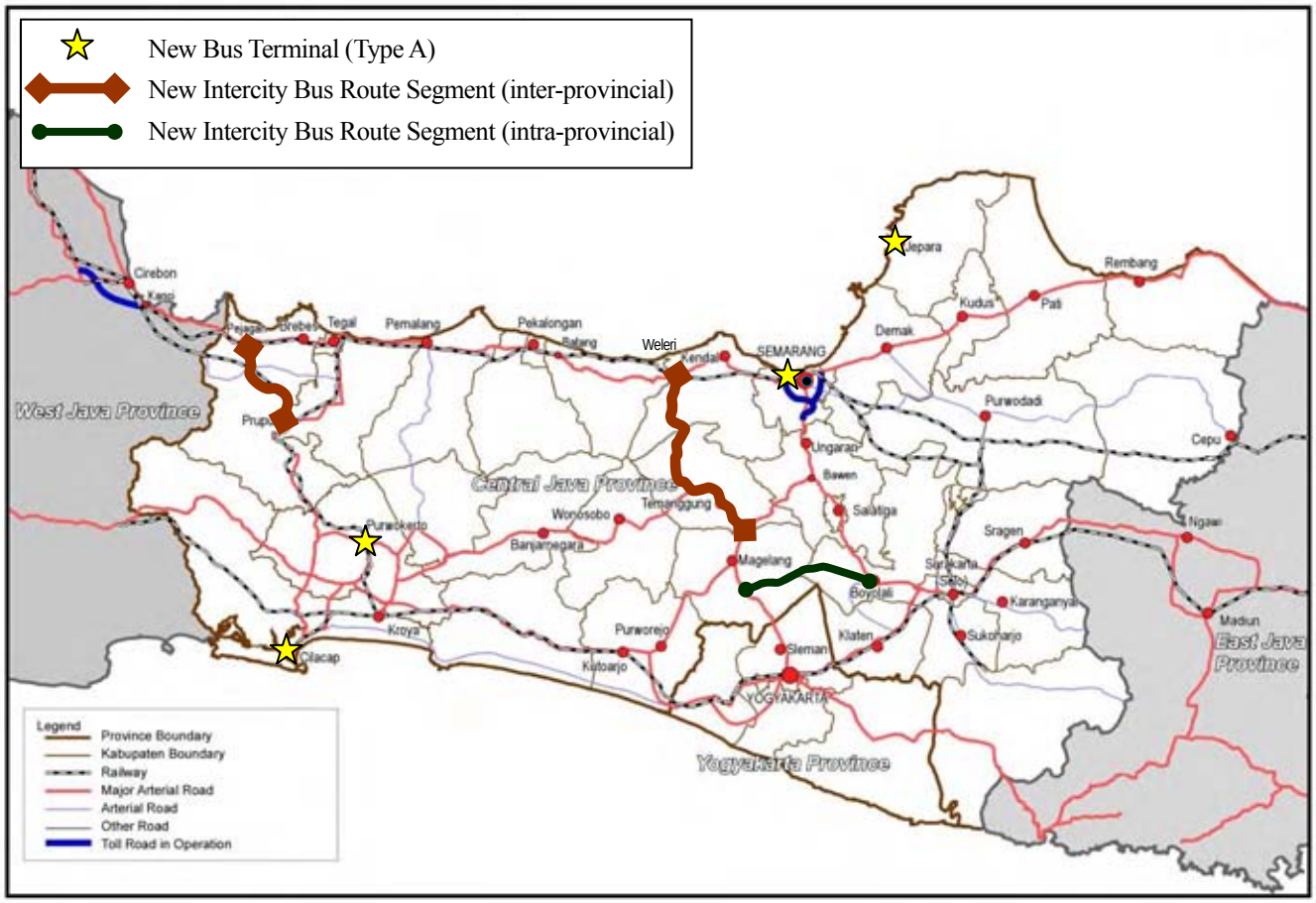
As the regulation against overloading becomes stricter, more trucks will be necessary because each truck will be able to carry a smaller volume of cargos than before. Hence, the unit transport cost of cargos is expected to increase. Along with the soaring fuel prices, it will be a disadvantage for trucks in terms of modal competition for freight transport. On the other hand, it will be a great opportunity for railways to draw attention of shippers and forwarders as a more cost-efficient mode of transport.

5.3.2 Bus

(1) Intercity Bus Transportation

Major developments for the intercity bus transportation including new bus terminals and intercity bus routes that have been proposed in the Central Java region are presented in Figure 5.3.3. New bus terminals of Type A, which is used for both inter-provincial and intra-provincial bus services, are planned at four locations: namely, Semarang, Jepara, Purwokerto, and Cilacap. Among others, the one in Semarang, which is called Mangkang Terminal, is currently under construction. Located in the west of the city, Mangkang Terminal will serve intercity bus routes especially connecting Semarang and the cities in the west including Jakarta after its scheduled opening in 2009.

As for intercity bus routes, a new segment of Pejagan – Prupuk is planned to serve as part of an alternative route between Purwokerto and Jakarta, and it will be used for both inter-provincial and intra-provincial bus services. The existing intercity, intra-provincial bus route segment of Weleri – Temanggung will be upgraded to be used for inter-provincial bus services, making an alternative route between Yogyakarta and Jakarta. A new intercity bus route segment of Magelang (Borobudur) – Boyolali is planned to open for intra-provincial bus services.



Source: Studi Penyusunan Tataran Transportasi Wilayah (TATRAWIL), Central Java Province (2004)

Figure 5.3.3 Planned Development of Intercity Bus Transportation

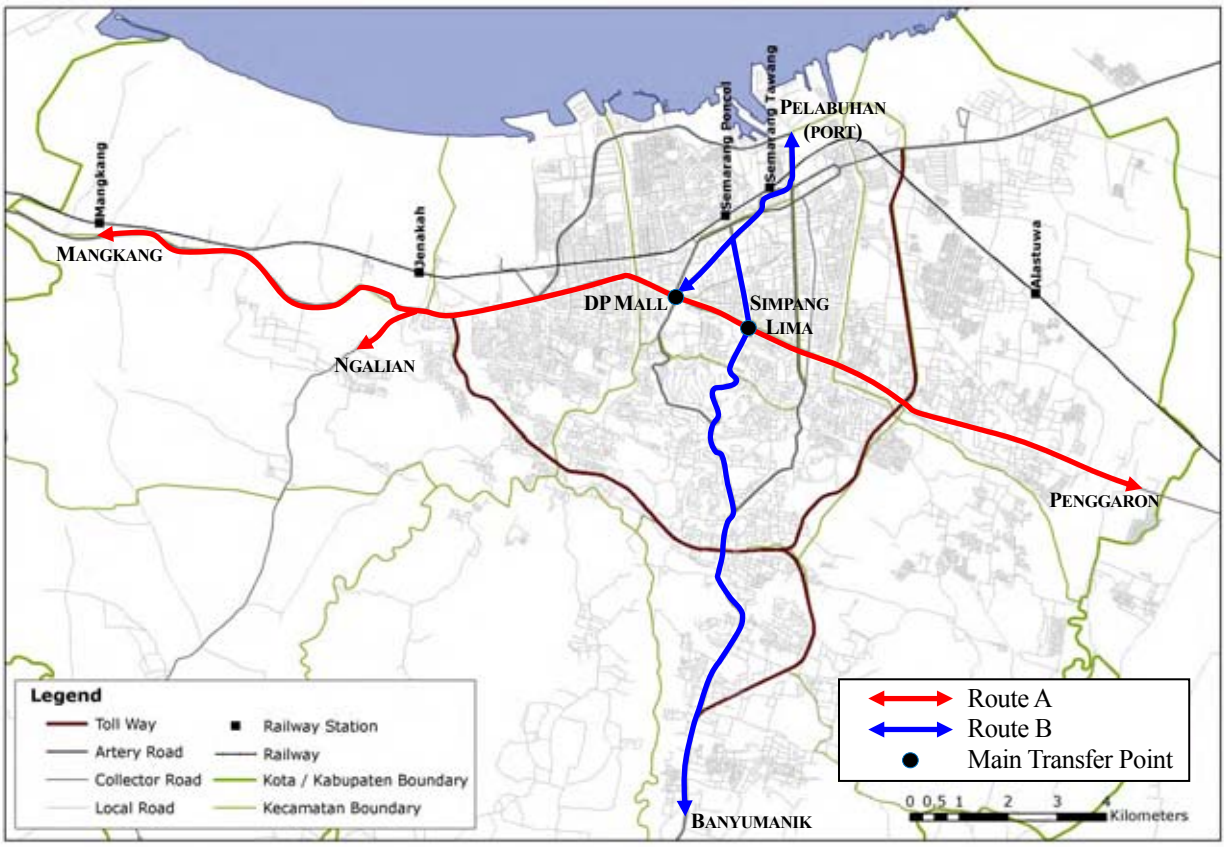
(2) Bus Rapid Transit

In February, 2008, a new bus rapid transit (BRT) system called Transjogja began its operation in Yogyakarta. Unlike Transjakarta in Jakarta, Transjogja does not have dedicated bus lanes. However, it is the first air-conditioned bus service in Yogyakarta with a fleet of 54 buses (34 seats each), and it stops only at the 67 designated bus shelters where each passenger must pay the flat fare of Rp. 3,000 (or Rp. 2,000 for students) before boarding the bus. As shown in Figure 5.3.4, there are three main routes, connecting all the main transportation terminals such as Tugu Railway Station, three bus terminals (Giwangan, Jombor, and Condong Catur), and Adi Sutjipto Airport as well as the major tourist spots such as Jalan Malioboro, Kraton, and Prambanan Temple. Since all the three Transjogja routes pass by Tugu Station, accessibility between the railway and the major places in the city has greatly improved.

Source: Dinas Perhubungan of DIY

Figure 5.3.4 Route Map of Yogyakarta BRT (Transjogja)

Implementation of a similar BRT system is also being studied in the cities of Semarang and Solo. In Semarang, two main BRT routes are planned as shown in Figure 5.3.5. One route runs east and west (Route A: Mangkang – Penggaron), and the other runs north and south (Route B: Banyumanik – Semarang Port). Both routes go through the center of Semarang and interconnect at Simpang Lima and DP Mall. Route B also crosses the railway and connects with the main station of the city (Semarang Tawang Station). Total necessary buses are estimated around 104 units (68 units for Route A and 36 units for Route B). Operation of Route A is scheduled to start in 2009.

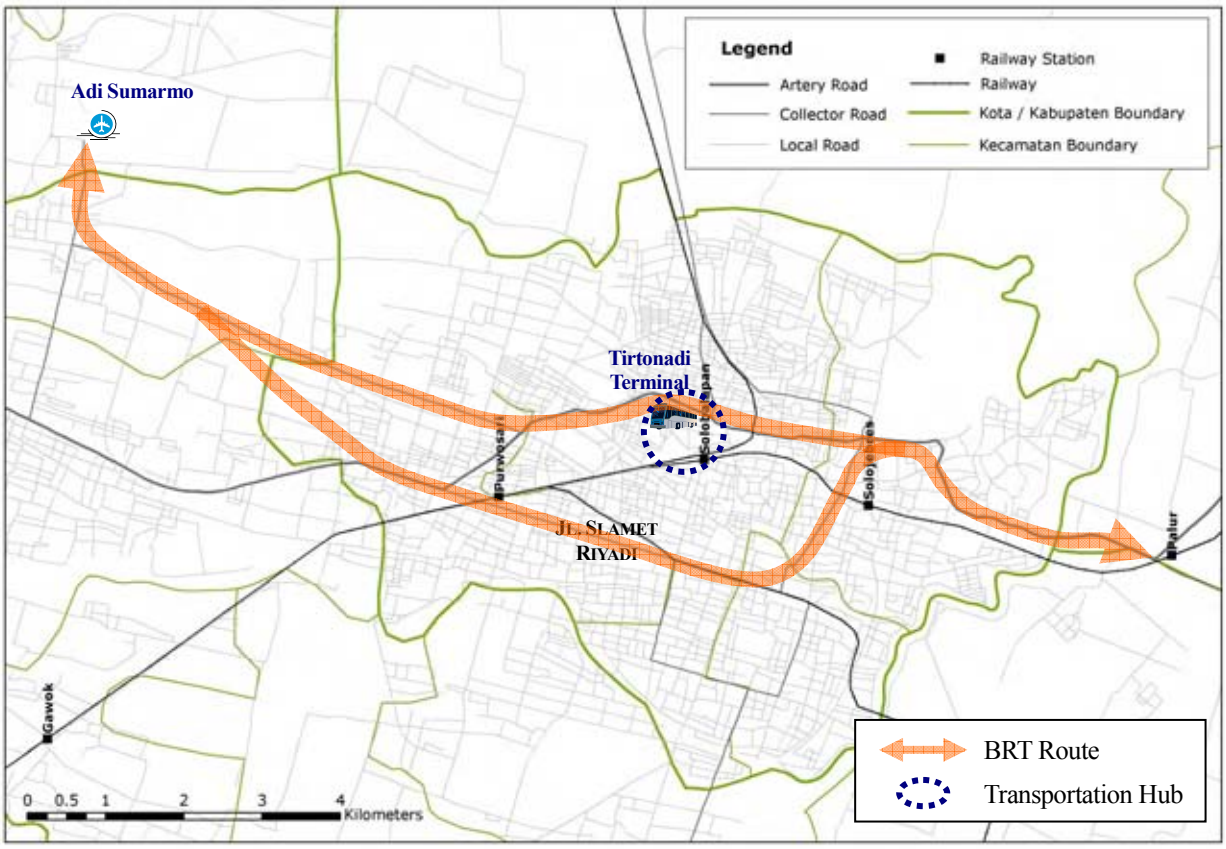


Source: Dinas Perhubungan of Kota Semarang

Figure 5.3.5 Planned BRT Routes in Semarang

In Solo, a BRT system is planned for operation in 2009 by rationalizing the existing 10 microbus routes and 12 medium-size bus routes. The BRT route will run basically east and west, connecting Adi Sumarmo Airport, Solo Balapan Railway Station, Jalan Slamet Riyadi, and Palur, as shown in Figure 5.3.6. About 20 buses are considered necessary for operation of the BRT. Furthermore,

the existing intercity bus terminal (Tirtonadi) which is located around 500 m from Solo Balapan Station is planned to be expanded and integrated with the railway and BRT facilities to make a transportation hub of the city.



Source: Badan Perencanaan Daerah (BAPEDA) of Kota Solo (Surakarta)

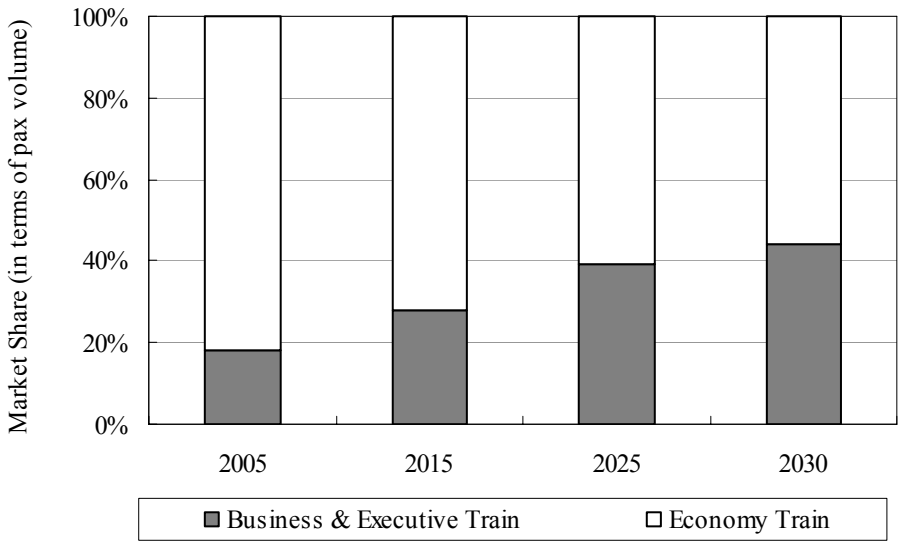
Figure 5.3.6 Conceptual BRT Routes in Solo

5.3.3 Railway

(1) Passenger Transport

As for the future prospect of railway passenger transport, according to the draft master plan of the Indonesian railways for 2006 – 2030 which was prepared by PT. KA as well as the Ministry of Transport, the mode share of railways is forecasted to increase from the current 6% (as of 2005) to 10% (in a moderate case) or 20% (in an optimistic case) in 2030. Regarding the future market share (in terms of passenger volume), while at present the majority of passengers are from economy class trains, improvement of railway services especially for business and executive train classes is

planned in order to increase the share. The share of business as well as executive class trains is expected to increase in the long term as shown in Figure 5.3.7. It is expected that the same trend will apply to the railways in the Central Java region.



Source: PT. (Persero) Kereta Api and Ministry of Transport

Figure 5.3.7 Expected Future Composition of Train Classes in Indonesia

In the Central Java region, there is a plan to eventually double-track the entire sections of Java north trunk line (Cirebon – Tegal – Semarang – Surabaya), Java south trunk line (Kroya – Yogyakarta – Solo), and the linking north-south line (Cirebon – Purwokerto – Kroya). The project of double-tracking the Java south trunk line and the linking north-south line is to be implemented with a Japanese ODA loan. The section of Kutoarjo – Yogyakarta – Solo has already been double tracked, and double-tracking the section of Kroya – Kutoarjo is now underway. Among the remaining sections, detailed design for the sections of Cirebon – Prupuk and Purwokerto – Kroya will be conducted through a Japanese ODA loan while the remaining section of Prupuk – Purwokerto will be double-tracked under the GOI's own budget.

As for the Java north trunk line, most of the sections have been or will be double-tracked under the GOI's own budget. The sections of Brebes – Tegal and Pemalang – Petarukan have already been double-tracked, and double-tracking the sections of Losari – Brebes and Tegal – Pekalongan will be finished by 2011. Double-tracking the section of Cirebon – Losari is also planned in the near future. The study for double-tracking the sections of Pekalongan and eastwards to Semarang has not been started yet.

(2) Cargo Transport

Regarding the long-term perspective of railway cargo transport, according to the draft master plan of the Indonesian railways for 2006 – 2030, the mode share of railways is forecasted to increase from the current very small share of 0.6% (as of 2005) to 5% (in a moderate case) or 10% (in an optimistic case) in 2030.

5.3.4 Airport

According to the master plan of Adi Sutjipto (Yogyakarta) Airport, along with expansion and development of the runway, taxiways, and apron parking area, the passenger terminal is planned to be moved north toward the existing Yogyakarta – Solo railway line. A new railway station, taking over old Maguwo Station, has been constructed and the station will be integrated with the new passenger terminal building (Figure 5.3.8). This plan is included in Phase 2 (2007 – 2008), and new Maguwo station started operation in June, 2008. In addition to the existing local business train (Prameks) which makes an additional stop at this station, new railway services linking the airport and Yogyakarta/Solo are expected to be provided after completion of the new passenger terminal and railway station.

For Ahmad Yani (Semarang) Airport, there is also a master plan with two-phase development including extension the runway and construction of new terminal facilities. Although there is a railway track which passes by the airport, an extension railway line needs to be constructed in order to access the existing railway because the new passenger terminal building is planned on the north of the runway, that is, apart from the existing railway (Figure 5.3.9).

As for Adi Sumarmo (Solo) Airport, a master plan study has been done by PT. (Persero) Angkara Pura I. New terminal building is planned be constructed. At present there is no railway nearby the airport, and so far, there is no plan to link the airport by railway.

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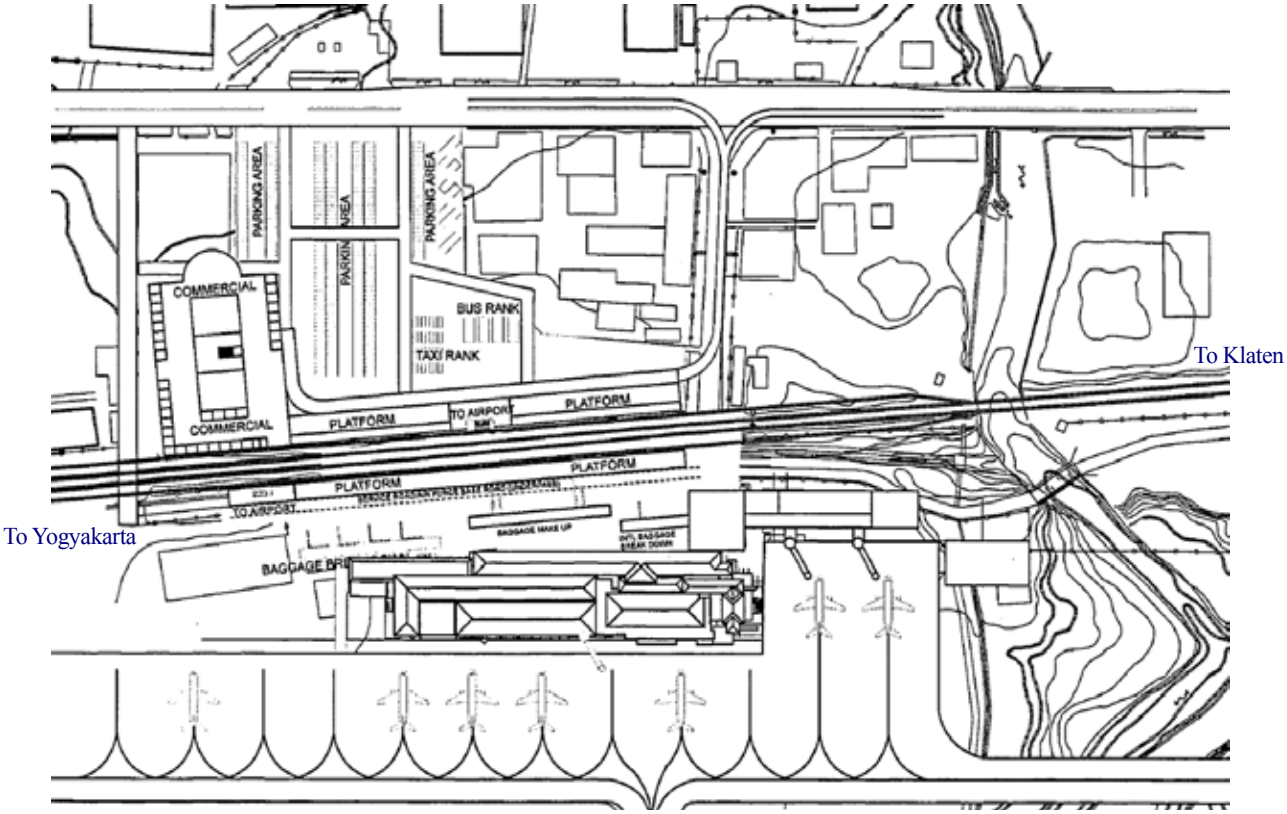
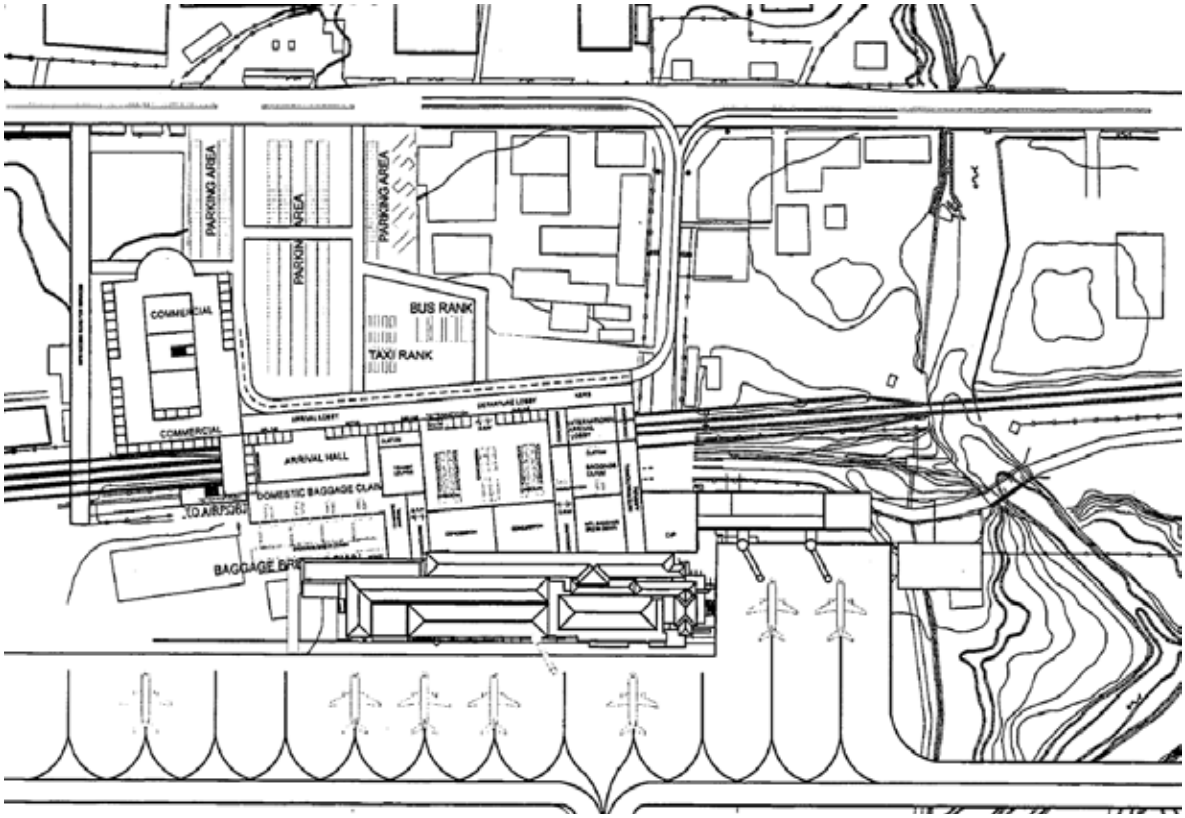
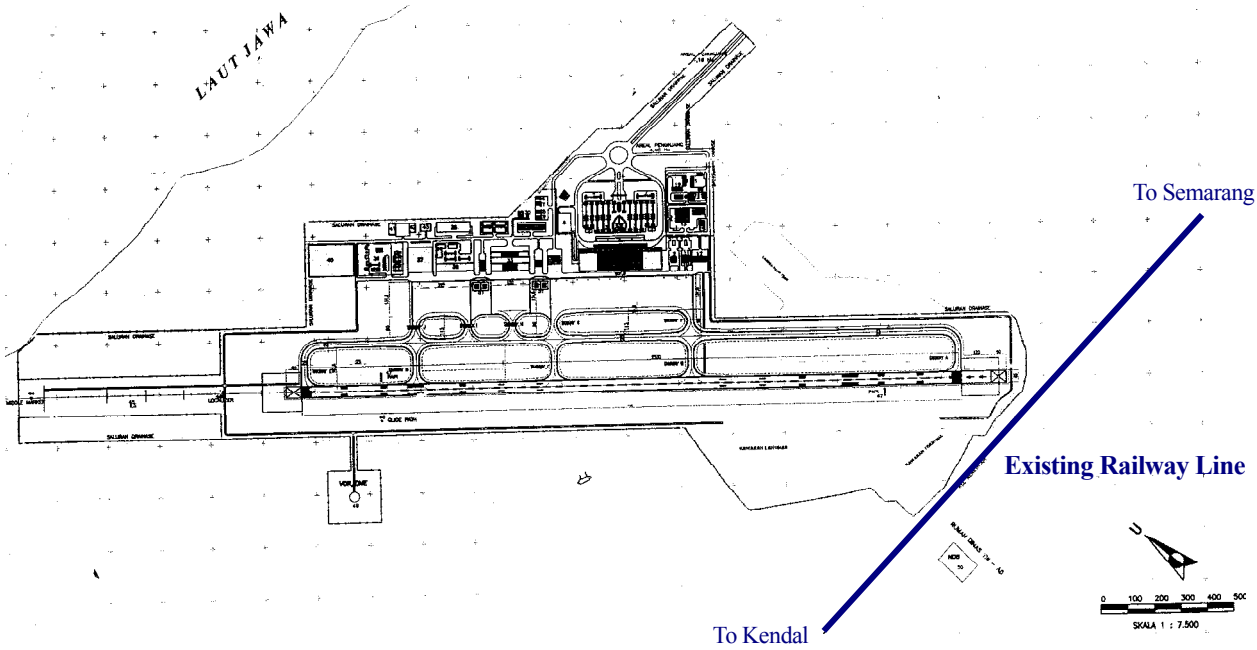


[Second Floor]



Source: Dinas Perhubungan, DIY, "Perencanaan Pengembangan Bandar Udara Adisutjipto Tahap I"

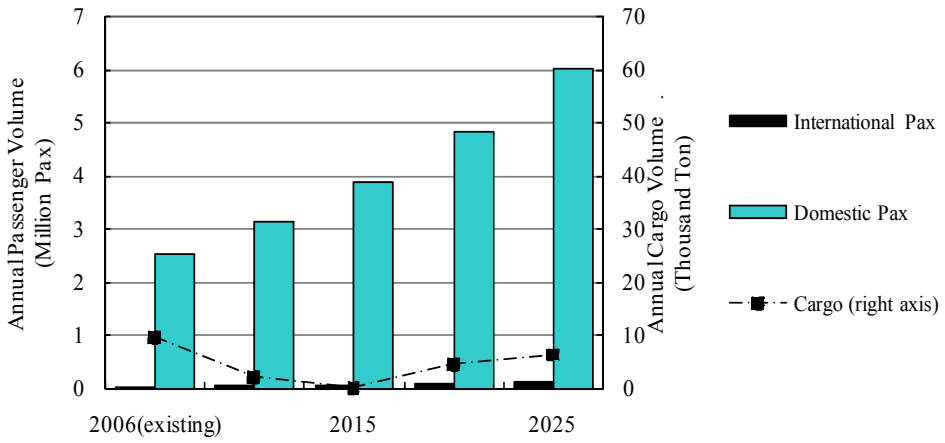
Figure 5.3.8 New Passenger Terminal and Railway Station of Adi Sutjipto Airport



Source: Ministry of Transport, "Perhubungan Peraturan Menteri Perhubungan Nomor: 53 Tahun 2007 Tentang Rencana Induk Bandar Udara Internasional Ahmad Yani Kota Semarang Provinsi Jawa Tengah"

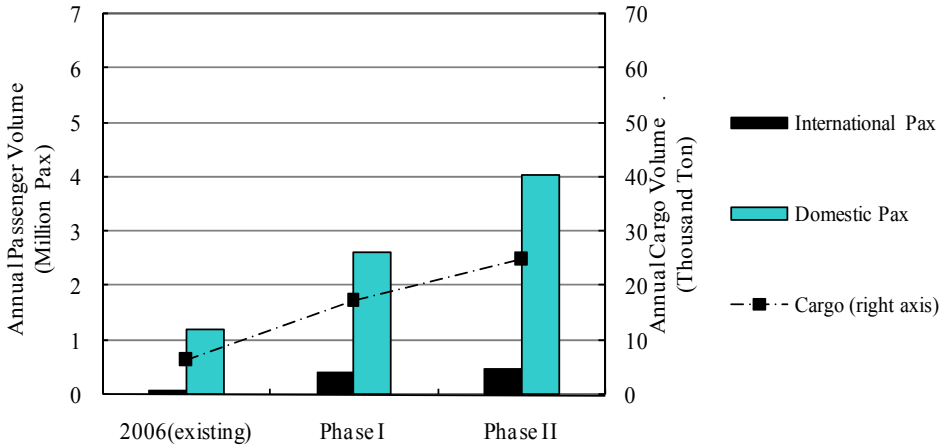
Figure 5.3.9 Development Plan of Ahmad Yani Airport

Future passenger and cargo volumes that are estimated in the master plan of each airport are presented in Figure 5.3.10 (Adi Sutjipto Airport, Yogyakarta), Figure 5.3.11 (Ahmad Yani Airport, Semarang), and Figure 5.3.12 (Adi Sumarmo Airport, Solo). Adi Sutjipto (Yogyakarta) Airport plans mainly to serve domestic passengers and thus a significant increase is expected, while international passenger and cargo traffic are not really focused on. Ahmad Yani (Semarang) Airport is expected to cope with the increase in both (international and domestic) passenger and cargo traffic. As for Adi Sumarmo (Solo) Airport, it plans to specialize in international passenger and cargo transportation.



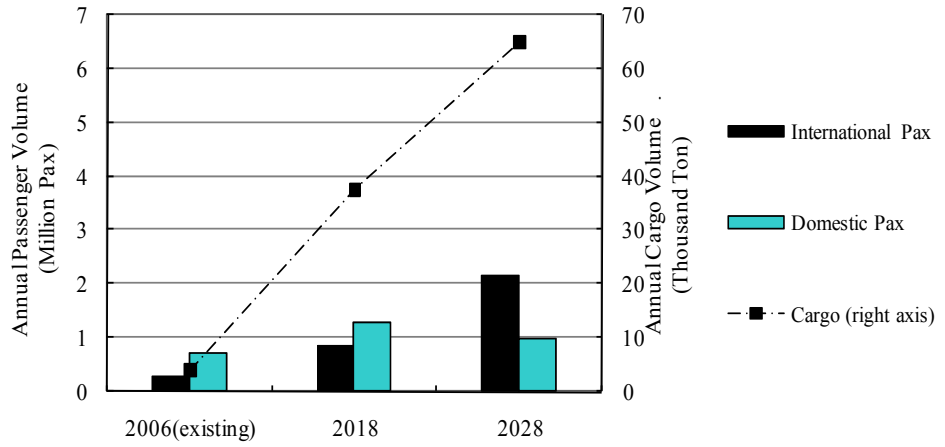
Source: Propinsi Daerah Istimewa Yogyakarta

Figure 5.3.10 Estimated Passenger and Cargo Volume: Adi Sutjipto Airport (Yogyakarta)



Source: Ministry of Transport

Figure 5.3.11 Estimated Passenger and Cargo Volume: Ahmad Yani Airport (Semarang)

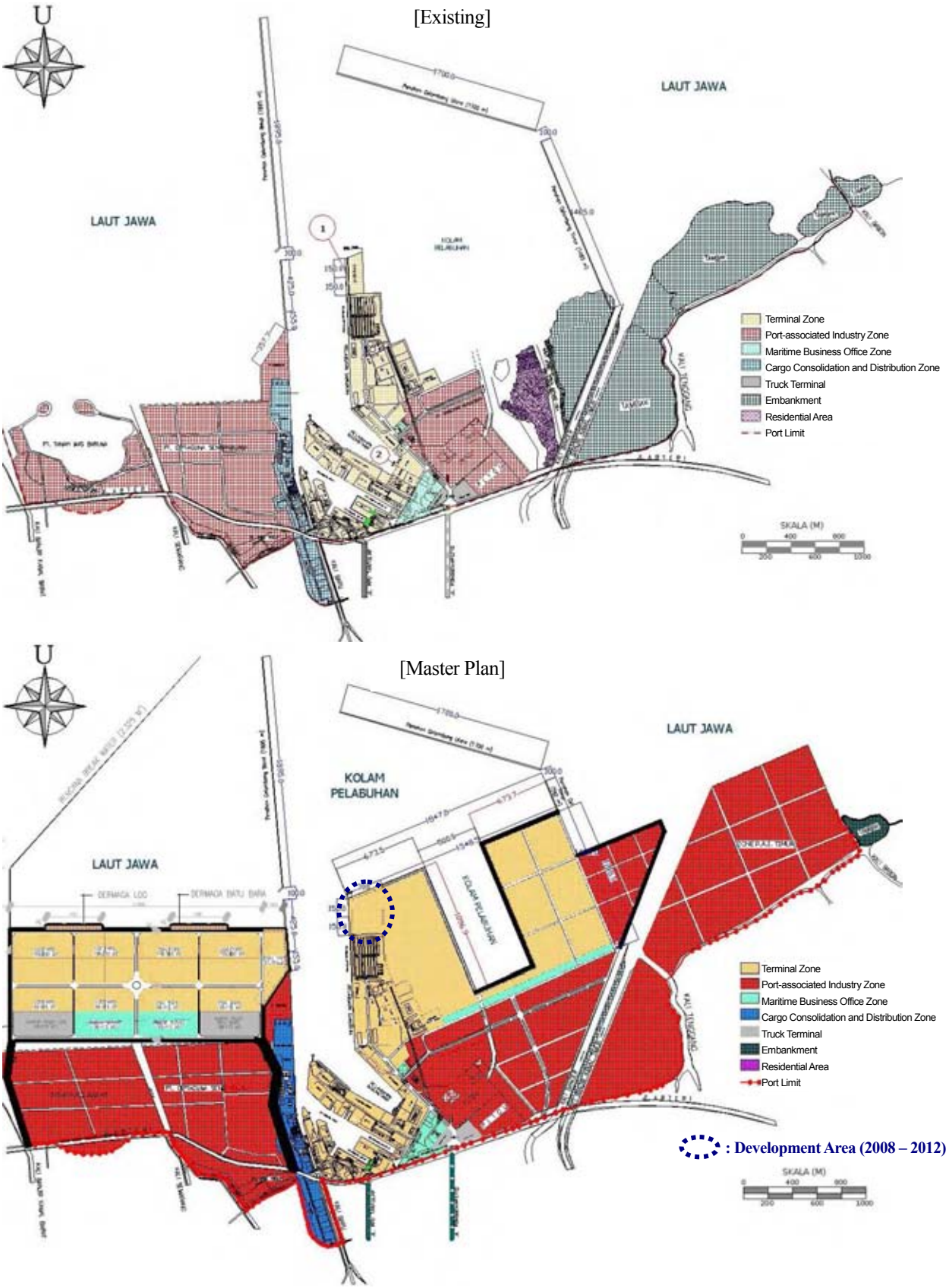


Source: PT. (Persero) Angkasa Pura I

Figure 5.3.12 Estimated Passenger and Cargo Volume: Adi Sumarmo Airport (Solo)

5.3.5 Port

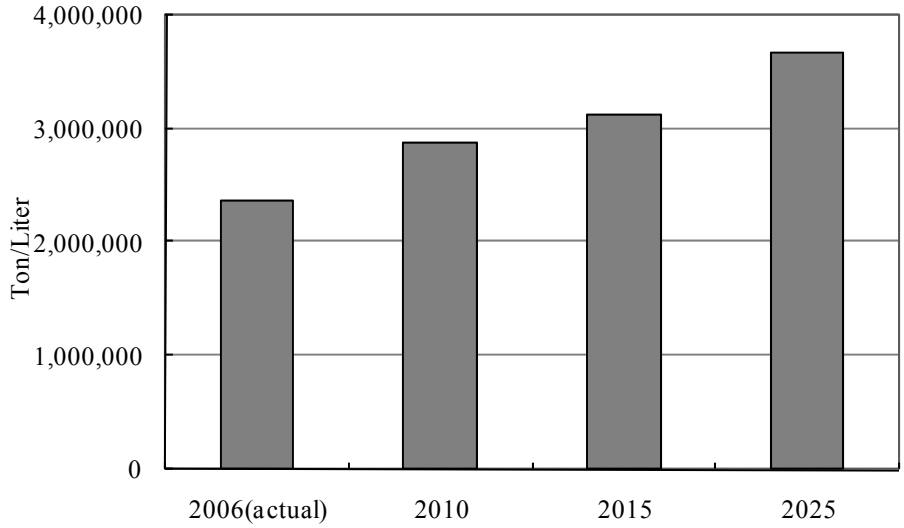
In order to plan the needs of developing port services, navigation safety, and supporting facilities, a master plan of Tg. Emas port has recently been prepared for the next 25 years along with phased improvement plans considering national port affair regulations, regional/city spatial plans, and environmental aspects. Existing and planned layouts of Tg. Emas port are shown in Figure 5.3.13. Bulk cargo area including coal is planned to be moved to the west of the port (toward the existing marina) in order to expand the existing container terminal and general cargo area. In the short-term development plan (2008 – 2012), the development area which is indicated in the planned layout includes additional berths (2 x 150 m) in the east direction and a container yard (6 ha).



Source: PT. (Persero) Pelabuhan Indonesia III, "Master Plan Pelabuhan Tanjung Emas Semarang 2001-2025"

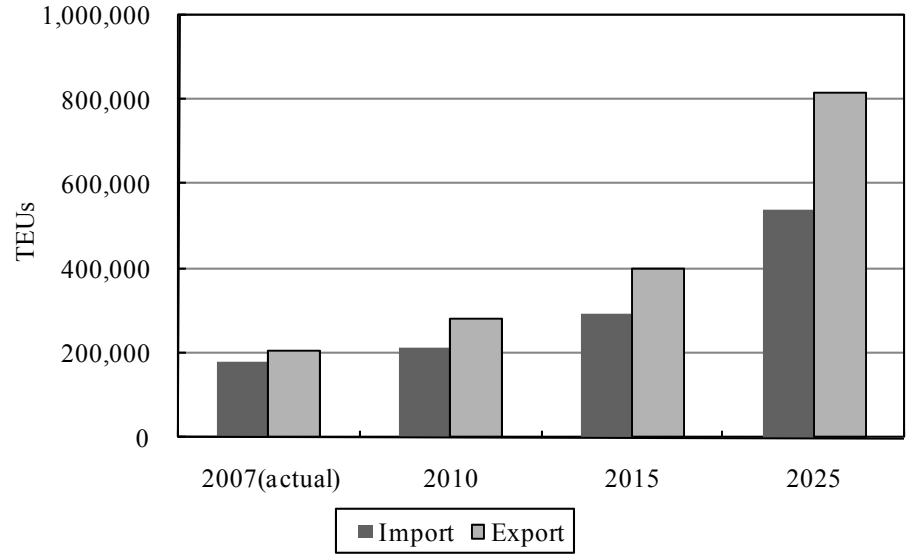
Figure 5.3.13 Existing and Planned Layout of Tg. Emas (Semarang) Port

In accordance with the port expansion and improvement, volumes of fuel, containers, and non-container cargos have been forecasted in Figure 5.3.14, Figure 5.3.15, and Figure 5.3.16, respectively. Growth in the handling volume is expected for most commodity types. Among others, rapid and stable growth of container volume is expected for both import and export.



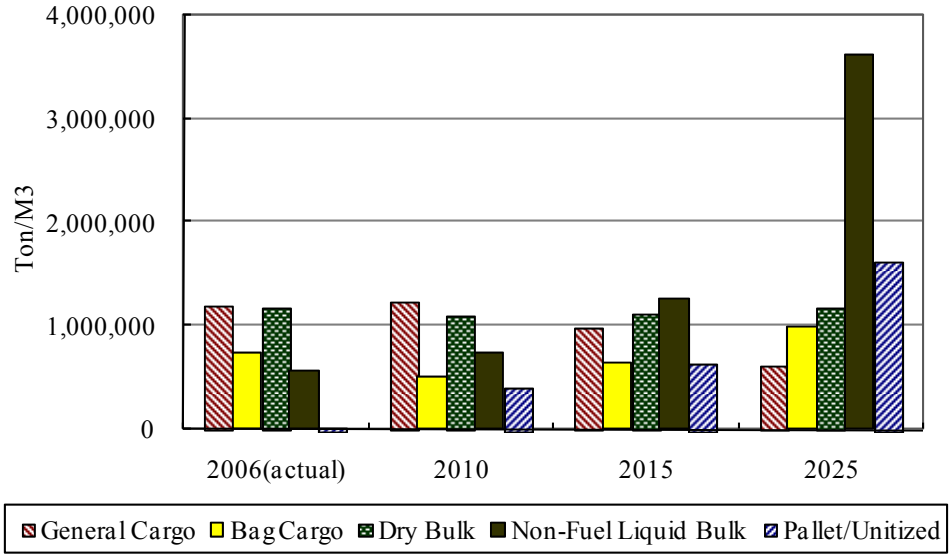
Source: PT. (Persero) Pelabuhan Indonesia III, "Master Plan Pelabuhan Tanjung Emas Semarang 2001-2025"

Figure 5.3.14 Forecast of Fuel Volume at Tg. Emas Port



Source: PT. (Persero) Pelabuhan Indonesia III, "Master Plan Pelabuhan Tanjung Emas Semarang 2001-2025"

Figure 5.3.15 Forecast of Container Volume at Tg. Emas Port



Source: PT. (Persero) Pelabuhan Indonesia III, "Master Plan Pelabuhan Tanjung Emas Semarang 2001-2025"

Figure 5.3.16 Forecast of Non-Container Cargo Volume at Tg. Emas Port

Chapter 6 Identification of Planning Issues and Development Objectives

6.1 Planning Issues on Regional Railway System Development

1) Anticipated Urban Transportation Problem

Urban transportation problems are anticipated due to urban population growth, expansion of urban areas, and increase of car ownership due to real household income increase. To prevent the consequent traffic congestion in metropolitan areas, service level of the public transportation system should be enhanced by making the railway transportation system a trunk system.

2) Necessity of Improvement of Railway Transportation System

The service level of the existing railway system is assessed as being unsatisfactory. The train often is delayed and railway accidents often occur by various causes. For intercity passenger transport, the ridership of railway transport has been decreasing due to the emergence of low cost carriers for long distance travel and buses: namely, "Travel" and private passenger cars on the toll road as a competitor for middle distance travel. Reliability of railway operations has been lost and shippers are changing mode of transport from railway to roads.

3) Financial Source Increase required for Railway System Development

The problem structure of railway transportation is drawn in Figure 6.1.1. This diagram indicates relationship between components of problems and shows the vicious downward spiral of the railway transportation problem. One of the crucial causes for the insufficient level of railway service is lack of financial sources of both the Central government and PT. KA for rehabilitation and improvement of the railway system.

An improved railway transportation system could bring about improvement of accessibility and shorter travel time and as a consequence, land value along the railway corridor would increase. However this increase in land value would not be captured by the railway operator and instead only land owners would enjoy the increase of their property value.

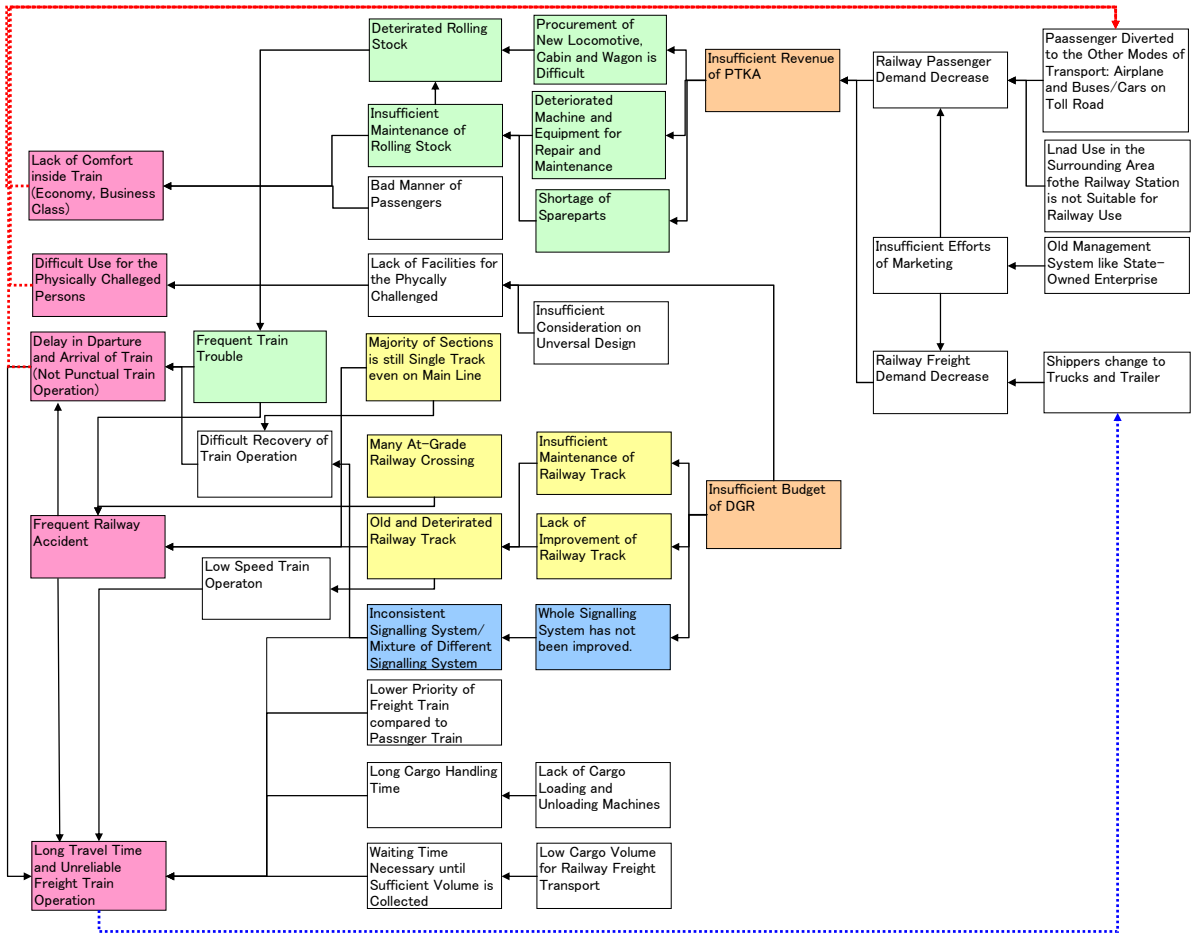


Figure 6.1.1 Problem Structure of Railway Transportation in the Central Java Region

4) Enhancing Railway Freight Transport to reduce Road Damage

Road damages caused by overloaded trucks and trailers are significant and Department of Land Transport is making traffic enforcement gradually stricter this year. Until last year, the allowance for overload was 100% but it is planned to reduce allowance to 0% by the end of 2008. If this goal is achieved, it will lead to significant increase in costs to road transport. In other words the cost for transporting cargoes by trucks and trailers will increase and the cost of railway freight transport will become comparatively cheaper. On the other hand, if this scenario does not happen, then the damages to the road will continue (please refer to Section 3.3) and the central and local government will have to continue to spend considerable amounts for road repair and maintenance. By shifting heavy road traffic to railway transport the damage of the roads would be reduced and this would justify subsidy to the railway transportation by the government sector.

5) Food Security as Constraint for Urban Development

Since Indonesia has been facing shortage of food production, the government is seriously concerned about conversion of agricultural land into industrial and residential land. Urbanization is however expected to proceed in the Central Java region and the requirement of urban land will increase due to housing demand and the need for industrial land. Although conversion of agricultural land is inevitable to some extent, but it should be minimized.

6) Flooding Problem in Semarang and Countermeasures

Flooding is a chronic problem in the region, in particular, in the urban area of Semarang. Railway facilities including railway track and stations often suffer from floods. The flooding problem has been caused by land subsidence and a fundamental solution should be provided by flood control measures. Currently an urban drainage project is being undertaken and will be completed in six years; then the area will be enclosed by Bajir Kanal in the east and west and the planned dike to be constructed parallel to the harbor road in the northern part of the city canal.

6.2 Objectives for Central Java Regional Railway System Development

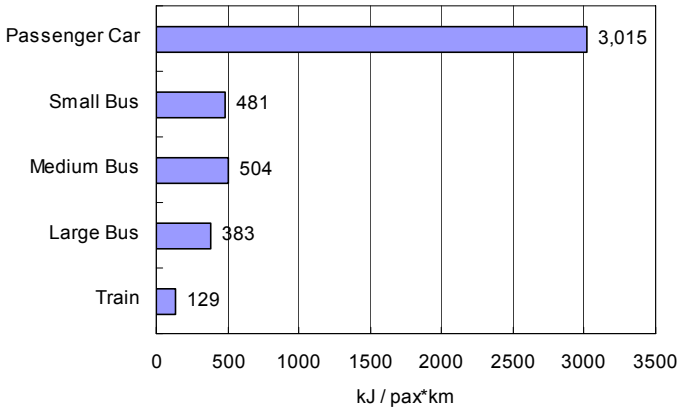
The analysis of the present transportation problems and the planning issues in the Central Java region have resulted in the identification of four major principles, which the railway transportation system development needs to pursue.

(1) Efficiency in Transportation System

1) Intercity Transportation

For improvements of the energy efficiency of total transportation system in the Central Java Region, it is effective to promote railway transportation and facilitate modal shift from passenger cars and various types of buses to trains. Amounts of energy consumption by mode of transportation are

depicted in Figure 6.2.1. Even though mass transit system consumes more energy for operation of each unit, it can save the energy consumption per person-km, because of its higher transport capacities and greater energy efficiency than private vehicles.



Source : Study on Integrated Transportation Master Plan for Jabodetabek, 2004

Figure 6.2.1 Energy Consumption by Mode of Transportation

2) Intra-Urban Transportation

In the Central Java region, three metropolitan areas (Semarang, Solo (Surakarta) and Yogyakarta metropolitan areas) lead the regional economy by providing business services to industries of the region. In these metropolitan areas development of efficient transport system is of great importance to support economic activities. Railway transit system has an advantage over private modes of transport in terms of travel costs and lesser consumption of space in the context in urban area. In general, traffic congestion in urban areas leads to a considerable amount of economic loss to society because of longer travel times, lack of punctuality and the deterioration of the environment.

Traffic congestion in the metropolitan areas has not been severe compared to Jakarta but the situation will get worse as urbanization proceeds and total population of the metropolitan areas increase. As real household income of residents increases, ownership of motorcycles and private passenger cars will increase rapidly but development of road network will not be able to catch up with increasing traffic demand on the roads. It is proposed therefore to establish an efficient and convenient public transportation network to prevent shifting to private modes of transportation. Railway transportation should play the primary role in the public transportation network.

a) Integration with Other Modes of Public Transportation

It is recommended to provide commuter railway service to formulate trunk public transportation network in the urban areas. The railway lines should be integrated with the other modes of public

transportation such as busway and primary bus system such as TransYogya.

b) Integration with Urban Development

Integration of land use and transportation system will bring about increase of transportation efficiency. Transit Oriented Development (TOD) is a concept to integrate urban land use with a transit system. High-density housing and commercial development should be incorporated with transport nodes, i.e. railway stations.

This means that the surrounding areas of the railway station should be developed with rather high density residential area such as high-rise apartments and commercial area including convenience stores in the beginning and supermarkets and shopping malls in a later stage. In addition, the access roads to railway stations should be improved or developed for convenient access to railway services and a station plaza should also be prepared to allow for transferring from feeder mode to a train.

(2) Equity in Transport to All the Members in the Society

a) Low Income Household

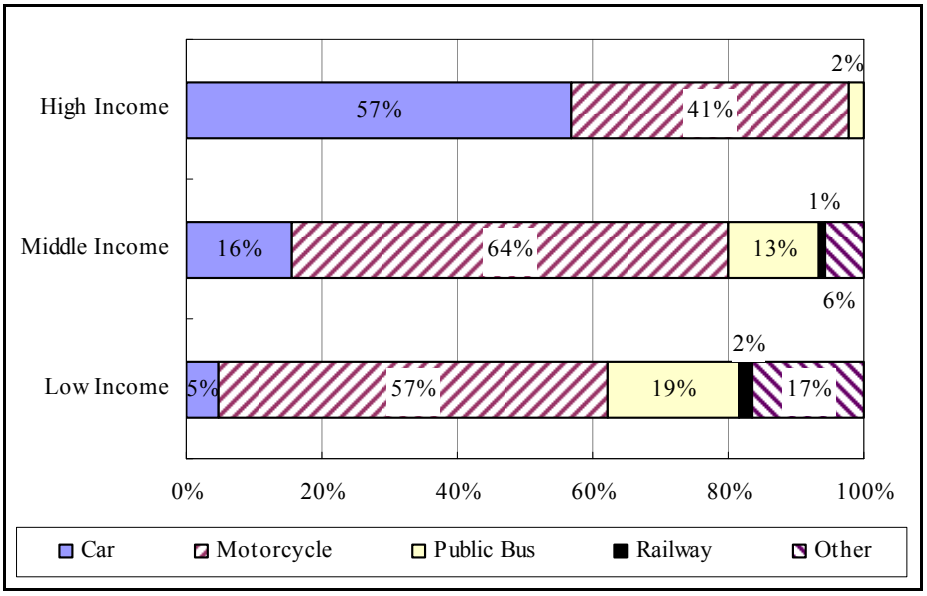
A minimum level of transportation service should be provided to all members of the society as a minimum. In the Central Java region, the mobility of the low-income group is limited due to their insufficient income. Thus public transport should provide low cost means of transport for members belonging to low income households. Railway transport has been playing a role for providing transportation service for the poor in the country. The tariff for economy class passenger trains is determined by the Central government and the current railway operator PT. KA receives a subsidy as PSO (Public Service Obligation) to compensate for the loss for operation of an economy class train.

Mode of transport used for daily travel varies according to income level of households. (Figure 6.2.2) High income households heavily depend on private passenger cars and motorcycles. More than half of their trips are made by cars and the remaining are mostly by motorcycles. The share of public transport is very small, only 2%.

On the other hand, motorcycles are the most significant mode of transport for both middle income and low income households. 64% of trips made by middle income households are made by motorcycle, while 57% of trips of low income household are also made by motorcycle. This implies that if their real income increased and they could afford to purchase cars, then they will use private cars instead of motorcycles. This would result in further serious traffic congestion, especially in urban areas.

Dependence on public transportation of low income households is heavier than high and middle

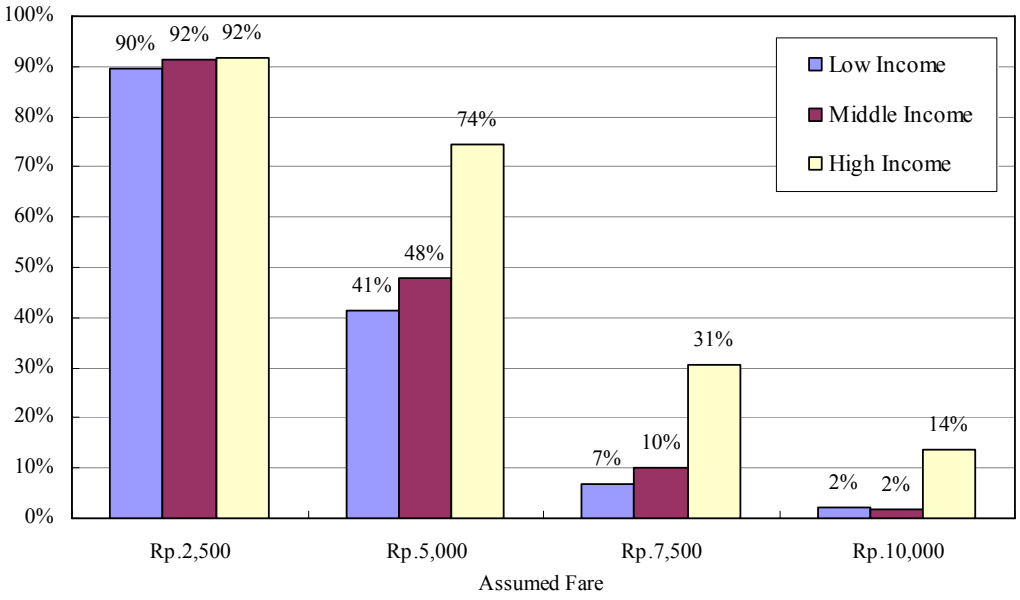
income households. In addition, the share of non-motorized mode of transport in their travel is very high, 17%. This indicates that low income households sometimes want to save transportation expense by avoiding even use of public transportation. Consequently provision of public transportation service is still of great importance to secure means of transportation for the transportation poor.



Note:
1) Low Income: Less than Rp. 1 million / month
2) Middle Income: Rp. 1 - 4 million / month
3) High Income: Over Rp. 4 million / month
Source: CJRR Stated Preference Survey, 2008

Figure 6.2.2 Modal Share by Household Income

The CJRR Stated Preference Survey indicates difference of willingness to pay for new railway service among three income levels. More than 90% of respondents replied that they would use railway service if the fare was set at Rp. 2500 (Figure 6.2.3). If the fare level increases to Rp. 5000, then willingness to use railway would drop significantly to 48% for middle income group and 41% for low income group although 74% of high income group still remain as users. This indicates affordability of railway fare varies according to income level.



Source: CJRR Stated Preference Survey, 2008

Figure 6.2.3 Willingness to Pay for New Railway Service

Currently the Central government set the railway fare for economy class at low level taking into account the affordability of the low income group. The service level of economy class train however is very low with deteriorated and badly maintained train cars. This decreases the attractiveness of railway service and results in reducing railway passenger demand. The service standard should be clearly defined and the gap between fare revenues and cost to fulfill the service in accordance with the standard should be paid to the railway operator from the government. If this cannot be committed to by the government, it is difficult to attract private sectors to railway business.

Railway fare for economy class should be set low and subsidy provided to the railway operator as public service obligation (PSO). However as a public mode of transportation, bus service provides wider service coverage compared to railway so that from the equality point of view it is better to regard bus transportation as the preferred mode of transportation for the poor.

As real income increase in the future, subsidy to railway transport should be gradually reduced and eliminated.

b) Physically Challenged

At present availability of the railway facilities for the physically challenged is still vey limited in the region. It is sometimes difficult to ride on the trains due to the gap between floor of train and ground even for able-bodied people.

Since it is essential to provide a satisfactory mode of transportation for all members in the society, it is recommended to develop transportation facilities for the physically challenged. Since this requires funds for provision of facilities such as elevators, escalators, rest rooms for the physically challenged and it will take time to provide them at all the stations; thus, gradual improvement of such facilities should be incorporated in the railway system development plan.

(3) Environmental Betterment related to Transport

a) Air Pollution

Air pollution produced by motor vehicles brings about diseases and threatens human health. By promoting railway use and diversion from automobile traffic to railway, air pollution should be reduced.

b) Global Warming

Global warming is an urgent issue in the world and many countries have been making efforts to reduce greenhouse gases. In the transportation sector, passenger cars, buses and trucks are producing the greatest amount of greenhouse gases. To deal with this problem, a common countermeasure is promoting diversion from passenger cars, buses and trucks to more environment-friendly to mode of transport such as railway.

(4) Transportation Safety

Since human life is invaluable, transportation safety should be enhanced and the number of accident victims should be minimized. Railway transportation is commonly regarded as a safe mode of public transportation but as argued in Section 4.6, in Indonesia railway accidents frequently occur and the traffic accident rate is high even compared to road transport.

Table 6.2.1 Comparison of Railway Accidents (per million train km)

Country	Train-km (million train km)	Derailment	Collision (Train vs Train)	Accidents at Railway Crossing (Train vs Public Transport)
Indonesia	47.6	1.198	0.126	1.555
India	214.9	1.331	0.121	0.302
Japan	1,320.0	0.015	0.004	0.426
Korea	86.6	0.048	0.000	0.866
France	570.2	0.081	0.122	0.312
German	872.4	0.121	0.081	0.254

Note: Indian data for the year 1997and Korean data for the year 2000
Source: World Railway Statistics 1998

Analysis on the causes of railway accidents shows that various kinds of factors bring about railway accidents in Indonesia. Factors include human errors of PT. KA employees and by people outside of the PT. KA.

Causes of railway accidents occurring from January 2004 up to May 2006 were examined in the railway accidents in Indonesia by ITB (Table 6.2.2). Causes of 26% of the railway accidents have not been clearly identified and 3% of accidents were caused by natural disasters such as flood and landslide. Although more than half of the remaining railway accidents were made by internal and external human errors, 25% of the accidents were caused by failure of infrastructure and 19% by disordered rolling stock.

Table 6.2.2 Causes of Railway Accidents in Indonesia: Jan 2004 to May 2006

Cause of Accidents	Number of Accidents	Composition	Composition
Human Errors (External)	90	37%	27%
Human Errors (Internal)	53	21%	15%
Rolling Stock	49	19%	14%
Infrastructure	57	22%	16%
Subtotal	255	100%	71%
Flood/Landslide	10	-	3%
Under Investigation	94	-	26%
Total	359	-	100%

Source: Calculated based on the Data in "Railway Accident in Indonesia", ITB, 2006

Table 6.2.3 Causes of Railway Accidents in Indonesia: Jan 2004 – May 2006

Code	Cause of Accident	# of Accidents	Victim	
			Fatality	Injured
HUMAN FACTOR (EXTERNAL)				
A.1	Public transport passing the railway carelessly	44	77	74
A.2	Careless Pedestrian	42	14	25
A.3	Public transport is out of order on the railway	1	-	-
A.4	Passenger is dropped from the train	2	1	-
A.5	Equipment stolen	1	-	-
A.6	Obstacle on railway track	6	-	
	Subtotal	**96**	**92**	**99**
HUMAN FACTOR (INTERNAL)				
B.1	Driver breaks the signal	18	19	63
B.2	Driver is careless	1	-	-
B.3	Driver breaks the speed limit	3	-	-
B.4	Driver fell asleep	6	-	-
B.5	Traffic officer signal disorder	7	2	2
B.6	Traffic officer fell asleep	1	-	-
B.7	Station officer careless	10	-	2
B.8	Slogan officer careless	4	-	-
B.9	Crossing guard fell asleep	1	7	19
B.10	Conductor is hit by train	1	1	-
B.11	Other internal human error	1	-	-
	Subtotal	**53**	**29**	**86**
ROLLING STOCK				
C.1	Train burns down	4	2	-
C.2	Train is broken	1	-	-
C.3	Brake is broken	10	-	-
C.4	Wheel axle is broken	11	-	-
C.5	Wheel temperature is too high	4	-	-
C.6	Axle box is broken	2	-	-
C.7	Wheel is broken	2	-	-
C.8	Train roof is broken	1	-	-
C.9	Day coach sequence is broken	2	5	6
C.10	Pantograph is hooked	2	2	10
C.11	Other rolling stock problem	10	10	18
	Subtotal	**49**	**19**	**34**
INFRASTRUCTURE				
D.1	Broken Railway	45	-	-
D.2	Broken Ballast	4	-	-
D.3	Broken Switch	8	-	-
	Subtotal	**57**		
	FLOOD/LANDSLIDE	**10**		
	UNDER INVESTIGATION	**94**	**-**	**-**
	TOTAL	**359**	**139**	**219**

Source: Railway Accidents in Indonesia, Institut Teknologi Bandung (ITB) 2006.

Since railway accidents are caused by various kinds of factors, various countermeasures should be taken to reduce them. As examined in Section 4.6, the majority of the existing rolling stock of PT. KA is not in good condition since they are old and maintenance is insufficient. Although the present performance is not bad at the workshop, tools and equipment are also aged, thus speed of repair work cannot be increased. Due to the limited revenue, PT. KA, cannot afford to buy new rolling stock or tools/equipment.

To tackle the railway safety issue, not merely rolling stock, but also infrastructure should be upgraded and improved. Despite efforts in developing and improving railway infrastructure by the Central government, the railway facilities still need further upgrading and rehabilitation.

Many railway accidents have occurred at level crossings due to lack of careful driving practices of public road transport and so on. In this regard, railway crossings in urbanized areas, where commuter railway services are proposed, should be elevated as much as possible to reduce conflict with road traffic.

Chapter 7 Forecast of Future Railway Demand

This chapter forecasts the future demand of railway passengers and cargos up to 2030. Future passenger and cargo volumes are projected mainly based on the population and the GRDP of the study area as well as logistics strategies of some industrial sectors.

7.1 Forecast of Railway Passenger Demand

7.1.1 Growth of Passenger Demand

The Study Team expects that, apart from individual railway projects focusing on certain railway corridors, the future railway passenger demand as a whole will grow in accordance with ongoing double-tracking projects and proposed overall improvements in railway operations and management. As long as those are successfully implemented and the demand grows smoothly, an increase in the number of railway passengers caused by population and economic growth in the Study area can be foreseen and it is projected forward assuming the same growth rate as GDP per capita in the Central Java region.

The results up to 2030 are presented in Table 7.1.1. Future growth rates are targeted at around 3.8% - 4.4% per annum. In 2030, the annual number of railway passengers in the Central Java region is expected to increase from the current 9.5 million (as of 2007) to 24.4 million passengers. In the "Transport Sector Strategy Study (TSSS)" made by Asian Development Bank (2000), the railway passenger travel demand in Java Island for the period of 1998 – 2009 was predicted to increase from 30.6 million in 1998 to 41.6 million in 2009 with an average growth rate of 2.8% per annum. In the Central Java region, although the actual annual total railway passenger volume fluctuated by year, the average growth is calculated as around 2.0% per annum. As shown in the table below, future railway passenger growth rates in the Study team estimates are higher than this rate and the 'future' predicted growth in TSSS. This is because the overall system improvement in railway operation and management is planned to be achieved for future years.

Table 7.1.1 Projected Annual Number of Railway Passengers in Central Java Region

Year	Annual Total Passengers (million/year)	Annual Growth Rate
2007 (actual)	9.5	2.0%*
2015	13.3	3.8%
2020	16.1	4.0%
2025	19.7	4.1%
2030	24.4	4.4%

* Average annual growth rate from 2003 to 2007.
Source: PT. (Persero) Kereta Api (for 2007) and JICA Study Team (for future years)

On the other hand, in the "Central Java Province Transportation Development Plan (TATRAWIL): 2003 – 2008", average annual growth of the road traffic volume has been forecasted as 4.7% per year for the period from 2009 to 2019. For another reference, TSSS predicted that the annual growth rate in road traffic in Java Island would be 6.7% for the period of 2004 – 2009. Compared to these figures, the future volumes of railway passengers in the Central Java region predicted by the Study Team are reasonable. However, a great modal shift that is forecasted in the draft master plan of the Indonesian railways for 2006 – 2030, such as an increase from the current 6% (as of 2005) to 10% (in a moderate case) or 20% (in an optimistic case) in 2030, may be hard to be realized at least in the Central Java region.

7.1.2 Passenger Demand for Individual Railway Project Corridors

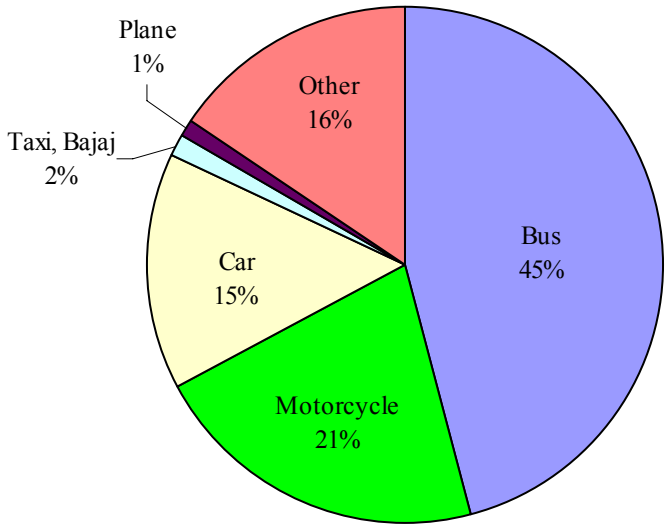
While an overall great modal shift to the railway may be unrealistic, growth of the passenger demand caused by the modal shift can be well expected from individual railway projects focusing on certain railway corridors in addition to the increase in the number of railway passengers due to the population and economic growth in the Study area. The modal shift that will be caused by individual railway projects is expected to add to the number of railway passengers that is forecasted in the previous section.

For the commuter railway corridors that have been proposed in this Study, detailed stated preference (SP) surveys were conducted and the passenger demand is analyzed in more detail in Chapter 9. On the other hand, SP data were not collected for intercity railway projects. However, traffic count data and origin-destination (OD) trip data on the project corridors are available by vehicle type from the Road Traffic Survey. Furthermore, information on the intercity bus services (for both inter-

and intra-provincial routes) has been collected. For modal shift, the Study Team assumes that some of the current bus passengers, car users, and motorcycle users will be attracted to new railway services such as new commuter trains, urban railways, and intercity trains.

In the Central Java region, Prameks is an existing intercity railway service that has been operated between Solo and Yogyakarta since 1994. In 2006, the Prameks service was upgraded using brand-new trains and running on the newly double-tracked lines. Furthermore, since February 2008, Prameks has extended its service further west to Kutoarjo. As for passengers of Prameks, however, no survey has been conducted to study the modal shift that occurred after the new or improved operation of this intercity railway service.

Instead, a Railway Traffic Survey was conducted in this Study, and railway passengers were asked about not only origin and destination, but also their alternative transport mode to make the same travel. The result focusing only on the Prameks passengers is presented in Figure 7.1.1. While the majority of them (45%) regard bus as an alternative mode to travel, some passengers regard motorcycle (21%) or car (15%) as an alternative.



Source: JICA Study Team

Figure 7.1.1 Alternative Transport Modes for Prameks Passengers

Assuming that the current Prameks passengers would use the above-mentioned alternative mode without Prameks, modal shift induced by this intercity railway service is estimated as shown in Table 7.1.2. For this purpose, only the trips with ODs in Yogyakarta and Solo were considered. The greatest modal shift seems to have occurred from bus to Prameks in terms of the number of

shifted trips as well as the shifting ratio in each mode. As for motorcycle and car, while a certain number of trips seem to have shifted to Prameks, the shifting ratios are much smaller because the total volumes of trips are larger.

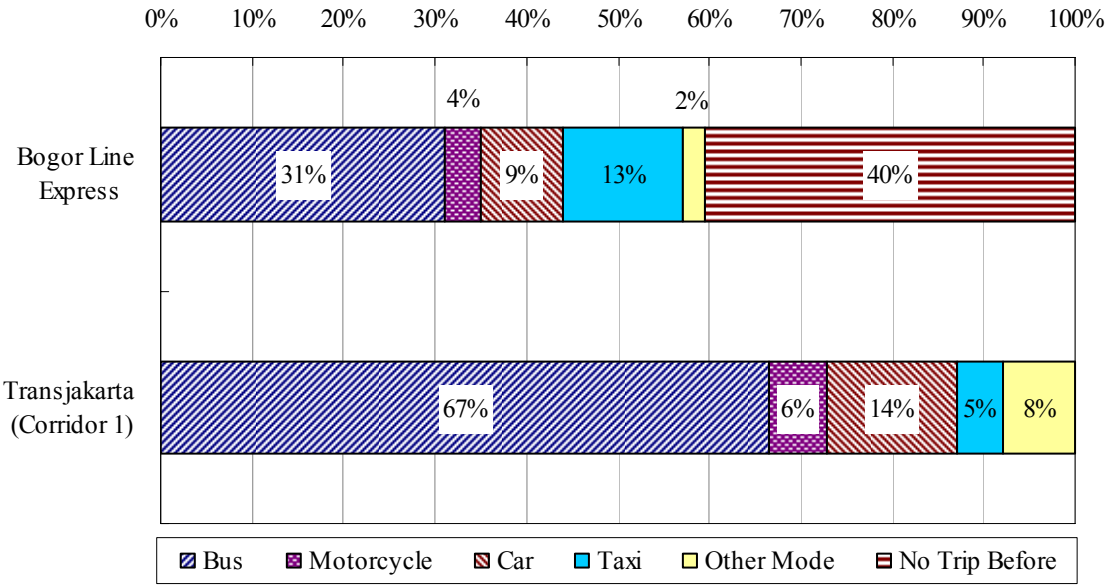
Table 7.1.2 Estimation of Modal Shift Caused by Prameks Operation

Mode	Total Trips between Yogyakarta*1 and Solo (pax/day)		Trips Shifted to Prameks (pax/day)	Modal Shift Ratio (shifted %)
	Without Prameks*2	With Prameks		
Bus	1,073	336	-737	69%
Motorcycle	5,064	4,720	-344	7%
Car	9,602	9,356	-246	3%
Railway (Prameks)	-	1,637	1,326	-

*1: Including Kota Yogyakarta and Kab. Sleman.
*2: Assumed volume based on the alternative modes for Prameks passengers.
Source: JICA Study Team (based on the Road and Railway Traffic Surveys)

Two more examples of modal shift caused by operation of new railway/rapid transit services have been cited from the Jakarta metropolitan area, namely, passengers of an intercity Bogor Railway Line Express and an urban Transjakarta (Corridor 1) bus rapid transit (BRT). Figure 7.1.2 shows the composition of travel modes that those passengers used to take for the same pattern of trip before using the railway or BRT. Conditions of those two transport services (i.e., type of service, location, length, tariff, etc.) are so different. For Bogor Railway Line Express, about 40% of users answered that they did not make the same trip before. Thus, additional trip demand induced by intercity railway services may be significant.

Apart from that, the relative compositions of previously used modes have similar tendencies. That is, the majority of passengers shifted from bus (including air-conditioned express bus). Around two thirds of Transjakarta BRT (Corridor 1) passengers shifted from buses because it has replaced part of the previous conventional bus routes for integration of the transit network. In both transport services, the second largest share of previously used mode is car (and taxi) followed by motorcycle.



Source: SITRAMP (2004)

Figure 7.1.2 Composition of Modes Previously Taken by Specific Transport Users

Taking all the above references into consideration, the Study Team assumes that, for intercity trips with both origin and destination along the new railway project corridor, some 70%, 10%, and 10% of the existing bus, car, and motorcycles users respectively will shift to the new railway service after its operation. Actual modal shift from each mode may vary depending on the type of service (e.g., with or without air-conditioning) provided by the new railway. Furthermore, a considerable number of additional intercity trips may be induced by the new railway. As for commuter railways, detailed modal shift is analyzed based on the SP Survey, and is discussed in Chapter 9 as a case study.

7.2 Forecast of Railway Cargo Demand

7.2.1 Forecast of Cargo Demand at Port

Due to the economic crisis, the historical trend of total cargo tonnage at the ports in Indonesia is discontinuous during 1997 – 1998. For the demand forecast, this discontinuity of the cargo tonnage means that time series analysis is not a suitable methodology because this forecasting method assumes the continuity of observed values as time proceeds. Rather, simple regression analysis is often utilized to forecast cargo demand at the port.

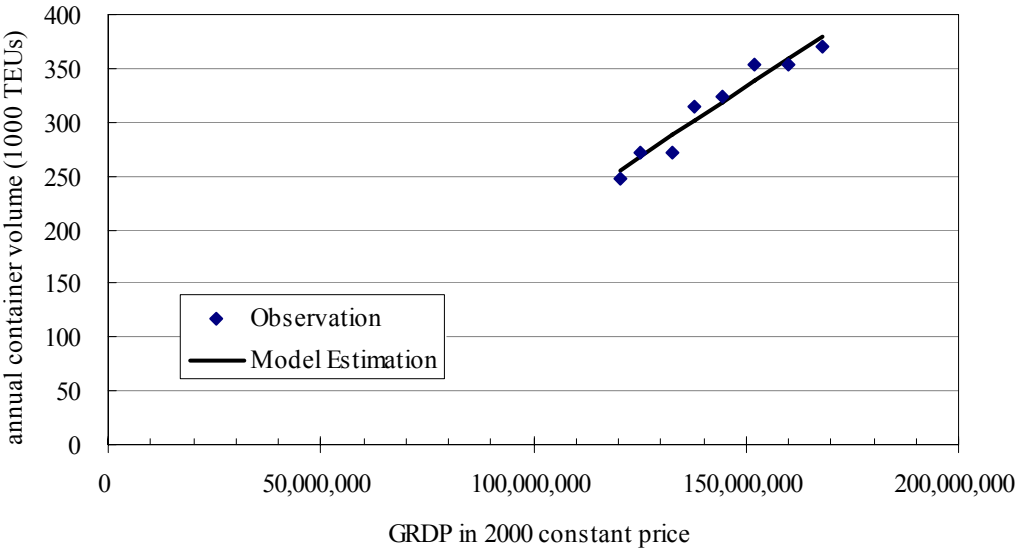
Usually demand for cargo movement is caused by economic activities, and the volume of cargo to be transported is correlated with magnitude of economic activities. An economic index such as GDP or GRDP is often selected as an independent variable, and it shows high correlation with port demand in most cases.

For forecasting the port demand of containers, Tg. Emas (Semarang) Port is focused on since it is the only port that handles containers in the Central Java region. The volume of container demand at Tg. Emas Port is estimated using the model discussed below. To arrive at the projection, the container handling volumes from 1999 to 2006 have been utilized for regression analysis.

$$CONT = \underset{(t = -1.4)}{-57.6} + \underset{(t = 9.2)}{2.6 \times 10^{-6}} \times GRDP \qquad (R^2 = 0.97)$$

where, *CONT*: annual container volume (1,000 TEUs)
GRDP: GRDP in 2000 constant price (million Rp.)

The graph in Figure 7.2.1 shows the plot of observed container volumes with an estimated regression line. R^2, which is the measure of fit of the model, is 0.97. As this value is close to 1.0 and also from the visual investigation of the graph, it is concluded that the regression model fits the observations well.



Source: JICA Study Team

Figure 7.2.1 Model of Annual Container Volume at Tg. Emas Port

Based on the estimated model, container volumes for future years are projected as shown in Table 7.2.1. Assuming the share of import and export containers will follow the recent trend, some 1.2 million TEUs of containers (0.54 million TEUs for import and 0.65 million TEUs for export) are projected in 2030. Estimated growth of container volumes is moderate compared to the projection in the Tg. Emas Port Master Plan. However, the Study Team's estimates may be more realistic figures based on the GRDP growth of the Study area.

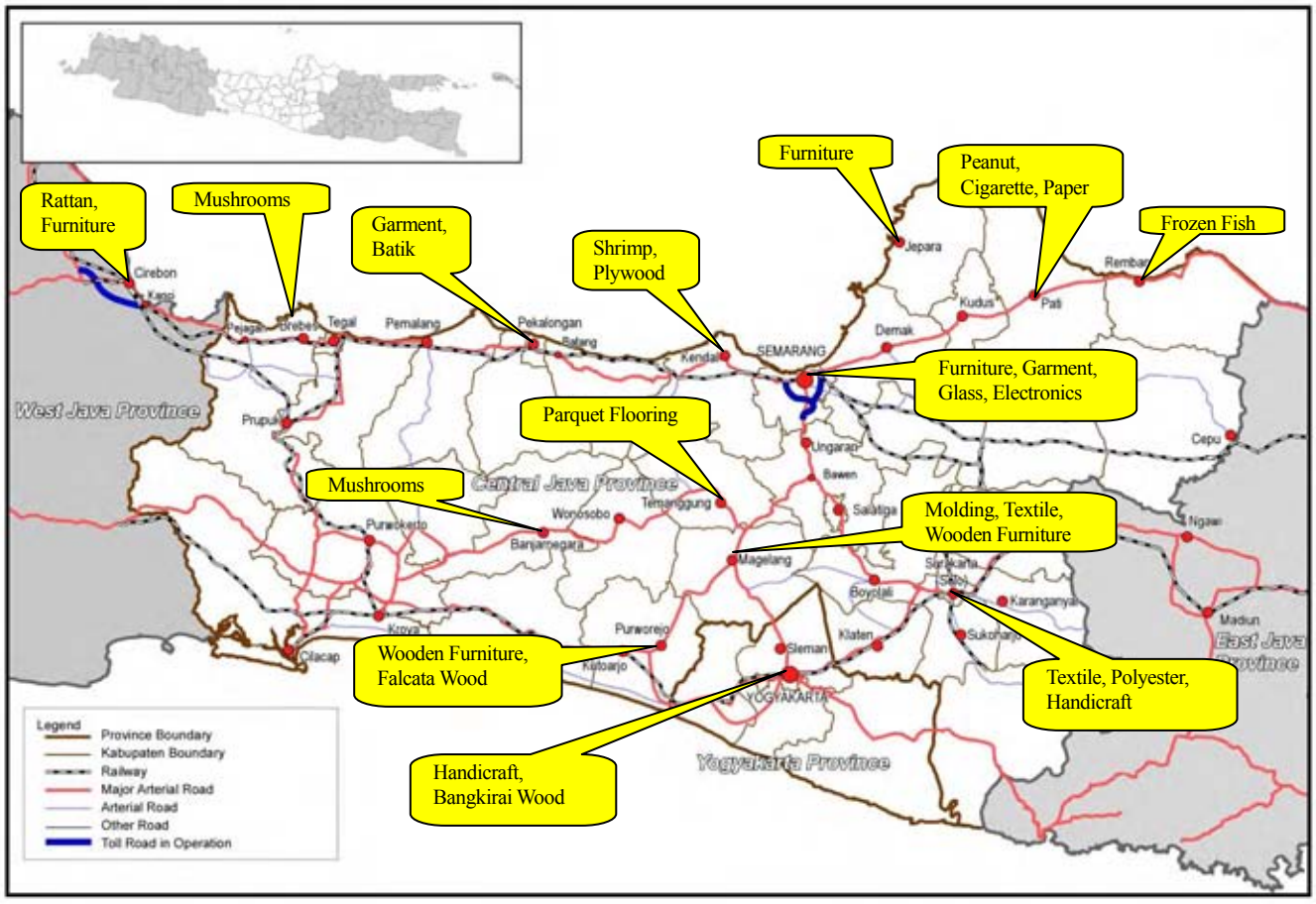
Table 7.2.1 Projected Future Container Volume at Tg. Emas Port

Year	Estimated Future Container Traffic (1,000 TEUs)			*Port Master Plan* (1,000 TEUs)*
	Import	Export	Total	*Total*
2010	217	262	479	*495*
2015	277	334	611	*692*
2020	345	415	761	-
2025	428	515	942	*1,358*
2030	537	647	1,184	-

* PT. (Persero) Pelabuhan Indonesia III, "Master Plan Pelabuhan Tanjung Emas Semarang 2001-2025"
Source: JICA Study Team

7.2.2 Projection of Container Volume by Railway

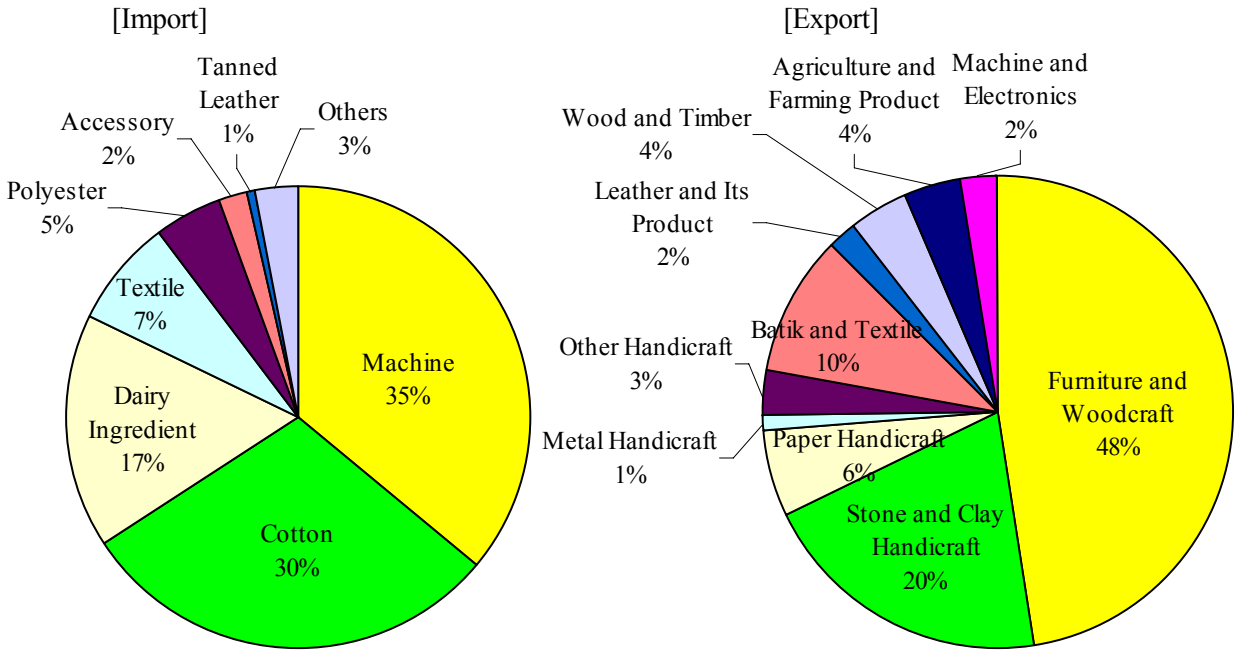
In order to forecast the volume of containers transported by railway, it is necessary to understand from/to which part of the Study area containers are transported to/from Tg. Emas Port. The entire Central Java region as well as some eastern part of West Java Province is the potential hinterland of Tg. Emas Port as shown in Figure 7.2.2.



Source: PT. Pelindo III, Terminal Peti Kemas Semarang

Figure 7.2.2 Potential Hinterland of Tg. Emas Port (Container Terminal)

For DIY, statistics of import and export items are available, and the volume compositions are presented in Figure 7.2.3. Overall, raw materials are imported and finished products are exported. The majority of those commodities are transported in containers through Tg. Emas Port.



Source: Dinas Perindustrian dan Perdaganan (DIY)

Figure 7.2.3 Major Import and Export Items in DIY in 2007

However, no data was available as to how many containers are currently transported from/to each region of the Study area. The Study Team therefore roughly estimated the origin/destination regions of containers exported/imported through Tg. Emas Port by utilizing the results of the roadside interview survey conducted on the major kota/kabupaten boundaries. Current composition of origin and destination regions of container trailers that go to/come to Tg. Emas Port was calculated. This was used as a proxy for future regional composition of origin and destination of containers handled through Tg. Emas Port, and the distribution of the containers for future years were estimated as shown in Table 7.2.2.

Table 7.2.2 Projected Future Container Volume between Major Regions and Tg. Emas Port

Direction from/to	Regional Composition	Container Volume in 2015 (1,000 TEUs / year)			Container Volume in 2030 (1,000 TEUs / year)		
		To Port	From Port	Total	To Port	From Port	Total
Solo area*1	16%	43	55	99	537	647	1,184
Yogyakarta area*2	8%	25	25	50	84	107	191
Demak, Kudus, Pati, Rembang	20%	89	45	134	48	48	96
Kab. Semarang, Kendal	19%	-	93	93	172	88	260
Other	37%	120	115	235	-	181	181
Total	100%	277	334	611	233	223	456

*1: Solo area includes Kota Solo, Kab. Boyolali, Kab. Sragen, Kab. Karanganyar, Kab. Sukoharjo, Kab. Klaten, and Kab. Wonogiri.
*2: Yogyakarta area includes the whole DIY.
Source: JICA Study Team

For most of the destinations listed in the above table, there is a potential of utilizing the railway for freight transport if the necessary construction and rehabilitation of the railway facilities are conducted including the access to Tg. Emas Port. Among others, if a new dry port in Solo and the existing inland port in Yogyakarta are planned to be connected to the railway, it can be assumed that a significant share of containers from/to Solo and Yogyakarta will be transported by railway. In this Study, achievable railway market shares for containers have been set as 50% for Solo dry port and 70% for Yogyakarta inland port, as discussed in Section 9.2.1. Likewise, for containers in the direction of Demak, Kudus, Pati, and Rembang, the achievable railway share may be assumed as 70% if the railway is developed along this northern corridor.

Another potential for transporting containers by railway is Kendal Special Economic Zone (SEZ). Located just next to Kota Semarang, Kendal SEZ with 1,000 ha in area, it is planned to accommodate diversified industries including high-tech industry. Since it is an SEZ, all the products are for export consumption. In Kendal there is just a domestic port, and both import and export are to be made at Tg. Emas Port. As such, there is a plan to connect Kendal SEZ and Tg. Emas Port with a new port access railway line in order to transport all the goods to and from the port efficiently.

Since detailed plans of Kendal SEZ such as industrial zoning, volume of products and raw materials, and year of operation are not clear yet, it is assumed that the future container cargo transport demand for this SEZ has already been included in the figure of container volume estimated for Semarang and

its vicinities. Total area of the industrial zones in Kota Semarang and Kabupaten Semarang is 1,491 ha and 2,532 ha, respectively. Assuming that container transport demand in Semarang area is generated in those industrial zones, the demand is divided into Kendal SEZ and other industrial zones in proportion to the areas.

In summary, the Study Team has estimated the future demand of Tg. Emas Port containers to be transported by railway by origin/destination as shown in Table 7.2.3.

Table 7.2.3 Future Volume of Tg. Emas Port Containers Transported by Railway

Origin/ Destination	Container Volume in 2015 (TEUs / day)			Container Volume in 2030 (TEUs / day)		
	To Port	From Port	Total	To Port	From Port	Total
Solo (Solo dry port)	92	72	164	179	140	318
Yogyakarta (Yogyakarta inland port)	58	58	116	113	111	224
Demak, Kudus, Pati, Rembang	106	208	314	205	402	607
Kendal SEZ	80	-	80	156	-	156

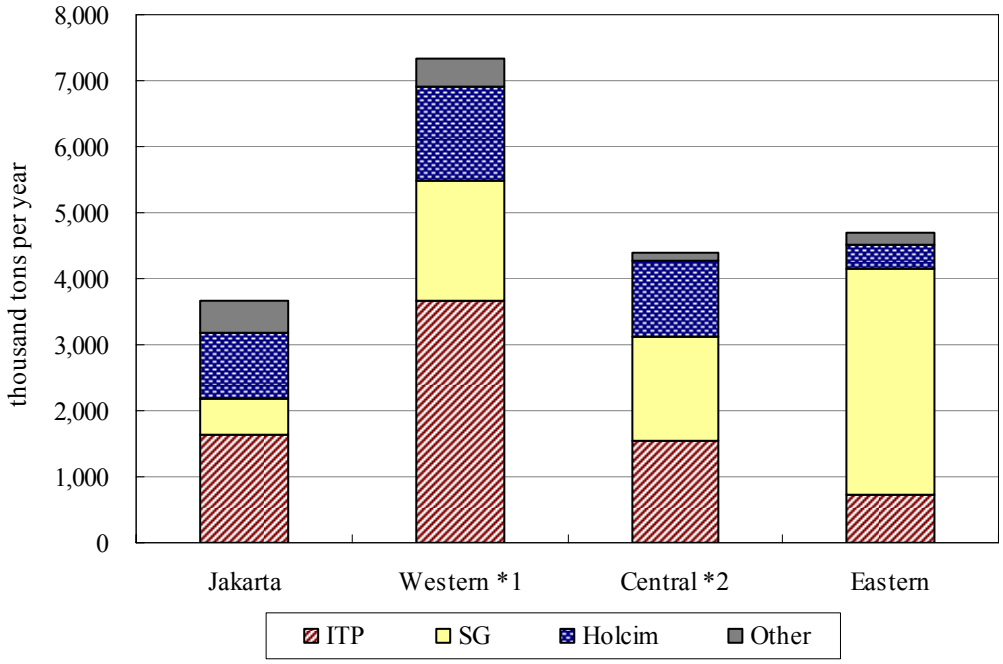
Source: JICA Study Team

7.2.3 Projection of Other Cargo Volume by Railway

As explained in Chapter 2, major bulk commodities that are currently transported by railway are cement, quartz sand, fertilizer, and fuel. Future volumes of these four commodities transported by railway are forecasted. Furthermore, potential demand of transporting coal, steel, dried cassava, and other commodities by railway is also discussed below.

(1) Cement

In Java Island, there are three major cement companies: PT. Holcim Indonesia, PT. Indocement Tunggal Prakarsa (ITP), and PT. Semen Gresik (SG). Market sales of these three companies in Java Island as of 2006 are shown by region in Figure 7.2.4. In the Central Java region, ITP and SG have nearly the same share (36%), followed by Holcim (26%).



*1: Western Java includes West Java Province and Banten Province.
*2: Central Java includes Central Java Province and DIY.
Source: Indonesia Cement Association

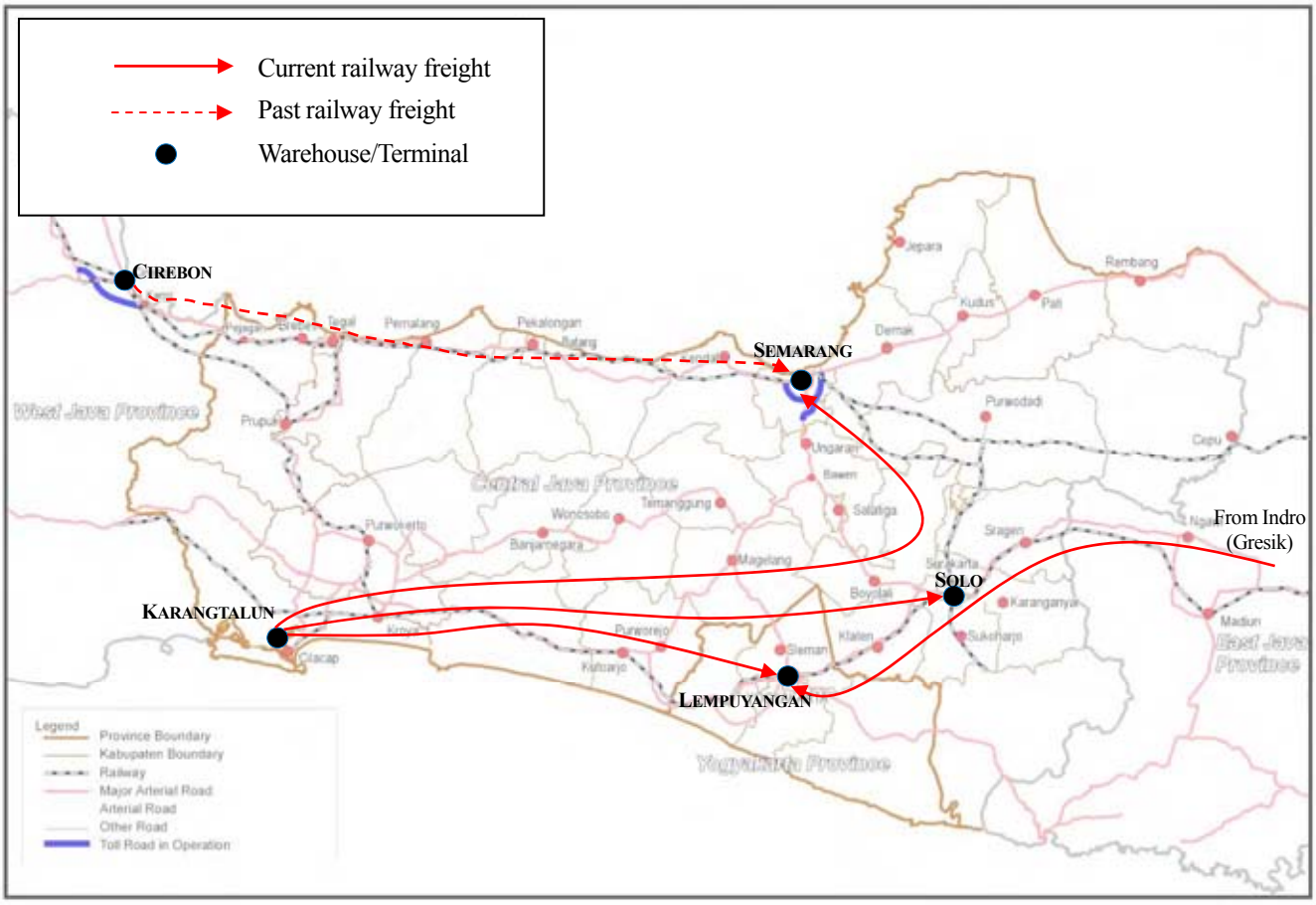
Figure 7.2.4 Market Sales of Major Cement Companies in Java Island (as of 2006)

Among these three companies, at present, only Holcim has a plant in the Central Java region. According to PT. Holcim Indonesia, they distributed about 1.4 million tons of cement to the Central Java region in 2005. Transport route goes via the south Java corridor from Cilacap, where the cement plant is located, east to Yogyakarta, Solo, and towards Surabaya. Not only truck but also railway is utilized to transport the cement. Major destinations and volumes of cement transported by railway are summarized in Table 7.2.4. Railway branch line extends to the plant site (Karangtalun Station), from which the bagged cement is transported every day to Yogyakarta (Lempuyangan Station), Solo (Purwosari, Solobalapan, and Sragen Stations), and Semarang (Semarangponcol and Brumbung Stations) areas (Figure 7.2.5). There is a cement warehouse at each destination station, and bagged cement is distributed to customers from each warehouse by truck. Some wagons that are used to transport cement to Solo and Semarang areas are utilized to transport quartz sand on the way back to the plant in Cilacap.

Table 7.2.4 Current Cement Transportation from Cilacap by Railway

Destination Area	Distance* [km]	Cement Volume	
		[ton/day]	[ton/year]
Yogyakarta (Lempuyangan)	175	350	126,000
Solo	228	150	54,000
Semarang	337	250	90,000
Total	-	750	270,000

* Distance is from Cilacap.
Source: PT. Holcim Indonesia



Source: JICA Study Team (based on data collected from PT. KA and cement companies)

Figure 7.2.5 Cement Transport and Stock System by Railway in Central Java Region

However, it is still limited for carrying cement by railway because of limited number of wagons for

cement transport. Number and type of wagons that are currently available for transporting cement are summarized in Table 7.2.5. The number of wagons decreased from about 500 in 1996 to 201 presenting 2008, most of which are type GW/GR with transport capacity of only 15 tons per wagon although the required capacity is 30 tons per wagon (type GGW). All the wagons are very old, and additional staffs are necessary to operate wagons due to the manual braking system. Limitations are also caused by long unloading time due to the manual unloading system and long waiting time for a shunting locomotive at the destination station. As a result, average turnaround time is 3 – 4 days, although the actual one-way transit time is only about 6 hours between Cilacap and Yogyakarta.

Table 7.2.5 Available Railway Wagons for Cement Transport

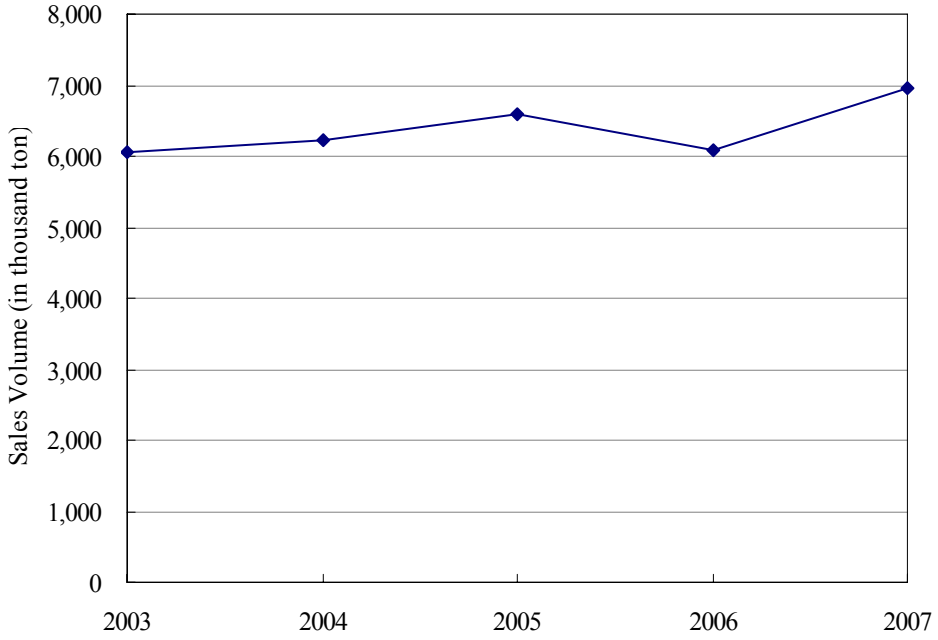
Wagon Type	Number of Units	Capacity [ton/wagon]	Average Age [years]
GW/GR	137	15	> 45
GGW*	29	30	> 30
TTW (open-cup type)	35	30	> 40
Total	201	-	-

* Including wagons which belong to PT. Pupuk Sriwidjaja
Source: PT. KERETA API (Persero)

While the current volume of cement transported by railway is 750 tons per day, Holcim plans to increase this volume to 1,850 tons per day in the short term. To this end, PT. KA, Holcim, and a forwarding company are exploring a joint operation project of cement transport by railway. This plan is to transport the cement with 6 – 7 trains per day from Cilacap to Yogyakarta, Solo, and Semarang areas. Future transport destinations from Cilacap by railway may also include Madiun and Banyuwangi in East Java Province. The plan also includes procurement of new flat-type wagons (PPCW) that are designed for containerization and are expected to reduce the loading and unloading times greatly.

Recent trend of domestic cement sales by Holcim is presented in Figure 7.2.6. While the volume fluctuated by year depending on the market condition, average annual growth from 2003 to 2007 is 3.6%. In the first semester of 2008, the national demand for cement rose 21% (17% in the Java market and 26% outside Java), driven by high-rise and residential construction. Despite this, the Indonesian Cement Association maintains its conservative growth scenario of 5 – 6%. In this

Study, future demand growth of cement in the Central Java region has been set as 3% including the planned volume of cement transported by railway.



Note: Volume includes clinker sales as well.
Source: PT. Holcim Indonesia

Figure 7.2.6 Trend of Domestic Cement Sales by PT. Holcim Indonesia

The other two companies that distribute cement to the Central Java region as well are ITP, with plants located in West Java Province (Citeureup and Palimanan), and SG, with plants located in East Java Province (Gresik and Tuban). For cement distribution to the Central Java region, SG is partly (around 5%) utilizing railway to transport the cement. Since SG has a warehouse at Lempuyangan (Yogyakarta), cement is transported from Indro (Gresik, East Java) to Lempuyangan. Other destinations are Klaten and Prambanan. Transport by railway was frequent until early 1990s when the roads from Tuban and Gresik were not in a good condition. However, since the road conditions have become better, the transport volume by railway is now very limited with a frequency of only once a week. SG also plans to construct a new cement plant in Sukolilo (Kab. Pati, Central Java) near the karst area, but the location is far from the current railway network. On the other hand, ITP is currently using their own fleet of trailers and bulk tank trucks for cement distribution to the Central Java region.

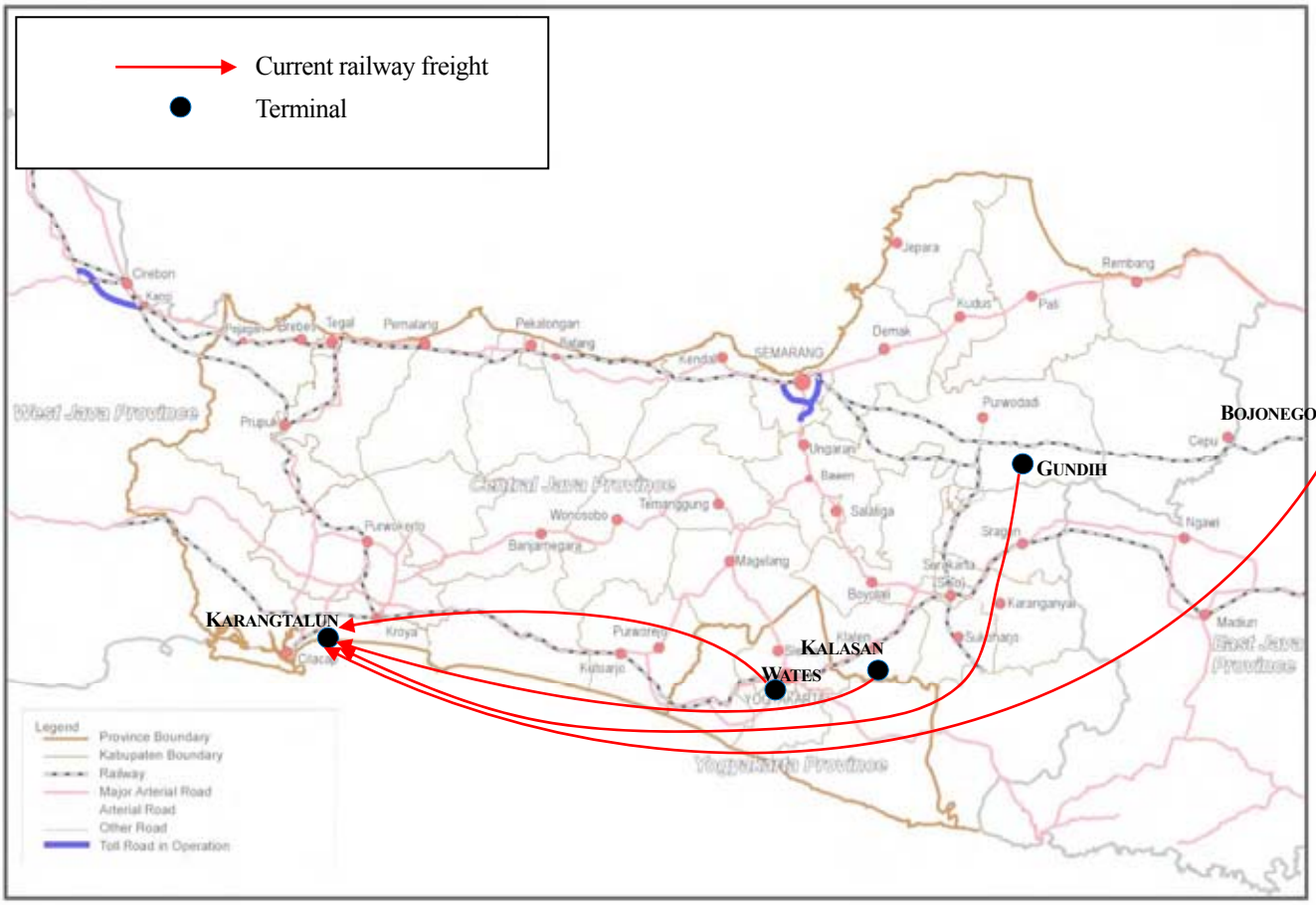
(2) Quartz Sand (Silica)

While limestone, which is a main raw material for cement, is mined in Nusa Kambangan Island (Kab. Cilacap), quartz sand (silica), which is another important raw material for cement, is mined at different locations in the Central Java region. Railway is also used to transport quartz sand. It is usually transported from the place of mining to the place where it is consumed.

The major destination of sand transport by railway is Karangtalun in Cilacap, where the cement plant of PT. Holcim Indonesia is located. Outline of quartz sand transport by railway is presented in Figure 7.2.7. Quartz sand that is supplied to this cement plant is mined partly in Rembang. It is first transported to Kalasan in DIY, and then transshipped to train and transported to Karangtalun. Quartz sand is also mined partly in Kabupaten Kulonprogo in DIY, and it is transported from Wates to Karangtalun by railway. At present, sand is also transported from Bojonegoro (East Java) and Gundih (Kab. Grobogan) to Karangtalun. For transporting sand from Kalasan and Gundih, railway wagons are utilized on the way back to Karangtalun after transporting cement to Solo and Semarang areas.

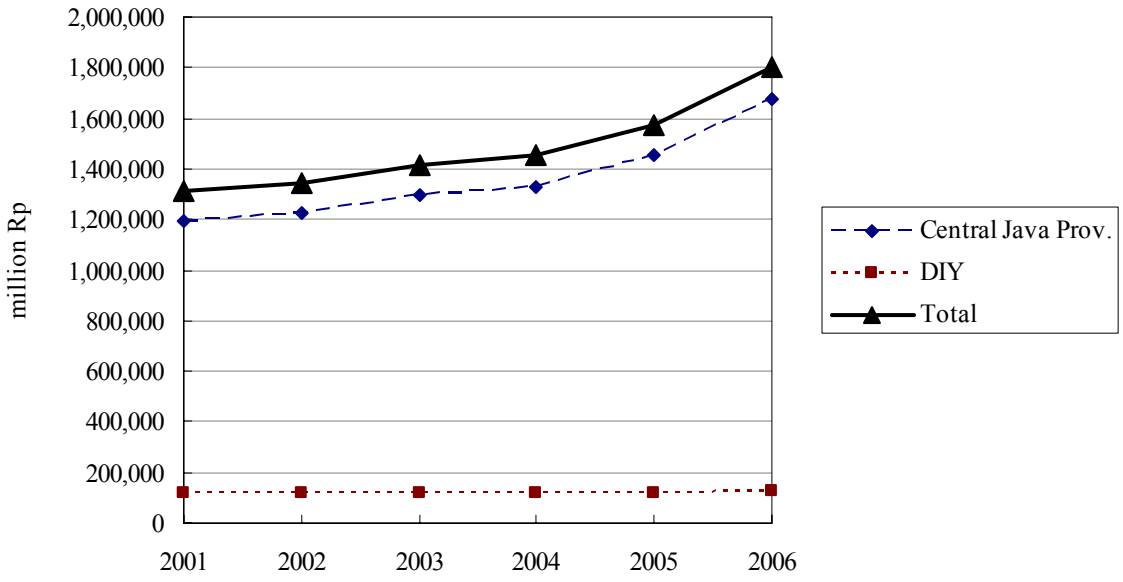
PT. KA regards the route of Bojonegoro – Gundih – Solo – Yogyakarta – Cilacap as the main corridor to transport sand. As described in Chapter 3, DAOP IV (Semarang) and DAOP VI (Yogyakarta) have recorded the volume of sand separately from other commodities, and average annual volume of sand transported by railway in the Central Java region is estimated as around 100,000 tons per year.

For projection of the future growth in the demand of sand transported by railway, trend of GRDP in the mining and quarrying sector in the Study area was considered (Figure 7.2.8). During the period from 2001 to 2006, the GRDP in this sector showed a steady growth with an average rate of 6.6% per year in the Central Java region. As such, an annual growth rate of 6% (and 5% from 2013) has been assumed for projection of future demand of sand transported by railway.



Source: JICA Study Team (based on data collected from PT. KA and cement companies)

Figure 7.2.7 Outline of Quartz Sand Transport by Railway in Central Java Region



Note: Figures are in 2000 constant price.
Source: BPS

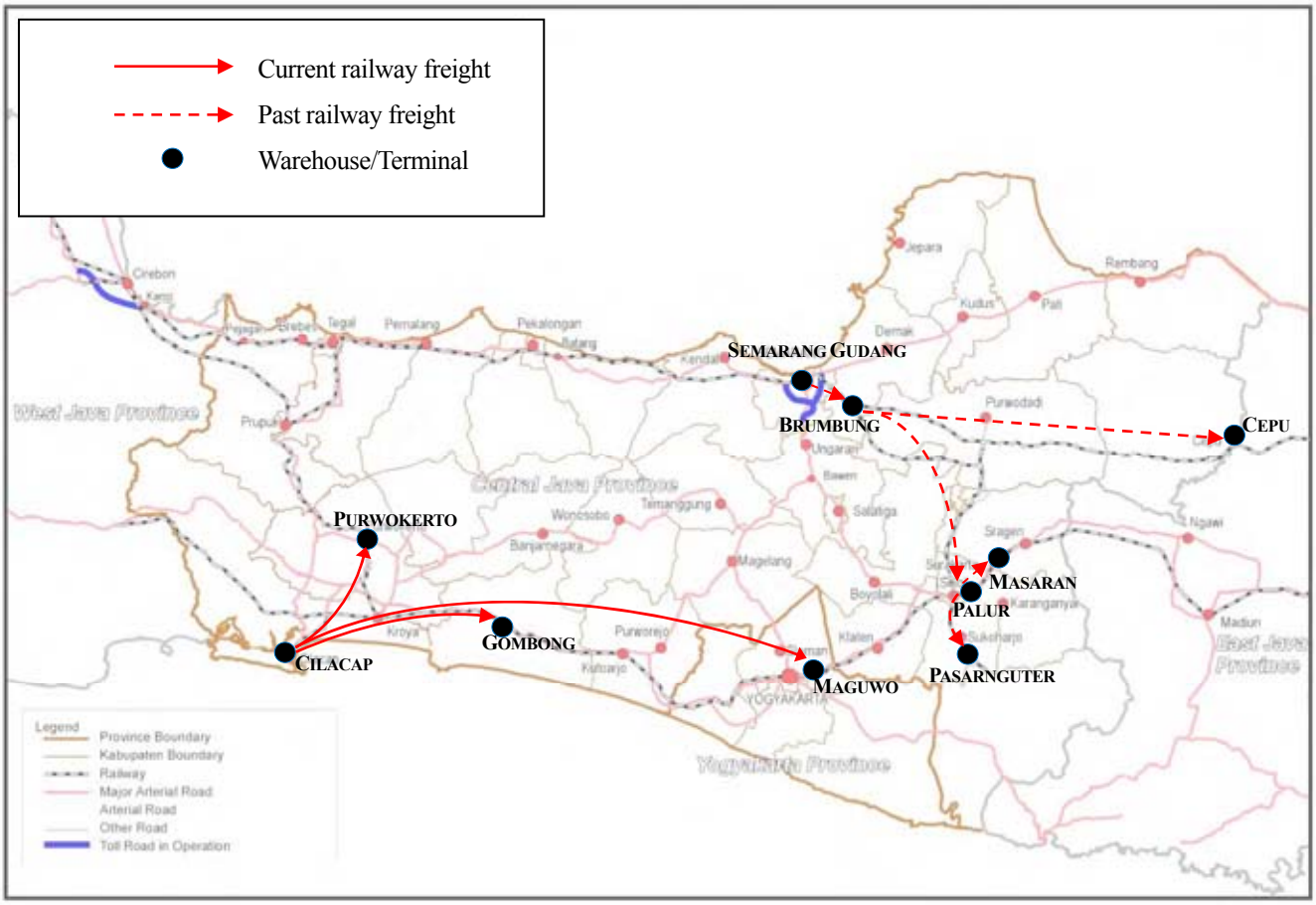
Figure 7.2.8 Trend of GRDP in Mining and Quarrying Sector in Central Java Region

(3) Fertilizer

In Indonesia, there are five major fertilizer producing companies: PT. Pupuk Sriwidjaja (Pusri), PT. Pupuk Kalimantan Timur (Kaltim), PT. Petrokimia Gresik, PT. Pupuk Kujang, and PT. Pupuk Iskandar Muda. Until 2003, PT. Pusri was designated as the sole company to distribute fertilizer all around Indonesia. Thus, fertilizer was packed with a logo of PT. Pusri.

PT. Pusri has a urea fertilizer plant in Palembang in Sumatra Island, and fertilizer is transported to Tg. Emas (Semarang) and Tg. Intan (Cilacap) in Central Java Province as a bulk cargo by ship. In Semarang and Cilacap, fertilizer is bagged at the packing unit beside the port. Total packing capacity at these units is 70,000 tons per month, and the fertilizer is sold at Rp. 940,000 – 945,000 per ton. From Semarang and Cilacap, bagged fertilizer is transported to the inland supply depots or the fertilizer stock warehouses beside the railway for distribution. Major routes of fertilizer transported by railway are: from Semaranggudang (Tg. Emas) to Brumbung/Cepu and Palur/Masaran/Pasarngutar (Solo area), and from Cilacap (Tg. Intan) to Maguwo (DIY), Purwokerto, and Gombong (Kab. Kebumen) (Figure 7.2.9). PT. Pusri owns a total of 162 wagons (type GGW): 65 wagons in DAOP IV (Semarang) and 97 wagons in DAOP V (Purwokerto). Freight train frequency varies depending on the schedule of incoming ships to the port and the subsequent packing process.

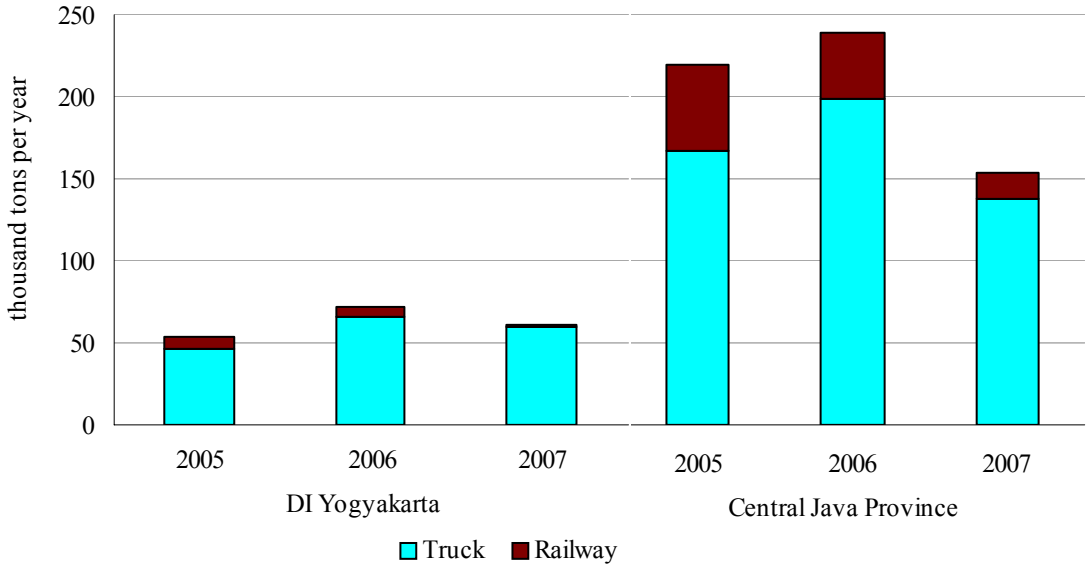
However, in 2003, the Ministry of Commerce and Industry (Menperindag) issued a decree of regionalization for fertilizer distribution, No.70/MPP/Kep/2/2003, and the 'monopolistic' situation by PT. Pusri ended. Through subsequent decrees, PT. Pusri's service area in the Central Java region was limited to DIY and only 12 kabupatens in Central Java Province, and the remaining kabupatens that were mostly supplied from Semarang were shifted to PT. Kaltim's service area. PT. Kaltim, which did not have any railway wagons, used only trucks to transport fertilizer from the packing unit at Tg. Emas Port (Semarang). As a result, the railway line that used to connect to the fertilizer packing unit in the multi-purpose terminal of Tg. Emas Port has been discontinued. At present, the railway track at the port has been submerged in the water, and PT. Pusri's 65 wagons in DAOP IV have been left unused as well as some PT. Pusri's stock warehouses.



Source: PT. Pupuk Sriwidjaja

Figure 7.2.9 Fertilizer Transport and Stock System by Railway in Central Java Region

In July 2008, another decree, No.21/M-DAG/PER/6/2008, was issued, and the whole Central Java region was made PT. Pusri's service area. Although it will actually take some years to hand over all the kabupatens back to PT. Pusri, railway may be able to be utilized again from Semarang. However, significant investment is necessary to rehabilitate the submerged railway track. From Cilacap, on the other hand, part of bagged fertilizer continues to be transported by railway, though the recent trend is decreasing as shown in Figure 7.2.10. For example, fertilizer is transported by railway from Cilacap to Maguwo, where there is a stock warehouse for distribution to the Yogyakarta region.

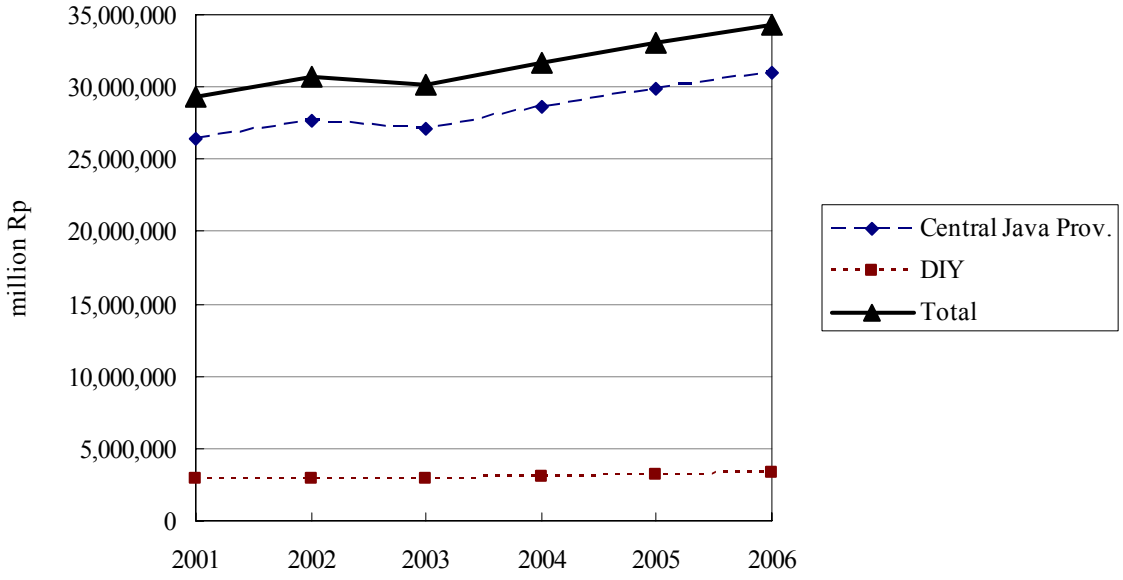


Source: PT. Pupuk Sriwidjaja, UPP Cilacap

Figure 7.2.10 Trend of Fertilizer Distribution from Cilacap by Truck and Railway

One of the reasons why transport of fertilizer by railway has decreased in volume and been replaced by road transportation may be the competition with trucks in terms of cost, flexibility of transport service, and so on. Another reason may be insufficient railway facility and rolling stock to establish a better railway transport network for fertilizer. Ideally, PT. Pusri would need 175 wagons and 4 main line locomotives with some railway rehabilitation to transport fertilizer to their 17 stock warehouses in Java.

As for the future demand, while transport of fertilizer from Semarang may not be expected, the Study team assumed that the current fertilizer transport by railway would be maintained in the future as well. For projection of the future growth in the demand of fertilizer transported by railway, trend of GRDP in the agriculture sector in the Study area was considered (Figure 7.2.11). During the period from 2001 to 2006, the GRDP in this sector showed a steady growth with an average growth rate of 3.2% per year in the Central Java region. As such, an annual growth rate of 3% (and 2.5% from 2013) has been assumed for projection of future demand of fertilizer transported by railway.

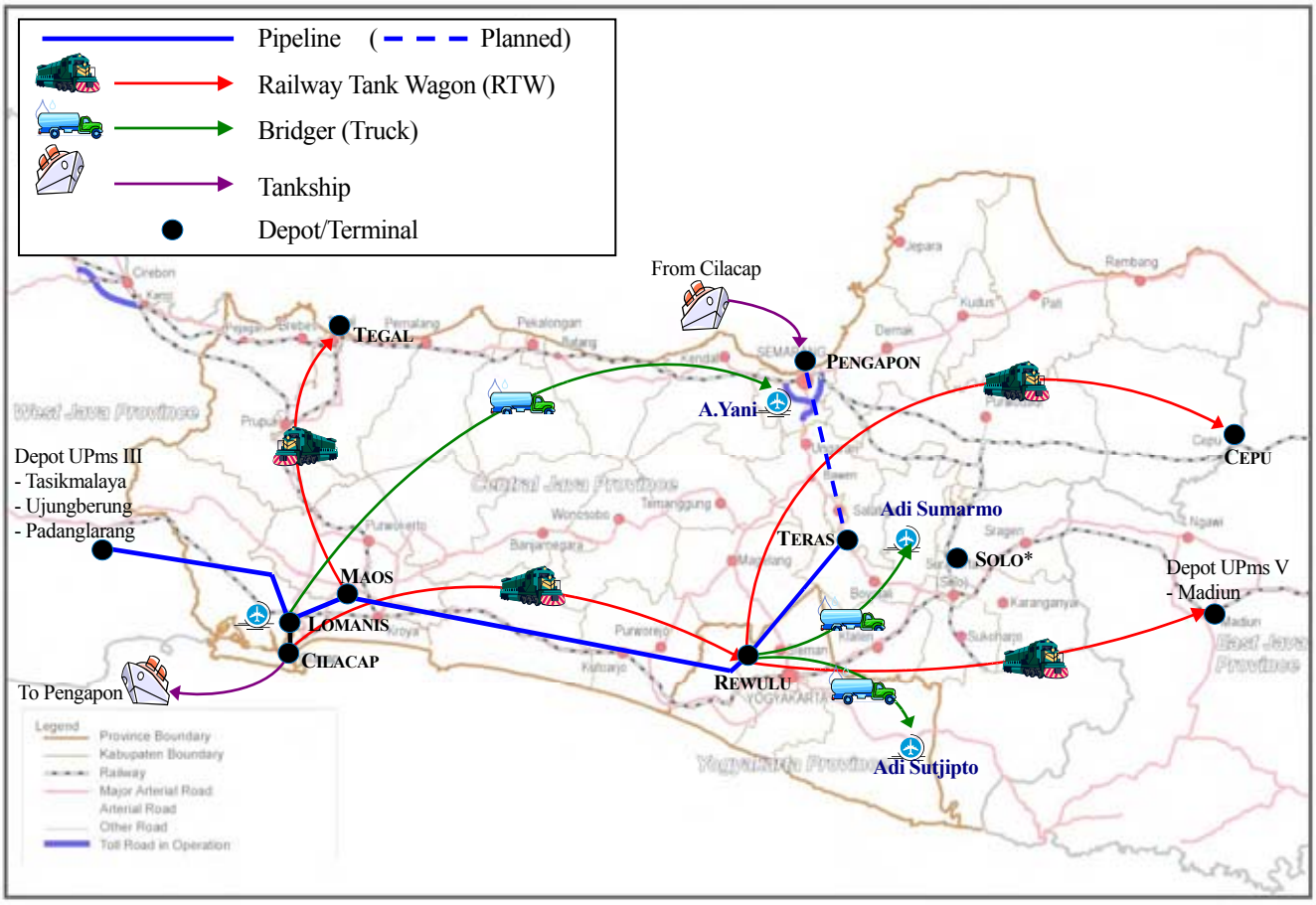


Note: Figures are in 2000 constant price.
Source: BPS

Figure 7.2.11 Trend of GRDP in Agriculture Sector in Central Java Region

(4) Fuel

Most fuel consumed in the Central Java region is refined in Cilacap by PT. Pertamina (Persero), a state-owned oil and gas company, and transported between the depots by pipeline, railway, truck, or ship. To transport fuel from each depot to the market, tanker trucks are used. Main fuel transport and stock system in the Central Java region is outlined in Figure 7.2.12. Pipelines are the main mode of transport, connecting Cilacap, Maos, Rewulu (near Yogyakarta), and Teras (newly opened depot near Boyolali) as well as Cilacap and the depots in West Java Province. The depot in Rewulu is the largest in Indonesia, and as much as 950 kL of gasoline, 300 kL of kerosene, and 500 kL of diesel is transported from Cilacap to Rewulu every day. For Semarang, which is the largest city in the Central Java region, fuel is supplied from Cilacap by tanker ship which is owned by PT. Pertamina.



* The depot in Solo will be taken over by the new depot in Teras and will be closed soon.
Source: PT. Pertamina (Persero)

Figure 7.2.12 Outline of Fuel Transport and Stock System in Central Java Region

While the three major fuel types, namely, gasoline, kerosene, and diesel, can be transported by pipeline, aviation fuel is transported by railway tank wagon (RTW) or by special truck called Bridger. For supplying aviation fuel to Adi Sutjipto (Yogyakarta) and Adi Sumarmo (Solo) Airports, a daily average of 312 kL of aviation fuel is transported from Cilacap to Rewulu by RTW and then from Rewulu to each airport by Bridger. For Ahmad Yani (Semarang) Airport, fuel is transported by Bridger only.

RTW is also utilized to transport fuel (gasoline, kerosene, and diesel) between depots such as Maos – Tegal, Rewulu – Cepu, and Rewulu – Madiun (East Java Province). Among others, Maos – Tegal is a trunk transport route, and three RTW trains each consisting of 13 to 15 wagons run between these two depots every day. However, since passenger trains have priority to achieve punctual operation, RTW trains are sometimes delayed especially in the in a busy season, causing the threat of shortage of fuel in the Tegal region. Another disadvantage of RTW is transport cost. According to PT. Pertamina, while the unit price of fuel transport by the company-owed ISO tank is Rp. 450 – 500 per kL per km, it is over Rp. 750 per kL per km by RTW wagons owned by PT. KA.

As for future fuel transport, PT. Pertamina plans to connect all the depots by pipeline, which will greatly reduce the unit transport cost to as low as 10% – 15% compared to RTW. Pengapon (Semarang) will be connected with Teras by pipeline in 2009. The depot in Cepu is planned to be connected with the main terminal in Tuban in East Java Province. Cepu will also be connected with Semarang by pipeline in the future. The depot in Madiun is planned to be closed and replaced by a new depot in Jombang, which will be connected with East Java by pipeline. The depot in Tegal will be connected with the depot and the refinery in Balongan (near Indramayu in West Java Province) by pipeline.

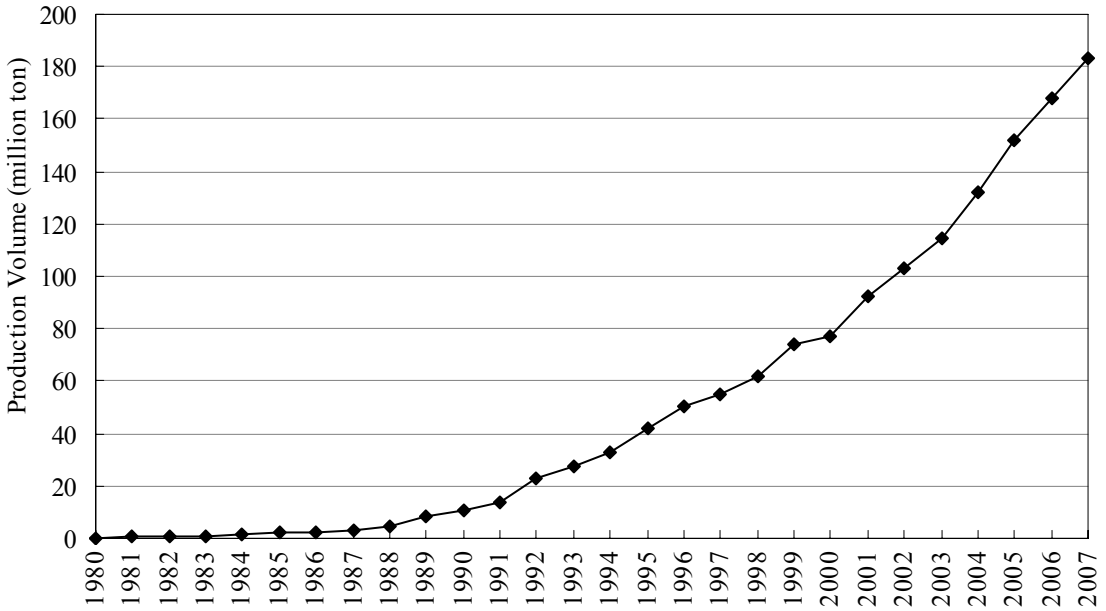
Thus, the remaining possibility of fuel transport by RTW is aviation fuel. Assuming that aviation fuel transport from Cilacap to Rewulu (and to Adi Sutjipto and Adi Sumarmo Airports by Bridger) will continue in the future as well, the Study Team estimates the future transport volume in accordance with the growth in air travel demand that is planned by each airport (Figures 2.4.6 and 2.4.8).

Another potential in the long term may be transporting liquefied petroleum gas (LPG) which is expected to overtake kerosene and to increase in consumption. Since LPG cannot be transported by pipeline, railway and truck are suitable for land transport. Future demand and possibility of railway transport need to be further examined.

(5) Coal

In Indonesia, most of the coal reserves are located in Kalimantan Island (53%) and in Sumatra Island (46%). The government of Indonesia has given high priority to exploiting coal as a most important energy resource. Nowadays coal also serves as an important source of foreign exchange. Furthermore, Indonesia has shifted from an oil-producing country to an oil-importing country, and international oil price has been rising sharply. Thus, coal is becoming more and more important for Indonesia.

The volume of coal production has been rapidly growing as shown in Figure 7.2.13. Now Indonesia is one of the largest coal-producing countries in the world with annual production volume of 183 million tons (as of 2007).



Source: Indonesian Coal Mining Association

Figure 7.2.13 Volume of Coal Production in Indonesia (1980 – 2007)

Domestic demand for coal consumption has also been growing in Indonesia. According to the World Coal Institute, about 25% of the total coal production in Indonesia was consumed domestically as of 2005. Various factors contribute to this demand growth such as construction of coal power plants, energy conversion from oil to coal in industry (especially in cement production), and diffusion of coal briquettes in households. Among others, around 75% of coal consumption is used for electricity production. In Java Island, four coal power plants are currently in operation: namely, Suralaya in Banten Province, Muara Krang in DKI Jakarta, and Gresik and Paiton in East

Java Province. In addition, 10 more major coal power plants are planned in Java. Out of those 10 power plants, two are located in the Study area: one in Rembang and the other in Cilacap in Central Java Province. Coal is planned to be procured from Kalimantan Island.

In the Central Java region, coal is not actually transported by railway at present. However, the potential for transporting coal by railway is possible in three conceivable cases. One is transporting coal from Tg. Emas Port (Semarang) to Solo by railway in order to supply coal to be used for small power plants of the textile factories in Solo and its vicinities. Those factories need around 7,000 tons of coal per week to generate electricity for themselves in order to save on the manufacturing cost.

A second case is transporting coal from Kendal Port (near Semarang) to Kabupaten Kulonprogo (near Wates) via Solo and Yogyakarta. Since iron sand is extracted in this area, PT. Jogja Magasa Mining (JMM) is planning a steel/iron factory and targeting start of the production in 2015. In the current plan, approximately 2,000 tons of coal per day will be transported from Kalimantan Island to Tg. Intan (Cilacap) Port by ship and then from Cilacap to the factory near Wates by truck. Alternatively, however, it would cost less in terms of both tariff and time if this amount of coal were transported from Kalimantan to Kendal Port and then from Kendal to the factory via Sola and Yogyakarta. The possibility of the latter route of coal transportation is currently being investigated.

Third, there is potential to transport coal from Tg. Intan Port to Karangkandri, where a coal steam power plant with a capacity of 600 MW is in operation. The location is about 10 km away from Cilacap, and the transport distance is relatively short. At present, about 5,000 tons of coal per day is transported from Tg. Intan Port to the power plant by truck. However, if coal is transshipped directly from a ship to railway wagons at the port and transported to the power plant by railway, coal transport will become very efficient.

As for projection of the future growth in the demand of coal transported by railway, the same rate as the GRDP growth in the Study area has been assumed. That is, the annual demand growth ratio is estimated as approximately 5.1% for the period of 2009 – 2012 and 4.1% for 2013 onwards.

(6) Steel

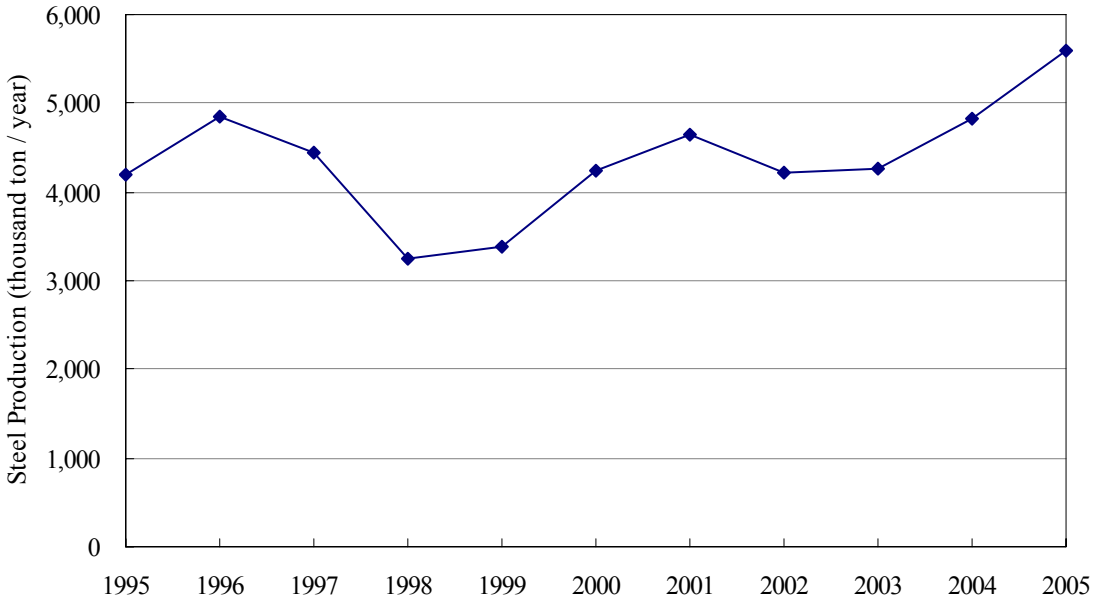
In Indonesia, state-owned PT. Krakatau Steel (KS) has a DRI (direct reduced iron) plant, and thus it is the only steel manufacturer with an iron-making process (i.e., smelting iron ore). Current annual production capacity of PT. KS is: 2.3 million tons of reduced iron, 2.0 million tons of slabs, 0.6 million tons of billet, 2.0 million tons of hot rolled coils, 0.85 million tons of cold rolled coils, and 0.58 million tons of wire rod coils.

Approximately 10% - 15% of PT. KS' steel products for the domestic market are shipped to Central Java Province, DIY, and East Java Province. PT. KS, which has an extended railway line in its plant in Cilegon, Banten Province, utilized railway to supply part of their products especially to the market areas along the north trunk railway line. About 10 railway wagons of type YYW (with no roof) were mainly used to transport the steel products from Cilegon to Semarangponcol and to Waru (Surabaya) every day. On the way back to Cilegon, the freight wagons were utilized to transport cement (from SG) or cattle from Surabaya to Jakarta. Thus, around 20% to 30 % of the steel products supplied to the central and east Java region were transported by railway.

However, since the contract with PT. KA was terminated in 2001, the railway is no longer used to transport steel products and only trucks are currently used. One of the reasons was lower total cost of transport by truck. Even if steel products are transported by railway, trucks are still necessary to carry the products from the destination station to the final destination where each consumer is located. Thus, double handling is unavoidable in the case of railway. Another reason may be the fact that it sometimes took nearly a week to transport steel products from Cilegon to Surabaya by railway because operational priority was given to passenger trains. In some cases, the locomotive was detached on its way to be used for other trains. Furthermore, since products could not be transported in small lots for cost efficiency reasons, the freight train sometimes had to wait for sufficient number of wagons to be connected before departing. As a result, the delivery of the products via railway was unpredictable and often delayed.

Nevertheless, the situation is changing at present. Due to the hike in fuel prices as well as the current more tightened control over overloaded trucks at weigh stations, transport cost by truck has significantly risen. Thus, PT. KS is now making a review of utilizing railway for transporting it products again. As for procurement of raw materials and fuel (i.e., natural gas and coal) for power generation, small trucks are used to carry scraps by land, and nearby Ciwanda Port is utilized for import or for inter-island transport. Hence, possibility of using railway for procurement of raw material and fuel may be small.

Trend of annual volume of steel production in Indonesia is shown in Figure 7.2.14. Production volume basically increased after the Economic Crisis although there are some fluctuations. Average annual growth rate between 2000 and 2005 is about 5.8%. For future volume of steel products transported by railway, it is assumed that, as soon as the railway transport is resumed, there will be one train service per day, namely, carrying about 320 tons (in 10 wagons) towards Surabaya. Annual growth in the steel production is forecasted to be 5%.



Source: International Iron and Steel Institute

Figure 7.2.14 Volume of Steel Production in Indonesia (1995 – 2005)

(7) Dried Cassava

Cassava, which is used not only for food but also for many purposes such as flour (tapioca), chemical and pharmaceutical materials, livestock feed, paper, and construction materials, has long been an important farm product. Indonesia is now the fourth greatest cassava- producing country after Nigeria, Brazil, and Thailand, producing some 20 million tons per year out of the total 220 million per year in the world. Among others, the volume of cassava production in Kabupaten Wonogiri is the largest in the Central Java region.

Until 1980s, dried cassava (*gaplek*) was transported from Wonogiri to Semarang and Cilacap via Solo by railway and exported to China and other countries. Indonesia was famous for its quality of cassava. However, residual pesticides in cassava produced in Indonesia were found to be much greater than the WHO standard. Due to this issue, cassava export was greatly reduced including the shipment from Wonogiri, and cassava is since then no longer transported by railway.

Recently, cassava has been widely noticed as the primary raw material for bio-ethanol. For exporting dried cassava to China, Kabupaten Wonogiri and the government of Guangxi Zhuang Autonomous Region of China reached an agreement in the form of letter of intent in 2007. Starting with 300,000 tons per year, targeted volume of dried cassava to be exported to Guangxi is 1 million tons per year. Transporting dried cassava from Wonogiri to Semarang and Cilacap by railway is also under review.

(8) Other Potential Commodities

In Kabupaten Kulonprogo, DIY, there is a plan to develop a bio-ethanol industry which will process corn as the primary raw material. The bio-ethanol plant will have a production capacity of 330 L per day. Transporting bio-ethanol to Semarang and Cilacap by railway is currently under review.

In Tg. Intan (Cilacap) Port, the existing tapioca factory is studying the possibility of transporting tapioca to Jakarta, Yogyakarta, and Solo by railway. It is located next door to PT. Pusri's fertilizer plant, and the railway line is already available in their site. About 200 tons of tapioca is currently transported every day by truck.

In Tg. Intan Port, the sugar refinery, which is located just across the road from the tapioca factory, is also considering transporting sugar to Jakarta, Bandung, and Surabaya by railway. The sugar refinery produces around 3,000 tons of sugar every day.