Republic of Indonesia
Ministry of Transportation
Directorate General of Railways

Preparatory Survey on Capacity Expansion of Railway Line - Lahat and Kertapati in South Sumatra, Indonesia (PPP Infrastructure)

Final Report (Full Version)

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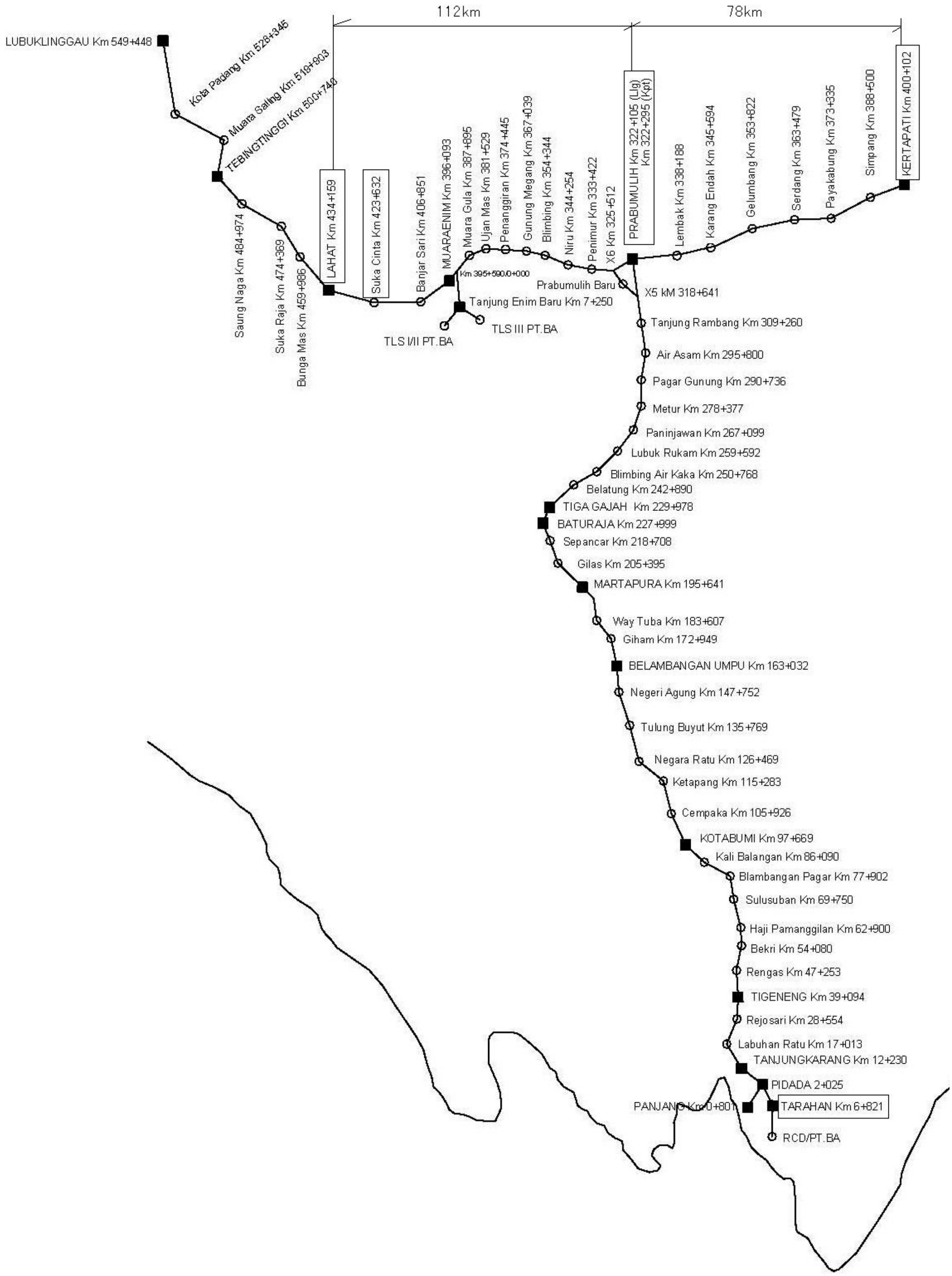
Abbreviations

A	
ADB	Asian Development Bank
ADSCR	Average Debt Service Credit Ratio
AMDAL	Indonesian EIA
APBN	National Budget
AUAID	Australian Agency for International Development
B	
B to B	Business to Business
BOD	Biochemical Oxygen Demand
BAPEDAL	Badan Pengendalian Dampak Lingkungan
BAPPEDA	South Sumatra State Regional Development Agency
BAPPENAS	National Development Planning Agency
BKPM	Capital Investment Coordinating Board
BOO	Build, Operate and Own
BOQ	Bill of Quantity
BOT	Build, Operate and Transfer
BT	Build and Transfer
C	
C.O.D.	Chemical Oxygen Demand
CAPEX	Capital Expenditure
CAPM	Capital Asset Pricing Model
CCTV	Closed-circuit Television
CDM	Clean Development Mechanism
CRP	Country Risk Premium
D	
DEL	Diesel Electric Locomotive
DFID	UK Department For International Development
DGR	Directorate General of Railways
Divre3	South Sumatra Division of PT. KAI
DMO	Domestic Product Use Obligation
DPD	Regional Representative Board
DPR	National Cabinet
DSCR	Debt Service Coverage Ratio
DSR	Debt Service Ratio
E	
EIA	Environmental Impact Assessment
EIRR	Economic Internal Rate of Return
EMD	Electro-Motive Diesel
ENPV	Economic Net Present Value
EPC	Engineering, Procurement and Construction
EPP	Export Parity Price
F	
FIRR	Financial Internal Rate of Return
FNPV	Financial Net Present Value
G	
GCA	Government Contracting Agency
GDP	Gross Domestic Production
GHG	Green House Gas
GMR	Global Market Premium
GOI	Government of Indonesia
H	
HTT	Handheld Tie Tamper
IEDC	Indonesia Economic Development Corridor
I	
IEE	Initial Environmental Examination

IIF	Indonesia Infrastructure Finance
IMF	International Monetary Fund
IMO	Infrastructure Maintenance and Operation
IPP	Independent Power Producer
IRR	Internal Rate of Return
ISO	International Organization for Standardization
J	
JBIC	Japan Bank for International Cooperation
JICA	Japan International Cooperation Agency
JR	Japan Railways
JTC	Japan Transportation Consultants Ltd.
K	
KA-ANDAL	TOR for AMDAL
KALOG	PT. KAI Logistics
KNKT	National Transportation Safety Committee
L	
L/A	Loan Agreement
LARAP	Land Acquisition and Resettlement Action Plan
LLCR	Loan Life Cover Ratio
LNG	Liquid Natural Gas
M	
MOSOE	Ministry of State Owned Enterprises
MP3EI	Master Plan for Economic Acceleration and Integration
MPE	Marginal Propensity of Export
MPR	Indonesian National Council
MTPA	Million Ton Per Annum
MTT	Multiple Tie Tamper
N	
NC	Numerical Control:
NEXI	Nippon Export and Import Insurance
NPV	Net Present Value
O	
O&M	Operation and Maintenance
OCC	Opportunity Cost of Capital
OD	Origin and Destination
ODA	Official Development Assistance
P	
P/Q	Pre-qualification
PAPs	Project Affected People
PC	Pre-stressed Concrete
PER	Public Expenditure Review
PERSERO	State Owned Company
PII	PT. Penjamin Infrastruktur Indonesia
PIU	Project Implementation Unit
PLN	Perseroan Listrik Negara
PMU	Project Management Unit
PPP	Public Private Partnership
PROPENAS	Mid Term National Development Plan
PSC	Project Steering Committee
PSIF	JICA Private Sector Investment Finance
PSO	Public Service Obligation
PT. BA	PT.Tambang Batubara Bukit Asam Tbk
PT. BAU	PT. Bara Alam Utama
PT. INKA	State Owned Rolling-stock Manufacture
PT. KAI	State Owned Railway Operator
PWC	Price Water House Coopers Co.

R	
R	Radius
R42	Rail Type of 42kg/m
R54	Rail Type of 54kg/m
RCD	Rotary Car Dumper
RENSTRA	National Transportation Planning Strategy
RJPP	PT. KAI's Rencana Jangka Panjang Perusahaan
RKL	Environmental Management Plan
ROE	Return On Equity
Rp.	Rupiah
RPJMN	National Mid-term Development Plan
RPJPN	National Long-term Development Plan
RPL	Environmental Monitoring Plan
S	
SIL. 4	Safety Integration Level 4
SDR	Social Depreciation Rate
SEA Games 26	South East Asia Games 26
SISTRANAS	National Transportation System Plan
SOP	Standard Operation Procedure for Toxic Wastes
SPC	Special Purpose Company/Vehicle
STEP	Special Terms for Economic Partnership
T	
TAC	Traffic Access Charge
TATRALOK	Regional Level Transportation Plan
TATRANAS	National Level Transportation Plan
TATRAWIL	State Level Transportation Plan
TOR	Terms of Reference
TSL	Two Step Loan
TSP	Total Suspended Particle
TSS.	Total Suspended Solid
U	
UIC	International Railway Union
UKL	Upaya Pengelolaan Lingkungan
UNFCCC	United Nations Framework Convention on Climate Change
UPL	Upaya Pemantauan Lingkungan
V	
VAT	Value Added Tax
VOC	Vehicle Operation Cost
W	
WACC	Weighed Average Cost of Capital

Project Line Map



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Chapter 1

Background of the Project

1.1. Summary of Indonesia

1.1.1. Outline of the Country

(1) Overview of the Country

① Location

The proper name of Indonesia is the Republic of Indonesia, a name that originates from the Greek words “Indos”, meaning “India”, and “Nesos”, meaning “island”. The country is located between latitude 6° 8’ north and 11° 15’ south, and between longitude 94° 45’ east and 141° 5’ east. The distances of the country from east to west and from north to south are approximately 5,100km and 1,760km respectively. Reputed to be the world’s largest archipelagic country, Indonesia is made up from 17,508 large and small islands, of which approximately 6,000 are inhabited. Its land area extends roughly 1.86million km^2, making Indonesia the world’s 16^{th} largest country, and it has about 5 times more land than Japan. Among the islands, the largest is Kalimantan (539,000km^2, followed by Sumatra (426,000km^2), Irian Jaya (422,000km^2), Sulawesi (174,000km^2), and Java (129,000km^2). [Fig. 1-1-1] shows the map of Indonesia.

DKI Jakarta is the capital of Indonesia, and is located on the northwest coast of Java island, forming the main city of Indonesia. Surabaya is Indonesia’s second largest city, and is located at the eastern end of Java Island. Other cities include Bandung, Medan, Semarang, Yogyakarta, Denpasar, Padang, Palembang, Makassar, Manado, Banjarmasin, Balikpapan, and Jayapura.

(Source: Coordination Agency National Survey and Mapping (Bakosurtanal), Indonesia)

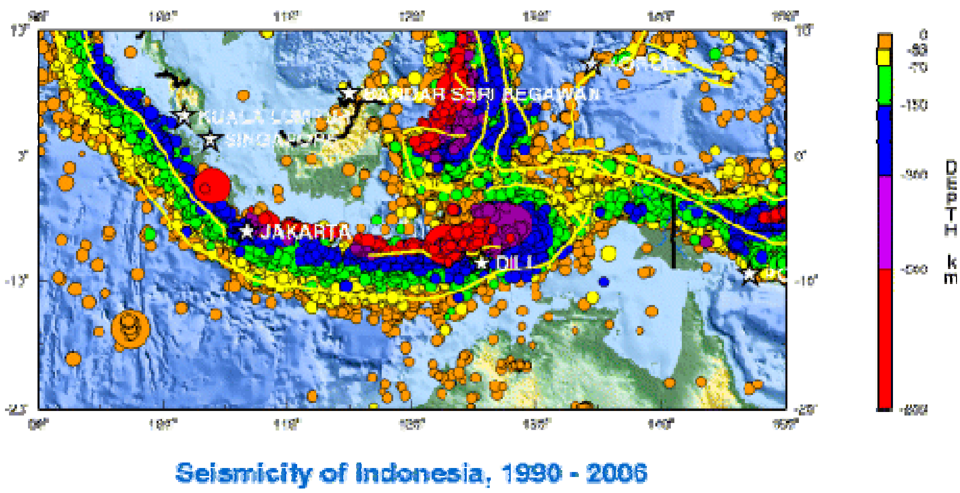
[Fig. 1-1-1] Map of Indonesia

② Geographical Features

It is estimated that the total territorial area of Indonesia is approximately 9.8million km^2, of which 81% is sea and the remaining 19% is land. For the reason that the largest part of its area is sea, Indonesia is said to be the country with the longest coastline, with a length of 54,716km. In addition, because Indonesia is part of the circum-Pacific volcanic belt, the world's largest volcanic zone, the area stretching from Sumatra to Java, Bali, Lombok, Sumbawa, and Flores has many volcanoes, between 400 and 450, of which approximately 130 are active. Indonesia's highest mountain is Mount Jayawijaya in Papua, which is approximately 5,000m above sea level at its highest point and is covered with snow year-round. The country's largest lake is Lake Toba in Sumatra, which has an area of 1,100km^2, and the longest rivers are considered to be the Mahakam River and Barito River on Kalimantan Island, which are used for regional transportation. The majority of the coastline facing the Indian Ocean consists of steep cliffs, with part made up of sand dunes. In contrast, the islands in the sea located on the northern side are comparatively flat, due to the effect of sedimentation built up over many years.

③ Earthquakes

For the reason that the Indo-Australian Plate passes under the Eurasian Plate in the area in the south part of Indonesia bordering the Indian Ocean, many plate boundary type earthquakes occur in Indonesia. In recent years, these included earthquakes in Sumatra on December 26, 2004 (Magnitude 9.3) and on March 29, 2005 (Magnitude 8.7), and in Yogyakarta on May 27, 2006 (Magnitude 6.2). [Fig. 1-1-2] shows the distribution of seismicity (1990 - 2006) published by United States Geological Survey. Earthquakes have happened throughout the whole land of Indonesia.



(Source: USGS (United States Geological Survey))

[Fig. 1-1-2] Distribution of Seismicity (1990 - 2006)

④ Climate

Because Indonesia is located close to the equator, it has a tropical climate. Unlike the changing seasons in Japan, there are only two seasons consisting of a dry season and a rainy season. When the sun is above the northern hemisphere, a dry wind blows across the whole country from the southeast, while when the sun is above the southern hemisphere, a humid wind blows from the northeast. The dry season continues from around June until September, while the rainy season lasts from December to March. April and May, and October and November are the times when the two seasons change. The annual average temperature of the plains in 2008 was between 23℃ and 28℃. The humidity is comparatively high, and was observed between 71.0% and 88.0% in 2008. It rains almost throughout the year, even during the dry-season. The amount of rainfall differs depending on the month and the location. The average amount of rainfall in 2008 was between 949.1mm and 5,652.0mm. The annual average temperature of the plains in 2010 was between 25℃ and 32℃. The humidity is comparatively high, and was observed 74% in 2010. Rain is falling almost throughout the year, even during the dry-season. Average rainfall was observed 1,779 mm in 2010.

⑤ Population

The [Table 1-1-1] shows the population of Indonesia. As shown in the table below, the total population of Indonesia in 2010 was approximately 238million, and Indonesia was ranked 4th of nations with largest population in the world. Looking at the share of population by region, more than half of the population (51.5%) was concentrated in Java Island which equals only 7% of Indonesia’s land area. On the other hand, the shares of the other islands were all single digit figures (between 1.8% and 7.2%), except for Sumatra Island (25.2%). Thus, the population density in Java Island is the highest approximately 8 times higher than the national average.

Due to the implementation of population control programs such as family planning, the population growth rate has been reduced gradually from 1.45% between 1990 and 2000 to 1.24% between 2000 and 2005 and 1.08% between 2005 and 2010. However, it seems that the decentralization of population such as the implementation of migration is not much in progress in spite of the efforts of various countermeasures by the government due to the present condition of population above.

[Table 1-1-1] Population of Indonesia

Region	Land Area (Thousand km^2)	Population (Thousand) 2000	Population (Thousand) 2010	Population Density per km^2 (2010)
1. Sumatra				
(1) Aceh	58.0	3,929	4,487 (1.7%)	77
(2) North Sumatra	73.0	11,643	12,985 (4.9%)	178
(3) West Sumatra	42.0	4,249	4,846 (1.8%)	115
(4) Riau	87.0	3,908	5,543 (1.6%)	64
(5) Riau Islands	8.2	1,040	1,686 (0.4%)	206
(6) Jambi	50.1	2,407	3,089 (1.0%)	62
(7) South Sumatra	91.6	6,211	7,446 (2.6%)	81
(8) Bangka-Belitung	16.4	900	1,223 (0.4%)	75
(9) Bengkulu	19.9	1,456	1,713 (0.6%)	86
(10) Lampung	34.6	6,731	7,596 (2.8%)	220
(11) Total	480.8 (25.2%)	42,473	50,614 (17.9%)	105
2. Jawa	129.4 (6.8%)	121,294	136,563 (51.1%)	1,055
3. Bali & Nusa Tenggara	73.1 (3.8%)	10,982	13,068 (4.6%)	179
4. Kalimantan	544.2 (28.5%)	11,308	13,773 (4.8%)	25
5. Sulawesi	188.5 (9.9%)	14,882	17,359 (6.3%)	92
6. Maluku & Papua	495.0 (25.9%)	4,195	6,180 (1.8%)	12
Total	1,910.9 (100%)	205,133	237,556 (100%)	124

(Source: Statistical Yearbook of Indonesia 2010)

⑥ Language, Religion, and Ethnic Groups

The Indonesian language (Bahasa Indonesia) is commonly used as the official language. However, there are many regional languages, around 150 to 250, depending on the ethnic groups and regions, which are used in daily conversation among members of the same ethnic groups.

Indonesia guarantees freedom of religious belief through the provisions of Article 29 of the Constitution. Similarly to the situation with languages, many religions are spread out following the differences in regional geography. For example, the Hindu religion is widespread in most areas of Bali Island, while the Roman Catholic religion is found in the north part of Sulawesi Island, the Protestant religion in the eastern Indonesian islands including New Guinea, and the

Islamic religion is present in most areas nationwide. According to the statistical data, believers of the Islamic religion make up 86% of the total, followed by Christians with 9%, Hindus at 3%, Buddhists at 2%, and others. There are more than 170 million believers of Islam in Indonesia, making it the country with the largest Islamic population in the world.

As for the ethnic group, the majority of the population is Malays, but this also consists of many sub-ethnic groups such as the Jawa group of Central and East Java making up 45%, the Sunda group in West Java with 14%, the Madura with 8%, and other groups. In addition, 5% of the population is overseas Chinese Indonesians.

⑦ History

The history of Indonesia can be divided into a number of stages such as the prehistoric times, the introduction of Hinduism and Buddhism, the spread of Islam, the Dutch colonial period, the awakening of nationalism, the occupation by the Japanese imperial army, the declaration of independence, the introduction of democracy under Sukarno, the New Order under Suharto, and the quest for reforms in the post-Suharto period. The following is a summary of each of the stages.

From around the 1st century B.C., there was a spread of a unique culture influenced by the Hindu religion that was introduced by Indian traders. Then, from the 7th century, the Buddhist kingdom of Sriwijaya was established on Sumatera Island and Sailendra was established on Jawa Island. Meanwhile, the Hindu kingdom of Mataram was established on Java Island. In particular, the Majapahit kingdom established in 1292 greatly flourished between 1350 and 1390 under the strong leadership of Gajah Mada.

Meanwhile, in the 13th century, Islam was brought by the Indian and Arab traders who crossed the seas in search of spices and it spread to most of the country by the latter half of the 15th century. Thereafter, European traders had begun visiting Indonesia to trade in spices. Among them, the Netherlands government began directly administering Indonesia as its colony. Although resistance activities occurred in succession against the Dutch colonial administration following the expansion of the plantation business by the Dutch, these were all suppressed. During the 20th century, the Netherlands changed its formerly forceful colonial administration to one that was more lenient, and as a result the democratic movement began to grow larger.

In February 1942, the end of Dutch colonial control was marked by the attack and occupation by the Japanese imperial army. Two days after the unconditional surrender of Japan on August 15, 1945, the nationalist leader, Sukarno, declared Indonesian independence and was appointed president. Following this, the Netherlands tried to re-establish their colony, but this ended in failure due to resistance by armed Indonesians, and the Netherlands finally recognized Indonesian independence in December 1949. President Sukarno established the Sukarno concept in 1957 based on “guided democracy” and “guided economy”. Since he practiced it with the support of the military and the Communist Party seeking for anti-imperialist, anti-colonial policies, Indonesia became gradually isolated from international society. Meanwhile, the domestic economy rapidly worsened, affected by a steep rise in the cost of living due to inflation. At this time, the attempted Communist Party coup d’état on September 30, 1965 triggered a steep drop in Sukarno’s political influence, and Suharto, who had suppressed the attempted coup, was appointed president in 1968.

At the beginning of the Suharto era, known as the New Order period, Suharto reversed the foreign policies pursued in the Sukarno era by making approaches to Western nations. In addition, President Suharto positively encouraged investment from overseas countries, which resulted in economic development that continued for 30 years. In the Suharto era, this economic growth showed a high average rate of 6.7%, and the president succeeded in realizing economic and political stability. However, the Asian currency crisis in 1997 paralyzed the Indonesian economy. This triggered an explosion of dissatisfaction among the general populace in the Suharto regime, leading to bloody violence and rioting. As a result, Suharto resigned the presidency on May 21, 1998, and was replaced by Bucharuddin Jusuf Habibie, who had been vice president at the time. President Habibie introduced many political reforms including the liberalization of political activities, freedom of speech and gathering, release of political prisoners, and regional decentralization. However, in the elections of June 1999, the newly elected members of the People's Consultative Assembly (MPR) rejected the reappointment of Habibie, and Abdurrahman Wahid was elected president with Megawati Sukarnoputri as vice president. President Wahid tried to further promote democracy and economic growth while twice forming cabinets made up from many political party members, but the political situation became even more confused due to opposition from the People's Representative Council (DPR). President Wahid was unable to take effective measures to end the confusion, and finally on July 23, 2001 he was removed from office through a resolution of the People's Consultative Assembly (MPR), and Vice President Megawati became president as stipulated by the constitution.

Although President Megawati further promoted the reforms towards democratization begun in the Habibie and Wahid eras, these political policies placed greatest importance on unifying and stabilizing the country. However, Megawati was faced with many problems, including the spread of corruption, collusion and nepotism, regional secession and independence movements, the delay of economic reforms, and debt problems. Without taking appropriate measures despite being faced with these problems, Megawati gradually lost the trust of the Indonesian people. Finally in 2004 Megawati lost to Susilo Bambang Yudhoyono in Indonesia’s first direct presidential election.

President Yudhoyono was affected by many calamities after taking office, such as the earthquakes in Sumatra and Yogyakarta, the volcanic eruption of Mount Merapi, an outbreak of bird influenza, and the mud flow eruption at Sidoarjo. In addition, the president was forced to implement painful policies due to the effect of global high oil prices including raising the prices for fuel. Despite the mentioned problems, Yudhoyono was elected as a President for the second period from 2009 to 2014. Currently, his vice president is Boediono, a former Governor of the Indonesian central bank.

(2) Outline of Indonesian Politics and Administration

① Politics

The system of government in Indonesia is a constitutional republic. The 1945 constitution has been revised four times. In order to represent the characteristics of Indonesia’s multiplicity of languages, ethnic groups and religions, in the constitution the motto is “Bhinneka Tunggal Ika”, meaning “Unity in Diversity”.

After Suharto resigned the presidency in 1998, many political reforms were implemented. One of these is the separation of the executive, legislative, and judiciary powers. The president is the country’s head of state and also heads the government. Below the president is the vice president, but there is no post of prime minister. The revisions to the 1945 constitution applied limitations to the exercising of sole authority by the president. These included the prohibition of the right to enact laws, prohibition of the right to appoint members of parliament, and the necessity to obtain the cooperation of the parliament regarding personnel appointments.

As the legislative branch of government, there is the People's Representative Council (DPR), the Regional Representative Council (DPD), and the People's Consultative Assembly (MPR). Out of these, only the People's Representative Council, consisting of 550 members elected for five year periods in a general election, has the authority to enact laws. Other authorities of the People's Representative Council include the determination of the country’s budget and a supervisory function over the government. The Regional Representative Council was newly established in 2004 in response to regional administration issues, and is made up of regional representative council members selected by each province. The People's Consultative Assembly is currently positioned as a bicameral parliament, consisting of the People's Representative Council and the Regional Representative Council, and has the functions of revising the constitution, and exercising the authority to dismiss the president or vice president. General election including presidential election is going to be held in 2014.

② Foreign Policies

Immediately after securing independence, Indonesia’s basis for foreign relations was non-alignment. This kind of policy was named “Bebas Aktif”, meaning “free and active”.

Although various changes have been seen in the history of Indonesia's foreign policies, this basis has been constantly maintained. Additionally, since the Suharto New Order period, the forming of economic and political relations with Western nations and Japan has also been a basis of foreign policy. As a result, a large amount of economic aid has been received from donor countries, which has greatly contributed to Indonesia's economic development. Indonesia is a member of many international institutions, including the Association of South-East Asian Nations (ASEAN), the Non-Aligned Movement (NAM), and The Organization of the Islamic Conference (OIC).

In addition, special mention should be made of the fact that 2008 marked the 50th anniversary of the forming of diplomatic relations between Indonesia and Japan, as relations between both countries started in 1958. Many events were held in various fields to commemorate this.

③ National Security and Public Safety

The approximately 300,000 troops of the armed forces are charged with Indonesia's national security, consisting of army, navy, and air force. The highest command authority of the armed forces is vested in the president. In addition, the direct responsibility for the armed forces is exercised by the Minister of Defense, and military command is implemented by the officer commanding the national forces. Various reforms have also been carried out in the armed forces, and its representative seat in parliament was also abolished in 2004. In contrast, the country's public safety is the responsibility of the national police. In the Suharto era, the police were positioned below the armed forces, but in 1999 they were separated from the military and are now under the direct command of the president.

④ Administration

The president is the head of the Indonesian government, while the cabinet is established as the highest consultative institution for exercising administrative authority over the country. In addition to the president and vice president, the cabinet has three coordinating ministers, 20 ministers of various agencies, 10 state ministers, and three non-ministerial high-ranking officials. These ministers are appointed by the president, and assist the president in the various fields. The current cabinet is called the United Indonesia Cabinet and was established in October 2009. Minor reshuffle of this cabinet has been carried out in October 2011.

On the other hand, following the collapse of the Suharto regime, regional decentralization is being promoted in order to establish political democracy also at the regional level. Law No.22 was enacted in 1999 as the base law for regional government, and this law was further revised to become Law No.32 in 2004. According to these laws, the regional government administrative classification was stipulated as provinces (Provinsi), regencies (Kabupaten), and cities (Kota). In this classification, the country consists of several provinces, while provinces are made up of several regencies and cities. Each of the provinces, regencies, and cities can have their own regional governments and assemblies. In addition, it was stipulated that each of the regional governments can define their own roles in the various regions over a wider range than before in most fields with the exception of foreign policy, national security, religious affairs, judicial affairs and fiscal policy, which come under the jurisdiction of the central government. Further, it was also stipulated that regional governments would be able to implement other important affairs, including the direct election of the regional chief, the separation of administrative functions between central and regional governments, and the establishment of regional development plans. Currently, there are 33 provinces, 398 regencies, and 93 cities. Below the regencies and cities, sub-districts (Kecamatan) are established, and each sub-district is divided into villages (Desa) and neighborhood groups in cities (Kelurahan).

1.1.2. Economic, Industrial, and Fiscal Conditions

(1) Economic and Industrial Conditions

Between 1987 and 1997, as a result of the implementation of policies which were focused on promoting the creation of job opportunities and increasing exports in non-oil sector by the government at the time, Indonesia has maintained a high economic growth rate, nearly 7% per year. However, the 1997 Asian financial crisis caused Indonesia to experience extensive economic damage. For example, the weakness of the rupiah against the dollar, a drop in new investments, and a reduction in imports caused by the unstable currency rates have happened. As a result, the GDP growth rate in Indonesia dropped to minus 13%. Following this, due to the implementation of various reforms by the government and favorable domestic consumption, the GDP growth rate has reached 6% recently except for 2009 when a global financial crisis occurred, as shown in [Table 1-1-2]. Above this condition, it can be said that the Indonesian economy is recovering after the 1997 financial crisis.

However, looking at the economic structure, the private consumption occupied more than 60% of the total GDP. This type of economic structure is easily affected by the economic condition at each time. Therefore, in order to achieve the annual economic growth of 6% to 7% that the government is aiming for, it is said that it will be necessary to change the economic structure from initiative by private consumption to that by investment.

[Table 1-1-2] Statistical Data on Indonesian Economic Condition

Item	Unit	2006	2007	2008	2009	2010
1. Gross Domestic Product (GDP) (*1)	Rp10^9	3,339.2	3,950.9	4,951.4	5,613.4	6,241.8
2. GDP per Capita (*1)	Rp10^6	15.00	17.50	21.70	24.30	
	US$	1,636	1,916	2,237	2,327	3,015
3. Growth Rate of GDP (*2)	%	5.5	6.3	6.0	4.5	6.1
4. GDP by Sector (*1)						
(1) Agriculture, livestock, forestry, fishery	%	14.2	13.8	13.7	13.6	13.2
(2) Mining and quarrying	%	9.1	8.7	8.3	8.3	8.1
(3) Manufacturing industry	%	27.8	27.4	26.8	26.2	25.8
(4) Electricity, gas and water supply	%	0.7	0.7	0.7	0.8	0.8
(5) Construction	%	6.1	6.2	6.3	6.4	6.5
(6) Trade, hotel and restaurant	%	16.9	17.3	17.5	16.9	17.3
(7) Transport and communi-cation	%	6.8	7.2	8.0	8.8	9.4
(8) Financial, real estate and business services	%	9.2	9.3	9.5	9.6	9.5
(9) Services	%	9.2	9.3	9.3	9.4	9.4
5. Percentage Distribution of GDP (*1)						
(1) Private consumption	%	59.9	57.6	57.3	57.3	56.9
(2) Government consumption	%	8.0	7.8	8.1	9.0	8.5
(3) Fixed capital formation	%	21.8	22.5	23.7	23.4	24.0
(4) Export	%	47.0	48.0	49.6	42.8	46.4
(5) Import (Less)	%	37.6	38.6	40.0	32.5	36.0
6. Inflation Rate	%	6.6	6.6	11.1	2.8	7.0
7. Umemployment Rate	%	10.3	9.1	8.4	7.8	7.1
8. Percentage of Population be-low Poverty Line	%	17.6	16.6	15.4	14.2	13.3

Note : * 1: At current market price
* 2 : At 2000 constant market price

(Source: The World Bank, Statistical Yearbook of Indonesia 2010 and Website of JETRO)

On the other hand, the manufacturing sector occupied approximately 30% of the total GDP, and the commerce, agriculture, forestry and fisheries sectors followed it. These three sectors occupied over 50% of the total GDP. It is not too much to say that Indonesia has already become an industrial country from the point of view of GDP structure. The mining sector including oil and natural gas occupied almost 8%. Indonesia had been one of the world’s major oil and gas producing countries, but became an oil importing country since 2004 due to the ageing of its oil facilities, the lack of new investment in oil and gas sector and the rapid increase of domestic demand for fuels. Besides oil and gas, Indonesia produces a lot of minerals such as bauxite, silver, tin, copper, nickel and gold. Especially, the coal production capacity has been increased by opening coal sector to foreign investment.

Concerning the inflation rate, Indonesia experienced double-digit number of 17.1% in 2005. This was due to the increase in fuel price by an average of 126%. The inflation rate had been stable for a while after that, but became double-digit number of 11.6% in 2008 due to the re-increase in fuel price by an average 28.7% in May 2008. As shown in [Table 1-1-2] above, the rate of unemployment and the poor is still high. In order to improve the situation, the government recognizes that it is required to achieve high economic growth of 7% to 8%. To this end, the Indonesian government is implementing an economic growth package focused on promoting investment and trade, and on increasing employment opportunities. In addition, the government has also listed up measures as a high priority subject such as infrastructure development and energy management including research and development of alternative fuels in cooperation with private sector.

[Table 1-1-3] shows the latest statistics of Indonesian import and export. The table below shows that the amount of exports in 2009 achieved 116.5billion US dollars, while that of imports was 96.9billion dollars. The total amount of exports and imports had showed increasing tendency, but it decreased in 2009. As shown in the table below, the trade account balance has remained in the black, and its amount was 19.7 billion dollars in 2009. The current account balance deducting service balance, including interest of loans, transportation cost and the profit on foreign investment had become in the red in 2008, but turned in the black in 2009.

[Table 1-1-3] Export and Import Amounts between 2006 and 2010

(Unit : US $ Billion)

		2006	2007	2008	2009	2010 (*1)	Average Annual Increase Ratio (%)
Exports	Non Oil and Gas	79.6	92.0	107.9	97.5	59.4	7.7
	Oil and Gas	21.2	22.1	29.1	19.0	13.2	0.4
	Coal	6.1	6.7	10.5	13.8	-	32.7
	Total	100.8	114.1	137.0	116.5	72.5	6.1
Imports	Non Oil and Gas	42.1	52.5	98.6	77.8	49.8	30.5
	Oil and Gas	19.0	21.9	30.6	19.0	13.1	5.7
	Coal	0	0	0	0	-	0
	Total	61.1	74.5	129.2	96.9	62.9	23.5
Trade Balance	Non Oil and Gas	37.5	39.5	9.3	19.7	9.6	
	Oil and Gas	2.2	0.2	(1.5)	0	0.1	
	Coal	6.1	6.7	10.5	13.8	-	
	Total	39.7	39.7	7.8	19.7	9.7	
Current Account Balance		10.9	10.5	(0.6)	3.5	1.2	

Note: * 1: until June 2010

(Source: Statistical Yearbook of Indonesia 2010 and Website of JETRO)

(2) Fiscal Conditions

[Table 1-1-4] shows the Indonesian 2011 national budget. The annual revenue will be

1,105trillion rupiah, while expenditure will be 1,230trillion rupiah, and it is forecasted that budget deficit will be 125trillion rupiah. The annual revenue is composed of tax revenue, non-tax revenue and grant. It is estimated that 77% of the annual revenue will be gained from income tax, added-value tax and others, and 23% of that will be gained from sales of natural resources and profit of state-owned companies. On the other hand, 70% of the annual expenditure is planned to be allocated to the central government, but 58% of the expenditure is planned to be spent the interest of national debt and government subsidies. The remaining 30% of the annual expenditure is planned to be transferred to the local governments. It is assumed that the budget deficit will be last for several years, and the implementation of budget control is required to be more severe.

[Table 1-1-4] Indonesian 2011 National Budget

Item		Amount (Rp trillion)
1. Revenue	1. Taxation	850.3
	2. Non-taxation	250.9
	3. Grant	3.7
	Total	1,104.9
2. Expenditure	1. Central Government	836.6
	2. Transfer to Local Government	393.0
	Total	1,229.6
3. Balance		(124.7)
4. Funding	1. Balance of Domestic Funding	125.3
	2. Foreign Loan	(0.6)
	Total	124.7

(Source: Ministry of Finance)

1.1.3. Development Subjects and Governmental Development Plan

The local governments of Indonesia are composed of three-layer structure, such as provinces (33, including DKI Jakarta and D.I. Yogyakarta), cities (urban autonomy, 93) and regencies (local autonomy, 398). Each government has the authority to make a social economic development plan based on National Development Plan System Code (Articles 25, 2004) and a spatial plan based on Spatial Plan Code (Articles 26, 2007), and has implemented development based on these plans.

Indonesian development plan (social・economic development plan) at the national level, as shown in Table 1-1-5, is composed of National Long-term Development Plan (RPJPN) which is covering next 20 years and National Mid-term Plan (RPJMN) which is covering next 5 years. Development plan is under control of National Development Planning Agency (BAPPENAS).

Period of existing Long-term Plan (Law No. 17, 2007) is 2005-2025, and period of existing Mid-term Plan (Government Ordinance No.7, 2005) is 2004-2009.

[Table 1-1-5] List of Development Plan

	National Level	Local Level
Long-term Plan	National Long-term Plan RPJP Nasional RTRN	Local Long-term Plan RPJP Daerah RTRW
Mid-Term Plan	National Mid-term Plan RPJM Nasional	Local Mid-term Plan RPJM Daerah
Implementation Plan	Central Government Implementation Plan RKP	Local governments Implementation Plan RKP Daerah

(Source: Study team)

(1) Long-term Plan

National Long-term Plan which is covering next 20 years has an important role as showing mission and policies. Mid-term Plan which is made by the president after every 5-year direct election shows national development strategies, macroeconomic frame and 5-year preferential policy measures based on the President's policies.

As shown in the [Table 1-1-6] below, the Government divided 20 years, which is decided in National Long-term Development Plan, to 4 stages, and proposes objectives in each stage.

[Table 1-1-6] National Long-term Development Plan's Objectives in Each Stage

1st Stage	2005-2009	Aiming to reconstruct and develop Indonesia as a safe, peaceful, equal and democratic country.
2nd Stage	2010-2014	Aiming to further reconstruct focusing on development of science, technology and improvement of economic competetiveness including development of human resources.
3rd Stage	2015-2019	Accelerating overall improvement by achieving economic competitiveness based on advantage of natural and human resources and last-growing of science and technology.
4th Stage	2020-2024	Creating an independent, progressive, equal and prosperous society through accelerated growth by structuring strong economy with competitive human resources based on advantage of competitiveness.

(Source: Study team)

Also, in National Long-term Development Plan, the objectives of inter-regional cooperation and mutual development as priority subjects are as follows;

① Strategic Frame to Accelerate Dispersive Regional Development

- Coordinating development by reinforcing existing infrastructure development, and reinforcing the cooperation between urban and local area.
- Accelerating infrastructure development in the center of existing and new growing area (including agricultural urban area).

② Strategic Frame to Accelerate Independence

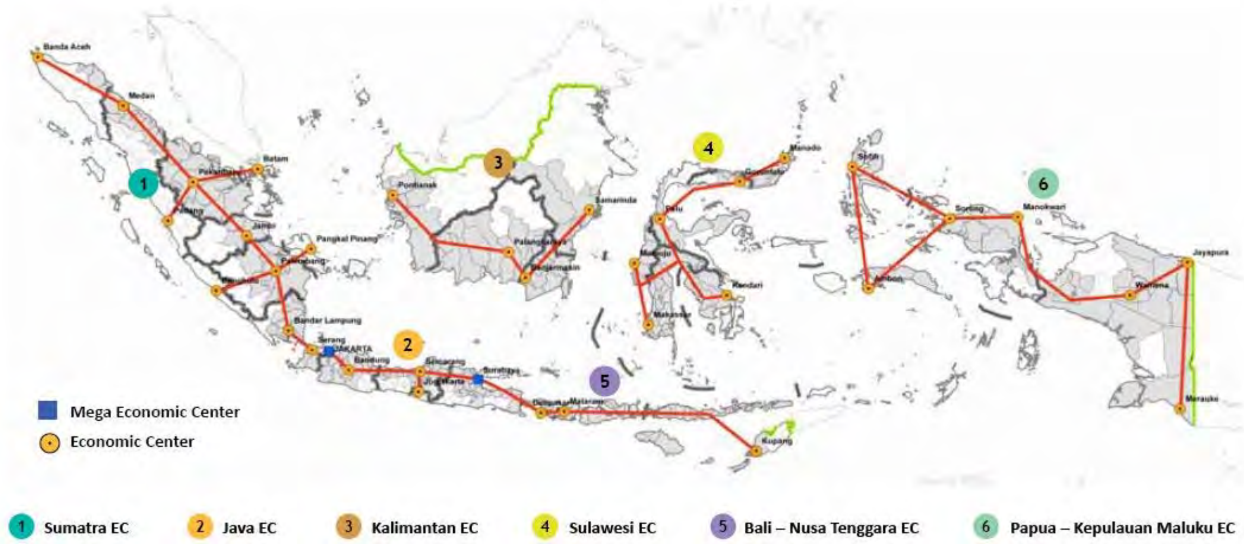
- Developing national border area as national strategic central area, and promoting cooperation between primary cities which are located at the edge of national border.
- Improving export-oriented economic development area based on local resources.
- Utilizing national border area as a dynamic security area in peace and emergency condition.
- Protecting and developing islands which are located around the national border.
- Improving services and infrastructure in specific area.

③ About MP3EI

In January 2010, the cooperation of Indonesia Economic Development Corridor (IEDC: Indonesia Economic Development Corridor)'s projects was confirmed between Hatta Rajasa, Coordinating Minister for the Economy, Republic of Indonesia, and Masayuki Naoshima, Minister for the Economy, Trade and Industry, Japan, and this is the new first step for relationship between Japanese and Indonesian economy. Priority industry and infrastructure is totally developed according to each corridor, infrastructure development (Road, Railway, Harbor, Electric generation plant and so on) with PPP (Public-Private Initiative) scheme are proposed as concepts.

In order to materialize the above IEDC, the Government of Indonesia officially published the Master Plan for the Acceleration and Expansion of Indonesian Economic Development (MP3EI), on May 27th 2011. This master plan is positioned as the center of long-term plan 2011 - 2025, and has been considered at the Government since the last half of the 2010's. Especially, this master plan was focused on making a strategic plan for infrastructure development to achieve the objective of long-term economic development. In This plan, specific projects are also listed.

In MP3EI, 6 economic corridors are set up in the country, and infrastructure development is aimed in order to improve cooperation inside of each corridor and between corridors. These economic corridors consist of ①Sumatera, ②Java, ③Kalimantan, ④Sulawesi, ⑤Bali-South East Nusa, and ⑥ Papua and Maluku Islands as shown in [Fig. 1-1-3]. Especially, development of Sumatra economic corridor and Java economic corridor is the high priority, and the biggest infrastructure development project is the Sunda Strait Bridge connecting the islands.



(Source: MP3EI)

[Fig. 1-1-3] Six Economic Corridors of Indonesia

In MP3EI, railway projects in South Sumatra are shown as following below.

- Railway development of Tanjung Enim - Lampung and Tanjung Enim - Kertapati
- Railway construction between Kertapati, Simpang and Tanjung Api Api.
- Railway coal transportation between South Sumatra and Lampung.
- Railway construction between Muaraenim and Tanjung Carat.

Concerning coal production in South Sumatra region, the mining site is far away from a harbor, although transportation infrastructure such as railway and road as land transportation, the fact that the transportation capacity is insufficient is mentioned as an issue. Although the coal reserve is endowed, this fact is a bottleneck in promoting coal development for the near future. Therefore, it is noted that railway infrastructure development is an important strategy from the point of view of transportation efficiency and global environment.

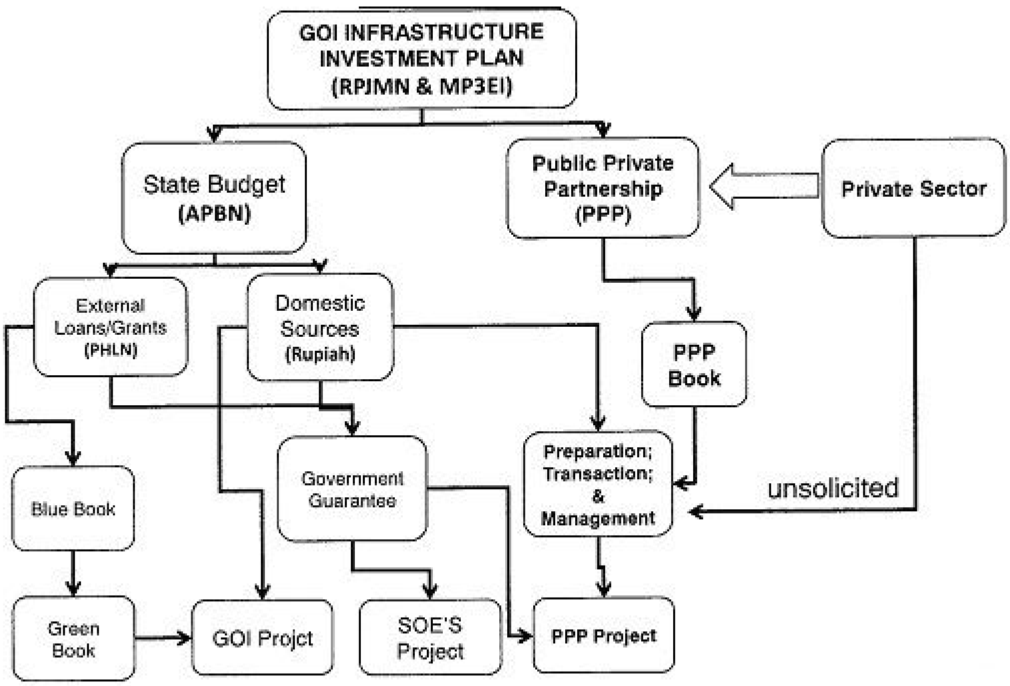
(2) Mid-Term Plan

The new National Mid-term Development Plan whose term is 2010 – 2014 has been implemented as executive order 5 in 2010. In the 2nd Stage of the long-term development plan (2005 – 2024), the previous plan is evaluated as Indonesia has overcome worldwide economic crisis and national disasters such as Sumatra Earthquake, and “independent, progressive, equal and rich Indonesia” is proposed as national vision, and 9 development policies by sector are shown. Especially, in this plan, in addition to the total development plan and the development plan by sector, there are new things that the development policies which are prepared at each local government.

The Government of Indonesia proposed that economic growth rate is 7% (2010, 6.0%), jobless rate is 5 – 6% (2010, 7.4%), poverty rate is 8 – 10 % (2010, 13.3%) as the objectives of 2014.

1.1.4. PPP Policy and Regulations

There are 2 regulatory flows for the development of social infrastructure in Indonesia, namely ① the projects being implemented under the state/government budget and ② the projects being implemented under PPP scheme. [Fig. 1-1-4] summarizes the regulatory flow.

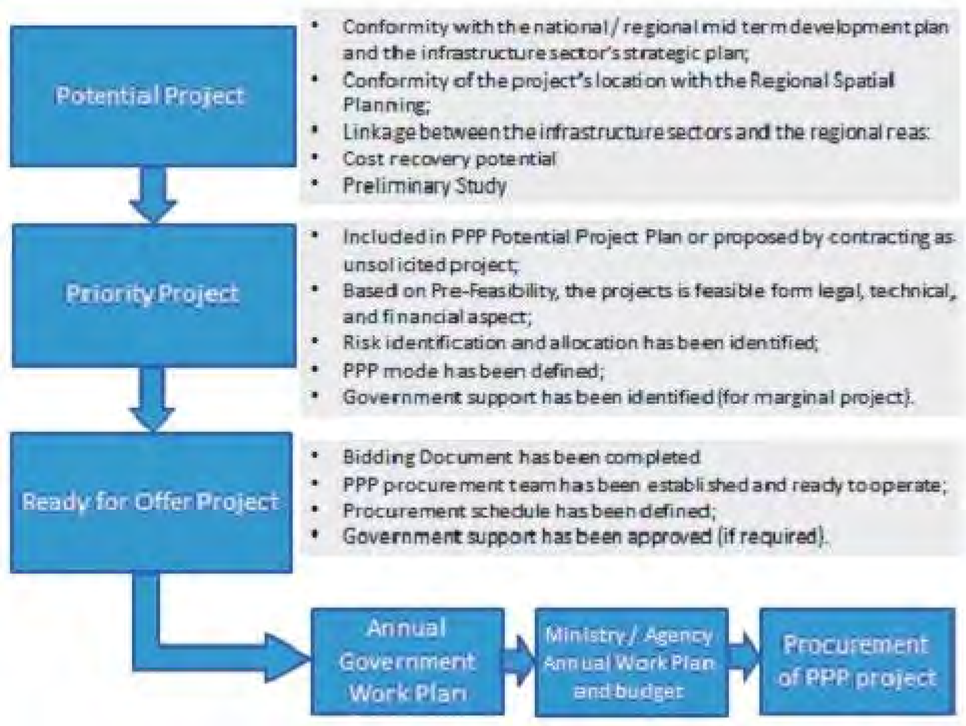


(Source: BAPPENAS presentation material)

[Fig. 1-1-4] Regulatory Flow of Social Infrastructures in Indonesia

As far as the PPP projects are concerned, the projects included/registered in the investment plan and/or master plan by the Central Government or State Governments will be initiated by the Government Contracting Agencies, and the projects will be registered in so called “PPP Book” – “Public Private Partnerships – Infrastructure Projects Plan in Indonesia” being issued by the BAPPENAS.

According to the PPP Book, there are three different categories in the project status, and the following chart summarizes each project status.



(Source: PPP Book)

[Fig. 1-1-5] PPP Project Status

BAPPENAS will evaluate any applications of the potential PPP projects when they receive the applications from a GCA (General Contracting Agency). As the result of their evaluation, they will decide to register new projects and re-register formerly registered but eliminated projects. Details of railway related projects registered in the PPP Book are summarized in Section 1.2.6. (P. 1-46).

The PPP book has been revised once a year in the past 3 years, in which BAPPENAS updated the candidate project list based on request by or hearing from GCA. The record of the past revision is described in 1.2.6. (P. 1-46).

According to the relevant information issued by BAPPENAS and Hadiputranto, Hadinoto & Partners which is the largest law firm in Indonesia, the process to proceed with the PPP business is as follows (refer [Fig. 1-1-6]). Here, the term “Solicited”implies PPP business initiated by GCA.

(1) Project formation

GCA formulate a projects, gives priority for them and request BAPPENAS to enlist them in the PPP book. Thereafter, implementation of pre-F/S and bid preparation will follow.

(2) Bid Preparation

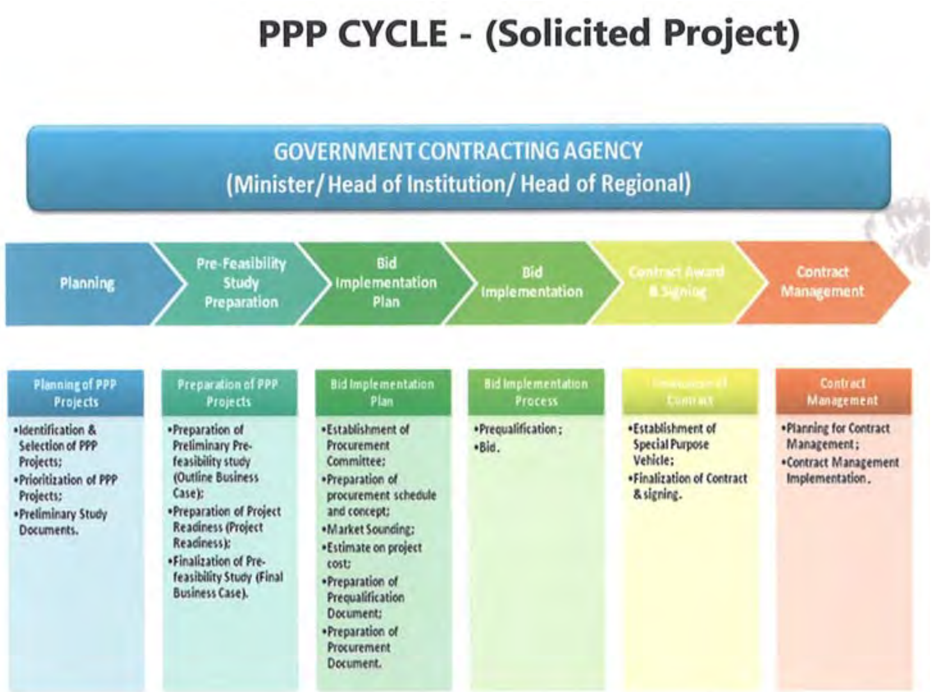
The GCA organizes Procurement Committee and establishes process for procurement and bidding. Hearing to market players concerned is conducted if necessary and project cost is estimated. Preparation of pre-qualification documents and bidding documents will follow.

(3) Bidding

The GCA selects a contractor through pre-qualification, bidding and bid evaluation.

(4) Contracting

The GCA organizes SPC (Special Purpose Company) to work as a implementing agency if necessary, and concludes contract with the successful bidder. The SPC performs the contract and supervises the project.



(Source: BAPPENAS)

[Fig. 1-1-6] PPP Project Cycle for Solicited Project Type Project

On the other hand, it is called “Unsolicited” for projects initiated by private sector. F/S for the project is conducted in the joint effort of a private company and GCA. If the private company participated the bidding of the project, the company will be given a choice of either 1) 10% of bonus point. 2) adjust the bidding price to the lowest bidder to win and 3) buy the project including copy right of the project.

As mentioned above, even though constructing a framework for setting up the projects under the PPP scheme has been proceeded, only “Central Jawa Coal Fired Power Plant Project” was completed as of this moment. As mentioned in 1.2.6. (P. 1-46), as far as railway sector is concerned, there are some progresses of Soekarno Hatta Airport - Manggarai Project and Palaci - Bangkuang Coal Railway in Central Kalimantan, but they have not been completed yet.

There are many reasons why few projects are completed in Indonesia. For example, risk allocation between public and private is unclear and Indonesian related organizations don’t have enough capability to formulate potential PPP projects, etc. As a result, there are still some problems, such as necessary budget for governmental portion is not allocated and there is not much information for private company to make a decision of investment. On the other hand, some good action in order to encourage private companies to go into the PPP projects in Indonesia can be seen. For example, PT. Penjamin Infrastruktur Indonesia (PII) has decided to guarantee Soekarno Hatta Airport - Manggarai Project and Palaci - Bangkuang Coal Railway in Central Kalimantan. In addition, the project to enhance government’s functions has been proceeded under the support by JICA. It is expected that the project may contribute to streamline the legal framework on PPP, strengthen performance of relevant agencies through PPP project implementation as a model, and promote private companies’ investments to develop infrastructure.

However, since the project scheme has been changed to “B to B scheme” (Business to Business) as the result of discussions with PT. KAI, it has been confirmed with BAPPENAS that the above summarized PPP framework will not be applied.

1.1.5. Environment Related Laws

(1) National Level

National administrative organizations in Indonesia are the Ministry of Environment and Environmental Management Agency (hereinafter BAPEDAL) which was established based on President Decree in 1990 and reinforced its capacity in 1994. The Ministry of Environment has a role of environmental administration and BAPEDAL conducts the implementation of environmental measures and protections including approve of EIA. For actual duties BAPEDAL has many local branches.

Related regulations on Environmental Impacts Assessment are improved and upgraded every year. Since this project is required to make EIA (AMDAL), the following regulations are duly observed;

- Decree of Minister of Environment No.02 Year 2000 regarding Guidance on Review of EIA

Document

- Decree of Minister of Environment No.45 Year 2005 regarding Guidance on the Preparation of Reports for Environmental Management Plan (RLK) and Environmental Management Plan (RPL)
- Regulation of Minister of Environment No.08 Year 2006 regarding Guidance on the Preparation of EIA
- Regulation of Minister of Environment No.11 Year 2006 regarding Type of Effort and/or Activity which obliged to provide with EIA
- Regulation of Minister of Environment No.12 Year 2007 regarding the Documents for the Effort and/or Activity which do not have the Environmental Management and Monitoring Plan
- Decree of Minister of Environment No.05 Year 2008 regarding Work Flows of Commission of Assessment on EIA

(2) Provincial Level

As the project covers some districts, responsible organization for EIA is provincial BAPEDAL. Since this project is required to make EIA, the following regulations at provincial level are duly observed;

- Decision of Head of BAPEDAL No.299/11/1996 regarding Technical Guidance on Social Aspect Study in the Preparation of EIA
- Decision of Head of BAPEDAL No.127/12/1997 regarding Guidance on Municipal Health Study in the Preparation of EIA

(3) Related Regulations on Environment

Since this project is required to make EIA, the following regulations are duly observed in the process;

- Act of the Republic of Indonesia concerning Conservation of Living Resources and their Ecosystems (No. 5, 1990)
- Law of protection on cultural sites (No.05/1992)
- Act of the Republic of Indonesia concerning Environmental Management (No. 23, 1997)
- Government regulation on Forest Protection (No.28/1985)
- Government Regulation of the Republic of Indonesia concerning the Control of Water Pollution (No. 20, 1990)
- Government regulation on Swamp Land Management (No.27/1991)

(4) Related Regulations on Land Acquisition and Resettlement

Land Acquisition and Resettlement should be implemented based on integrated many sector regulation under consideration of local traditional culture. Since this project accompanies resettlement in the 3rd Stage, the following regulations are duly observed in the process Related regulations are as follows;

- Act No.05/1960 concerning Basic Regulation on Agrarian Principle
- President Decree No.55 Year 1993 regarding Land Acquisition for the Development of the Public Interest.
- President Decree No.36 Year 2005 regarding Land Acquisition for Development for Public Interest.
- President Decree No.65 Year 2006 regarding Correction on President Decree No.36 Year 2005 regarding Land Acquisition for Development for Public Interest.
- Regulation by Head of National Land Body (BPN) No.03 Year 2007 regarding Provision of Implementation of President Decree No.36 Year regarding Land Acquisition for the Development of the Public Interest as Already Corrected by the President Decree No.65 Year 2006 regarding Correction on President Decree No.36 Year 2005 regarding Land Acquisition for Development for Public Interest.

1.1.6. Laws and Regulations for Foreign Investment

(1) Foreign Investment Acts in Indonesia

In 1967, Law No. 1/1967 on Foreign Investment was issued (and revised in 1994), and incorporation by foreign companies is allowed in Indonesia. This foreign investment acts allow foreign investors to operate business, to protect their equity and to exempt certain import duties. Further, this acts define overseas remittance of profit, asset/property transfer, certain guarantee to protest assets in case of nationalization, employment of foreign engineers.

In case of investment by foreign companies, a firm must be established as stock company according to laws and regulations in Indonesia. Revision in 1994 allows 100% ownership by foreign companies, however there is certain limitation to such ownership percentage by foreign investors in certain business field including but not limited to railway, namely, limited up to 49% of foreign investment for railway operation business in Indonesia (remaining 51% equity should be invested by Indonesian firms).

BKPM is a window organization to receive and evaluate the applications for incorporation by foreign investors except for oil & gas and banking & insurance field.

However, as described in 1.1.4. (P. 1-16) in the above, since the project scheme has been changed to “B to B scheme” through the discussions with PT. KAI during the field survey period, railway operation is being conducted by PT. KAI and, therefore, it is confirmed with a local accountant that there will be no foreign investment restriction to the proposed SPC.

(2) Foreign Investment in Railway Sector

Presidential Degree No.36 (Negative List in 2010) establishes a limitation of ownership by foreign investors as well as restricted business field.

This restricts foreign investment ownership up to 49% in case of container cargo transport and general cargo transport. Therefore it is assumed that a SPC on this project may allow maximum 49% of foreign investment.

This restricts foreign investment ownership up to 49% in case of container cargo transport and general cargo transport. However it is confirmed that there will be no foreign investment restriction under the proposed new “B to B scheme”. The details of regulations on establishment and operation of the lease company, restriction of foreign investment, and their approval procedure will be confirmed in discussion with law firm in the project formation process after this study.

Negative list announced in 2010 is available in the website of JETRO as below.

http://www.jetro.go.jp/jfile/country/idn/invest_02/pdfs/indonesia_list.pdf

(3) The Railway Law

The railway law comprising of 19 chapters and 218 articles has been newly issued on April 2007. The main objective of this new railway law is to open door for joining in the railway business not only from central government but also from local government as well as private sector. Conversely saying, local government and private sector will also be able to take part in the railway business in Indonesia.

If it is realized, multiple railway operators will appear and competition among those operators will be possible unlike the present condition of PT. KAI monopoly. And, such business environment is expected to lead to raising a quality of railway transport service via healthy competition among operators, which is also designed to issue the new railway law.

Main contents of this railway law can be roughly summarized as follows.

- Railways are composed of public railway and special railway in its function. Public railway is furthermore divided into intercity railway and intra city railway. Special railway is the one exclusively used by a specified railway enterprise for supporting main activities of the said enterprise.
- Central government as well as local government (province and regency/city) will arrange a railway master plan at each level for development of public railway while maintaining a consistency of supervisor plan as well as development plan at each level.
- Central government has an authority to set out a plan regarding railway development policy,

regulating and supervising the railway system, developing and activating railway business, etc. For this purpose, the central government will arrange the required regulations, and will give a guidance and support for local government.

- Local government is responsible for developing and supervising the railway system at each level, and at the same time it will also give guidance and support for subordinate organization, residents, etc.
- Development of infrastructures for public railway such as track, station facilities, train operation facilities, etc. as well as their maintenance will be implemented by central government or local government. In some cases, it is possible to entrust those activities to state-owned company, public enterprise or private sector.
- Arrangement of rolling stock for public railway will be principally conducted by state-owned company, public enterprise or private sector. In a special case, it is possible to be arranged by the central government.
- Train operation and maintenance of rolling stock for public railway will be implemented by state-owned company, public enterprise or private sector.

After the issuance of No.23/2007, other related laws, such as GR 56/2009, 27/2009 were also issued. In those governmental regulations, the matters regarding development of railway business, railway infrastructure, rolling stock and train operation are regulated.

Regarding the ownership of the railway right of way, Article 23 to 53 of the law regulates acquisition and maintenance of land, but the details are subject to other regulations to be announced by the government. Land use and maintenance of railway right of way is regulated in Chapter 5 and 6, in which Article 13 to 22 of Chapter 5 says that land use, maintenance and acquisition is expected to be implemented by central government and/or local government and/or railway operator separately or jointly.

(4) Tax and Accounting Overview

- Corporate tax in Indonesia is currently 25% according to the 3rd revision of Degree No. 36 dated September 23, 2009. Further, because there is a tax treaty between Indonesia and Japan, withholding tax rate for dividend is currently 10%.
- The construction services are subject to final withholding taxes, 2 - 6% of gross amount of payment (excluding VAT) for construction implementation.
- In general, the payments of interest made to resident are subject to withholding tax of 15% and the payments of interest made to non-resident are subject to withholding tax of 20%. Also, under the prevailing income tax law, the payments made to local banks are exempted from withholding tax. Further, under the tax treaty between Indonesia and Japan, the interest payment made by an Indonesian resident taxpayer to a financial institution wholly owned by Japanese government is exempted from the withholding tax. Since JICA is considered as

financial institution wholly owned by the Japan government, the interest payment made to JICA will be exempted from the withholding tax.

- Transfer of taxable goods or taxable services is subject to VAT of 10%.
- In Indonesia, all fixed assets are categorized in 4 groups according to their economic lives, and their depreciation rate can be calculated in either straight-line method or declining-balance method (except for buildings). Also, as for the diesel locomotives and wagons, their depreciation rate can be calculated in their economic lives of 20 years.
- In general, import of rolling stocks into Indonesia is subject to VAT and withholding tax at the rates of 10% and 2.5%. But, import duty for rolling stocks, locomotives and wagons, may be free.
- For leasing business in Indonesia, the Decision of the Finance Minister Number: 1169/KMK.01/1991 will be generally applied.

As mentioned above, a variety of regulation has been established in railway sector. However, in order to prompt private companies to go into a business in railway sector, effective collaboration among related organizations such as Ministry of National Development Planning, National Development Planning Agency (BAPPENAS), BKPM (Investment Coordinating Board) is expected. On the other hand, as mentioned in 1.2.6. (P. 1-46), action to mitigate private companies' concern like guarantee from PT. Penjamin Infrastruktur Indonesia (PII) should be explored.

1.2. Indonesian Railway Policies

1.2.1. Outline of the Railway Sector

(1) Positioning of the Railway Sector from the View Point of the Transportation Sector

The positioning of the transportation sector in the actual GDP over the last 5 years (at 2000 market prices) is shown in the [Table 1-2-1]. As shown in the table, the share of transportation sector in the GDP increased from 3.5% to 3.8% between 2003 and 2006, and 3.7% in 2010. Compared with other industries, this ratio is not particularly large. In the transportation sector, the largest division is for road transportation, followed by the sea and air. Considering that Indonesia not only has a huge land area, but is also an archipelagic country, this may be a natural consequence.

On the other hand, although the annual growth of GDP in the transportation sector decreased in 2007 and 2008, it is being maintained at more than 6%. However, in order to secure the annual growth rate of nearly 7% of national GDP that the country is targeting, it is expected that the growth of 10% of the transportation sector will be necessary.

[Table 1-2-1] Positioning of the Railway Sector in the Real GNP (2000 Market Prices)

	2006			2007			2008			2009			2010		
	GDP		Annual Growth Rate (%)	GDP		Annual Growth Rate (%)	GDP		Annual Growth Rate (%)	GDP		Annual Growth Rate (%)	GDP		Annual Growth Rate (%)
	$Rp.10^6$	%		$Rp.10^6$	%		$Rp.10^6$	%		$Rp.10^6$	%		$Rp.10^6$	%	
1. Transportation															
(1) Railway Transport	0.623	0.03%	-	0.631	0.03%	1.28	0.639	0.03%	3.98	0.634	0.03%	-3.35	0.611	0.03%	-3.60
(2) Road Transport	29.774	1.61%	-	30.860	1.57%	3.65	31.986	1.53%	4.93	34.412	1.57%	5.12	36.313	1.57%	5.50
(3) Ferry & River Transport	2.432	0.13%	-	2.513	0.13%	3.33	2.597	0.12%	3.94	2.860	0.13%	5.93	3.043	0.13%	6.40
(4) Sea Transport	9.497	0.51%	-	9.238	0.47%	-2.73	9.490	0.45%	5.05	12.381	0.57%	8.06	14.307	0.62%	9.05
(5) Air Transport	11.466	0.62%	-	12.419	0.63%	8.31	13.451	0.64%	5.32	16.660	0.76%	14.47	19.260	0.83%	15.61
(6) Services Allied to Transport	17.014	0.92%	-	17.116	0.87%	0.60	17.219	0.82%	0.41	20.405	0.93%	8.40	22.252	0.96%	9.10
(7) Sub Total	70.806	3.83%	-	72.777	3.71%	2.78	75.382	3.61%	2.71	87.352	3.99%	7.60	95.786	4.15%	6.72
2. Others	1,776.494	96.17%	-	1,891.193	96.29%	6.46	2,012.068	96.39%	6.39	2,101.868	96.01%	4.46	2,213.844	95.85%	5.33
3. Total of GDP	1,847.300	100.00%	-	1,963.970	100.00%	6.32	2,087.450	100.00%	6.06	2,189.220	100.00%	5.10	2,309.630	100.00%	5.50

(Source: Created based on Action Program 2010 formulated by MOT)

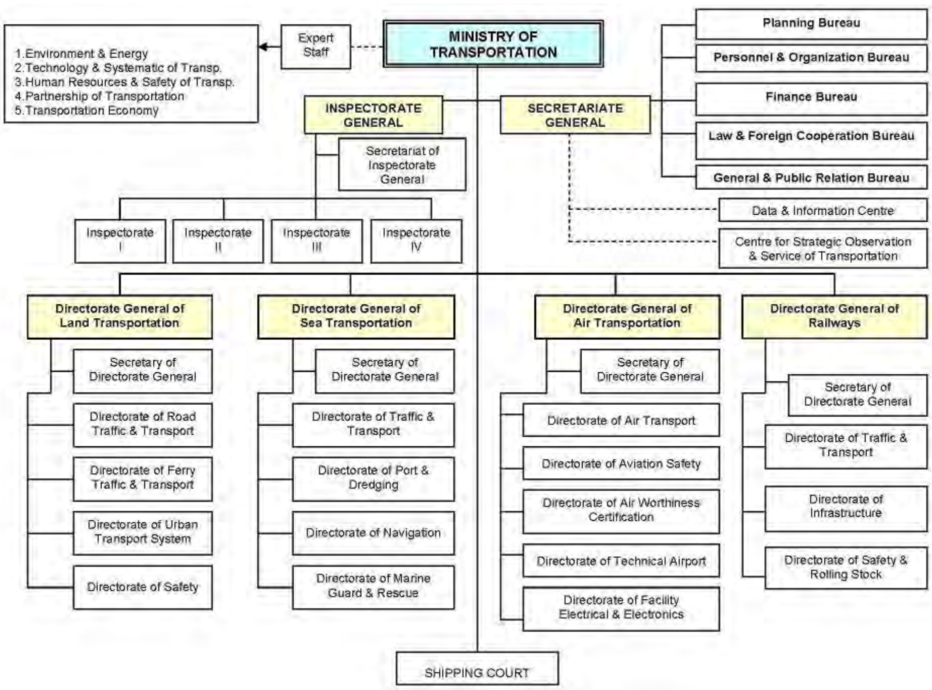
(2) Legal Structure of the Railway Sector

The new code No.23/2007 has been established replacing the old one No.13/1992, to allow local governments and private companies to take part in train operation. Refer 1.1.6. (3) (P. 1-22) for the detail.

(3) Organization of the Ministry of Transportation and PT. KAI

① Organization of Ministry of Transportation

Transportation administration in Indonesia is implemented by the Ministry of Transportation, one of the nation's 20 ministries. The current organizational diagram of the Ministry of Transportation is shown in [Fig. 1-2-1]. As shown in this chart, the organization is structured from the secretary general, four directorates in charge of land, sea, air, and railway transportation, and the inspector general. National Transportation Safety Committee (KNKT) was incorporated in the Ministry of Transportation in 1999 as an independent institution to investigate accidents and to make recommendations to prevent the recurrence of similar accidents. The number of employees in the Ministry of Transportation was 31,200 in 2007, showing an increase of 8% over 2006. Approximately 59% of the employees are assigned to the Directorate General of Sea Transport, followed in numbers by the Directorate General of Air Transport.

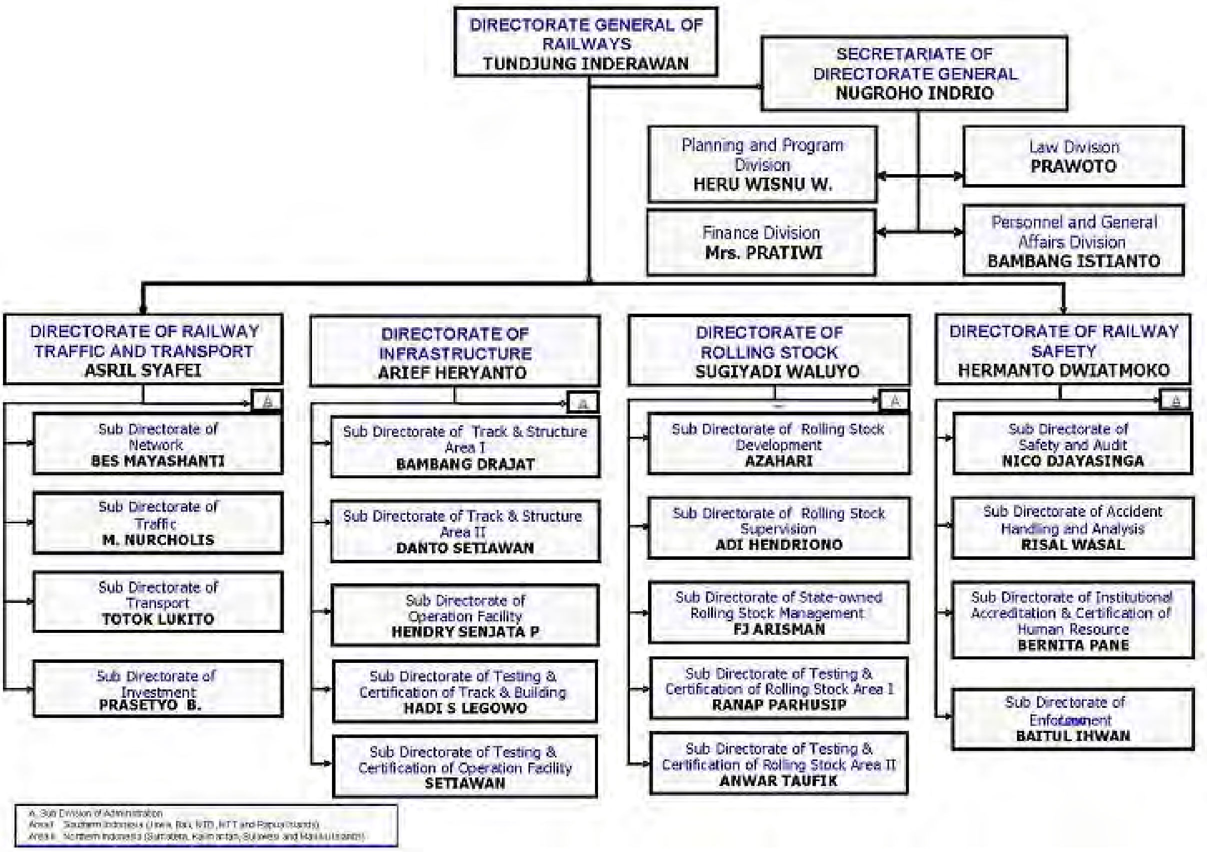


(Source: Ministry of Transportation)

[Fig. 1-2-1] Organization Structure of Ministry of Transportation

② Organization of DGR

Directorate General of Railways (DGR) is composed of 4 directorates such as Directorate Railway Traffic and Transport, Directorate of Infrastructure, Directorate of Rolling Stock, Directorate of Railway Safety, except Secretariat of Directorate General. Each directorate has sub departments. Directorate of Railway Traffic and Transport has four sub directorates as follow; Network, Traffic, Transport, Investment. Directorate of Infrastructure has five sub directorates as follow; Track & Building Area I, Track & Building Area II, Operation Facility, Testing & Certification of Track and Building, Testing & Certification of Operation Facility. Directorate of Rolling Stock has five sub directorates as follow; Rolling Stock Department, Rolling Stock Supervision, State-owned Rolling Stock Management, Testing & Certification of Rolling Stock Area I, Testing & Certification of Rolling Stock Area II. Directorate of Railway Safety has four sub directorates as follow; Safety and Adult, Accident Handling and Analysis, Institutional Accreditation & Certification of Human Resource, Law Enforcement.



(Source: DGR)

[Fig. 1-2-2] Organization Structure of DGR

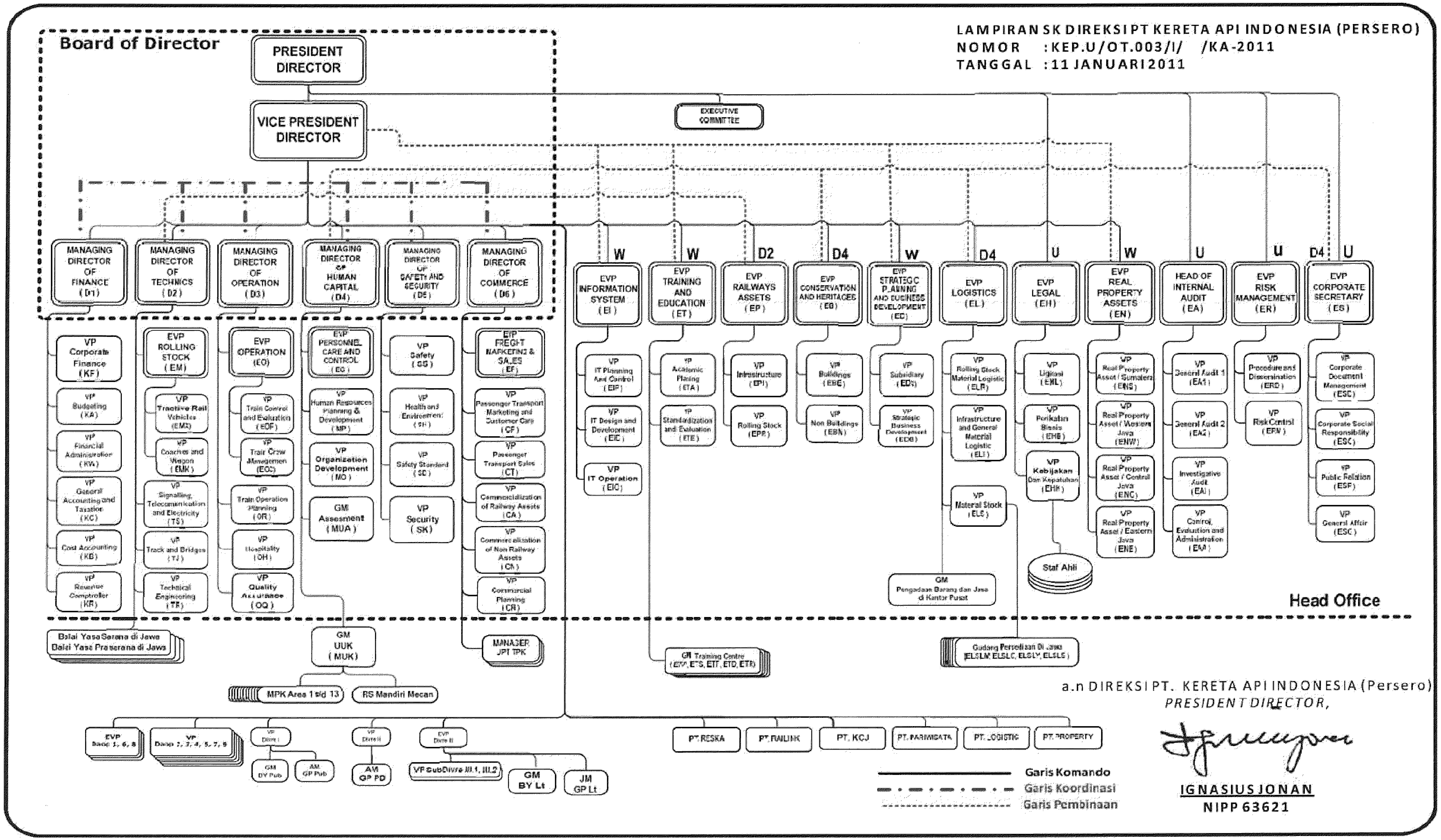
③ Organization of PT. KAI

The organization structure of PT. KAI is shown in [Fig. 1-2-3]. The management structure of the Indonesian railway sector changed since the transfer of the administrative right to the Indonesian government, from national railways to Government Corporation in accordance with the government policy at the times. The current management form is the railway company called PT. KAI that was established in June 1996 in which the government owns 100% of the stake. At the present time, PT. KAI is operating and administering the Indonesian railways as the sole railway administrator in a kind of monopoly. However, following the announcement of the new railway law No.23/2007 in April 2007 in which multiple operators and open access to the same railway tracks is permitted, it is believed that this monopoly condition will be changed before long.

Under such condition, it is expected that PT. KAI will implement full reforms of the railway management and mental change of administrative people. It can be said that the separation of the Jabotabek Railway from PT. KAI is a process of this reform. The plan to spin off Jabotabek Railway from PT. KAI was considered as being necessary to separate the commuter railway business which has a different nature from long distant railway management. The separation itself was finally realized as a subsidiary of PT. KAI in August 2008 after much discussion.

When the railway management structure changed from the government railway company (Perumka) in 1999 to the railway company (PT. KAI), the railway facilities were basically split into 2. One is infrastructure such as railway track, civil structure and operating equipment (under component in the infrastructure and operation separation scheme), and other is not infrastructure such as stations and rolling stock (upper component in the infrastructure and operation separation scheme). The former are owned by the government, while the latter are owned by PT. KAI.

ORGANIZATION STRUCTURE OF PT. KAI



(Source: PT. KAI)

[Fig. 1-2-3] Organization Structure of PT. KAI

(4) Railway Transportation Situation

① Railway Transportation Share

The number of passengers and volume of freight throughout Indonesia by each transportation mode including road, rail, sea, air, and inland waterways (ferries and rivers) in 2010, together with the shares of each, are shown in [Table 1-2-2]. As shown in this table, the road transportation volume shows the largest share of any of the modes both for passengers and for freight, which were 84% and 89% respectively. Although the second largest share for the transportation mode was railway for passengers and sea for freight with the volume as small as around 8% and 10% respectively. Other transportation modes showed minimal volumes of less than 5% or close to 0%. In general, transportation volume depends on the size of network and the capacity of each mode of transportation. In this view, those described above clearly represents the current situation of the transportation sector in Indonesia.

[Table 1-2-2] Transportation Volume and Share for Each Mode in Indonesia (2010)

Mode	Passenger Transport		Freight Transport	
	Volume (10^6 People)	Sharing (%)	Volume (10^6 ton)	Sharing (%)
1. Road	2,144.2	84.32	3,208.7	89.18
2. Railway	201.9	7.94	18.9	0.53
3. Ferry	59.2	2.33	13.5	0.38
4. Sea	16.8	0.66	354.3	9.85
5. Air	117.2	4.61	2.2	0.06
6. River	3.5	0.14	0.2	0.01
Total	2,542.9	100	3,597.9	100

(Source: Website of Ministry of Transport of Republic of Indonesia)

② Traffic Volume

The railway passenger and freight traffic volumes in recent years are shown in [Table 1-2-3]. The passenger traffic volume reached 202million in 2010, showing an average annual increase of 5.78% over the 5 year period. The vast majority of passengers are carried in Java Island, where the largest part of the population is concentrated and large and medium size cities are located in succession from west to east. Approximately 70% of the passenger transportation on Java island is originating in Jakarta metropolitan area (JABOTABEK region), where a railway commuter system has already been established. The railway transportation is getting an indispensable transportation means supporting peoples' daily lives in the JABOTABEK area in these days. Problems triggered by motorization, including traffic jams and air pollution due to exhaust gas, caused by the concentration of population are becoming severe, and there are plans to incorporate railway commuting systems in other cities including Surabaya, Bandung, Medan, and Yogyakarta with the purpose of alleviating pollution. Although passenger rail services also exist in Sumatra Island, the scale is much smaller, with amounts that were less than 2% of the total in 2007.

The freight traffic volume is approximately 18million tons annually, and maintains almost constant level. The share of the traffic volume of coal, cement, fuel oil and plantation product is approximately 90% in the all railway freight traffic volume. In particular, the share of the coal traffic volume is 50 - 60% in the all railway freight traffic volume, and the coal traffic volume increase year after year. Approximately 70% of all the freight traffic occurs on Sumatra island, and 76% of this is the transportation of coal that is concentrated particularly in south Sumatra. In consistent with the government policy of saving fuel consumption, it is also planned to increase coal production, and that railways should be used to transport the additional coal. Particularly in South Sumatra, there are currently several railway facility projects being planned, including the improvement of existing lines and building new lines.

According to the railway timetable revised in February 2008, the number of regularly operating trains in Sumatra and Java totaled 1,044 daily, consisting of 811 passenger trains and 233 freight trains. Comparing this with the figures for 2007, there was a 1.6% increase in passenger trains and a 12% decrease in freight trains. Out of the 811 passenger trains, 95% trains are operated in Java with 330 commercial class trains and 441 economy class trains. The remaining 40 passenger trains are operated in Sumatra consisting of 12 commercial class trains and 28 economy class trains. On the other hand, out of the 233 freight trains, 108 are operated in Java, with the remaining 125 trains are in Sumatra.

[Table 1-2-3] Railway Passenger and Freight Volumes in Recent Years

Passenger Transport	Transported Volume (10^3 person)					Average Annual Growth Rate
	2006	2007	2008	2009	2010	
1 Java & Sumatra excluding Jabotabek (1) Commercial	25,190	24,199	30,599	31,202	32,216	+ 6.34%
(2) Economy	31,674	33,162	40,475	45,296	46,959	+10.35%
2 Jabotabek	104,425	111,096	126,700	130,632	122,756	+ 4.13%
Total	161,289	168,457	197,774	207,130	201,931	+ 5.78%

Freight Transport	Transported Volume (10^3 ton)					Average Annual Growth Rate
	2006	2007	2008	2009	2010	
1 Oil Fuel	2,892	2,966	2,624	2,470	1,825	-10.87%
2 Fertilizer	156	69	35	4	0	-100.0%
3 Cement	3,448	3,143	2,974	2,750	2,443	- 8.25%
4 Coal	8,942	8,542	10,926	11,030	11,147	+ 5.66%
5 Plantation Product	532	644	645	1,038	993	+16.89%
6 Containers	476	271	266	111	123	-28.70%
7 Quartz Sand	44	29	29	28	7	-36.84%
8 Rabber	14	15	7	0	0	-100.0%
9 Express Freight	98	101	106	98	87	- 2.93%
10 Freight by Passenger	34	41	57	76	130	+39.84%
11 Others	847	930	1,595	858	2,186	+26.75%
Total	17,483	16,751	19,264	18,463	18,941	+ 2.02%

(Source: DGR)

(5) Issues Relevant to the Project in View of Railway Sector

PT. KAI established in 1999 was permitted to have more than one operator and open access since to the enactment of new railway laws in 2007, and private-sector entry was permitted for the purpose of promoting privatization at the operator side.

In Indonesia, especially in South Sumatra, since coal production raise has been promoted, it is predicted that increase of transportation demand between mining site and shipping site. PT. KAI has attempted to expand coal transportation capacity, because coal transportation is considered to be more profitable business as compared to other commodities. However, the important point here with regard to the transportation is that, since the rail transportation demand is expected to grow in the near future in accordance with the government policy, railway infrastructure is expected to be upgraded by public sector.

1.2.2. Situation and Problems of Existing Infrastructure

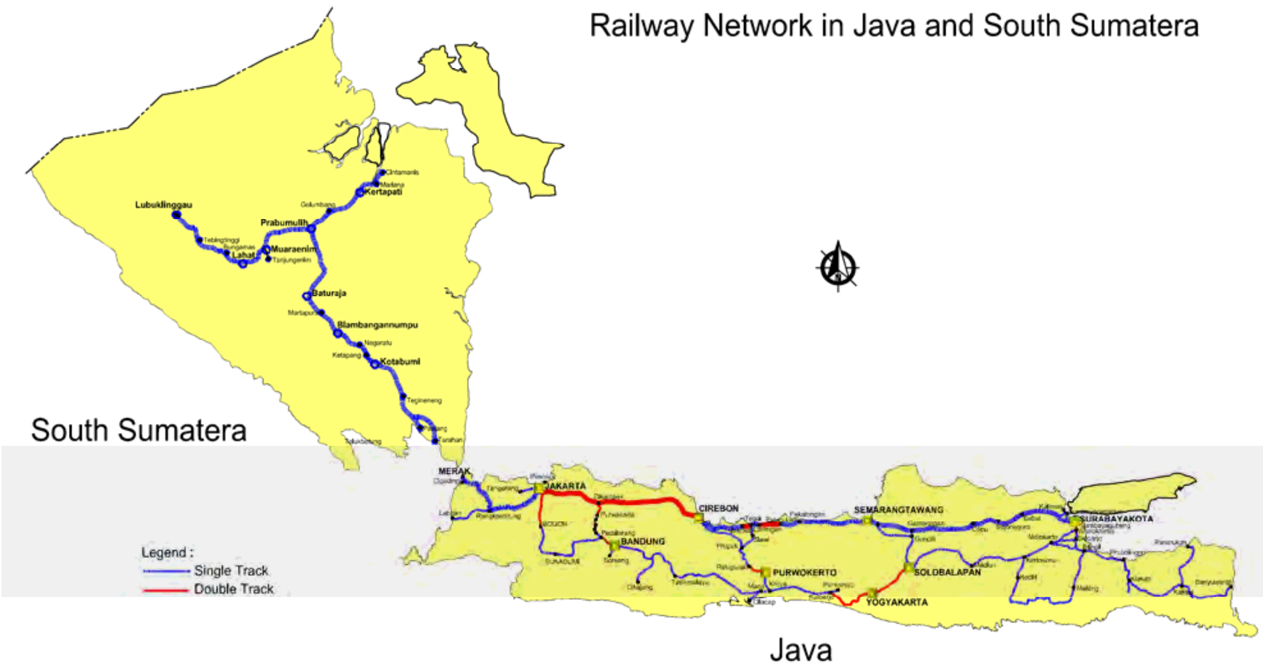
(1) Present Condition of Railway Infrastructure

① Railway

The Indonesian railways network covers Java and Sumatra islands. The total length of railway line is approximately 8,000km at present. Most of the lines are single track (the length of double track is approximately less than 400km).

The trunk lines in Java island are Java North Line, Java South Line and Bandung Line. Java North Line connects Jakarta and Surabaya through Cirebon and Semarang with distance of approximately 730km. Java South Line diverges from Java North Line at Cirebon and leads to Surabaya through Yogyakarta which is the ancient capital and Solo with the distance of approximately 830km. Bandung Line connects Jakarta, the capital city of Indonesia, and Bandung, the academic city located in highland area, with the distance of approximately 180km. The head office of PT. KAI is located in Bandung.

Urban railway has been constructed with the distance of approximately 161km in Jakarta urban area, approximately 25km in Surabaya urban area, out of which 156km has been electrified in Jabotabek.



(Source: Study team)

[Fig. 1-2-4] Railway Route Map

[Table 1-2-4] The Length of Railway

Area	Length of Line (km)	Gauge (mm)	Operated Line (km)	Non-Operated Line (km)	Double Track (km)
Java	4,787	1,067	3,216	1,116	373
Sumatra	1,705	1,067	1,348	336	—
Total	7,984	—	4,564	1,452	373

(Source: Report of Performance and Operation Condition of PT. KA)

② Civil Engineering Structure

The 90% of bridges of Indonesian railways were made of steel. Most of the bridge structure is I-beam and plate girder, also through-truss and deck-truss structures are applied to most of the bridges having long span. Steel girders have been renovated due to the increase of axle load. The bridge members and paint are severely deteriorated due to the insufficient maintenance and waste discharge. The quality of paint maintenance is appeared to be not properly done because the concept of paint maintenance method is not well understood. Therefore, it is necessary to carry out training and education for the maintenance division clews on the paint maintenance method.

Most of the substructures constructed during the Dutch colonial period were composed of stone masonry, and they should be repaired or replaced due to the progression of floating around foundation, scouring and deterioration.

On the Java North Line, the restoration work for the piers in a high-risk condition and subject to repair is in under going. Cisomang Bridge which is the longest bridge on Bandung Line has been repaired with the assistance of Australia in 2004 because it had been constructed more than 100 years ago. The total length of bridges of Indonesian railways is 52,000m for steel bridge and 6,000m for concrete bridge.

The number of tunnel is as few as 18 places. Most of them are located in Java Island. The longest tunnel located in West Sumatra is approximately 1,100m. Most of the tunnels are not wrapped with lining concrete.

Platform height is very low with the variety of 18cm, 20cm and 43 cm, accordingly passenger steps are necessary to get on and off a train. Although the platform height has been raised up to 84cm and 95cm as part of modernization project for Jabotabek line, the low platforms are still remaining.

③ Track

There are 6 types of rail ranging from 54kg/m to 25.75kg/m (54kg, 50.4kg, 42.59kg, 41,52kg, 33.4kg and 25.75kg). Although rail replacement from R42kg/m to UIC54, there still remains 33 kg/m rails even in trunk lines and 25kg/m rails in branch lines. Although most of the sleepers are wooden type, a lot of steel sleepers still exist in local area. There are 3 types of fastener, and recently Pandrol type fastener is coming to dominant in order to reduce maintenance work burden. The other 2 types of fastener are DE clip and KA clip.

Most of the railway lines were constructed more than 10 years ago without material replacement. Thus, rails, sleepers and fastenings are over used. Ballast which supports sleepers dent into roadbed having hollow spots inside due to washout by rainfall, thus causing mud pumping. Also, improvement of track is required by using heavier rails to increase transportation capacity. It is an urgent necessity to replace track materials and establish a proper maintenance method in order to avoid serious accidents which disturb train operation caused by rail overhung under heated weather and rail damage.

④ Level Crossing

According to the general list of level crossing in Java and Sumatra island kept by DAOP of PT. KAI, the total number of level crossing is 5,585. The number of manned level crossing (security officer) is 1,125 (20%), and that of unmanned level crossing is 3,836, and that of illegal level crossing (unacknowledged level crossing) is 624. The number of level crossing equipped with electric safety facility is 845 (15%), and level crossing with mechanical safety facility is 280 (5%). There are so many accidents at level crossing in Java island, and local governments are asking improvement of safety facility. However, facility improvement of level crossing is not implemented due to the lack of budget.

⑤ Signaling and Telecommunication Facilities

Various electronic interlocking devices of signaling facilities have been installed, and they have been installed at over half of the stations. However, electronic interlocking device is divided into 3 types, and the non-standardization makes it difficult to implement maintenance work. Most of the spare parts to be provided when a project has been completed are supposed to be supplied from overseas, and it makes it difficult to repair damaged parts well due to the lack of budget for the procurement of spare parts. Although the efforts to repair light damages by themselves worth praising, the fundamental problems are not resolved due to the lack of budget for outsourcing the repair work. Securing minimum budget for maintenance work is the urgent and significant subject. In addition, thunder attack occurs often during rainy season in Indonesia, and the specification considering the countermeasures against them is required.

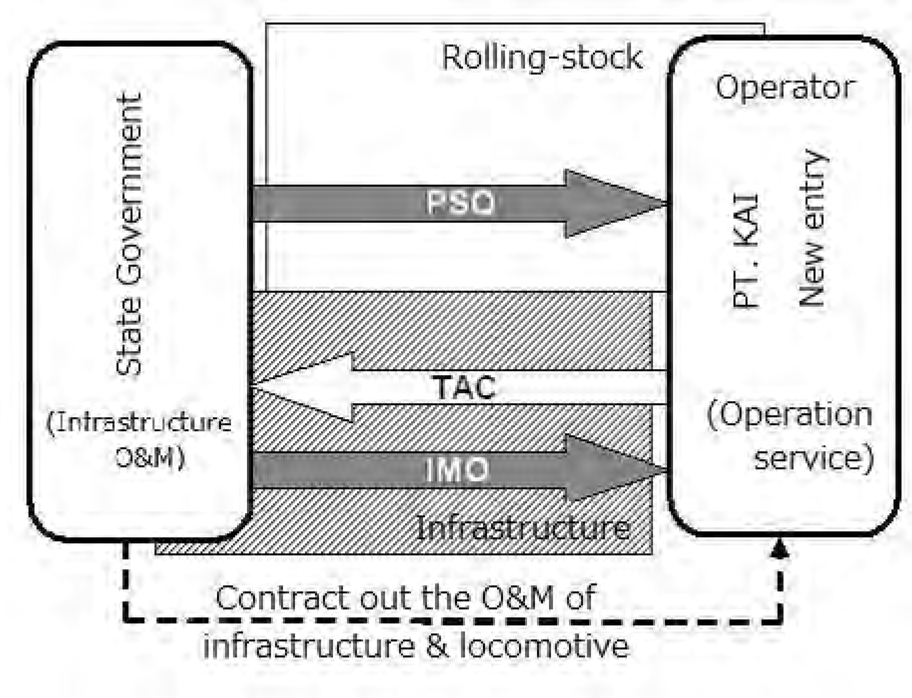
Based on these facts, it is necessary for the Government to consider appropriate budget allocation policy for maintenance to comply with the signaling safety standard which is the main stay of safety railway operation. Also, development of signaling system technical standard for Indonesian climate is required to perform proper maintenance by its own effort.

(2) Issues of Railway Facilities on this Project

Each facility of railway infrastructures such as civil engineering structure, track, level crossing, signaling system and telecommunication system are getting decrepit due to the lack of budget for required improvement. In addition, the safety which is the most important component for railway operation is not assured due to the lack of maintenance in general in terms of management ability, human resources and procurement of parts. As a result, it is impossible to increase the speed of trains since the performance of trains is not exerted sufficiently if running condition is not good no matter how high the performance of the locomotives. Another issue is the punctuality of operation which is not assured due to breakdown, accident, and lack of emergency maintenance. Improvement of railway facilities and thoroughness of maintenance are necessary in order to assure sufficient transportation capacity in accordance with increasing demand for coal transportation in the near future.

1.2.3. Railway Tariff Policy

Concerning railway tariff, the organization of financial assistance for PT. KAI, which is called PSO-IMO-TAC system, has been established to support the financial burden of PT. KAI which is required for economy-class train operation with low tariff. PSO is a grant which is paid from the Government to PT. KAI to cover the additional expenditure for economy-class train operation with low tariff which is required by the Government. IMO is the outsourcing expenses from the Government to PT. KAI because the Government outsources maintenance work of infrastructure which belongs to the Government. Instead of these two things, PT. KAI is required to pay usage charge of infrastructure because PT. KAI operates trains using the infrastructure which belongs to the Government. This is the TAC. And, the amount of difference among these three is the grant from the Government to PT. KAI. The relationship among PSO, IMO and TAC mentioned above is shown in [Fig. 1-2-5].



(Source: Study team)

[Fig. 1-2-5] PSO – IMO – TAC

Basically, freight tariff is determined based on contract of transportation weight-km or volume-km of each item between PT. KAI and a cargo owner, and governmental permission is not necessary. Specific example of freight tariff of PT.KAI is shown in [Table 1-2-5].

In the case of coal transportation, tariff is negotiated considering the competition price against truck transportation, and also by considering of loading and unloading responsibility, whether by PT. KAI or cargo owner. It is also assumed that setting coal transportation tariff on this project will affect profit performance, and it will be an important factor.

[Table 1-2-5] Freight Tariff of PT. KAI (2010 - 2011)

Item	Tariff (Rp.)	Unit	Description
Coal	250～590	ton-km	
Oil	600	kℓ-km	
Cement	230～290	ton-km	
Clinker	390	ton-km	
Pulp	210～310	ton-km	
Baggage car	640～1,170	ton-km	
Container	1,750～2,010	TEU-km	Equivalent Unit
Cash	3,310～4,410	ton-km	
Palm Oil	230～1,020	ton-km	
Silica sand	230	ton-km	

Note: TEU = Twenty Foot Equivalent Unit

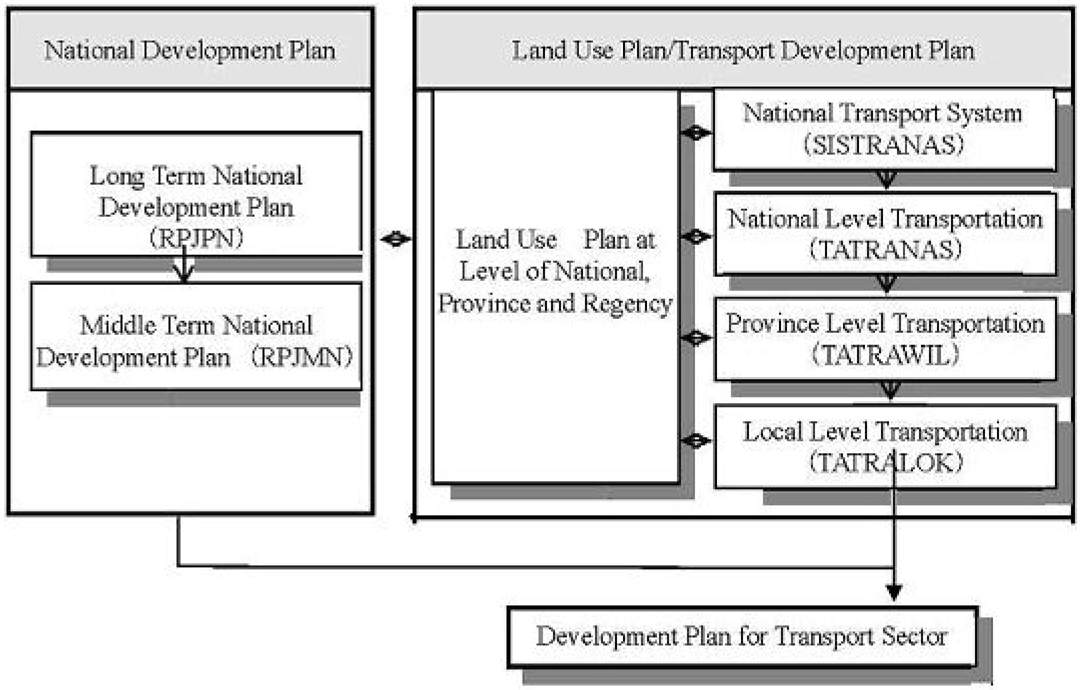
(Source: Study team)

1.2.4. Development Plan of the Government

(1) Transportation Development Plan

In the transportation sector, development plans are made consistent with the National Development Plan, which are structured as the National Transport System (SISTRANAS in the Indonesian acronym), National Level Transportation (TATRANAS), Provincial Level Transportation (TATRAWIL), and Regional Level Transportation (TATRALOK). These are all established by regulations, with SISTRANAS and TATRANAS being determined by presidential decree, while TATRAWIL is established by provincial ordinances and TATRALOK by regional regulations. SISTRANAS describes the basic development concepts for each mode of transportation system in Indonesia, including consideration of the infrastructure, service, demand, safety and maintenance of order, and the public finance, management, and organization. It acts as a guideline for planning, developing, and managing transportation systems in Indonesia. In addition, it also acts as a reference when preparing documentation concerning transportation development plans contained in other plans such as the Long Term National Development Plan (RPJPN) and the strategic plans (RENSTRA).

In order to realize the national policy stipulated in SISTRANAS for the transportation sector at every level from the central government down to the regencies and cities, each entity makes medium-term and long-term development plan as TATRANAS, TATRAWIL, and TATRALOK. All of these plans are made at the responsibility of central government or regional government in harmony with all relevant development plans, and is reviewed at least once every 5 years. As can be expected, each of the above plans is planned while integrating it with the land use plans at the regional level. The relationships between each of the development plans described above are shown in [Fig. 1-2-6].



(Source: Study team)

[Fig. 1-2-6] Relationships between National Development Plan, Land Use Plan, and the Transportation Development Plans

(2) Railway Development Plan

① National Railway Master Plan 2011-2030

The railway development long-term plan (Rencana Induk Perkeretaapian Nasional) as a national railway master plan (2011-2030) was made by Ministry of Transportation under the assistance of Australian Agency for International Development (AUAID).

The overall target of national railway development up to 2030 is "National railway has market segment for passenger 11-13% and freight 15 - 17 % of total market segment for national transportation in 2030". In order to achieve the target, the master plan sets strategy and specific target of each strategy as follows.

- Development of Railway Network and Service
    - National railway network reaches 12,100 km (Spreading in Java-Bali, Sumatera,

Kalimantan, Sulawesi and Papua) including urban/city railway network along 3,800 km.

- Facilities of passenger transportation with number of locomotives 2,840 units, inter-city train 28,335 units and urban train 6,020 units.
- Facilities of freight transportation with number of locomotive 1,985 units and wagon 39,645 units.

- Improvement of Railway Safety and Security;
  - Increasing of railway safety and security with an indicator of safety and security interference ratio 50% in the period of 2010 to 2030.
- Technology Transfer and Development of Railway Industry;
  - The reduction the foreign technology up to 25%, at least 85% local content and a minimum of 90% is supplied by domestic industry.
- Development of Railway Human Resource;
  - The availability of professional and competent regulators and operators.
- Development of Institutional Organization of Railway;
  - Railway Infrastructure Operator minimum 8 (eight) business entities with distribution level consist of 1 (one) business entity at every big island (Sumatera, Jawa-Bali, Kalimantan, Sulawesi and Papua), and 3 (three) business entities in urban area;
  - At least 5 (five) business entity of railway operator;
  - Coordinating agency for railway infrastructure and railway operator.
- Investment of Fund of Railway.
  - The fulfillment of strong financing of railway supported by private investment with investment targets estimated to reach USD 67,219.5 million with financing ratio through government investment (30%) and private (70%).

② Strategic Plan on Railways 2010-2014

DGR has made RENSTRA (2010-2014, Rencana Strategis / Strategy Plan), and 6 projects are planned as below.

- Sukacinta - Kertapati (190km/Double)
- Tanjung Enim - Padang (50km/Single)
- Padang - Pulau Baai (160 km/New)
- Muaraenim - Tanjung Api-api (256km/New)
- Banko Tengah - Srengsem (280km/New)
- Tanjung Enim - Baturaja (78km/Short cut)

(3) Plan of PT. KAI

PT. KAI formulated a five-year plan every 2 years, and projects are implemented based on it. Currently, Long-Term Plan of PT. KAI (RJPP: Rencana Jangka Panjang Perusahaan = Company

Long Term Plan) 2009-2013 is the base of projects.

The purpose of this plan is to provide high-quality transportation service and high competitiveness by railway, and to expand domestic and international market in order to support national economy and political program. Also, the purpose is to implement maintenance of railway infrastructure and facilities effectively, and implement smooth passenger and freight transportation.

This plan focuses on the following 5 subjects.

- Railway transportation service in accordance with customer demand, and provision of public service demanded by the Government.
- Maxim use of existing asset.
- Improvement of productivity of business area expansion.
- Optimization of company asset management.
- Achievement of coal transportation projects in Divre 3 (South Sumatra)

In this plan, during the planned period, it was set as a target to increase profit by up to 10% with passenger transportation increase forecast by average of 4% annually in entire PT. KAI. Concerning freight transportation, the target annual profit increase is average of 44%, particularly in Divre 3 (South Sumatra) it is 55%. Also, it is expected that freight transportation in Java is increasing from 250 containers per month to 1,000 containers per day. This target can be achieved if investment scenario by self-support or by government is worked smoothly.

PT. KAI clearly describes that investment for railway facilities, infrastructure, human resource is necessary in order to achieve the target, particularly improvement of decrepit track and installation of automatic train stop system (ATS) are required to improve transportation safety in this plan. Also, the scale and amount of money of investment plan, and income and expenditure plan is released officially as specific data for the plan shown in the [Table 1-2-6], [Table 1-2-7] and [Table 1-2-8] below.

[Table 1-2-6] Planned Scale of Investment in Infrastructure (2009 - 2013)

(Unit: billion Rp.)

NO	ITEM	LOCATION	2008 Existing	2008 Addition	2009	2010	2011	2012	2013
1.	**ROLLING STOCK**								
	a. PROCUREMENT :								
	a. Loc CC 205	Divre 3	6	-	-	24	20	-	-
	b. Loc CC 204	Jawa	2	10	10	12	15	13	12
	c. K 1 (Executive Car)	Jawa	10	16	-	-	-	8	8
	d. K 2 (Business Car)	Jawa	-	-	10	10	10	10	27
	e. K 3 (Economy Car)	Jawa	-	-	-	36	36	52	63
	f. KM 1/M 1 (Dining Car)	Jawa	-	2	-	2	2	4	4
	g. KM 2/KMP 2	Jawa	-	-	1	4	4	8	10
	h. KM 3/KMP 3	Jawa	4	-	-	6	6	10	10
	i. BP	Jawa	-	2	-	5	5	10	12
	j. B	Jawa	20	20	-	-	-	-	-
	k. KKW	Ja-Sum	70	-	-	-	-	-	-
	l. KKBW (max.capacity 50 ton)	Divre 3	130	-	-	466	369	661	-
	m. PPCW (max.capacity 50 ton)	Divre 3	-	-	-	60	-	50	50
	n. PPCW (max.capacity 44 ton)	Jawa	38	20	50	-	20	-	30
	o. Others	Ja-Sum	1 package	-	1 package	1 package	1 package	1 package	1 package
	b. Retrofit/Rehab/Modif./MO/Reengine/Repowering,etc.								
	a. Loc DH	Divre 1	-	-	-	5	5	5	5
	b. K 1/Tourism Car	Ja-Sum	15	-	6	-	4	4	-
	c. KM 1	Ja-Sum	2	-	-	-	2	2	2
	d. BP/B	Ja-Sum	-	-	-	-	2	2	-
2.	**PRASARANA**								
	a. Longsiding	Divre 3		-	4	-	3	-	-
	b. Doubletrack	Divre 3		-	-	85	100	99	35
	c. Blok Post	Divre 3		-	1	-	-	-	-
	d. Station (new & rehab/improvement)	Ja-Sum		-	2+8	10	5	8	10
	e. Development of Workshop and Depo	Ja-Sum	1 package	-	1 package	1 package	1 package	1 package	1 package
	f. Bridge rehabilitation	Divre 1	-	-	-	8	8	10	17
	g. Rail Procurement (km)	Ja-Sum	-	-	-	200	200	300	300
	h. Turnout Procurement (unit)	Ja-Sum	-	-	-	50	50	75	100
	i. Signal Procurement	Ja-Sum	-	-	-	1 package	1 package	1 package	1 package
	j. Development of Education and Training Centre	Jawa	-	-	-	1 package	1 package	1 package	1 package
	k. Others	Ja-Sum	1 package	-	-	1 package	1 package	1 package	1 package
3.	**FACILITY**								
	a. Procurement of Machine-2 Workshop & Depo	Ja-Sum	1 package	-	1 package	1 package	1 package	1 package	1 package
	b. Procurement of mesin-2 infrastructure	Ja-Sum	1	-	1	-	2	-	1 package
	d. Procurement of Weighing Equipment	Ja-Sum	2	-	-	2	1	2	-
	e. Facility of Education/audio visual	Jawa	-	-	-	1 package	1 package	1 package	-
	f. Others	Ja-Sum	1 package	-	1 package	1 package	1 package	1 package	1 package
4.	Development of IT	-	-	1 package	-	1 package	1 package	1 package	1 package
5.	**HUMAN RESOURCES**	Ja-Sum	-	-	-	1 package	1 package	1 package	1 package
	(Recruitment and Development of Human Resources)								
6.	**CORPORATE SAFETY PLAN**	Ja-Sum	PROCUREMENT OF ANTO COLLISION DEVICE & AUTOMATIC TRAIN STOP =						

(Source: Company Long Term Plan of PT. KAI 2009-2013)

[Table 1-2-7] Amount of Money of Investment in Infrastructure (2009 - 2013)

(Unit: billion Rp.)

NO	ITEM	LOCATION	2008		2009	2010	2011	2012	2013
			Existing	Addition					
1.	**ROLLING STOCK**								
	1) PROCUREMENT :								
	a. Loc CC 205	Divre 3	244,96	-	-	960,00	800,00	-	-
	b. Loc CC 204	Jawa	35,60	192,50	173,94	231,00	288,75	250,25	231,00
	c. K 1 (Executive Car)	Jawa	41,40	79,01	-	-	-	40,00	40,00
	d. K 2 (Business Car)	Jawa	-	-	27,50	27,50	27,50	27,50	74,25
	e. K 3 (Economy Car)	Jawa	-	-	-	90,00	90,00	130,00	157,50
	f. KM 1/M 1 Dining Car)	Jawa	-	9,59	-	10,00	10,00	20,00	20,00
	g. KM 2/KMP 2	Jawa	-	-	3,30	13,20	13,20	26,40	33,00
	h. KM 3/KMP 3	Jawa	10,80	-	-	16,20	16,20	27,00	27,00
	i. BP	Jawa	-	15,31	-	38,27	38,27	76,54	91,85
	j. B	Jawa	40,00	39,91	-	-	-	-	-
	k. KKW	Ja-Sum	52,50	-	-	-	-	-	-
	l. KKBW 50 ton	Divre 3	106,60	-	-	419,40	332,10	594,90	-
	m. PPCW (max.capacity 50 ton)	Divre 3	-	-	-	42,00	-	35,00	35,00
	n. PPCW (max.capacity 45 ton)	Jawa	20,90	13,00	32,50	-	13,00	-	19,50
	o. Others	Ja-Sum	20,03	-	53,41	20,00	20,00	20,00	20,00
	Total a)		**572,79**	**349,32**	**290,65**	**1.867,57**	**1.649,02**	**1.247,59**	**749,10**
	2) LENGTHEN ECONOMICAL LIFE SPAN								
	a. MO/Reengine/Repowering Loc DH	Divre 1	-	-	-	40,00	40,00	40,00	40,00
	b. Retrofit/Rehab K 1	Ja-Sum	33,00	-	20,00	-	8,80	8,80	-
	c. Retrofit/Rehab KM 1	Ja-Sum	4,40	-	-	-	4,40	4,40	4,40
	d. Retrofit/Rehab BP/B	Ja-Sum	-	-	-	-	3,00	3,00	-
	TOTAL b)		**37,40**	**-**	**20,00**	**40,00**	**56,20**	**56,20**	**44,40**
	TOTAL ROLLING STOCK		**610,19**	**349,32**	**310,65**	**1.907,57**	**1.705,22**	**1.303,79**	**793,50**
2.	**INFRASTRUCTUR**								
	a. Longsiding	Divre 3	-	-	-	-	24,54	-	-
	b. Doubletrack	Divre 3	-	-	-	858,50	1.010,00	999,90	353,50
	c. Blok Post	Divre 3	-	-	-	-	-	-	-
	d. Station (new & rehab/improvement)	Ja-Sum	-	-	221,22	169,00	10,00	16,00	20,00
	e. Development of Workshop and Depo	Ja-Sum	4,64	-	4,43	50,00	50,00	50,00	50,00
	f. Bridge rehabilitation	Divre 1	-	-	-	80,00	80,00	100,00	170,00
	g. Rail Procurement	Ja-Sum	-	-	-	140,40	140,40	210,60	210,60
	h. Turnout Procurement	Ja-Sum	-	-	-	40,00	40,00	60,00	80,00
	i. Signal Procurement	Ja-Sum	-	-	-	50,00	50,00	50,00	50,00
	j. Development of Education and Training Centre	Jawa	-	-	-	25,00	25,00	25,00	-
	k. Others	Ja-Sum	0,20	-	70,50	10,00	10,00	10,00	10,00
	NUMBER OF INFRASTRUCTURE		**4,84**	**-**	**296,14**	**1.422,90**	**1.439,94**	**1.521,50**	**944,10**
3.	**FACILITY**								
	a. Procurement of Machine-2 Workshop & Depot	Ja-Sum	22,64	-	40,98	50,00	50,00	50,00	50,00
	b. Procurement of mesin-2 infrastructure	Ja-Sum	7,35	-	26,79	-	100,00	-	75,00
	d. Procurement of Weighing Equipment	Ja-Sum	2,61	-	-	3,00	1,50	3,00	-
	e. Facility of Education/audio visual	Jawa	-	-	-	25,00	25,00	25,00	-
	f. Others	Ja-Sum	4,68	-	3,40	15,00	15,00	15,00	15,00
	NUMBER OF FACILITY		**37,27**	**-**	**71,16**	**93,00**	**191,50**	**93,00**	**140,00**
4.	Development of IT	Ja-Sum	**5,25**	**-**	**20,00**	**31,30**	**12,00**	**9,00**	**-**
5.	**HUMAN RESOURCES**	Ja-Sum	**-**	**-**	**-**	**25,00**	**25,00**	**25,00**	**-**
	(Recruitment and Development of Human Resources)								
6.	**CORPORATE SAFETY PLAN**	Ja-Sum			**-**	**-**	**100,00**	**100,00**	**100,00**
	TOTAL		**657,56**	**349,32**	**697,95**	**3.479,77**	**3.473,66**	**3.052,29**	**1.977,60**

(Source: Company Long Term Plan of PT. KAI 2009-2013)

[Table 1-2-8] Income and Expenditure Plan (2009 – 2013)

(In billion Rupiah)

No	Item	2008	2009	2010	2011	2012	2013
1.	Operating Income						
	a. Passenger	1.987,75	2.357,93	2.593,72	2.853,10	3.138,41	3.452,25
	b. Freight	1.328,07	1.786,24	2.417,87	3.659,49	4.588,20	6.696,12
	c. Supporting operation	109,98	212,77	234,05	257,45	283,20	311,52
	d. PSO (Public Service Obligation)	544,67	459,17	460,04	487,64	516,90	547,92
	e. IMO (Infrastructure, maintenance,Op)	886,64	922,01	998,15	1.235,28	1.412,43	1.758,71
	f. Sharing of Jabotabek passsenger transp.	-	280,00	338,00	439,40	571,22	742,59
	g. Sharing of Passenger transp. profit	-	12,42	32,93	64,90	114,78	259,30
	Total Operating Income	**4.857,10**	**6.030,54**	**7.074,77**	**8.997,27**	**10.625,14**	**13.768,40**
2.	Operating Cost						
	a. Employee	1.374,36	2.000,30	1.945,47	2.188,66	2.407,52	2.648,28
	b. Fuel	862,83	796,81	895,90	958,61	1.025,72	1.097,52
	c. Maintenance :						
	- Rolling stock	842,28	1.064,61	1.173,31	1.407,97	1.689,57	2.027,48
	- Infrastructure	487,04	573,94	612,46	780,32	927,37	1.186,72
	d. Depreciation	155,05	184,11	257,41	506,29	707,91	907,85
	e. Supporting Operation	207,07	239,58	275,94	298,64	323,26	349,98
	f. Insurance	8,25	9,49	10,44	11,48	12,63	13,89
	g. general	227,36	281,19	300,80	323,42	347,78	374,01
	h. Interest	-	32,70	325,63	844,17	1.266,66	1.403,95
	i. TAC (Track Access Charge)	886,64	922,01	998,15	1.235,28	1.412,43	1.758,71
	Total Operating Cost	**5.050,88**	**6.104,74**	**6.795,52**	**8.554,85**	**10.120,84**	**11.768,38**
	Profit/Loss Operation	**-193,78**	**-74,20**	**279,24**	**442,41**	**504,29**	**2.000,02**
3.	Non-Operating Income						
	a. Property	118,45	221,53	243,69	420,91	799,73	1.203,49
	b. Interest of Deposit & Current Accounts	82,42	81,08	89,19	125,97	245,34	507,62
	c. others	26,95	16,91	18,51	20,26	22,19	24,32
	Total Non-operating Income	**227,81**	**319,53**	**351,38**	**567,14**	**1.067,26**	**1.735,43**
	Total Income (1+3)	**5.084,91**	**6.350,07**	**7.426,15**	**9.564,41**	**11.692,39**	**15.503,83**
4.	Non-operating Cost						
	- Non-operating cost	19,41	30,73	34,24	47,94	73,97	122,34
	Profit/Loss before tax	**14,62**	**214,59**	**596,39**	**961,62**	**1.497,58**	**3.613,11**
5.	**Tax**	**4,39**	60,09	149,10	240,40	374,40	903,28
	Nett Profit/Loss	**10,24**	**154,50**	**447,29**	**721,21**	**1.123,19**	**2.709,83**

(Source: Company Long Term Plan of PT. KAI 2009-2013)

(4) Status of this Project in Development Plan

This project is equivalent to double tracking project between Sukacinta and Kertapati shown in RENSTRA which is a plan of DGR, and is consistent with policy of the Government. Also, according to the five-year plan of PT. KAI, the achievement of coal transportation projects in South Sumatra is clarified in the business policy. It is possible to receive cooperation of the Government of Indonesia and PT. KAI.

1.2.5. Government Policy of Financial Resource for Railway Development

(1) Annual budget of Ministry of Transportation

The total amount of annual budget of the Ministry of Transportation, including the amount expended from foreign loans, is shown in [Table 1-2-9]. As shown in this table, the amount of budget has been increasing by an annual average of 17%, and from 2007 reached a double-digit trillion amount of Rupiah. Also, the budget in 2010 is approximately 15.8 trillion.

The budget for improvement of infrastructure such as harbors, airports and railways is insufficient. Thus, it is necessary to raise fund using PPP scheme and promoting infrastructure development by government enterprises. Modernization of existing railway infrastructure has been implemented with public investment whose resource is Japanese Yen loan, but private investment is expected in the sectors which profit performance is expected. In Indonesia, utilization of PPP scheme is promoted, but it has been successful in power sector alone so far, and this project will be a pilot project if this project is materialized.

[Table 1-2-9] Annual Budget of the Ministry of Transportation

Purpose	Amount of Annual Budget (Rp billion)					Average Annual Increase Ratio
	2006	2007	2008	2009	2010	
1. Personnel	697	977	1,214	1,273	1,280	16.41
2. Purchasing Goods	1,360	1,686	1,991	2,486	2,898	20.82
3. Development of Infrastructure	6,444	8,547	12,094	13,218	11,655	15.97
Total	8,501	11,210	15,299	16,977	15,833	16.82

(Source: Website of Ministry of Transport of Republic of Indonesia)

1.2.6. Status of Railway Projects being Implemented under PPP Scheme

Recently, due to higher demand and budget constraint in the governments, in the railway sectors in the world, many railway systems are being constructed under PPP scheme. It is a universal process that a pilot project is implemented first, and additional projects will then be proceeded. Generally, the railway projects may have uncertainty of revenue flow especially in case of passenger projects; therefore PPP scheme is more popular for power, port and other infrastructure sectors. In case of railway projects, many projects in the world market are still under BOT scheme or revenue guarantee scheme. In addition, no railway PPP projects have been materialized as of December 2011 in Indonesia.

In Indonesia, Soekarno Hatta Airport- Manggarai Project and Palaci - Bangkuang Coal Railway in Central Kalimantan are 2 major PPP railway projects as of February 2012. The status of such projects are summarized below, however both projects take longer time especially after pre-qualifications have been done. This is because the projects will need to have security or guarantee scheme, and such pre-qualifications have been proceeded prior to the finalization of the detailed project scheme including but not limited to security and guarantee. As for South Line of Soekarno Hatta Airport - Manggarai Project, however, the project will be implemented by PT. KAI under the recently issued Presidential regulations.

In the meantime, in the PPP Book as explained in Section 1.1.4. (P. 1-16), three editions have been issued so far, and the following tables show the number of the projects listed in each PPP Book.

[Table 1-2-10] Projects Listed in PPP Book 2009 Version

	Railway	Sea Transport	Air Transport	Land Transport	Road	Water	Power	Waste
Project ready for bidding	2 ● Palaci - Bangkuang, Central Kalimantan (※1) ● Soekarno Hatta Airport - Manggarai (※2)	1	0	0	3	1	1	0
Priority projects	0	0	0	0	8	8	0	2
Potential projects	13 ● Kualanamu ● West Sumatera ● Simpang - Tanjung Api-Api ● Tanjung Enim - Batu Raja ● Lahat - Kertapati ● Railway Facility - Blue/Green Line (Jakarta Monorail) ● Gedebage, Bandung, Integrated Terminal (Railway) ● Bangkuang - Lupak Dalam ● Kudangan - Kumai ● Puruk Cahu - Kuala Pembuang ● Tumbang Samba - Nanga Bulik ● Kuala Kurun - Palangka Raya - Kuala Kapuas ● East Kalimantan (Puruk Cahu - Balikpapan)	5	3	1	21	11	7	0

(Source: PPP Book)

[Table 1-2-11] Projects Listed in PPP Book 2010 Version

	Railway	Sea Transport	Air Transport	Land Transport	Road	Water	Power	Waste
Project ready for bidding	0	1	0	0	0	0	0	0
Priority projects	0	0	0	0	18	6	0	3
Potential projects	9 ● Jakarta Monorail (Re-listed) ● Padang Monorail (Re-listed) ● Gedebage, Bandung, Integrated Terminal (Re-listed) ● Bangkuang - Lupak Dalam (Re-listed) ● Kudangan - Kumai (Re-listed) ● Puruk Cahu - Kuala Pembuang (Re-listed) ● Tumbang Samba - Nanga Bulik (Re-listed) ● Kuala Kurun - Palangka Raya - Kuala Kapuas (Re-listed) ● Maratuhup - Kalipapak - Balikpapan (Re-listed)	11	7	2	17	18	5	3

(Source: PPP Book)

[Table 1-2-12] Projects Listed in PPP Book 2011 Version

	Railway	Sea Transport	Air Transport	Land Transport	Road	Water	Power	Waste
Project ready for bidding	0	2	1	0	2	6	0	2
Priority projects	0	0	0	0	17	0	2	2
Potential projects	3 ● Rantau Prapat - Duri - Tl.Kuantan - Muaro (Newly Listed) ● Gedebage, Bandung, Integrated Terminal (Re-listed) (※3) ● Maratuhup - Kalipapak - Balikpapan (Re-listed) (※4)	4	7	2	3	18	4	4

(Source: PPP Book)

Among the above listed railway projects, the 2 “Project Ready for Bidding” (※1, ※2) and 2 projects listed in all 3 issues of PPP Book (※3, ※4) are summarized below.

[Table 1-2-13] Status of 4 Specific PPP Projects

Project	Contracting Agency	Status
Palaci-Bangkuang, Central Kalimantan (※1)	Central Kalimantan Gov.	● Japan Transportation Consultants completed a study in 2008 as requested by JETRO. ● In May 2010, total 15 groups participated in the pre-qualification, and only 4 groups have been shortlisted until today. - Itochu - Toll Consortium - Drydocks World LLC - PT MAP Resources Indonesia Consortium - PT Bakrie - SNC Lavalin - Tyssencrupp Consortium - China Railway Group Limited - PT Mega Guna Ganda Semesta – PT. Royal Energi Consortium ● In November 2011, PT. Penjamin Infrastruktur Indonesia (PII) announced its intention to provide guarantee for the project.
Soekarno Hatta Airport – Manggarai (※2)	Ministry of Transportation	● This project includes two lines, North route (called express line) and South route (called commuter line). ● North circle line is totally 33km elevated in length with a total project cost of Rp. 7,600 billion. The section between Manggarai and the location at Km 22 has already been in service; the remaining 11km is an extension. The employer will implement all the works including land acquisition, construction, operation, etc. PQ stage has already started; there is no progress after evaluation even there are 7 companies joined. ● The guarantee from PT. Penjamin Infrastruktur Indonesia (PII) for north circle line has already been determined. They are 8 guaranties such as the pay of guarantee charge equal to 1.5% of the total project cost, guaranty for land acquisition, etc. However, the details are still unclear. ● On the other hand, according to the presidential decree No. 83/2011 effectuated in November 2011, PT. KAI will be the employer for south circle line. 7km new line connecting the current railway network and the airport will be constructed with a total cost of $250 million (Rp. 2.25 trillion). PT. KAI will confer with domestic banks (PT. BNI, PT. BRI, PT. Bank Mandiri) about loan origination. A period of approximately 10 years for repayment is expected. The remaining 15% is planned to be self-financed by PT. KAI.
Gedebage, Bandung, Integrated Terminal (※3)	Bandung City	Under investigation
Maratuhup – Kalipapak – Balikpapan (※4)	East Kalimantan Gov.	Under investigation

(Source: Study team)

As mentioned above, there are many potential PPP projects and further progresses of these projects are expected. However, since PPP projects are carried out through tender definitely, private company which proposed a project can’t always be awarded. Therefore, it's believed that current regulation partially interfere with the progress of PPP projects. Also, like Soekarno Hatta Airport - Manggarai Project, there is a case that PT. KAI will construct new line and operate and do maintenance by themselves in accordance with Presidential order. Therefore, it is hard to say that market in railway sector is wide open to private companies.

Further, the Study team unofficially received PPP Book Issue No.4 (2012 version) which has not been publicly issued as of May 2012. According to this Issue No.4, there are 3 “Ready to Offer Projects”, 26 “Priority Projects” and 29 “Potential Projects”, however only 3 railway related projects are registered as “Potential Projects” (Rantau Prapat-Muaro Railway, Bundung Railway Term,inal, Dl Yogyakarta Rail Stations) which is similar to Issue No.3 (2011 version). According to BAPPENAS, it does not select nor eliminate railway sector projects, however railway sector projects are not recently proposed primarily due to difficulties to realize railway projects which require significant government involvement.

1.3. Energy Policy in Indonesia

1.3.1. Outlook of International Energy Market

(1) Correlation between World GDP Growth and Energy Consumption

The world energy consumption has increased by 2% per year from 1970’s in accordance with world GDP growth. It is said that the main reason for the increase is due to increase of energy consumption in developing countries supported by economic growth.

(Source: 2009 Energy White Book)

[Fig. 1-3-1] Correlation between World GDP Growth and Energy Consumption

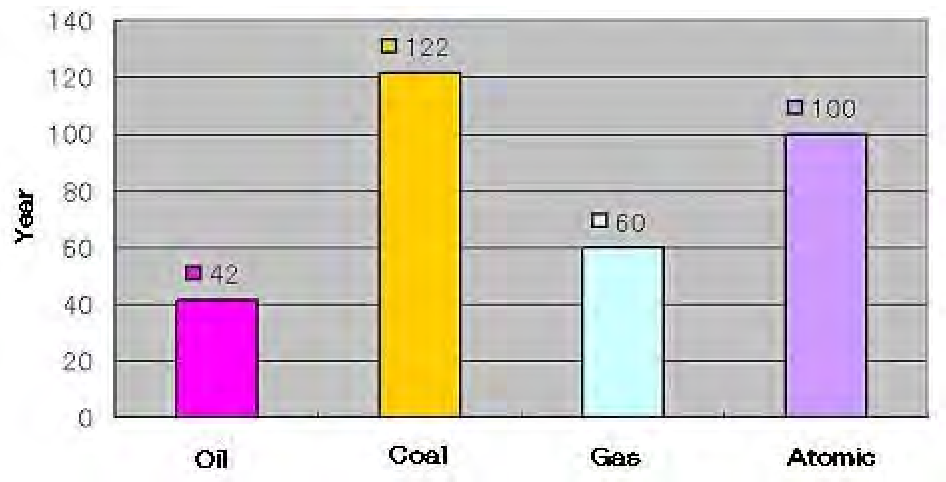
(2) Outlook for World Energy Consumption

The world energy consumption in 2030 will increase to 1.4 times of the one in 2007. The half of the world energy consumption is occupied by the demand in Asia Pacific region (excluding

OECD countries). It is expected that the demand of fossil fuels, such as oil, coal, and natural gas will substantially increase.

(3) Reserve Production Ratio of World Energy

[Fig. 1-3-2] shows the recent Reserve Production Ratio of major fossil fuels in the world. Especially oil is expected to dry up within 42 years. We are required to secure own source of fossil fuels more aggressively, since the supply is easily affected by world affairs. Acceleration of research & development of new energy is also key factor from the long term point of view.



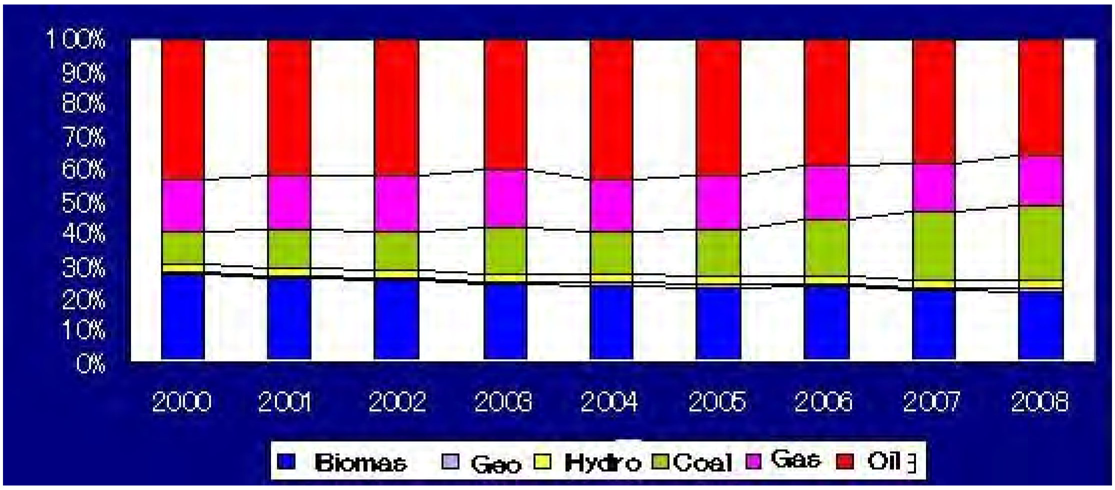
(Source: "Japan Energy 2010" issued by Resources & Energy Agency)

[Fig. 1-3-2] Reserve Production Ratio of World Energy

1.3.2. Situation in Indonesia

(1) Proportion of Energy Supply in Indonesia

The Indonesian energy supply volume in 2000 was 960 million BOE (Barrel Oil Equivalent), which was composed of Oil (43.4%), Natural Gas (16.5%), Coal (9.4%), and Biomass (27%). After that, the supply volume stably increased and reached 1,260 million BOE in 2008. The energy supply in 2008 was composed of Oil (36.2%), Natural Gas (15.3%), Coal (23.0%), and Biomass (22.2%). The main reason for the increase of supply volume during 2000-2008 was due to the increase of Coal supply in Indonesia. The proportion of Coal in the total energy supply has continues increasing.

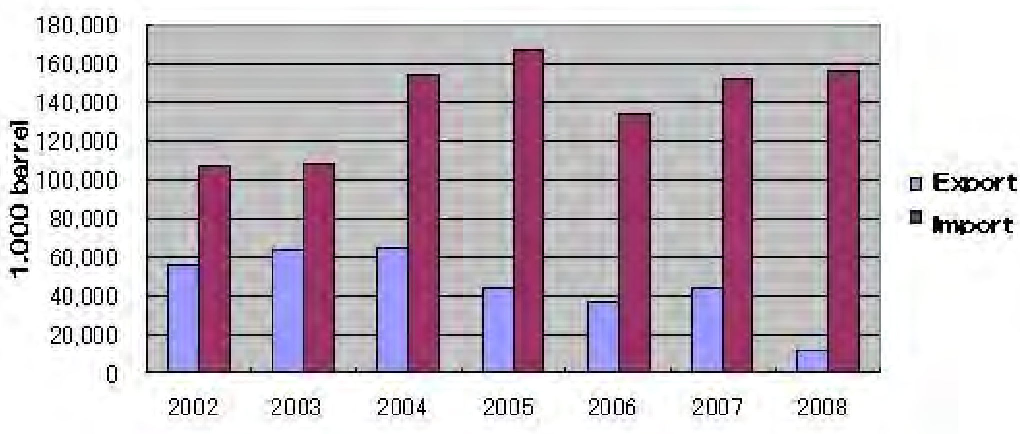


(Source: Based on 2009 Handbook of Energy & Economics Statistics of Indonesia)

[Fig. 1-3-3] Proportion of Indonesian Energy Supply

(2) Oil

Indonesia is 2nd largest crude oil producer following China in Asia. But crude oil production is gradually decreasing. The production in 2000 was 518.1 million barrel but the production in 2008 decreased to 358.1 million barrel. Since the domestic refining capacity is not able to catch up with the increase of demand, Indonesia changed to net import country of oil products since 2004. Indonesian government compensates for the loss of imported oil products and it is a big burden on government finance. Therefore, the decrease of domestic oil consumption is one of the biggest targets in energy policy of government from 2006.

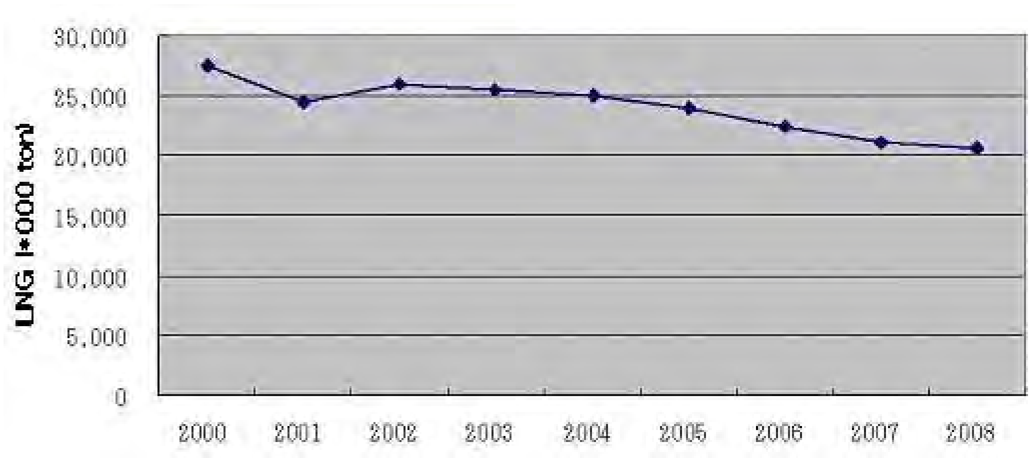


(Source: Based on 2009 Handbook of Energy & Economics Statistics of Indonesia)

[Fig. 1-3-4] Change of Indonesian Oil Product Import & Export

(3) Natural Gas

The major producing area of Natural Gas is South Kalimantan, South Sumatra, Irian Jaya and the production volume has been decreasing after reaching its peak in 2003. Indonesia is exporting country of Liquefied Natural Gas (LNG) and the export volume is expected to increase more due to the construction of new export facility in Tangguh gas field in addition to Arun and Bontang. Indonesian government plans to set up domestic pipeline networks in accordance with the increase of production of Natural Gas.



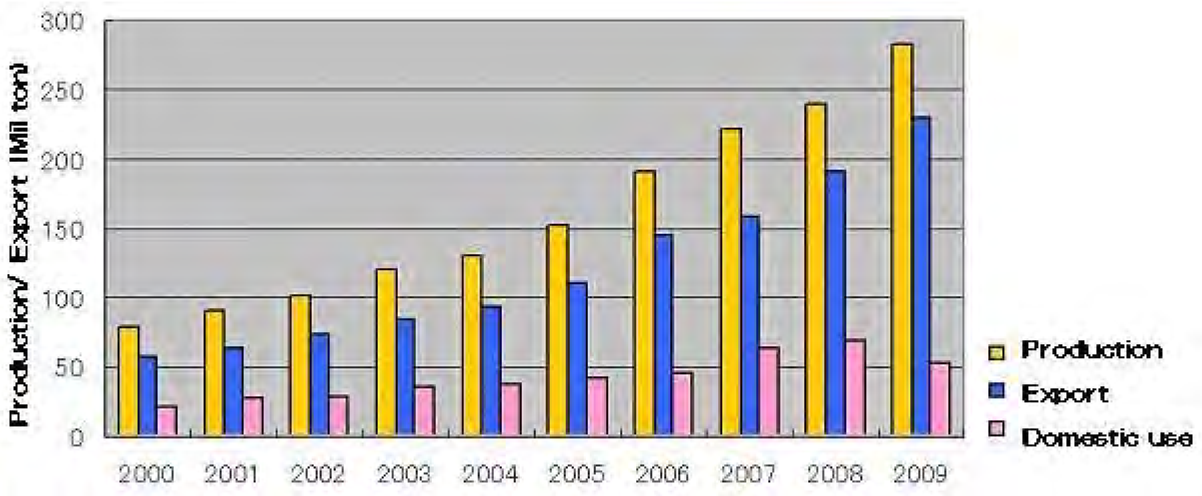
(Source: 2009 Handbook of Energy & Economics Statistics of Indonesia)

[Fig. 1-3-5] Change of Indonesian LNG Export

(4) Coal

Indonesia is the world biggest thermal coal exporter. Its production and export volume have increased by 10% per year from 2000. The main reason of the increase is due to expansion of existing and new coal mine, which are supported by the import demand not only from regular importers in Japan, Korea, Taiwan, but also new demand from other developing countries such as China and India. The production will stably continue increasing.

On the other hand, it is not easy to expect if coal export volume will stably continue increasing, because domestic demand will rapidly grow and government promotes Domestic Market Obligation (DMO) and put priority on the supply to domestic coal-fired power plant.



(Source: Based on 2009 Handbook of Energy & Economics Statistics of Indonesia)

[Fig. 1-3-6] Change of Indonesian Coal Production and Export

(5) Electricity

Perusahaan Listrik Negara (PLN) is solely responsible for electricity supplier in Indonesia. PLN produces electricity and also buy from domestic Independent Power Producer (IPP), and electricity is supplied only through power transmission lines owned by PLN.

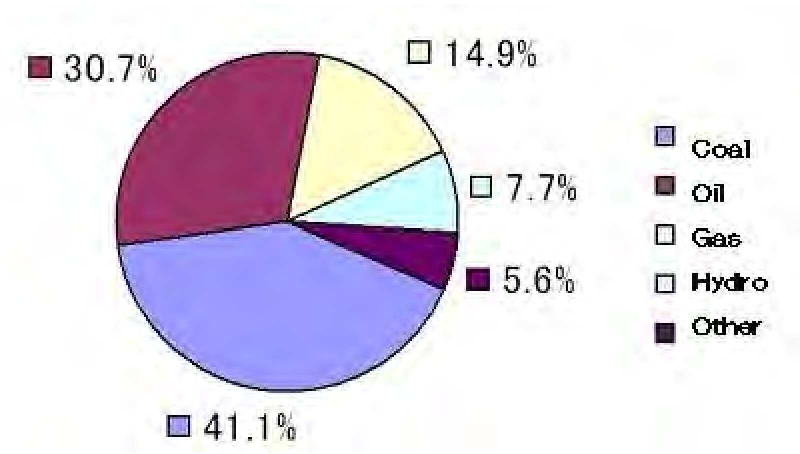
The government compensation for electricity charges is a big burden on government finance. Government plans to raise electricity charges gradually to 960 Rp./kWh by 2015 to decrease the amount of compensation.

In terms of fuels, the proportion oil has decreased every year and it only occupies 31% of the fuels. Instead, the proportion of coal is increasing these days and it occupies more than 40% after 2003. Natural gas occupies about 15% in 2008 and expected to hold a firm position as major fuel. The research and development of renewable energy such as Hydroelectric, Geothermal, and Solar power is proceeding.

[Table 1-3-1] Electricity Power Production and Proportion in Indonesia

		2002	2003	2004	2005	2006	2007	2008
Electricity Production（Gwh）		108,217	114,467	120,163	127,371	133,109	142,440	149,441
Proportion（%）	Coal	39.7	40.6	40.1	40.7	44.0	44.8	41.1
	Oil	34.8	32.8	33.6	31.0	29.7	28.5	30.7
	Gas	10.6	13.2	12.7	14.7	14.0	13.8	14.9
	Hydro	9.2	7.9	8.1	8.4	7.2	7.9	7.7
	Others	5.8	5.5	5.6	5.2	5.0	5.0	5.6

(Source: Based on 2009 Handbook of Energy & Economics Statistics of Indonesia)



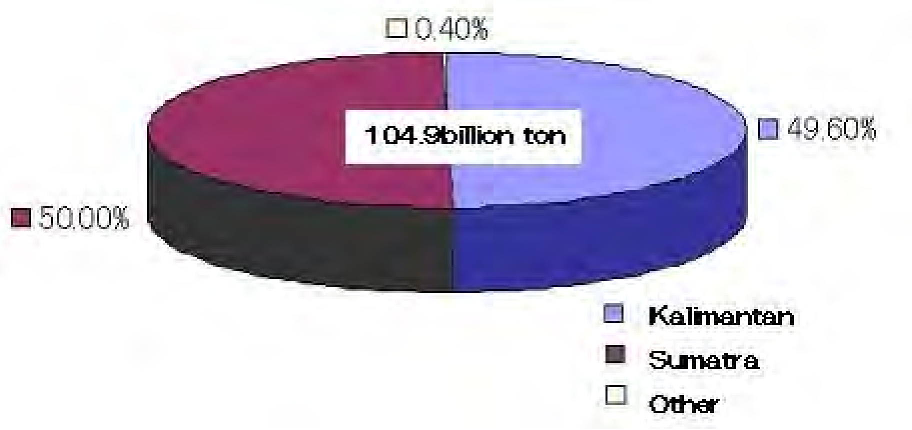
(Source: 2009 Handbook of Energy & Economics Statistics of Indonesia)

[Fig. 1-3-7] Proportion of Electricity Production in 2008

1.3.3. Development Subject and Government Development Plan

(1) Coal Resources and Reserves

Coal Resources in Indonesia are 104.94 billion tons. Most of them are located in Kalimantan (52.1 billion tons, 49.6%) and Sumatra (52.45 billion tons, 50.0%). Technically minable Coal Reserves are expected as 12.47 billion ton. Coal Resources and Reserves will increase further, since there are lots of unexplored areas.



(Source: Indonesia Coal Book 2010/2011)

[Fig. 1-3-8] Indonesian Coal Resources by Region

(2) Coal Production Plan

[Table 1-3-2] shows Coal Production Plan made by Indonesian government. The key point is if the expansion of new and existing coal mine develops as per government plan.

[Table 1-3-2] Coal Production Plan

(Unit: Million Ton)

Year	2010	2011	2012	2013	2014	2015	2020	2025	2030
Production	270	280	290	297	321	321	361	405	430

(Source: Directorate General of Mineral, Coal and Geothermal, 2009)

(3) Coal Mine Development Project

The new coal mine development projects with over 20 million tons per year production are Maruwai project developed by joint venture of BHP Billiton and PT. Adaro Energy in East-Central Kalimantan, and East Kutai Project developed by MEC (Minerals Energy Commodities) Holdings.

Expansion of existing coal mine is also ongoing. In case the expansion plan by Adaro, Arutmin, and Kideco goes as scheduled, totally the production increases by 100 million ton.

(4) Development Subject

Any problem isn't heard to occur in mine management and operation under new mining law issued in 2009. But it is concerned that strict government regulation to the approval of development in forest areas (IPPKH) will affect new development project, since the expansion of existing coal mine and new development project must start at inland areas.

On the other hand, logistics infrastructure is not fully prepared in lots of areas. The main logistics still rely on barge transportation through rivers. But the transportable volume reduces in dry season due to low water level of rivers. Therefore, the soonest set up of coal dedicated railway networks are desired so that Indonesian coal meets increasing demand in domestic and Asian region.

(5) Promotion of Coal Resource Development

As shown in MP3EI and IEDC above, especially coal resource development in South Sumatra region is positioned as a contributed project to development of Indonesian economy due to the bountiful reserve and increase of world demand. Development of transportation infrastructure, mainly railway, is required urgently. In order to promote development of infrastructure smoothly for the near future, it is assumed that PPP project is also effective from the viewpoint of financial burden reduction of the government of Indonesia and utilization of private finance.

1.4. South Sumatra Province

1.4.1. Summary of the Region

(1) Geography

Sumatra Island is the second largest island in Indonesia, located in west edge of the Country. South Sumatra Province is the area located south part of Sumatra Island, indicating green color in [Fig. 1-4-1]. Total area is 60,303km^2; it is third largest province among 10 provinces in Sumatra Island. South Sumatra Province have a border of Jambi Province in North, Bengkulu Province in west, Lampung Province in South, and east side is faced on Bangka sea channel.

(Source: Wikipedia)

[Fig. 1-4-1] Location Map of South Sumatra Province

(2) Population, Race, Language, Religion

Capital of South Sumatra Province is Palembang City located estuary of Musi River, having more than 1million population. Population of Province is over 7.4million and it is consist of 60% young generation under 24 years old. Main race is Malay (31%) and Java (27%). Most of persons speak Indonesian. In addition, main religion is Islam (96%) and then following by Christian (2%) and Buddhism (2%).

(3) Industry, Trade, Transportation

There are many natural resources and long history of its development. Main industry is mining of coal and oil, cement, wood. Main export items are agricultural products such as coffee, spices, fish, and industrial products such as fertilizer, rubber.

Traffic system is road and railway. Almost all export products are exported using railway to South (Tarahan and Panjang port). More than 90% of export products are coal. There is an international airport in 20km north from center of Palembang city.

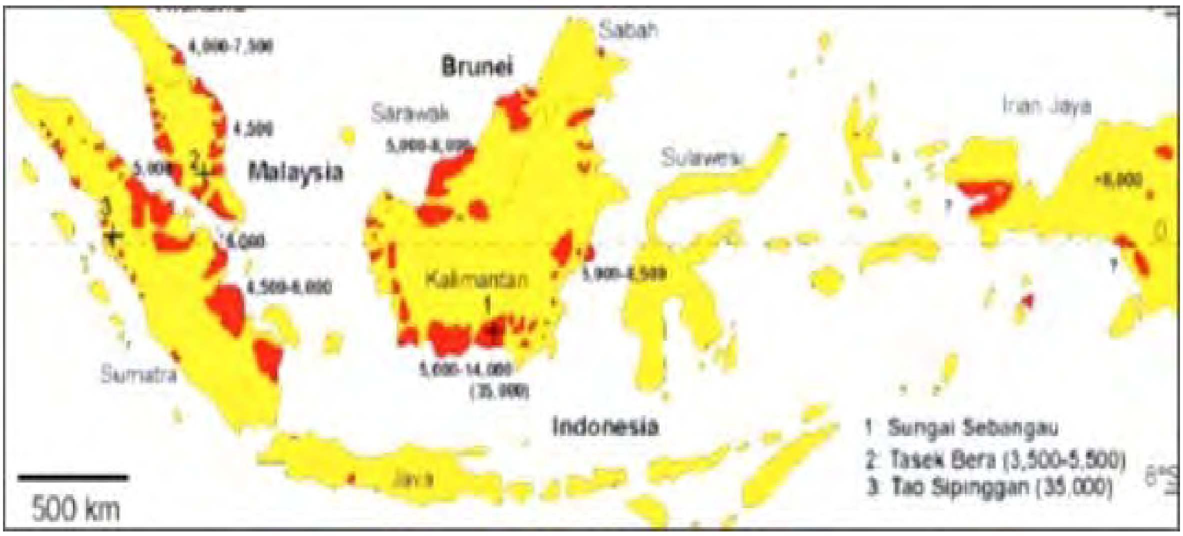
1.4.2. Environment of the Project Area

(1) Topography

There is the Barisan mountain chain in western area of South Sumatra Province. Main mountains are Mt.Dempo (3,159m), Mt.Nanti (1,619m), and Mt.Pesagi (2,231m). There is steep mountainous land in western part of the Lahat coal mine area. Meanwhile eastern part of the Province is mainly low swamp lands and there are big peat bog lands near the coast line with mangrove.

(2) Soil

There is big peat bog in eastern area, especially near coast and river in south Sumatra province. Red color marks of [Fig. 1-4-2] below show “peat bog” in Indonesia.



(Source: Wetlands International)

[Fig. 1-4-2] Distribution of Peat Bog in Indonesia

(3) Climate

It is monsoon climate with annual rainfall of 2,200mm~3,000mm. Rainy season is from October to April. There is little rain in dry season and it affect to water level of rivers. Temperature is 26^0C - 32^0C and humidity is 78% - 88%.

(4) Water Resources

There are two wide and deep rivers, Musi River and Lematang River, in South Sumatra Province. Water resources of rivers are mostly come from Barisan Mountains and flow to Bangka sea channel. Meanwhile all of Ogan river, Komering river, Lematang river, Kelingi river, Lakitan river, Rawasu river, flows to Musi river.

1.4.3. Position under National Development Plan

DGR, Ministry of Transport mentioned about the target projects up to year 2030 under National Railway Master Plan as follows;

- Cargo transportation services in Sumatra Island have cross relation with development of natural resources same as Kalimantan Island. Indonesian Government makes aggressive support for expansion of railway transportation to meet with rapid production of mineral resources.
- Under New Railway Law No.23 issued in 2007, Provincial Government is authorized to promote railway project inside the province. Since this project shall be completed inside a province, it will be organized and approved by South Sumatra Provincial Government.
- Under National Development Plan, railway investment is targeting to reach US$672 million by increasing private investment. The target ratio of Government and Private ratio are 30% and 70% respectively.

1.4.4. Future Development Plan

Regional Development Planning Board (BAPPEDA) of South Sumatra Province mentioned about railway development in their medium term 5 years (2008~2013) development plan.

- Since railway development in South Sumatra did not reach the target, it affects to the coal mining industry.
- Transportation of coal should be reach 22 million ton/year urgently by changing sleeper, double tracking, increasing of new station.
- May, 2009 Central Government promised to support for double tracking project in South Sumatra. However, project is delaying now and it is expected to reach target of transportation volume of 22 million ton/year.

BAPPEDA long term 20years (2005~2025) development plan also mentioned 3 main targets of transportation sector as follows;

- Road construction in East-Midland area.
- Development of cargo terminal.
- Railway construction from Palembang to Tanjung Api Api Port.

Final destination of the above listed railway construction plan is Tanjung Api Api Port, the same destination of this project. Currently, this project plans to increases transportation capacity by taking most cost effective means of “Railway transportation - River transportation by barge - Tanjung Api Api Port”, which coincides with BAPPEDA long term plan.

Chapter 2

Project Rationale

2.1. Coal Industry in South Sumatra Province

2.1.1. Overview

Coalfields in Indonesia are found all over the country, but the most significant resources lie on the island of Kalimantan and Sumatra.

Sumatra in particular holds almost half of the coal resources in the country. Some of the major coalfield includes the Central - South Sumatra Coalfield that stretches throughout the South Sumatra, Jambi and Riau Provinces, the Ombilin Coalfield in West Sumatra Province, and the Bengkulu Coalfield in Bengkulu Province.

Central - South Sumatra Coalfield hosts coal from the Neogene period. With thick seams and large resource base, they provide an ideal condition for mining. However, majority of the resource are sub-bituminous coal, and mining activities to date has been limited, conducted by companies such as PT. BA.

However, with the growing demand for lower grade coal, the Central - South Sumatra Coalfield is seen as the next major supply base in Indonesia.

With the constraint on the capacity of the inland coal transportation, however, the increase in coal production is being hampered, and there is a necessity to address this issue as soon as possible.

(Source: NEDO)

[Fig. 2-1-1] Coalfields in Sumatra

(1) Coal Resources

According to the "Indonesian Coal Book 2010/2011" compiled by the Indonesian Coal Mining Association, the total coal resource in Indonesia is around 104.9billion tons.

Among those resources, Sumatra holds around 52.5billion tons, which represents almost 50% of the total, and Kalimantan hosting around 52.1billion tons. Almost all of the coal resources in Indonesia lie within these 2 islands.

[Table 2-1-1] Coal Resources in Indonesia by Region

Region	Resources (million tons)	Percentage (%)
Sumatra	52.449.87	50.0
Kalimantan	52,100.79	49.6
Others	389.55	0.4
Total	104,940.21	100.0

(Source: compiled from data obtained from Indonesian Coal Book 2010/2011)

Within Sumatra, most of the coal resources are concentrated in South Sumatra Province, with the province holding almost 90% of the total.

[Table 2-1-2] Coal Resources in Sumatra by Province

Province	Resources (million tons)	Percentage (%)
South Sumatra	47,085.07	89.77
Banten	13.31	0.03
Lampung	106.95	0.20
Bengkulu	198.65	0.38
Jambi	2,069.07	3.94
West Sumatra	732.16	1.40
Riau	1,767.54	3.37
North Sumatra	26.97	0.05
Nanggroe Ache	450.15	0.86
Total	52,449.87	100.00

(Source: compiled from data obtained from Indonesian Coal Book 2010/2011)

(2) Coal Production

Although Sumatra holds the largest coal resources in Indonesia, majority of the production comes from Kalimantan.

[Table 2-1-3] Coal Production in Indonesia by Region

(Unit: thousand tons)

Region	2005	2006	2007	2008	2009
Sumatra	11,035	12,360	12,098	17,415	19,180
Kalimantan	154,558	184,179	204,832	222,818	211,377
Total	165,593	196,539	216,930	240,233	230,557

(Source: compiled from data obtained from Indonesian Coal Book 2010/2011 and 2011 Coal Manual)

PT. BA accounts for a large portion of coal produced in Sumatra.

[Table 2-1-4] Coal Production in Sumatra by Company

(Unit: thousand tons)

Company	2005	2006	2007	2008	2009
PT. BA	8,607	9,292	8,555	10,099	10,831
Others	2,428	3,068	3,543	7,316	8,349
Total	11,035	12,360	12,098	17,415	19,180

(Source: compiled from data obtained from Indonesian Coal Book 2010/2011 and 2011 Coal Manual)

In terms of production from South Sumatra Province only, the share of production by PT. BA increases significantly.

[Table 2-1-5] Coal Production in South Sumatra Province by Company

(Unit: thousand tons)

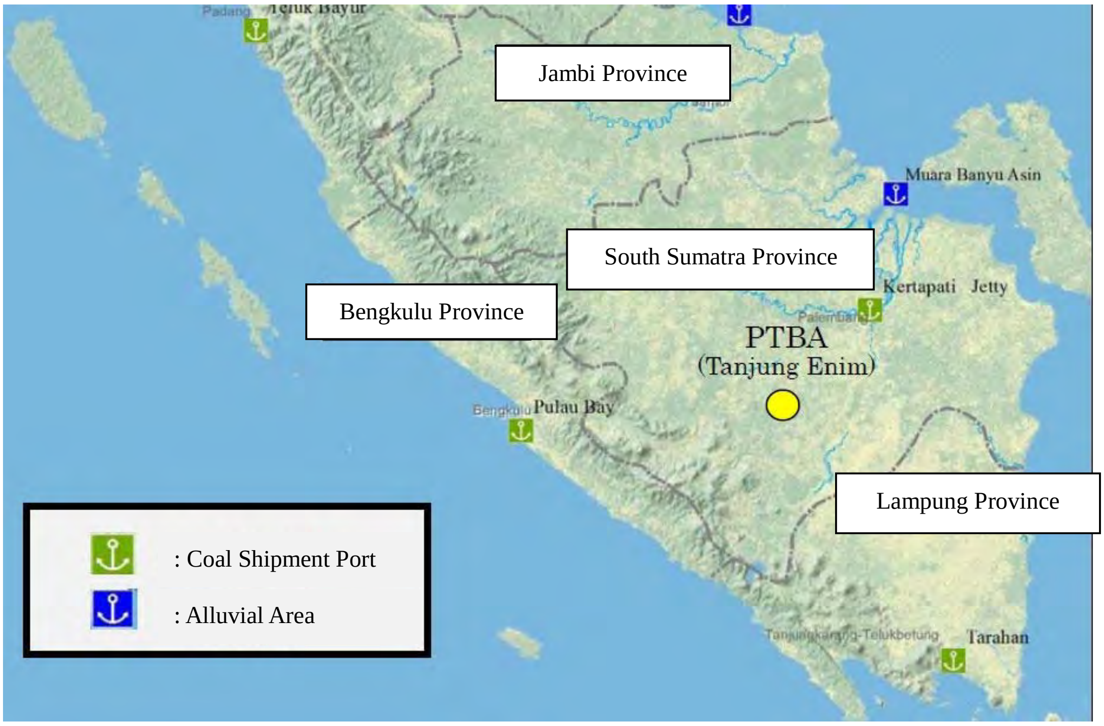
Company	2005	2006	2007	2008	2009
PT. BA	8,607	9,292	8,555	10,099	10,831
Others	-	-	-	656	1,054
Total	8,607	9,292	8,555	10,755	11,885

(Source: compiled from data obtained from Indonesian Coal Book 2010/2011 and 2011 Coal Manual)

(3) Inland Transportation and Shipping Infrastructure for Coal

PT. BA is the largest coal producer in South Sumatra Province. Their mine is located in Tanjung Enim. Coal mined by PT. BA is railed to either Kertapati barge loading facility at

Palembang or to Tarahan Port, that is located in the adjacent province of Lampung, to be shipped out.



(Source: NEDO)

[Fig. 2-1-2] Infrastructure Used by PT. BA in South Sumatra Province

Meanwhile, there are many private companies that hold mining rights in Muara Enim and Lahat Regencies that is in close proximity to PT. BA's mine. Some of those private companies conduct coal mining, and they are being transported by trucks mainly on public roads to Kertapati or other barge loading facility to be shipped.

Therefore, modal distribution of coal transportation is equal to replace the "PT. BA" to rail and "Others" to road in the [Table 2-1-5] (P. 2-4). Since it was PT. BA alone that used railway until 2007, the railway share was 100% by then, but since private coal mines started production in 2008, the share of road has been picking up. As a result, the railway share is about 91% and the rest is road in 2009.

2.1.2. Development Plan and Agenda

(1) Development Plan

With the increasing demand for lower grade coal, Sumatra, with its vast coal resources is attracting significant attention. In South Sumatra Province also, there are numbers of plan for the development of coal mines and expansion of production capacity.

The development and expansion plans within the Muara Enim and Lahat Regencies in particular are set out in [Table 2-1-6] below.

[Table 2-1-6] Production Capacity of Coal Mines in Muaraenim and Lahat Regencies

(Unit: thousand tons)

Company/Mine	2010	2011	2012	2013	2014
PT. BA	12,500	12,500	12,500	12,500	12,500
Bara Alam Utama	-	800	2,500	4,000	4,000
Reliance	-	-	-	2,700	5,500
Pendopo	-	-	-	-	200
Batualam Selaras	200	500	500	500	500
Batubara Lahat	1,000	1,000	1,000	1,000	1,000
Total	13,700	14,800	16,500	20,700	23,700

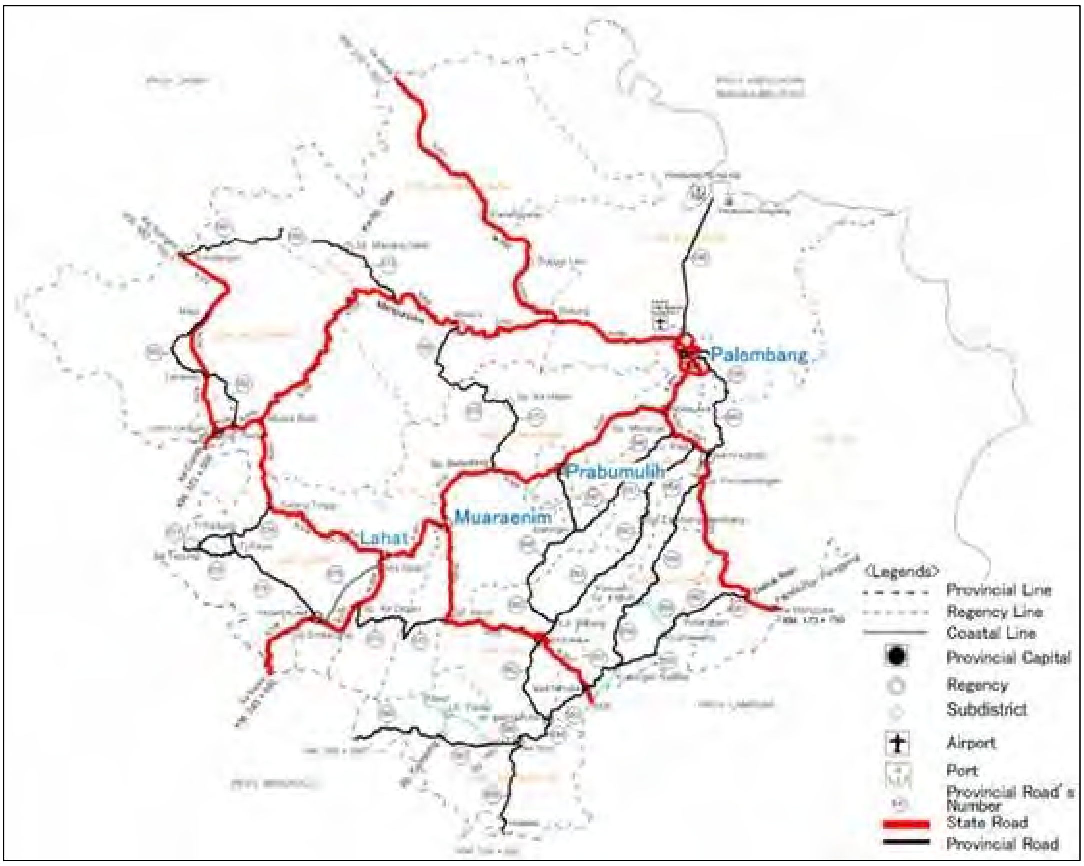
(Source: compiled from data obtained from Indonesian Coal Book 2010/2011and company announcements)

(2) Agenda

As discussed earlier, there are plans to almost double the coal production by 2014 from mines in Muara Enim and Lahat Regencies in South Sumatra Province. However, constraints on the inland transportation capacity may prove to be a roadblock for such expansion.

PT. KAI's rail operation is running at almost full capacity transporting coal produced by PT. BA, with little room for additional tonnage. Besides, transportation by track on public road is also limited because coal tracks are allowed to pass after 17:00 of a day until 8:00 of the next day and the volume of coal load of each track is limited to 10 ton. These measures are taken because as it can be seen in [Fig. 3-1-6], the road network in South Sumatra has no alternatives but to use national road connecting Lahat to Kertapati only which leads to deterioration of road due to insufficient maintenance, and also leads to environmental problem such as air pollution, noise and vibration along the road. As a result, about 37% of the national road is damaged as it is shown in [Table 3-1-8]. The number of registered vehicle is rapidly increasing in recent years as shown in [Fig. 3-1-7] and it is expected that the trend will continue, thus the coal transportation by road will be affected due to short of maintenance and environmental concerns.

And as such, the expansion of coal production capacity in Muaraenim and Lahat Regencies must be accompanied by an increase in inland transportation capacity, which will be the major challenge going forward.



(Source: Public Work Service of South Sumatra Province)

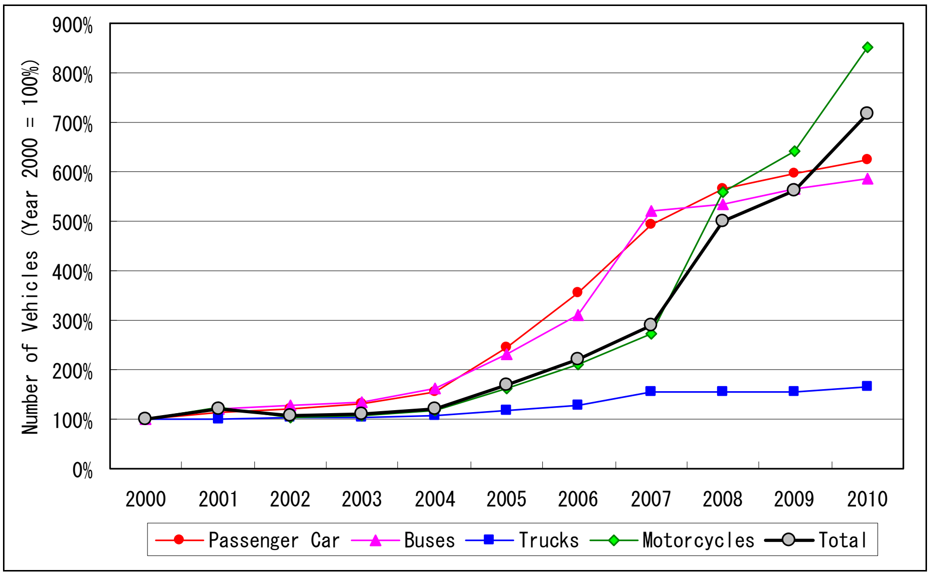
[Fig. 3-1-6] (Re-taken) Roads Network of South Sumatra Province in 2010

[Table 3-1-8] (Re-taken) Length of Roads by Type of Surface in South Sumatra Province in 2009

(Unit: km)

Type of Condition	State		Provincial		Regency		Total	
	Length(km)	Rate(%)	Length(km)	Rate(%)	Length(km)	Rate(%)	Length(km)	Rate(%)
Good	827.1	63.7	495.4	28.3	9,514.4	62.6	10,836.9	59.4
Medium	424.8	32.7	608.3	34.8	-	-	1,033.1	5.7
Slightly Damaged	46.3	3.6	498.0	28.5	3,900.1	25.6	4,444.4	24.3
Heavy Damaged	-	-	146.8	8.4	1,788.0	11.8	1,934.8	10.6
合 計	1,298.2	100.0	1,748.5	100.0	15,202.5	100.0	18,249.2	100.0

(Source: Mid-term Development Plan for South Sumatra Province 2008-2013, BAPPEDA)

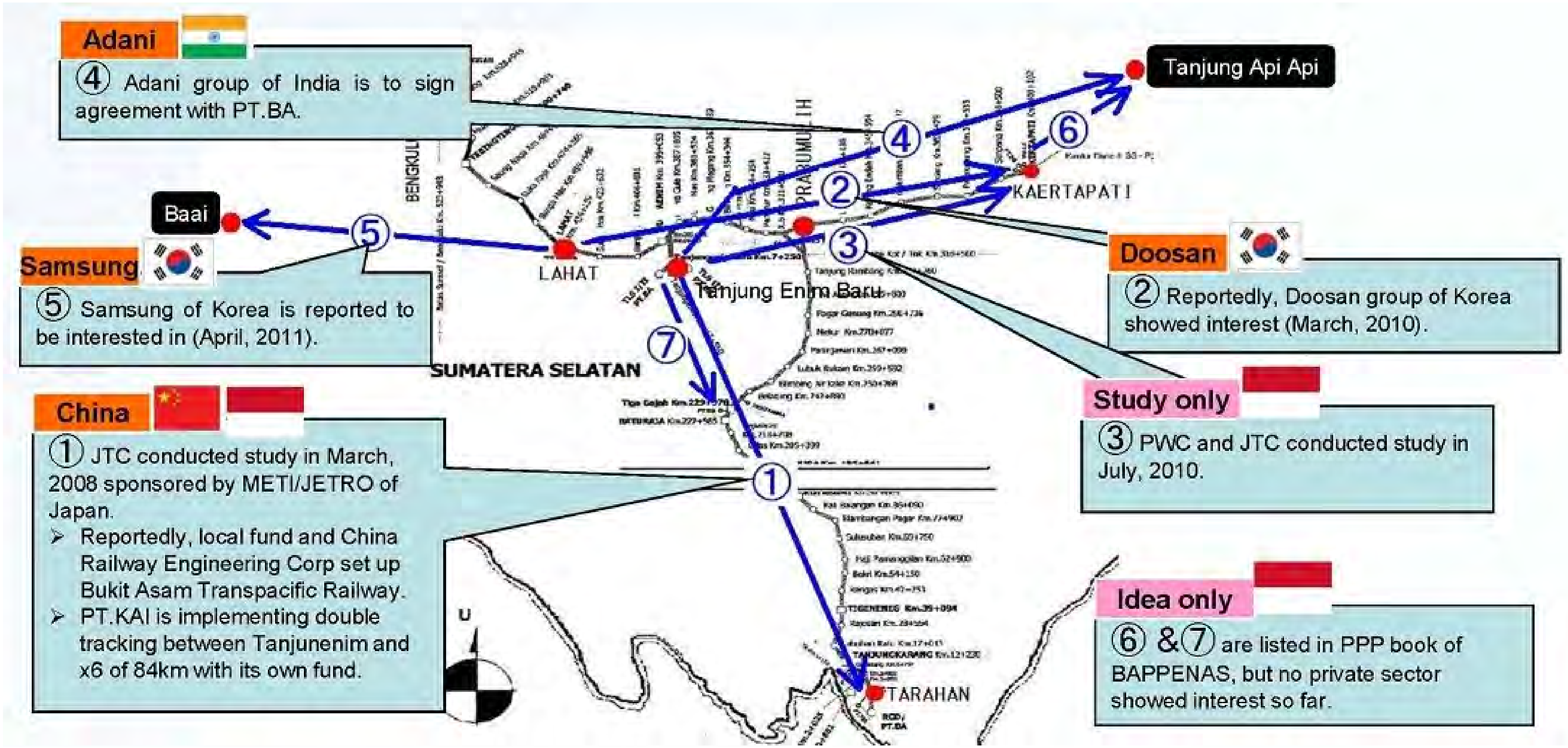


(Source: Statistical Yearbook of Indonesia 2000-2011, BPS)

[Fig. 3-1-7] (Re-taken) The Number of Registered Motor Vehicles by Type in South Sumatra Province (Year 2000 = 100%)

2.1.3. Private Sectors Initiatives

Given such major challenge, many studies have been or are being conducted to look into the expansion of coal railing capacity from Muaraenim and Lahat Regencies. However, those initiatives are merely a study at this moment, and there are no concrete plans to implement the upgrade. This is mainly because those plans are based on obtaining offtake rights of coal, or is being based on a BOT scheme. For example, all of the project being mulled by Adani Group (India), Samsung C&T (Korea) and CREC (China) are aiming to conclude a BOT contract based on PT. BA's coal. For more details on each group's plan, refer to Chapter 2.3.2. (P. 2-13).



(Source: Study team)

[Fig. 2-1-3] Studies to Expand Railing Capacities from Muaraenim and Lahat Regencies

2.2. Railway in South Sumatra Province

2.2.1. Present Situation and Problem

70% of railway freight of Indonesia is handled in Sumatra island. Major commodities are coal, pulp, fertilizer, cement which constitutes more than 90% of all freight.

Presently, coal transportation by rail in South Sumatra is almost for PT. BA from Tanjung Enim to Tarahan, Kertapati. The transportation volume is 10MTPA for Tarahan and 2MTPA for Kertapati respectively.

Since railway transportation capacity is saturated at this moment, coal transportation by rail to be allocated for private coal companies is limited to PT. BAU only with the volume of 0.5MTPA going to Kertapati. Other private coal companies have no choice but to depend on road transportation by 10ton truck. The road transportation is not expected to be expanded with several limitations such as traffic volume, traffic jam, bad road condition, and environmental problem. At present, local government restricts coal transportation by truck during night time between 6:00PM to 8:00AM. As such, it is an urgent agenda in South Sumatra transportation sector to shift the coal transportation mode from road to railways by strengthening railway transportation capacity.

Meanwhile, South Sumatra provincial government has a long term plan of constructing new railway going to Tanjung Api Api and seaport terminal there. However, it is projected to take time and big construction cost to materialize the plan because the new line is located in swampy area with land subsidence.

2.2.2. Railway Development Funds and Provincial Government

The State takes major part of budgetary responsibility for the development and maintenance of the railways sector in Indonesia. In 2010, the railroad sector budget of the South Sumatra Provincial government was Rp.86.4billion (JY 0.78billion) against the aggregate State budget allotment of Rp. 3,916.9billion (JY 35.61billion), while only accounting for 2.2%[1]. A large part of the budget emanates from infrastructure development both in the State and South Sumatra government, while accounting for 98.4% and 100% in 2010, respectively[2].

Over the past 5 years from 2006 to 2011, the railroad sector budget of the Provincial and the State governments increased by 4.1% and -19.8% respectively in real terms (2006 price level)[3].

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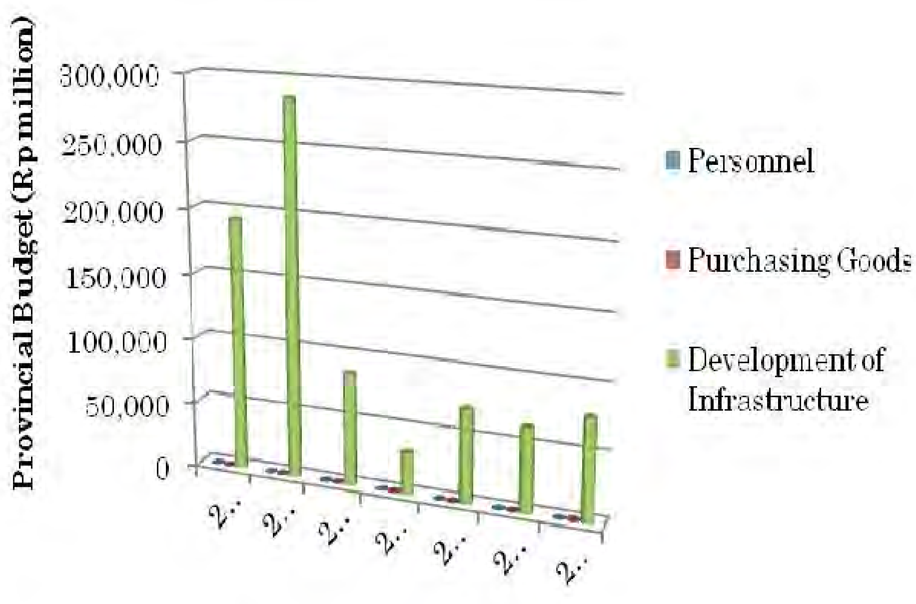
1 Source: DGR, Project Management of South Sumatra Railways Infrastructure Projects, February 2012

2 Besides infrastructure development, budget in 2010 was allotted to personnel and procurement of goods, accounting for 0.6 % and 1.0 %, in that order.

3 Inflation rates from 2007 through 2011 are placed at 6.4%, 10.3%, 4.9%, 5.1%, 5.4% 6.4%, 10.3%, 4.9%, 5.1%, 5.4% in descending order. (Source: Bank of Indonesia)

Nonetheless, funds of the Provincial government to the sector in 2012 is anticipated to bounce back to Rp. 78.7billion (JY 0.71billion), increasing by 21.5% in nominal term.



(Source: Project Management of South Sumatra)

[Fig. 2-2-1] South Sumatra Provincial Government Budget (real term)

2.2.3. Railway Tariff and Provincial Government

While the Law No. 23 of 2007 on railway deregulation pointed out an important role and participation of local governments and the private sector in the sector finance and operation, provincial government plays diminutive part in administratively setting railway tariff scheme. Passenger tariffs (commercial and Non-commercial) are revised every year by DGR in compliance with "The Regulation of the Minister of Transportation No. 34/Year 2011" (February 28, 2011) on calculation procedure and determination of passenger and freight transport tariff by train. Basic tariff (BT, Rp. per passenger-km) imposed on operator including PT. KAI is figured out by the following formula. Meanwhile, freight tariff is set by agreement between PT. KAI and customers.

Basic Tariff (BT) (Rp. per passenger-km)

= [(100% + Profit) × Base Cost[4]] ÷ [Load Factor[5]× Passenger Capacity × Travel Distance]

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[4] Aggregate of capital, operating costs, and expenses maintenance/repair

[5] load factor which is the proportion of passengers with a payload capacity

2.3. Justification of the Project

The objective of the Project is to help increase the coal production volume of private coal mines located around Lahat area by expanding transportation capacity which is the major factor for restricting production volume. Therefore, this type of project is usually formulated with private sector initiative. In fact, many private sector initiative projects are proposed as it can be seen in [Fig. 2-1-3] (P. 2-9), but none of them are considered to be firm. Here exists the reason why this project is proposed to be formulated in PPP scheme using ODA facility.

Firstly, due to large amount of initial investment with long term recovery period which is eminent in railway projects is mentioned, most of railway projects are initiated by public sector. Secondly, although it is peculiar in South Sumatra, the huge impact of coal industry to regional economy is mentioned. Furthermore, considering the fact that the coal industry in South Sumatra is in one of the 2 biggest production sites in Indonesia, the impact to Indonesian national economy by coal production hike is huge as well. Thirdly, since the development of regional economy in South Sumatra is tied to Palembang city, provision of cheap and stable transportation means to secure access to Palembang city will greatly contribute in reducing regional poverty, which complies to ODA principle.

The followings are the details of the justification.

2.3.1. Priority and Requirement of the Project

The result of hearing survey is as follows:

(1) South Sumatra Government

It is the first priority for South Sumatra government to develop coal mining and also rerated railway transportation is very important. All the parties concerned that the study team made hearing including BAPPEDA, PT. KAI, PT. BA, and private coal mine companies, PT. BAU expressed strong desire to expand railway transportation capacity for coal.

(2) BAPPEDA Medium Team Plan (5 Years)

Medium term 5 years (2008~2013) development plan of BAPPEDA says that the target railway coal transportation is 22MTPA for the year 2010. Although the implementation is being delayed by PT. KAI which is undertaking operating & maintenance of railway in South Sumatra due to budget allocation priority of PT. KAI and expectation to private investment, this project still secures high priority and support by South Sumatra Government.

(3) PT. KAI's Latest Transport Plan

According to the latest coal transportation plan of PT. KAI, transportation target of PT. BA's coal in the year 2014 is 20MTPA ton for Tarahan and 2.7MTPA for Kertapati respectively. In order to achieve this target, double track construction between Muaraenim and X6 is going on by PT. KAI's own financing. Moreover, PT. KAI is planning to use the land located east side of Kertapati station for stock yard for private coal mining companies and also planning to construct new railway line to Mariana (35km) as part of its long term development plan.

Further, the following information has been obtained through various hearings from PT. KAI's senior managements.

- By 2020, the total of 70MTPA capacity will be achieved in South Sumatra, namely 5MTPA (Lahat to Kertaati), 15MTPA (Lahat to Mariana), 20MTPA (Lahat to Tarahan) and 30MTPA (Lahat to Slengsen).
- Further, the total of 100MTPA capacity will be achieved in the future.

It has been determined that, instead of railway operation by SPC, SPC's participation in PT. KAI's master plan by purchasing rolling stock and conducting infrastructure development to PT. KAI under "B to B scheme" will be the most ideal and practical solution.

2.3.2. Concerns by Private Investors on the Project

This project is targeting to increase coal transportation capacity making use of existing railway line for carrying coal produced by private companies in collaboration with PT. KAI. On the other hand, there are several new railway construction projects called "Special Railway" under BOT scheme proposed by India group, China Group and Korea Group. However, those "Special Railway" projects have several problems, such as land acquisition, huge amount of project cost, buying right of PT. BA coal, and its target operation is scheduled to 5 years later (after year 2017). Since all of these plans are targeting to carry PT. BA's coal only, transportation demand of private coal mining companies is out of the scope of these "Special Railway" plan. Meanwhile, the project proposed by this study aims at expediting the double tracking project which is implemented by PT. KAI under its "Capacity Expansion Plan" and this is the earliest possible way for capacity expansion. Present proposed projects are listed in [Table 2-3-1] below and the feasibility study, project proposal and financial arrangement of these projects are undertaken by each group independently.

[Table 2-3-1] Railway Coal Transportation Plan in South Sumatra

No.	Project Company	Route	Traffic Volume	Project Cost	Scheme	Remarks
1	PT. KAI	1) Lahat - Kertapati (190km) (East Route) Double track 2) Lahat - Tarahan (390km) (South Route) Double track	1) 2.7 MTPA 2) 20 MTPA	unknown	Own Fund	Muaraenim - X6 section, Double Track (under construction)
2	Transpacific : 80% PT. BA : 10% China Railway : 10%	Lahat - Tarahan (390km) (South Route) New Line	25 MTPA	U$4,800mil	BOT 20yr	Finance: CDB/ ICBC/China EXIM Target Operation : 2017
3	Adani Group (India) : 98% South Sumatra Gov. : 2%	Lahat - Tanjung ApiApi (270km) (N-E Route)New Line + Port construction	35 MTPA	U$1,600mil	BOT 30yr	(Coal Handling) Adani/PT. BA : 60%/40%
4	Samsung C&T (Korea)	Tanjung Enim - Baai Port(120km) (West Route) New Line	25 MTPA	U$1,500mil	BOT	Mountain railway to Bengkulu

(Source: Study team)

2.3.3. Involvement in Project by Other Institutions of Relevance

(1) The Asian Development Bank (ADB)

ADB has thus far had no experience in financing to PPP scheme projects in Indonesia. As regards the involvement to the coal-related projects, the Bank has recently been in a position not to extend any loans or technical assistances (TAs) due largely to ① The World Bank is now very reluctant to any lending/TAs to coal, ② environment issues that coal would aggravate worldwide environment, and ③ policy drive to encourage shifting of energy sources from fossil to renewable energy.

(2) The World Bank (The International Bank for Reconstruction and Development)

The World Bank has since early 2000s supported PPP projects in Indonesia to the road sector (highway toll road projects). Bank support to the railroad sector was the advisory technical assistance to DGR for institutional reform in 2000, and no bank has come ever since. As regards coal-related projects, Board of the Bank has rejected all of the Bank involvement due to ① environment issues that the use of coal would inversely effect worldwide environment by CO_2 emission, and ② policy drive to encourage shifting energy sources from fossil to renewable energy. In the light of global warming and climate change issue, the Bank expressed skepticism on the Indonesian Presidential commitment of decreasing 26% of CO_2 by the year 2025.

In association with the Law 23/2007 on railway deregulation regarding decentralization of

PT. KAI to institutionally split Divisi Regional (Divre III) South Sumatra, the Bank advised that no policy discussion has recently taken place in the Government, as such the concerned issue would have been dropped off from the Government's policy agenda. Unlike other transport sectors including roads and ports, railway sector has remained slumbering in growth and profitability except in South Sumatra, thereby leading to unlikeliness of PT. KAI to split concerned profit-making region from its management.

Reflecting the Bank view of lingering inefficiency in managing sector policy and operation by MOT and PT. KAI, World Bank is soon to issue Public Expenditure Review (PER) on the Indonesian railway sector to identify policy issues of and impediments lying to sector reform. With policy commitment of the Government to fulfill conditionalities set out in PER, the railroad sector reform loan would come in place to discussion and processing by the Bank.

Following the port sector, the Bank is soon to publicize PPP tool kit (technical and financial-economic analyses model) of the railway sector on the Bank website for free of charge.

(3) International Finance Corporation, WB Group (IFC)

IFC is a member institution of the World Bank Group focusing on the private sector enhancement in developing economies by providing financing and advisory services to help creating job opportunities by local business entities, as well as mobilizing capital market in the country. IFC likewise does not get involved in coal-related projects worldwide due to environment issue.

(4) Indonesian Infrastructure Finance (PT. IIF)

Established in 2010 by the equity participation of the Government of Indonesia, the Asian Development Bank (ADB), International Finance Corporation (IFC), and DEG (Deutsche Investitions und Entwicklungsgesellschaft mbH), PT. IIF is a non-bank financial institution focusing on providing long term Indonesia Rupiah funding for infrastructure projects by the private sector. PT. IIF provides fund up to 20% of the total project cost to commercially viable private infrastructure projects through debt instruments, equity participation or infrastructure financing guarantee for credit enhancement. Shareholding scheme of PT. IIF is depicted in [Fig. 2-3-1] below[6]. No financing record has been made thus far. While coal related projects would not be rejected by PT. IIF, finance decision depends on discussions with and concurrence from shareholders including ADB/IFC.

Meanwhile, as part of institutional framework for PPP infrastructure development in the country, PT. Indonesia Infrastructure Guarantee Fund (IIGF) provides guarantee over certain investment risks to enforce PPP project financial viability to facilitate the participation of the

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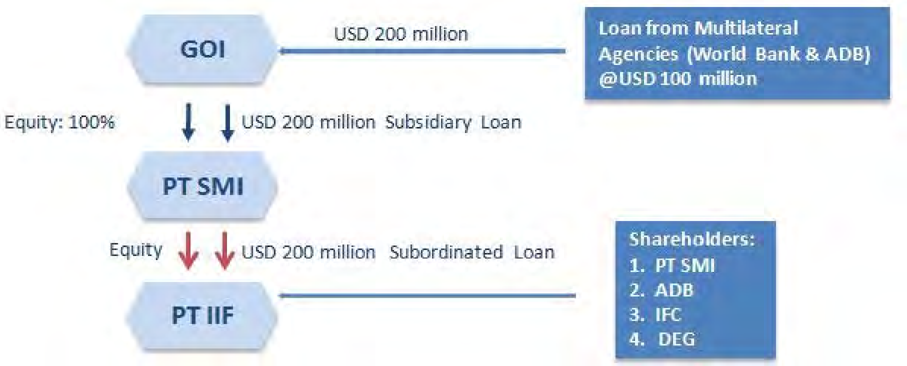
[6] Source: http://www.ptsmi.co.id/ptiif.php

private sector to infrastructure development.



(Source: Study team)

[Fig. 2-3-1] Shareholding Structure of PT. IIF

2.3.4. Consistency with Government Railway Plan and Law

(1) Consistency with Government Railway Plan and Law

In compliance with the long Term National Development Plan which mapped out the development vision for the 20 years, the Government of Indonesia officially published the Master Plan for the Acceleration and Expansion of Indonesian Economic Development (MP3EI) on May 27th 2011. This master plan is constitutes the center of long-term plan 2011 – 2025, in which it is mentioned with regard to coal production in South Sumatra region that the bottleneck in promoting coal development is the insufficient land transportation capacity because mining sites are located far away from harbor. Therefore, it is noted that railway infrastructure development is an important strategy from the point of view of transportation efficiency and global environment. In This plan, specific projects are also listed as follows.

① Railway development of Tanjung Enim - Lampung and Tanjung Enim - Kertapati
② Railway construction between Kertapati, Simpang and Tanjung Api Api.
③ Railway coal transportation between South Sumatra and Lampung.
④ Railway construction between Muaraenim and Tanjung Carat.

This project corresponds the ① above.

(2) New Railway Law

New Railway law No.23 was issued in 2007. Main purpose of the law is to allow Local Government and/or private companies to participate in railway service so that improvement of railway services is expected because PT. KAI will not be able to make monopoly of railway service under this new law.

- Under new railway law 23/2007, main role of DGR is administration of railway and approval for any railway development infrastructure which local government will conduct.
- Meanwhile, local government also has responsibility for local railway administration and requested to work with private company to minimize development cost.
- The target of this project is to expand the railway capacity of existing railway in collaboration between private company and PT. KAI in line with 5 years medium plan of South Sumatra Government (BAPPEDA). The scheme proposed by this study is completely different from "Special railway" projects which are proposed by other private groups. Involving private company for finance and technical aspect will make strong support for the implementation of the project smoothly and expeditiously.
- As mentioned in the section 2.3.2. (P. 2-13), at present several railway development projects are planned in South Sumatra with redundant manner under new Railway Law. However it is expected to be streamlined in taking lead by South Sumatra Provincial Government as the major beneficiary of coal which is the biggest local industry, in coordination with DGR, PT. KAI, PT. BA and private investors together to find out the best solution for the development of local economy.
- As mentioned in the section 2.3.1. (P. 2-12), it has been determined, through various meetings with PT. KAI's senior managements, to change the project scheme to "B to B scheme", and this has been basically acknowledged by both PT. KAI's managements as well as DGR's managements.

2.4. Necessity of PPP Scheme

Having heard from various sources, it has been confirmed that there are high demands to transport coal by railway especially from Lahat to Kertapati, and it is an urgent necessity to promptly increase the transport capacity because there are various private coal mines in this area.

In South Sumatra, there are some plans to enhance transportation capacity such as ① capacity expansion plan by PT. KAI, ② capacity expansion plan by Chinese, Indian and Korean companies. As for the plan ①, PT. KAI prioritize their another capacity expansion plan to Tarahan where there is a coal terminal owned by PT. BA. As for the plan ②, in order for them to conduct their project, firstly they have to acquire land and it is very difficult only for private company to proceed because project costs are too high. Therefore, they have much problem in starting their project.

On the other hand, this project should be considered as a project under the cooperation between public and private. Because so far almost of coals owned by private mining companies are transported by truck to Kertapati and proposed SPC will mainly transport coals owned by them. Considering the soundness and speed to cope with the situation, this study proposes to implement the Project in 3 stages to upgrade the non-electrified railway section between Lahat and Kertapati. In the 1st Stage, priority is given to quick remedy to the situation. Since Indonesian government is not in a position to improve the railway section by acquiring ODA financing for the time being, this study proposes private sector to finance for the infrastructure improvement component of the Project. However, railway projects are usually on the responsibility of public sector due to its huge initial investment cost and long investment recovery period. Therefore, it is necessary for this project to have public sector involved in order to attract private sector investment. Although, the main objective of the Project is to expand the coal transportation capacity, the Project will contribute to regional development and the involvement of public sector in the Project can be justified, thus the application of PPP scheme to the Project will be justified as well. In the 2nd and the 3rd Stages, since the cost for the infrastructure component will be even bigger than the 1st Stage, this study proposes to have public sector the greater involvement.

(1) The 1st Stage:

This scheme is to expand transportation capacity as big as possible with the existing single track. A Special Purpose Company (SPC), being established principally by private sectors, undertakes ① track rehabilitation work for Larat - Kertapati line and ② procurement of necessary rolling stock (locomotives and wagons) and loading/unloading facilities under the long term leasing contract between PT. KAI and SPC. Considering urgency and feasibility of this project, SPC will deal with urgent matter including its funding.

(2) The 2nd Stage and the 3rd Stage:

The 2nd Stage scheme is to expand transportation capacity as big as possible with the partial double track and the 3rd Stage is to achieve the coal transportation demand of 20MTPA. The SPC undertakes ① procurement of necessary rolling stock (locomotives and wagons) and ② outsourcing their operation & maintenance of rolling stocks and track to PT. KAI, while PT. KAI or DGR undertakes double-tracking works for Lahat - Kertapati line by borrowing loans from JICA in order to meet future demands.

No matter whichever the country including Indonesia, it is very difficult for only private company to construct new railway due to some problems such as land acquisition, relocation of residents, environmental matter, obtaining business licenses, etc. On the other hand, exporting coal can contribute to economic growth in Indonesia and implementing this project under the support of Indonesian and Japanese government can make the relationship between Indonesia and Japan stronger.

Chapter 3

Project Scale Formation

3.1. Demand Forecast for Target Railway Line and Section

3.1.1. Existing Condition of Land Transportation in South Sumatra Province

(1) Railway Transportation

① Freight Transportation

Result of the investigation for railway freight transportation in PT. KAI Divre Ⅲ from 2000 to 2011 are summarized here. The volume of railway freight transportation is shown in [Table 3-1-1] and [Fig. 3-1-1]. [Fig. 3-1-1] shows the volume of railway freight transportation setting 2000 number to 100%. [Fig. 3-1-2] shows the share of the volume of railway freight transportation by commodity in 2011.

The share of coal transportation of PT. BA is particularly big. The coal transportation volume from Tanjung Enim to Tarahan was 9.4MTPA and from Tanjung Enim to Kertapati was 2.1MTPA in 2011. The coal transportation volume had been stable with little fluctuation up to 2007, but it increased from 2008. Coal transportation of PT. BAU started in April 2011 and the coal transportation volume from Sukacinta to Kertapati was 0.146MTPA.

And the transportation volume of fuel oil, pulp and clinker in 2011 was 0.492MTPA, 0.394MTPA and 0.344MTPA respectively. The fuel oil transportation volume was stable with little fluctuation and increased about 8% compared with 2000. Although the transportation volume of pulp and clinker had a big fluctuation, it increased about 20% compared with 2000. Cement and fertilizer were transported by regular trains in the past, but fertilizer transportation ended in 2008 and cement transportation ended in 2010.

The share of railway freight transportation by commodity is shown in [Fig. 3-1-2]. The share of the volume of coal transportation is 90% in the volume of all railway freight transportations, and particularly the coal transportation is high with the share of 72% for the section between Tanjung Enim - Tarahan. The share of fuel oil, pulp and clinker transportation is 3 - 4%.

The railway service section and frequency of freight trains are shown in [Table 3-1-2].

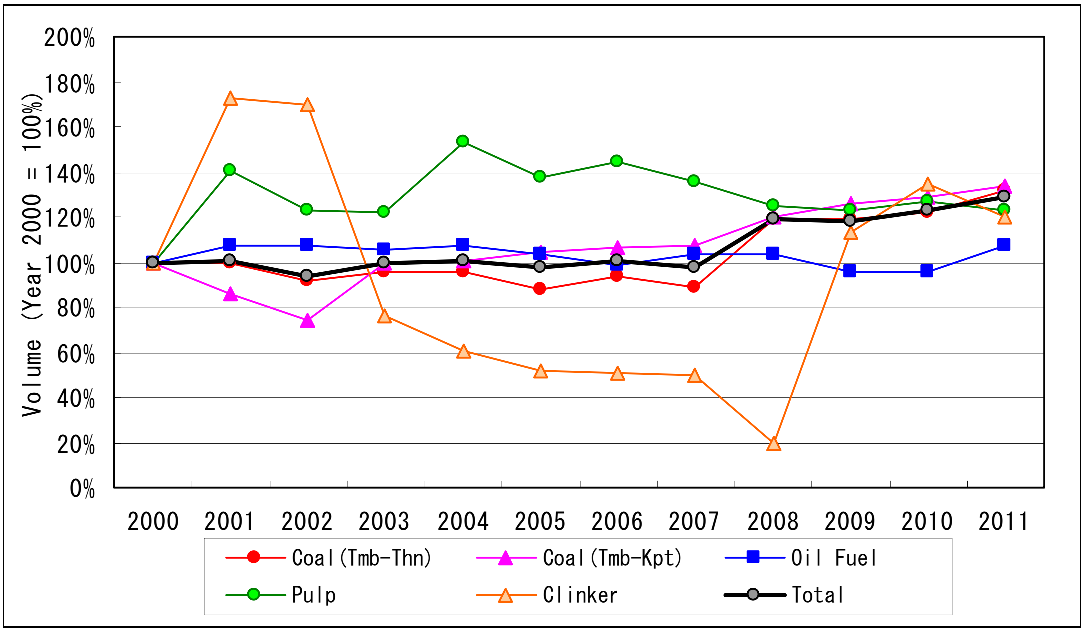
[Table 3-1-1] Railway Freight Transportation Volume

(Unit: ton/year)

Year	Commodity										Total
	Coal (PT. BA)			Coal (PT. BAU)	Fuel Oil	Pulp	Clinker	Cement	Fertilizer	Others	
	Tmb-Thn	Tmb-Kpt	Tmb-Tjh								
2000	7,116,100	1,580,189	26,610	-	457,130	321,298	286,240	28,820	0	213,789	10,030,176
2001	7,068,750	1,359,238	71,640	-	489,544	450,779	493,740	24,780	0	130,889	10,089,360
2002	6,539,600	1,168,650	105,660	-	491,994	396,341	486,593	18,310	0	171,840	9,378,988
2003	6,788,850	1,579,500	112,020	-	483,649	391,669	217,051	296,790	2,244	130,724	10,002,497
2004	6,806,350	1,593,062	123,411	-	491,729	491,504	173,833	287,197	9,408	125,431	10,101,925
2005	6,263,050	1,653,901	138,085	-	472,350	442,618	148,139	311,316	9,574	328,443	9,767,476
2006	6,690,650	1,684,140	139,080	-	451,147	462,791	146,190	322,750	13,753	181,277	10,091,778
2007	6,322,400	1,695,690	136,330	-	473,813	437,099	142,710	311,910	15,140	235,184	9,770,276
2008	8,480,300	1,897,490	125,850	-	472,089	402,185	56,580	255,240	4,650	274,819	11,969,203
2009	8,477,600	1,995,085	119,470	-	438,903	394,550	323,490	9,420	0	71,797	11,830,315
2010	8,712,100	2,041,190	112,735	-	437,800	406,311	386,120	8,970	0	259,741	12,364,967
2011	9,368,000	2,108,710	87,810	145,934	492,447	393,889	343,860	0	0	8,055	12,948,705

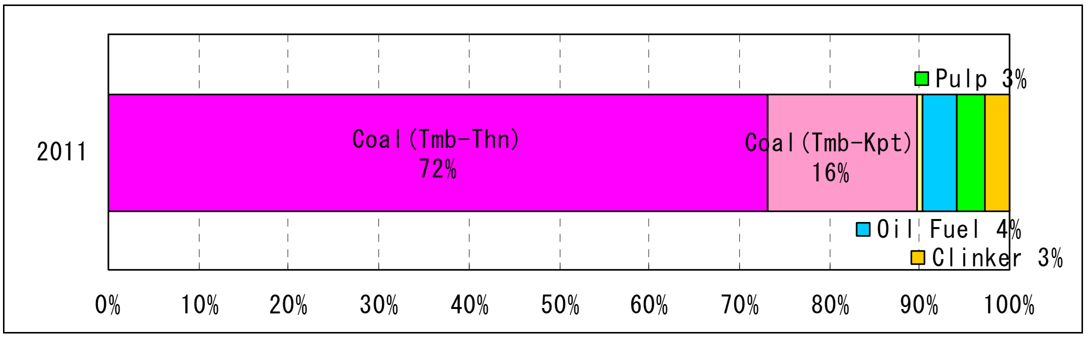
Note: Tmb - Tanjung Enim, Thn - Tarahan, Kpt - Kertapati, Tjh - Tigagajah

(Source: PT. KAI Divre Ⅲ)



(Source: PT. KAI Divre Ⅲ)

[Fig. 3-1-1] Railway Freight Transportation Volume (Year 2000 = 100%)



(Source: PT. KAI Divre Ⅲ)

[Fig. 3-1-2] Railway Freight Transportation Distribution by Commodity (Year 2010)

Regular trains have been operated for cement, fertilizer and mixed commodities in addition to present commodities, but the trains went out of service in 2008. Presently, freight train service provided by PT. KAI have limited transportation commodities based on the annual contract and a new coal transportation of PT. BAU started in April 2011.

Coal transportation train frequency is particularly high. In 2011, the number of PT. BA's coal transportation trains was 36trains/day for one way to Tarahan, 16 to Kertapati and 2 to Tigagajah. The number of PT. BAU's coal transportation trains was 12trains/day for one way to Kertapati. The total number was 66. The number of coal transportation trains in 2011 increased by 6trains

/day for one way to Tarahan and by 12 to Kertapati compared with 2010. The all coal transportation trains aren’t operated every day.

All coal transportation trains run through between Muaraenim and Prabumulih X6 and many coal transportation trains run through between Prabumulih X6 and Kertapati. So the total number of trains between Muaraenim and Kertapati is over line capacity in 2011.

[Table 3-1-2] Operation Section and Frequency of Freight Trains

Commodity	Section		Distance (km)	Conditions of Contract	Train Frequency[1] (one-way/day)						Remark
					2002	2004	2006	2008	2010	2011	
Coal - PT. BA	Tanjung Enim (Tmb)	Tarahan (Thn)	403.2	Negotiation	22	22	24	28	30	36	
	Tanjung Enim (Tmb)	Kertapati (Kpt)	159.0		14	12	14	16	16	16	
	Tanjung Enim (Tmb)	Tigagajah (Tjh)	169.4		2	2	2	2	2	2	
Coal - PT. BAU	Sukacinta (Sct)	Kertapati (Kpt)	179.3	Negotiation	-	-	-	-	-	12	Operation strart in Apr. 2011
Oil Fuel - PT.Pertamina	Kertapati (Kpt)	Lubuklinggau (Llg)	305.2	Negotiation	2	2	2	4	4	4	
	Kertapati (Kpt)	Lahat (Lt)	189.9		2	2	2	0	0	0	
	Kertapati (Kpt)	Tigagajah (Tjh)	170.1		2	2	2	2	2	2	
Pulp - PT. TEL	Niru (Nru)	Tarahan (Thn)	344.1	Negotiation	2	2	2	2	2	2	
Clinker - PT. SB	Tigagajah (Tjh)	Kertapati (Kpt)	170.1	Negotiation	4	6	4	2	4	4	
	Tigagajah (Tjh)	Pidada (Pid)	228.0		2	2	2	2	0	0	Operation end in Nov. 2008
Cement - PT.SB	Tigagajah (Tjh)	Pidada (Pid)	228.0	Negotiation[2]	2	2	2	2	0	0	Operation end in Nov. 2008
Fertilizer	Kertapati (Kpt)	Pidada (Pid)	398.1	Negotiation	2	2	2	2	0	0	Operation end in Nov. 2008
	Kertapati (Kpt)	Lubuklinggau (Llg)	305.2		2	2	2	2	0	0	
Mixed Freight Train	Kertapati (Kpt)	Pidada (Pid)	398.1	Non negotiation	2	2	2	2	0	0	Operation end in Nov. 2008
	Kertapati (Kpt)	Lubuklinggau (Llg)	305.2		2	2	2	2	0	0	
Sugar	Bekri (Bki)	Kertapati (Kpt)	346.0								
	Bekri (Bki)	Lubuklinggau (Llg)	491.4								
Casaba Powder	Bekri (Bki)	Kertapati (Kpt)	346.0								
Silica Sand	Panjang (Pjn)	Tigagajah (Tjh)	229.2								
Rubber	Lubuklinggau (Llg)	Kertapati (Kpt)	305.2								
	Tebingtinggi (Ti)	Kertapati (Kpt)	256.4								
Hulled Rice	Kertapati (Kpt)	Pidada (Pid)	397.7								
	Kertapati (Kpt)	Lubuklinggau (Llg)	302.6								
Freight by Passenger Train	Kertapati (Kpt)	Tanjung Karang (Tnk)	387.9	Non negotiation	2	2	2	2	0	0	Operation end in Dec. 2009
	Kertapati (Kpt)	Lubuklinggau (Llg)	305.2		2	2	2	2	0	0	

Note: 1) Refer to GAPEKA for train frequency. GAPEKA is the train operation timetable of PT. KAI.

2) Cement is a non negotiation commodity from Dec. 2008.

(Source: PT.KAI Divre Ⅲ)

② Passenger Transportation

Result of the investigation for railway passenger transportation in PT. KAI Divre Ⅲ from 2000 to 2011 are summarized here. The volume of railway passenger transportation is shown in [Table 3-1-3] and [Fig. 3-1-3]. [Fig. 3-1-3] shows the volume of railway passenger transportation setting 2000 number to be 100%. The percentage distribution of the volume of railway passenger transportation by class in 2011 is shown in [Fig. 3-1-4].

The total volume of railway passenger transportation was decreasing till 2004, but the total volume was increasing from 2005. The volume of railway passenger transportation was 2.0MPPA (million passenger per annum) in 2011.

Regarding the volume of railway passenger transportation by class, the volume of executive class had been showing a little change till 2008, but it increased again after the volume decreased in 2009. The volume of executive class in 2011 decreased about 10% compared with 2000 and the volume was 0.13MPPA. After the volume of business class decreased about 50% from 2001 to 2003, the volume is slightly decreasing. The volume of business class in 2011 decreased about 53% compared with 2000 and the volume was 0.391MPPA. The volume of economy class had been changing a little till 2005, but the volume was increasing from 2006. The volume of economy class in 2011 increased about 88% compared with 2000 and it was 1.03MPPA. The volume of local economy class operated from 2008 is continuing increasing. The volume of local economy class in 2011 increased more than twice compared with 2008 and it was 0.458MPPA.

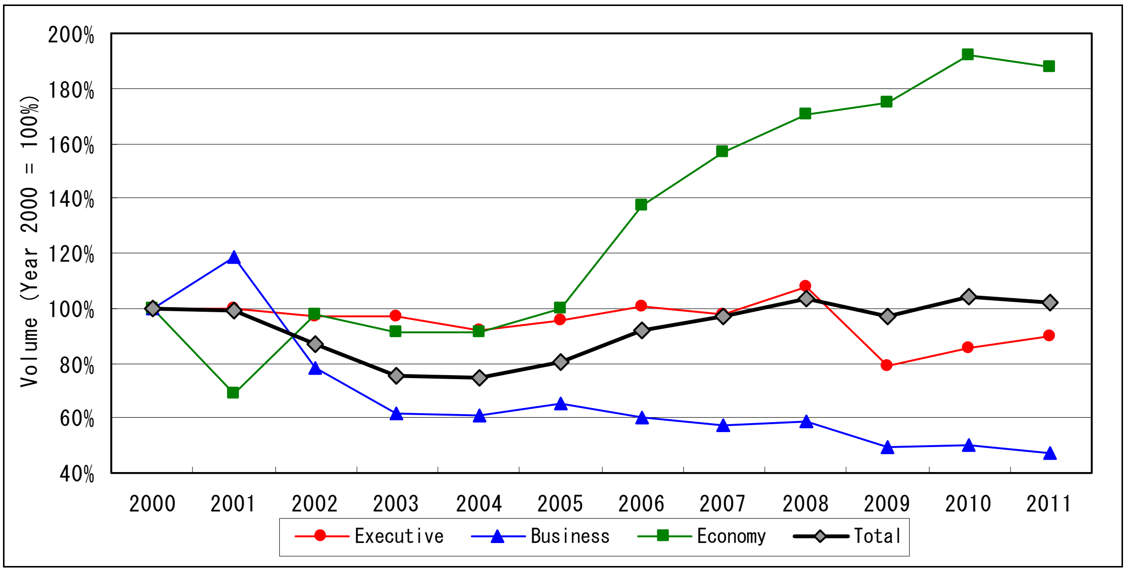
The percentage distribution of the volume of railway passenger transportation by class in 2011 is shown in [Fig. 3-1-4]. In 2011, the volume of executive, business, economy and local economy class occupied 6%, 19%, 51% and 23% respectively. The volume of economy class occupies more than half of the volume of railway passenger transportation in 2011.

[Table 3-1-3] Railway Passenger Transportation Volume

(Unit: passenger/year)

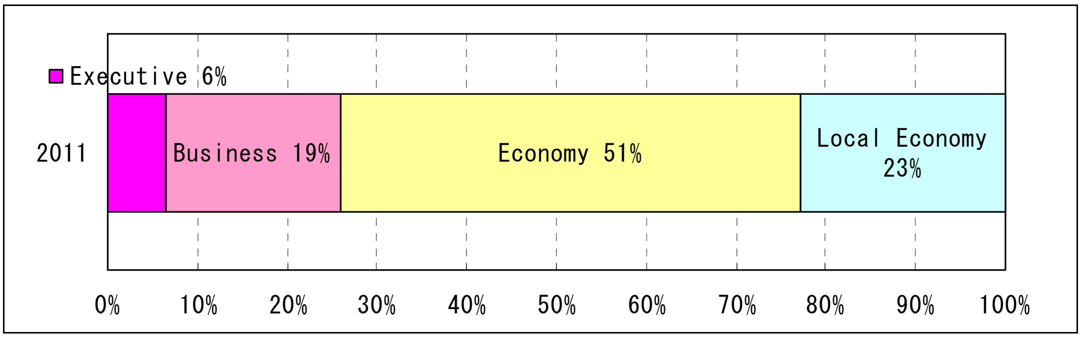
Year	Class				
	Executive	Business	Economy	Local Economy	Total
2000	144,411	831,006	549,271	—	1,524,688
2001	143,647	987,106	379,367	—	1,510,120
2002	140,371	650,638	535,755	—	1,326,764
2003	139,672	509,164	500,742	—	1,149,578
2004	132,712	507,277	500,542	—	1,140,531
2005	137,695	542,231	549,203	—	1,229,129
2006	144,811	501,826	752,199	—	1,398,836
2007	141,054	474,795	859,154	—	1,475,003
2008	156,081	489,840	934,428	221,784	1,802,133
2009	113,614	407,447	960,743	262,434	1,744,238
2010	123,131	414,825	1,055,258	346,764	1,939,978
2001	129,581	390,849	1,032,907	457,639	2,010,976

(Source: PT. KAI Divre Ⅲ)



(Source: PT. KAI Divre Ⅲ)

[Fig. 3-1-3] Railway Passenger Transportation Volume (Year 2000 = 100%)



(Source: PT. KAI Divre Ⅲ)

[Fig. 3-1-4] Railway Passenger Transportation Distribution by Class in 2011

The operation section and frequency of passenger trains are shown in [Table 3-1-4]. And the average occupancy of passenger trains by class from 2008 to 2011 is shown in [Table 3-1-5].

The operation sections of passenger trains are mainly Kertapati - Tanjungkarang and Kertapati - Lubuklinggau. There is an overnight train of executive and business classes and a daytime train of economy class operates and the each of the trains operates 1 both-way/day and a total of 2 both-way/day. In addition, the number of local economy class trains which started service in 2008 operates 2 both-way/day in the suburbs for each of Tanjung Karang and Kertapati.

The number of executive, business and economy class trains has not changed in the past 10 years. But the number of local economy class trains decreased 1 both-way/day and increased 2 both-way/day in the suburbs for each of Tanjung Karang and Kertapati. The reasons for the changelessness of the number of passenger trains except local economy class trains are that increasing the number of trains is very difficult, because there are many trains for coal transportation and there isn’t margin in line capacity between Muaraenim and Kertapati.

The average occupancy rate of passenger trains is high, and it is particularly high in the economy class trains. The average occupancy rate of passenger trains by class in 2011 is 75 - 85% in executive class, 70 - 80% in business class and over 100% in economy class. In particular, the average occupancy rate of economy class trains between Kertapati and Tanjung Karang is very high (157% in 2011).

[Table 3-1-4] Operation Section and Frequency of Passenger Trains

Train Name	Class	Train Formation 2010	Section		Distance (km)	Train Frequency* (oneway/day)						Remark
						2002	2004	2006	2008	2010	2011	
Sriwijaya	Executive & Business	2K1-4K2-1KM2	Kertapati (Kpt)	Tanjung Karang (Tnk)	387.9	2	2	2	2	2	2	Overnight Train
Sindang Marga	Executive & Business	2K1-4K2-1BP	Kertapati (Kpt)	Lubuklinggau (Llg)	305.2	2	2	2	2	2	2	Overnight Train
Raja Basa	Economy	6K3-1KP3	Kertapati (Kpt)	Tanjung Karang (Tnk)	387.9	2	2	2	2	2	2	
Bukit Sarelo	Economy	5K3-1KM3	Kertapati (Kpt)	Lubuklinggau (Llg)	305.2	2	2	2	2	2	2	
Elok	Local Economy	-	Batraja (Bta)	Kotabumi (Kb)	130.3	2	2	2	2	0	0	Operation end in Nov. 2008
Ruwahuuran	Local Economy	2KD3	Kotabumi (Kb)	Tanjung Karang (Tnk)	85.4	-	-	-	4	4	4	
Seruni	Local Economy	2KD3	Kertapati (Kpt)	Indralaya (Idr)	25.6	-	-	-	4	4	4	

Note: * Refer to GAPEKA for train frequency. GAPEKA is the timetable of PT. KAI.

(Source: PT. KAI Divre Ⅲ)

[Table 3-1-5] Average Occupancy of Passenger Trains by Classes (2008 – 2011)

Train Name	Section		Distance (km)	Class	Occupancy Rate				Remark
					2008	2009	2010	2011	
Sriwijaya	Kertapati (Kpt)	Tanjung Karang (Tnk)	387.9	Executive	103%	66%	85%	85%	Overnight Train
				Business	95%	86%	90%	78%	
Sindang Marga	Kertapati (Kpt)	Lubuklinggau (Llg)	305.2	Executive	101%	36%	69%	76%	Overnight Train
				Business	101%	90%	89%	69%	
Raja Basa	Kertapati (Kpt)	Tanjung Karang (Tnk)	387.9	Economy	144%	112%	138%	157%	
Bukit Sarelo	Kertapati (Kpt)	Lubuklinggau (Llg)	305.2	Economy	111%	109%	108%	112%	
Ruwahuuran	Kotabumi (Kb)	Tanjung Karang (Tnk)	85.4	Local Economy	139%	65%	77%	101%	
Seruni	Kertapati (Kpt)	Indralaya (Idr)	25.6	Local Economy	42%	18%	14%	20%	

(Source: PT. KAI Divre Ⅲ)

The average occupancy of the economy class trains is in high level. The congestion situation of economy class train at Kertapati station was surveyed by study team. The result of survey is shown in [Pic. 3-1-1].

<table>
<tr><td>
In the outside of the ticket counters (There were some passengers unable to buy a ticket.)</td><td>
On the platfom with an economy class train (Kiosks were located on the platform.)</td></tr>
<tr><td>
On the platfom with an economy class train (Many passengers seeking shade can be seen.)</td><td>
In the coach of economy class train to Lubuklinggau</td></tr>
</table>

Note: Above pictures were taken at Kertapati Station in November 2011.

(Source: Study team)

[Pic. 3-1-1] Congestion of Economy Class Train to Lubuklinggau

The train surveyed was the economy class train from Kertapati (9:20) to Lubuklinggau. In the outside of the ticket counters, some passengers unable to buy tickets were observed because the economy ticket was sold out. Many passengers beating the heat were waiting for departure of the economy class train on the platform and most of the seats are occpied in the coach of the economy class train. The congestion of passenger train was confirmed by looking at only 1 economy class train chosen as a sample.

One of the factors which causes the economy class trains to be overcrowded is that the economy class fare is politically capped at low price, thus railway is considered to be one of the most important transportation means to secure access to the cities for the low income population.

As mentioned above, it was confirmed that the economy class trains are functioning as the most popular transportation in the daily life. Therefore, if the line capacity between Lahat - Kertapati is increased by the implementation of the Project which will contribute to increase the number of passenger train, it is assumed that passenger train demand will be increased as well.

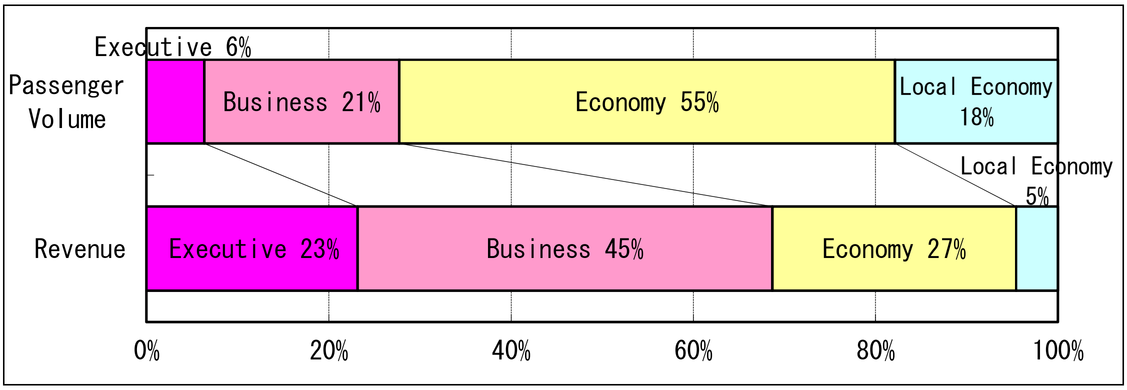
According to the data of passenger volume and revenue distribution by class in 2010, passenger volume of economy and local economy class contributes 73% of the total passenger volume. However, revenue from these two classes only contributes 33% of total revenue as shown in [Table 3-1-6] and [Fig. 3-1-5]. The reason of this condition is government control the fare of economy class to be affordable. Consequently, increasing of economy class passenger volume will not significantly contribute the revenue.

As mentioned above, it was confirmed that the economy class trains are functioning as the most popular transportation in the daily life. Therefore, if the line capacity between Lahat - Kertapati is increased by the implementation of the Project, which will contribute to increase the number of passenger train, it is assumed that passenger train demand will be increased as well. As aforementioned, increasing of economy class passenger will not significantly contribute the revenue, however, will contribute the society as a whole.

[Table 3-1-6] Comparison of Passenger Volume and Revenue Distribution by Class in 2011

Class	Passenger Volume Distribution (A)	Revenue Distribution (B)	Difference (= B - A)
Executive	6%	23%	+17%
Business	21%	45%	+24%
Economy	55%	27%	-28%
Local Economy	18%	5%	-13%

(Source: Study team)



(Source: Study team)

[Fig. 3-1-5] Comparison of Passenger Volume and Revenue Distribution by Class in 2011

(2) Road Transportation

① Road Network

The length of roads by class in South Sumatra province is shown in [Table 3-1-7] and the road network of South Sumatra province in 2010 is shown in [Fig. 3-1-6].

In 2010, the road length by administration is 1,444km for national, 1,748km for province and 13,443km for regency. Regarding the percentage distribution of the roads length by level of government authority in 2010, the national road is 9%, the provincial road is 11% and the regency road is 80%.

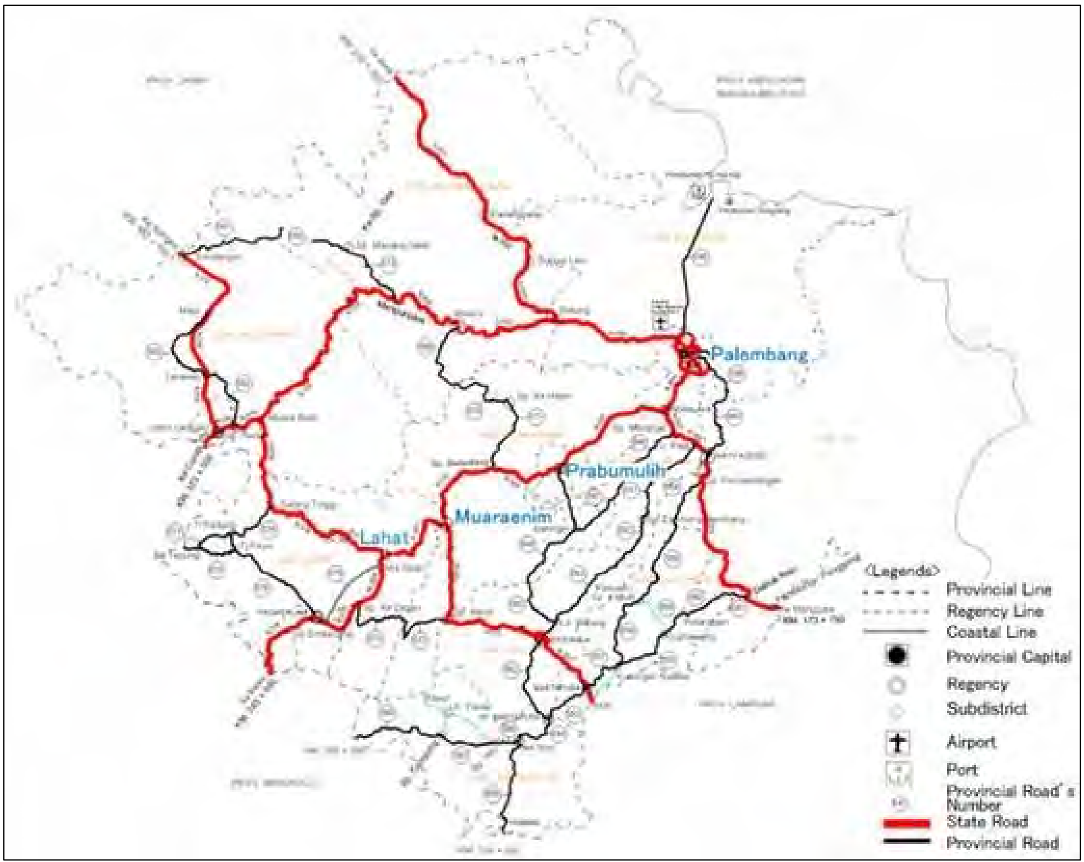
In South Sumatra, national road consists of 2 routes which connect Lampung province and Jambi province to north and south and 2 routes which connect the 2 national roads in the direction of east and west. And the national roads make the main frame of road network of South Sumatra province. The provincial roads spread in the southern part and the western part of South Sumatra province in the form where provincial roads complement national roads. Lahat and Muaraenim where many private coal mining companies are located and Palembang where river ports for coal transshipment by barge are located, are connected by national road.

[Table 3-1-7] Road Network of South Sumatra Province by Class

(Unit: km)

Year	State	Provincial	Regency	Total
2004	1,290	1,621	9,981	12,892
2005	1,290	1,621	11,269	14,180
2006	1,290	1,621	10,485	13,396
2007	1,290	1,621	11,153	14,064
2008	1,290	1,621	12,141	15,052
2009	1,444	1,748	13,215	16,407
2010	1,444	1,748	13,443	16,635

(Source: Statistical Yearbook of Indonesia 2005-2011, BPS)



(Source: Public Work Service of South Sumatra Province)

[Fig. 3-1-6] Roads Network of South Sumatra Province in 2010

The length of roads by surface condition in South Sumatra province in 2009 is shown in [Table 3-1-8]. Regarding the percentage of the length of roads in good condition by class in 2009, the national road is 64%, the provincial road is 28% and the regency road is 63%. In particular the condition of the provincial roads is as bad as 72% of the provincial is damaged. Also 36 - 37% of the national roads and the regency roads are damaged. While the increase of the road traffic volume is expected, it can be pointed out that the maintenance and management of the roads is a subject.

[Table 3-1-8] Length of Roads by Type of Surface in South Sumatra Province in 2009

(Unit: km)

Type of Condition	State		Provincial		Regency		Total	
	Length(km)	Rate(%)	Length(km)	Rate(%)	Length(km)	Rate(%)	Length(km)	Rate(%)
Good	827.1	63.7	495.4	28.3	9,514.4	62.6	10,836.9	59.4
Medium	424.8	32.7	608.3	34.8	-	-	1,033.1	5.7
Slightly Damaged	46.3	3.6	498.0	28.5	3,900.1	25.6	4,444.4	24.3
Heavy Damaged	-	-	146.8	8.4	1,788.0	11.8	1,934.8	10.6
Total	1,298.2	100.0	1,748.5	100.0	15,202.5	100.0	18,249.2	100.0

(Source: Mid-term Development Plan for South Sumatra Province 2008-2013, BAPPEDA)

For the private coal mining companies to transport the coal from Lahat to Palembang via Muaraenim by truck, there are only 2 routes; one is the national road which connects Muaraenim and Palembang and another is the provincial roads which divert from Belimbing or Prabumulih. So since the many coal transportation trucks concentrate to the section between Lahat and Belimbing, coal truck traffic at this section is huge, thus the following problems are pointed out in the coal truck transportation (refer to [Pic. 3-1-2]). Therefore, the coal transportation trucks are restricted to use the road between 17:00 and 8:00 of the next day with the weight of less than 10ton/truck.

- The damage of the road is getting worse due to the insufficient road maintenance.
- Since the running speed of the coal trucks is slow, other vehicle transports are blocked by the trucks.
- Environmental problems are getting eminent such as dispersal of coal particles, noise, vibration, etc.

(Source: Study team)

[Pic. 3-1-2] Coal Transportation Trucks (November 2011)

② Road Traffic Volume

Since the road traffic statistics in South Sumatra is not available, the coal truck traffic volume for coal mining companies is estimated in the following way. The number will be evaluated by comparing with truck traffic capacity estimated based on 3.1.3. (1) ② (P. 3-22).

Coal transportation volume by traffic mode in 2010 is shown in [Table 3-1-9]. Since the company using rail for coal transportation is PT. BA alone by the year 2010, other companies are assumed to have been using truck.

[Table 3-1-9] Coal Transportation Volume by Traffic Mode (2010)

Traffic Mode	Volume	Estimation Basis
South Sumatra Total (A)	15.300MTPA	Production volume (South Sumatra State Statistics 2011)
By Rail for PT. BA (B)	10.866MTPA	PT. KAI South Sumatra Divre
By Truck for Private Coal Mining Companies (C)	4.434MTPA	The difference between the above. (A-B)

(Source: Study team)

The coal transportation volume by truck is estimated to be 4.434MTPA which is equivalent to 1,417trucks/day as calculated in the formula shown below.

Estimate of the number of truck (2010)
Truck number = 4.434MTPA÷10ton/truck÷313days/year = 1,417truck/day Here, ● 10ton/truck : Maximum loading capacity for one truck by regulation ● 313days/year : Working days a year taken from PT. KAI's record

The number of truck for coal transportation in 2010 is estimated to be 4.434MTPA. It signifies that the coal transportation truck traffic volume is far exceeding the truck traffic capacity of the road as big as more than double of the capacity.

- The accessible road from Lahat and Muala Enim area where private coal mines are located, to Palembang for coal transportation is only one national road with single lane for each direction.
- The working time for a coal transportation truck is assumed to be 7hours a day considering that passable time frame for the trucks is between 17:00 of a day and 8:00 of the next day and travel time of about 8hours for a truck between coal mines and coal storage yard for barge forwarding (refer 3.1.3. (1) ② (P. 3-22)). Therefore, the number of truck in an hour is assumed to be about 202 (=1,417trucks÷7hours).
- Traffic volume of truck in national road (single lane) near coal mines is assumed to be 100trucks/hour/lane (refer 3.1.3. (1) ② (P. 3-22)).
- Therefore, the number of coal transportation truck in 2010 of 202truck/hour is bigger than capacity of 100truck/hour/lane.

③ Number of Registered Motor Vehicles

The number of registered motor vehicles by type in South Sumatra province from 2000 to 2011 is shown in [Table 3-1-10] and [Fig. 3-1-7]. [Fig. 3-1-7] shows the number of registered motor vehicles by type setting 2000 number to be 100%.

Regarding the number of registered motor vehicles by type of motor vehicles in South Sumatra province in 2011, the passenger car is 383thousand units, the bus is 72thousand units, the truck is 107thousand units and the motorcycle is 2.68million units. The number of passenger car, bus, truck and motorcycle occupies 12%, 2%, 3% and 83% respectively.

The growth rate of the number of passenger cars and buses became high from around 2004 and the number of passenger cars and buses increased by about 6 times compared with 2000. The number of motorcycles increased rapidly from around 2007 and increased by about 8.5 times compared with 2000. The growth rate of the number of trucks is lower than the growth rate of other vehicle types and the number of trucks increased by about 1.6 times compared with 2000. Considering the increase of the number of registered motor vehicles by type of motor vehicles, it is expected that the growth rate of the volume of passenger transportation by roads is much higher than the growth rate of the volume of freight transportation by roads.

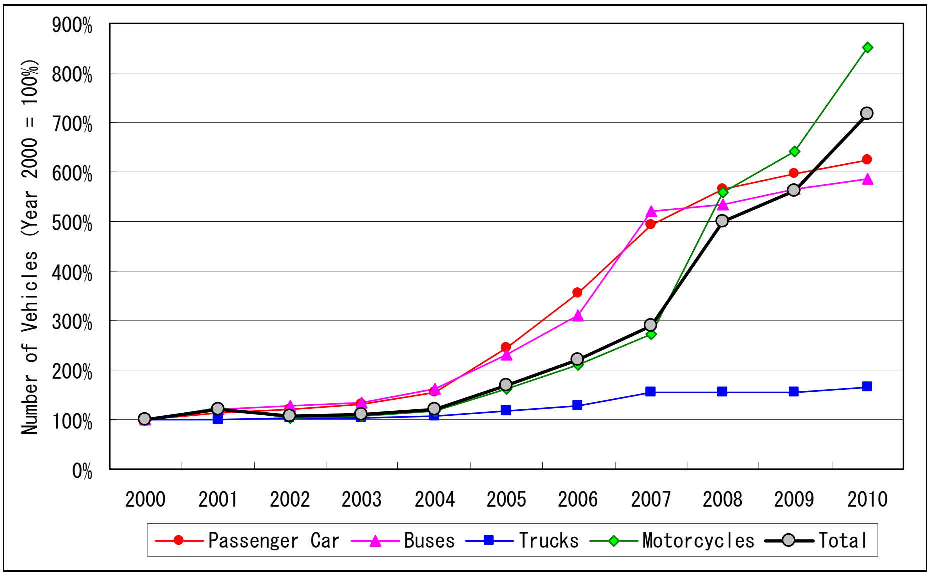
[Table 3-1-10] Number of Registered Motor Vehicles by Type in South Sumatra Province

(Unit: unit)

Year	Passenger Car	Bus	Truck	Motorcycle	Total
2000	61,409	12,283	64,830	313,996	452,518
2001	69,515	14,616	65,519	392,755	542,405
2002	73,913	15,589	66,644	325,757	481,903
2003	79,721	16,627	67,788	334,395	498,531
2004	94,866	19,747	69,120	364,998	548,731
2005	150,733	28,477	76,599	508,150	763,959
2006	218,782	38,223	83,312	663,154	1,003,471
2007	301,955	63,891	99,861	850,639	1,316,346
2008	346,968	65,611	100,033	1,757,324	2,269,936
2009	365,540	69,407	100,722	2,013,404	2,549,073
2010*	383,175	72,077	107,245	2,676,318	3,238,815

Note) *: Preliminary figures

(Source: Statistical Yearbook of Indonesia 2000-2011, BPS)



(Source: Statistical Yearbook of Indonesia 2000-2011, BPS)

[Fig. 3-1-7] The Number of Registered Motor Vehicles by Type in South Sumatra Province (Year 2000 = 100%)

3.1.2. Target and Methodology of Demand Forecast

The targets of demand forecast of this study are (1) Coal of private companies, (2) Coal of PT. BA, (3) Other freights than coal, and (4) Passengers. The methodologies of demand forecast are as explained below.

(1) Coal of Private Mining Companies

Since origins and destinations (hereinafter referred to as “OD”) of bulk cargo like coal are limited, in many cases, cargos volume by transportation mode is calculated from production plan of cargo owners. Future demand of coal transportation of private mining companies in South Sumatra province is assumed by the same method, however, capacity of existing railway and road shall be considered.

Coal transportation volume allocation to other private companies by railway is not enough because coal transportation of PT. BA is prioritized. As a result, PT. KAI only handles coal transportation of PT. BAU and no space to transport coal from others private mining companies.

In road transportation, passable time of the coal trucks is restricted to from 17:00 to 8:00 and loading capacity is restricted to 10tons/truck, due to the environmental problems as described in 3.1.1. (2) (P. 3-12). Therefore, transportation capacity of coal by truck will be limited in the near future.

Considering the contents of the various development plans by central and provincial government and also environmental problems of coal transportation by truck, expectation to increase transportation capacity of railway is very high, and also demand of coal transportation by railway will increase. Then, the future demand of coal transportation by railway and road is assumed as follows.

Railway: Demand of coal transportation is predicted based on observation of transportation demand in Lahat and Muaraenim area. Considering that coal transportation by railway will be prioritized, increasing of transportation capacity by this Project also will increases transportation demands. In case of transportation demand exceeds the transportation capacity of railway, the extra demand will be transferred to the road transport.

Road: Transportation capacity by truck is calculated based on road capacity. Road capacity per hour such as in Japan will be adopted to calculate road capacity. In calculation of road capacity, restriction of passable time in a part of South Sumatra Province is considered, and then loading capacity per truck will be multiplied with annual operation days.

(2) Coal of PT. BA

Since total production of coal by PT. BA is transported by railway based on yearly contract with PT. KAI, production plan of PT. BA is directly become transportation volume. Thus, volume of demand transportation in the future is observed by hearing survey with PT. KAI.

Specifically for transportation volume to Tarahan, specifics and working schedule of double tracking project between Tanjung Enim and Prabumulih X6 undertaken by PT.KAI and PT.BA will be taken into consideration. Projected transportation volume after the double tracking work is assumed to be the future transportation volume. In addition, for the transportation volume to Kertapati, existing transportation volume and planned improvement projects will be taken into consideration to calculate future transportation volume.

(3) Freights Other than Coal

As describe in 3.1.1. (P. 3-1), allocation for freight other than coal is limited because coal transportation in South Sumatra occupies 90% of railway freight. In addition, transportation volumes of other freights are narrowed down to yearly contract because strong influence from coal owners.

Existing transportation volume and future production plan or transportation plan of freights other than coal are estimated by hearing survey to PT. KAI. In addition, if the line capacity is increased by the implementation of transportation project and the line capacity has a margin to accommodate the projected coal transportation volume, the additional freight transportation volume is estimated based on the survey on the transportation demand of potential clients for other commodities.

(4) Passenger Transportation

Demand of passenger transportation forecast is normally conducted by establishing demand forecast model based on population growth, ownership ratio of car and motorcycle etc. However, in this study, although the OD survey data on passenger transportation volume is available, it is difficult to establish the demand forecast model with the following reasons.

The first reason is the difficulty of explaining modal choice of road and railway by service level (required time, cost, etc.), thus it is difficult to establish a reliable transportation choice model. Although the fare of railway is politically set in low price, number and volume of passenger trains is limited because coal transportation is prioritized, which means that passengers are not able to choose the rail no matter how cheap the fare. In addition, since the train frequency is limited and travel time by rail is not flexible, it is hard to assume that passengers are choosing the rail by travel time advantage.

The second reason is skepticism on the reliability of OD survey data. OD survey is conducted for all transportation modes in Indonesia every 5 years, and OD survey data in 2001 and 2006 were obtained in this study. Comparison of the 2 data on total transportation volume in South Sumatra province shows that the transportation volume in 2006 is smaller than that of 2001 by about 60%, while the number of registered motor vehicles, population and GRDP increased during the same period. This is a very unusual phenomenon therefore reliability of the OD survey data is dubious.

The third reason is the unavailability of passenger number of bus transportation which is one of the sources of modal shift to railway. Consequently, establishment of demand forecast model missing the bus transportation component has low accuracy.

According to the above reasons, transportation demand forecast is made by the hearing to PT. KAI, confirming the possibility of passenger train number increase when the line capacity was increased, and conducting regression analysis based on population growth and socio-economic variables.

3.1.3. Demand Forecast of Coal Transportation

(1) Coal of Private Mining Companies

① Market Demand

There are 17 companies in Lahat area which already started exploration, and those companies are shown in [Table 3-1-11]. According to the survey, the number of companies expecting to transport the coal by rail in 2014 is 2, namely PT. Bara Alam Utama (4MTPA) and PT. Batubara Lahat (1MTPA).

[Table 3-1-11] Private Coal Company in Lahat Area

No.	Company Name	Gov. Approval Date	Mining Area (ha)
1	PT. BANIASARI PRIBUMI	10/MAR/2010	519.84
2	PT. Baniasari Pribumi	29/APR/2010	799.60
3	PT. Bara Alam Utama	23/MAR/2010	500.00
4	PT. Batubara Lahat	29/APR/2010	1,524.00
5	PT. Budi Gema Gempita	27/APR/2010	1,881.00
6	PT. Bumi Merapi Energi	29/APR/2010	971.00
7	PT. Dizamatra Powerindo	27/APR/2010	357.00
8	PT. Duta Alam Sumatera	10/MAR/2010	1,913.00
9	PT. Golden Great Boreno	27/APR/2010	1,745.00
10	PT. Muara Alam Seiahtera	29/APR/2010	2,000.00
11	PT. Mustika Indah Permai	29/APR/2010	1,000.00
12	PT. Priamanaya Energi	01/NOV/2010	687.00
13	PT. Aman Toebillah Batubara	14/MAY/2010	150.00
14	PT. Andalas Bara Seiahtera	21/MAY/2010	500.00
15	PT. Bukit Telunuuk	02/JUN/2010	1,011.00
16	PT. Dianrana Petrojasa	02/JUN/2010	994.60
17	PT. Dianrana Petrojasa	03/JUN/2010	730.00

(Source: MEMR)

Meanwhile, among coal mining companies in Muara Enim area, the following companies are expecting railway coal transportation:

- Reliance Group (3 coal mining companies in Muaraenim)
  - PT. Brayan Bintang Tiga Energi (12,960ha)
  - PT. Sriwuaya Bintang Tiga Energi (10,600ha)
  - PT. Sugico Pendragon Energi (13,060ha)
- PT. Pendopo Energi Batubara
- PT. Prima Mulia Sarana Seiathera (513ha)

The total future demand from private coal mines in 2014 if the ones which are presently using track is assumed to be 12.2MTPA as shown in [Table 3-1-12]. After 2014, since the coal production depends on the land transportation capacity including road, no one has clear picture on production expansion. In other words, the demand will be increased in line with transportation capacity increase.

[Table 3-1-12] Traffic Demand of Private Coal Mining Company in 2014

No.	Coal Mining Company	Mining Area	Demand of Coal Transportation (1,000 ton)
1	PT. Bara Alam Utama (PT. BAU)	Lahat	4,000
2	PT. Batubara Lahat (PT. BL)	Lahat	1,000
3	PT. Batubara Selaras (PT. BS)	Lahat	500
4	PT. Pendopo Energi Batubara (PT. PEB)	Muaraenim	200
5	Reliance Group (3 companies)	Muaraenim	5,500
6	PT. Prima Mulia Serana Seiathera (PT. PMSS)	Muaraenim	1,000
		TOTAL	12,200

(Source: Indonesian Coal Book and Survey team)

② Assumption of Future Demand

According to the market survey on coal transportation demand, it is assumed that the future demand will increase to 20MTPA, which is sufficient for the Project. The reasons are as follows. Firstly, transportation capacity by truck is limited due to the problems as mentioned in 3.1.1. (2) (P. 3-12). Secondly, there is virtually no railway construction plan connecting Lahat and Muaraenim area to coal shipping port likely to be realized as mentioned in 2.1.3. (P. 2-8) other than this project. Therefore, all of the coal transportation demand in Lahat and Muaraenim area of which the amount is 20MTPA as shown in ① above, can be counted as the future demand for this project. So, it is assumed that the maximum future transportation demand by railway will be 20MTPA up to which the transportation capacity will grow along with the implementation of this project as shown later.

In the meantime, PT. KAI has its own plan to increase the transport capacity from Lahat to Kertapati/Marina up to 20MTPA by year 2020, therefore the above assumed maximum capacity in this report can be in line with PT. KAI's own plan. As for the southern route, namely Lahat to Kertapati/Slengsen, PT. KAI plans to increase the capacity up to 50MTPA by the year 2020.

The maximum transportation volume of coal by road between Lahat and Prabumulih is estimated as follows considering the fact that the National Road (2- way and 2-lane road) is the only route available. In this estimation, transportation capacity of truck (C_T) is assumed based on average of survey result of Japanese Commercial Vehicle Ratio (P_T). Thus, in case of C_T in Lahat and Muaraenim is available, transportation capacity by truck shall be recalculated.

- Assumption of Transportation Capacity of Trucks, C_T (trucks/hour/2-lane)

(Source: Japan Road Association, Traffic Capacity of Road, Sep. 1984)

$$C_T = (C_B \times \gamma_I) \times S \times P_T \div E$$
$$= 2{,}500 \times 0.85 \times 0.75 \times 0.25 \div 2 = 199.22 \fallingdotseq \underline{200 \text{ trucks/hour/2-lane}}$$

Where;

- Basic Capacity: C_B = 2,500 pcu/hour/2-lane (at 2-way and 2-lane road)

  pcu: Passenger Car Unit

- Possible capacity: $C = C_B \times \gamma_I$

  γ_I: Correction Factor of Road Condition (= 0.85: Level ground under 2 lanes)

- Design capacity: $C_D = C \times S$

  S: Correction factor of service level (= 0.75: Service level No.1[1)] in rural areas)

- P_T: Commercial vehicle ratio (≒25%: Average of national roads in Japan[2)])
- E: Passenger car equivalence of commercial vehicle (= 2.0)

Note: 1) Service level No.1: The service level is the annual maximum peak hour traffic doesn't exceed possible capacity. The service level is applied to the road where high service is required.

2) The commercial vehicle ratio is quoted from Road Traffic Census 2005 in Japan.

- Critical Coal Transportation by Truck
  - Transportation time by truck: 8hours = 240km÷30km/h (from Merapi to Gasin)
  - Time zone in which truck can leave a coal mine: From 17:00 to 24:00 = 7hours

    (It is assumed that the last truck leaves mining area at 0:00 and arrives at Gasin by 8:00.)
  - Maximum number of truck available: 700 trucks/day = $C_T \div 2 \times 7$ hours
  - Limit of transportation by trucks: 2.2MTPA ≒ 700 trucks/day×10 ton/truck×313 days/year

    (Annual operation ratio is assumed based on actual performance of PT. KAI of about 85%)

The coal transportation volume for private coal mines in the "without the project case" is set as 0.15MTPA which is the current volume for PT. BAU, the sole private coal mine using railway. According to GAPEKA 2011, train for private coal mines is allocated to 1.5MTPA with 6 roundtrip of train/day, but it has never been achieved due to railway infrastructure problems which will be rehabilitated under the Project.

Capacity expansion plan of PT. KAI was made irrelevant to the implementation of this Project. However, it should be noted that if the capacity expansion plan made by PT. KAI is not progressing on schedule, the line capacity will be tight and the future transportation demand projected in this Project of 20MTPA will be difficult to achieve.

(2) Coal of PT. BA

From the result of hearing survey to PT. KAI, the outline of capacity expansion projects of coal transportation to Tarahan is shown in [Table 3-1-13] and the projects is scheduled to be completed by 2014. Under the projects, PT. KAI is scheduled to increase the train formation of coal transportation to Tarahan into 2 new locomotives and 60 freight wagons and the number of trains will be 20 roundtrip/day. The volume of coal transportation to Tarahan will increase from 9.4MTPA at present to 20MTPA.

In addition, while the transportation volume of coal to Kertapati is limited by the number of train and the handling capacity of barge in Kertapati, it is targeted to be increased to 2.73MTPA by 2014. This target is the same as that of 2012, thus, particular improvement of facilities and equipments are not necessary to achieve it. By the implementation of the expansion projects as shown in [Table 3-1-13], some spaces of line capacity will be available between Tanjung Enim and Prabumulih X6, thus the target transportation volume of 2.73MTPA will be achieved. Regarding the volume of coal transportation from Tanjung Enim to Tigagajah, it is also assumed that it will be possible to achieve the transportation volume in 2012 (0.245MTPA) by 2014.

[Table 3-1-13] Outline of Expansion Projects of Transportation Capacity to Tarahan

Plan for 20MTPA to Tarahan		
Investor	Item	Area
PT. BA	Development of loading facility (from 3 places to 4 places)	Tanjung Enim
	Development of unloading facility (from 2 places to 4 places)	Tarahan
PT. KAI	Double tracking	Tanjung Enim - Purabumulih X6
	Partial double tracking	Purabumulih X6 - Tarahan
	Extension of siding track	Purabumulih X6 - Tarahan

Note: Above projects will be completed by 2014.

(Source: Study team)

Based on the above, the future demand of coal transportation of PT. BA is assumed as shown in [Table 3-1-14]. As for the coal transportation to Tarahan, as the double tracking project between Tanjung Enim and Prabumulih progresses, the train delay is expected to be decreased, the present target transportation volume will be achieved, and the next target volume of 13.21MTPA will be achieved by 2013. It is assumed that the further capacity expansion projects by PT.KAI will be completed in 2014 and the target transportation volume of 20MTPA will be achieved in 2015. Here, the transportation volume in 2014 when the capacity expansion project is scheduled to be completed is set as the mean value of planned volume of 2013 and 2015, assuming that full operation of facility and equipment in 2014 is difficult.

[Table 3-1-14] Future Demand of PT. BA's Coal Transportation

Year	Coal - PT. BA (Unit : ton/year)			
	Tmb-Thn	Tmb-Kpt	Tmb-Tjh	Total
2010	8,712,100	2,041,190	112,735	10,866,025
2011	9,368,000	2,108,710	87,810	11,564,520
2012	11,288,125	2,315,140	140,140	13,743,405
2013	13,208,250	2,521,570	192,470	15,922,290
2014	16,604,125	2,728,000	244,800	19,576,925
2015	20,000,000	2,728,000	244,800	22,972,800
2016	20,000,000	2,728,000	244,800	22,972,800
2017	20,000,000	2,728,000	244,800	22,972,800
2018	20,000,000	2,728,000	244,800	22,972,800
2019	20,000,000	2,728,000	244,800	22,972,800
2020	20,000,000	2,728,000	244,800	22,972,800
2021 -	20,000,000	2,728,000	244,800	22,972,800

Note: Tmb - Tanjung Enim, Thn - Tarahan, Kpt - Kertapati, Tjh - Tigagajah

(Source: Study team)

As shown in [Table 3-1-13] expansion projects of transportation capacity to Tarahan will give significant effect to transportation demand (or transportation capacity) to Kertapati which is scope of this study as well as railway freight transportation in PT. KAI Divre III. Therefore, by understanding the progress of expansion projects of transportation capacity to Tarahan, in some cases, appropriate review of demand forecast of this Project is necessary. Thus, according to hearing and questioner to PT KAI, some monitoring criteria is recommended as shown in [Table 3-1-15].

[Table 3-1-15] Monitoring Criteria of Railway Freight Transportation Capacity (Draft)

Classification	Item	Monitoring Criteria
Progress of Expansion Projects of Transportation Capacity to Tarahan	Improvement of Loading and Unloading Facilities	･ Number of Loading Facilities to be constructed in the Expansion Projects ･ Number of Unloading Facilities to be constructed in the Expansion Projects
	Improvement of Railway Tranportation Capacity	･ Length (or Ratio) of Double Tracking to be constructed in the Expansion Projects ･ Number (or Ratio) of Stations, including Siding Track, to be improved in the Expansion Projects
Improvement of Railway Freight Transportation Capacity	Improvement of Capacity	･ Railway Freight Transportation Volume by Commodity and OD (ton or ton-km)
	Improvement of Productivity	･ Number of Freight Trains by Commodity and OD (Plan) ･ Number of Freight Trains by Commodity and OD (Actual Result) ･ Operation Rate (=Actual Result / Plan)
	Improvement of Stability	･ Number of Freight Trains by Commodity and OD (On-time Operation) ･ On-time Operation Rate (= On-time / Plan)

(Source: Study team)

For comparison, although the PT. KAI Master Plan was not available for the study team, according to the hearing to PT. KAI[1], PT. KAI is projecting the aggregated coal transportation volume in 2020 is as big as 70MTPA in South Sumatra area. The break down is as follows. Based on the figures, the transportation volume between Lahat and Sinpang (one station before Kertapati) comes to 20MTPA (=5+15) and the amount is exceeding the demand forecast of this study.

① Lahat-Kertapati...................................5MTPA
② Lahat-Mariana (New line)................15MTPA
③ Lahat-Tarahan...................................20MTPA
④ Lahat-Slengsen (New line)...............30MTPA

(3) Coal Demand for Financial/ Economic Analysis

Railway transportation of coal to Kertapati is 2.1MTPA for PT. BA and the volume is

1 The meeting with the president of PT. KAI held on March 15, 2012.

scheduled to be expanded to 2.73MTPA after the completion of PT. KAI double tracking project which is currently under work. As for the private coal mines, PT. BAU alone is using railway since 2011 with the amount of merely 0.15MTPA at present.

This project aims at expanding coal transportation capacity for private coal mines. Coal transportation demand for aggregate private coal mines in 2014 is 12.2MTPA. It means that coal production of private coal mines are virtually restrained by the land transportation capacity including truck. In other words, the railway infrastructure is far short of coal transportation demand. Therefore, the coal transportation demand to be used for economic and financial analysis in this study hinges on what is the priority of transportation, while transportation demand commands the scale of the infrastructure in conventional project analysis (except for the 3rd Stage where conventional approach will be applied). In this study the transportation demands for the 1st, 2nd and 3rd Stage are set as 2.5MTPA, 5.0MTPA and 20.0MTPA respectively from the current volume of 0.15MTPA. The calculation basis will be described in 4.2.2. (P. 4-22).

3.1.4. Demand Forecast of Freight and Passenger Transportation other than Coal

(1) Demand Forecast of Freight Transportation other than Coal

From the result of hearing survey to PT. KAI, it was assumed that considering the production capacity of cargo owner's factory, the future transportation volume is not significantly increased, there is a plan to transport wood (from Tarahan to Niru) based on yearly contract from 2012, and new commodities other than wood are currently unavailable.

The reasons for no entry of new commodities other than wood are that the cargo owners are required to secure the transportation volume by train by annual base contract and that additional freight wagons procurement is the responsibility of cargo owners. There are cases that it includes the procurement of locomotives.

As for the transportation of wood, contract between PT. KAI and PT. TEL has been agreed to prepare 1 roundtrip/day, but freight wagons are not yet procured and fare are not yet decided. In addition, the wood transportation will be carried out only when the wood in South Sumatra will run short, which is extremely low comparing with coal demand. Based on these, it is assumed that there will be no new commodity which should be taken into consideration in this study.

Based on the above, it is assumed that the future demand of freight transportation other than coal is shown in [Table 3-1-16]. It is assumed that the future demand by commodities will increase to the planned volume made in 2012 by 2014 when the capacity expansion project of PT. KAI will be completed and it will remain constant after 2014.

In addition, it is assumed that the future demand will not change as shown in [Table 3-1-16] even if this project is not be implemented. However, if the progress of capacity expansion projects planned by PT. KAI is not on schedule, the planned volume shown in [Table 3-1-16] will not be achieved because the line capacity between Tanjung Enim and Prabumulih X6 will become tight.

[Table 3-1-16] Future Demand of Freight Transportation other than Coal

Year	Commodity (Unit: ton/year)				
	Oil Fuel	Pulp	Clinker	Others	Total
2010	437,800	406,311	386,120	259,741	1,489,972
2011	492,447	393,889	343,860	8,055	1,238,251
2012	532,898	433,593	365,240	10,000	1,341,731
2013	573,349	473,296	386,620	10,000	1,443,265
2014	613,800	513,000	408,000	10,000	1,544,800
2015	613,800	513,000	408,000	10,000	1,544,800
2016	613,800	513,000	408,000	10,000	1,544,800
2017	613,800	513,000	408,000	10,000	1,544,800
2018	613,800	513,000	408,000	10,000	1,544,800
2019	613,800	513,000	408,000	10,000	1,544,800
2020	613,800	513,000	408,000	10,000	1,544,800
2021 -	613,800	513,000	408,000	10,000	1,544,800

(Source: Study team)

(2) Demand Forecast of Passenger Transportation

The demand forecast of passenger is made by regression analysis based on socio-economic variables. The criterion variable is the number of railway passengers except for economy class passengers from 2004 to 2010 and explanatory variables are population number of South Sumatra Province and GRDP at 2000 constant market price.

Economy class was excluded from the total number of passengers as criterion variable because of the following reasons. Considering the scope and transportation characteristic of this project, passengers for medium and long distance consist of 3 classes (executive, business and economy) are targeted. However, operation frequency of passenger train is small, thus, separation of passenger volume by class will not enough. Consequently, considering total passengers as criterion variable is easier to be estimated.

The result of regression analysis between passenger volume and selected variables is shown in [Table 3-1-17]. The following equation is formulated since GRDP at 2000 constant market price shows the best statistical result as log approximation.

Demand of Passenger Transportation (passenger/year)
= 1,484,037×Ln(GRDP at 2000 Constant Market Price (billion Rp.)) – 14,783,510

The followings will explain the assumption of GRDP at 2000 Constant Market Price of South Sumatra Province, which is selected as explanatory variable. Average of economic growth rate of Indonesia from 2000 to 2010 is assumed equal with GDRP's growth rate of South Sumatra Province. According to this assumption, GDRP of South Sumatra is shown in [Table 3-1-18]. In addition, the economic growth rate of Indonesia is quoted from "World Economic Outlook Database (IMF, Sep. 2011)" (from 2011 to 2016), from "The Current of World Economy (Cabinet Office of Japanese Government, May 2010)" (from 2017 to 2029) and from "Asia 2050 - Realizing the Asian Century (ADB, Aug. 2011)" (from 2030 to 2040).

[Table 3-1-17] The Result of Regression Analysis on Railway Passenger Transportation

Explanatory Variable	Evaluation Criteria*	Approximation Formula			
		Linearization	Quadratic Polynomial	Cubic Polynomial	Logarithm
Population	Coefficient of Determination (R^2)	0.775	0.865	0.821	0.787
	Significant F-ratio	0.00556	0.00806	0.04421	0.00482
	t-value	All more than |2|	All more than |2|	All less than |2|	All more than |2|
	P-ratio	All less than 5%	All more than 5%	All more than 5%	All less than 1%
GRDP at 2000 Constant Market Price	Coefficient of Determination (R^2)	0.805	0.907	0.888	0.834
	Significant F-ratio	0.00382	0.00385	0.02223	0.00256
	t-value	Some less than |2|	All more than |2|	All less than |2|	All more than |2|
	P-ratio	Some more than 5%	Some more than 5%	All more than 5%	All less than 1%

Note: * The contents of evaluation criteria are shown as follows;

- Coefficient of determination: It is a measure of fitness for regression formula and shows the coefficient of determination adjusted for degree of freedom. It is so accurate to be close to one, and generally it is supposed to be accurate at 0.5 or more.
- Significant F-ratio: It is a probability which shows the significance of the whole regression formula. It is supposed that the significant F-ratio is less than 5％ statistically.
- t-value: It is a value of which shows the significance of the explanatory variables. It is supposed that the significant t-value is absolute value of 2 or more statistically.
- P-ratio: It is a probability which judgment that the explanatory variables are significant has mistaken. It is supposed that the significant P-ratio is less than 5％ statistically.

(Source: Study team)

[Table 3-1-18] Assumption of GRDP at 2000 Constant Market Price of South Sumatra Province

Category	Year	Growth Rate[1] of GDP of Indonesia	Growth Rate of GRDP of South Sumatra	GRDP[2] of South Sumatra (billion Rp.)
Calculation Method	—	(A_n)	$(B_n)=(A_n)*b/a$	$(C_n)=(C_{n-1})*(Bn)$
Actual Figures	2000～2010	Average 5.22%(=a)	Average 4.73%(=b)	—
	2010	6.10%	5.43%	63,736
Predicted Figures	2011	6.40%	5.80%	67,435
	2012	6.30%	5.71%	71,288
	2013	6.70%	6.08%	75,620
	2014	7.00%	6.35%	80,420
	2015	7.00%	6.35%	85,525
	2016	7.00%	6.35%	90,954
	2017	5.70%	5.17%	95,656
	2018	5.70%	5.17%	100,601
	2019	5.70%	5.17%	105,801
	2020	5.20%	4.72%	110,790
	2021	5.20%	4.72%	116,015
	2022	5.20%	4.72%	121,486
	2023	5.20%	4.72%	127,215
	2024	5.20%	4.72%	133,214
	2025	5.20%	4.72%	139,496
	2026	5.20%	4.72%	146,074
	2027	5.20%	4.72%	152,962
	2028	5.20%	4.72%	160,176
	2029	5.20%	4.72%	167,729
	2030	4.80%	4.35%	175,030
	2031	4.80%	4.35%	182,649
	2032	4.80%	4.35%	190,600
	2033	4.80%	4.35%	198,897
	2034	4.80%	4.35%	207,555
	2035	4.80%	4.35%	216,590
	2036	4.80%	4.35%	226,018
	2037	4.80%	4.35%	235,856
	2038	4.80%	4.35%	246,123
	2039	4.80%	4.35%	256,837
	2040	4.80%	4.35%	268,017

Note: 1) Growth rate of GDP is quoted from "World Economic Outlook Database (IMF, Sep. 2011)" (from 2011 to 2016), from "The Current of World Economy (Cabinet Office of Japanese Government, May 2010)" (from 2017 to 2029) and from "Asia 2050 - Realizing the Asian Century (ADB, Aug. 2011)" (from 2030 to 2040).

2) GRDP shows GRDP of South Sumatra at 2000 constant market price with oil and gas industry.

(Source: Study team)

Based on the above, it is assumed that the demand forecast of passenger transportation is as shown in [Table 3-1-19]. According to the hearing survey to PT. KAI, it was informed that if the future demand of passenger transportation exceeds the current transportation capacity, rolling stock or train frequency will be increased. This idea is considered to be unrealistic without implementation of this Project because the present train schedule between Prabumulih and Kertapati is set as to exceed the line capacity and therefore it is not possible to increase the number of passenger train. Although it is possible to increase the number of wagon in a train from 7 to 10 in the initial stage of transportation demand increase, it will be necessary to increase the number of train for further increase of passenger transportation demand. According to the demand forecast of this study, the timing of train number increase is after 2017.

[Table 3-1-19] Future Demand of Passenger Transportation

Year	Class			
	Exective	Business	Economy	Total
2010	123,131	414,825	1,055,258	1,593,214
2011	132,727	447,154	1,137,499	1,717,380
2012	139,100	468,623	1,192,112	1,799,834
2013	145,865	491,415	1,250,092	1,887,372
2014	152,924	515,197	1,310,590	1,978,711
2015	159,983	538,979	1,371,088	2,070,050
2016	167,042	562,761	1,431,586	2,161,389
2017	172,823	582,235	1,481,126	2,236,184
2018	178,603	601,710	1,530,667	2,310,980
2019	184,384	621,184	1,580,207	2,385,775
2020	189,669	638,989	1,625,501	2,454,159
2021	194,954	656,794	1,670,794	2,522,542
2022	200,239	674,599	1,716,088	2,590,926
2023	205,524	692,404	1,761,381	2,659,309
2024	210,809	710,209	1,806,675	2,727,692
2025	216,094	728,014	1,851,968	2,796,076
2026	221,379	745,819	1,897,261	2,864,459
2027	226,664	763,624	1,942,555	2,932,842
2028	231,949	781,429	1,987,848	3,001,226
2029	237,234	799,234	2,033,142	3,069,609
2030	242,121	815,698	2,075,024	3,132,843
2031	247,008	832,162	2,116,906	3,196,076
2032	251,895	848,626	2,158,789	3,259,310
2033	256,782	865,090	2,200,671	3,322,543
2034	261,669	881,554	2,242,554	3,385,777
2035	266,556	898,019	2,284,436	3,449,010
2036	271,443	914,483	2,326,319	3,512,244
2037	276,330	930,947	2,368,201	3,575,477
2038	281,217	947,411	2,410,083	3,638,711
2039	286,104	963,875	2,451,966	3,701,944
2040	290,990	980,339	2,493,848	3,765,178

(Source: Study team)

3.2. Tasks to be investigated to Determine Facility Size

3.2.1. Necessity of Existing Facilities Improvement for Transport Capacity Expansion

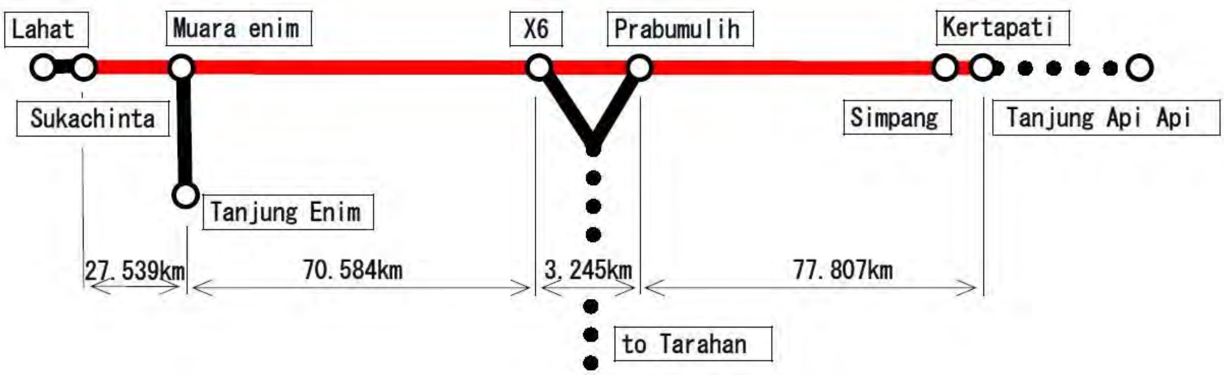
(1) Project Section

The project section of the study, as shown in [Fig. 3-2-1], is 189.864 km from Lahat to Kertapati, but since coal transportation is performed between Sukachinta and Kertapati, the transportation-capacity-expansion project study is carried out between Sukachinta and Kertapati. This section is roughly divided into 3 sections as follows, and since PT. KAI has already started the double-tracking project between Muaraenim and Prabumulih X6 section, this section is not included in the study. The technical specifications including train speed, axle load and radius of curve employed for the section complies with Indonesia Railway Standard which is applied in this project.

[Appendix 3-2-1] shows coal transportation capacity expansion plan in South Sumatra by PT. KAI which includes the double-tracking project. It was explained in the hearing with PT. KAI officials that the plan is going on schedule with no construction budget constrain and land clearance difficulties. However, as of March, 2012, only 28km between TLP - Prabumulih X6 was completed. This is scheduled to be completed by 2010 which is 2 years behind the schedule according to the plan. Therefore, if the work may go further behind the schedule, it will be necessary for this project to support expediting the progress.

Since the coal loading yard is located near Sukachinta station and Kertapati has a coal unloading yard, the actual study section for the project is 108.753 km.

- Between Sukachinta - Muaraenim (27.539 km)
- Between Muaraenim - Prabumulih X6 (70.584 km)
- Between Prabumulih X6 - Kertapati (81.214km = 3.407km + 77.807km)



(Source: Study Team)

[Fig. 3-2-1] Schematic Project Map

(2) Target Coal Transportation Capacity for Facility Improvement

The purpose of this project is to perform coal transportation using the existing railway from Lahat area to Kertapati. The target transportation capacity for coal from private coal mines at the final stage of the project is calculated by coal transportation demand of private coal mines of 12.2MTPA deducted by maximum track coal transportation volume of 2.2MTPA, which is 10.0MTPA. However, the current railway transportation volume to Kertapati is merely 1.9MTPA for PT. BA coal and that of private coal mine of PT. BAU is almost negligible. It means that in order to increase the private coal mine transportation volume up to 10.0MTPA from the current amount of almost zero, there is no other solution but to wholly double truck the section which is very costly as it is mentioned in Chapter 4. In addition, the transportation capacity will not be expanded by the completion of the work. Therefore, this study proposes to expand the capacity in step-by-step basis as it was mentioned in 2.4. (P. 2-17). The target capacity at each stage will be determined as follows.

① The 1st Stage

This is a measure to increase transportation capacity in maintaining the existing single truck configuration. In concrete, it is to improve railway infrastructure to cope with higher train speed and longer train set as it is described in 4.4. (P. 4-35). Therefore, the target capacity for private coal mines of the 1st Stage is determined not by transportation demand but by facility. The details will be discussed in 4.3. (P. 4-26) but the result is the addition of 2.5MTPA for private coal mines.

② The 2nd Stage

This is a measure to increase transportation capacity by partially double-truck the existing single truck. In concrete, it is to improve railway infrastructure including signaling system to cope with higher train speed and longer train set as it is described in 4.4. (P. 4-35). Therefore, the target capacity for private coal mines of the 2nd Stage is determined not by transportation demand but by facility. The details will be discussed in 4.3. (P. 4-26) but the result is the addition of 5.0MTPA for private coal mines.

③ The 3rd Stage

This is a measure to increase transportation capacity by wholly double-truck the existing single truck. The transportation capacity by wholly double-track the railway is far bigger than the transportation demand of 20.0MTPA, although the figure is not calculated in this study because it is irrelevant in the discussion.

As such, the 1st Stage was formulated giving priority on urgent remedy for the coal transportation capacity and project cost. However, it is strongly recommended to go forward to the 2nd and the 3rd Stage in order to achieve sustainable train operation.

Regarding passenger transportation, since the train schedule will be congested by the increased number of coal freight train in the 2nd and 3rd Stages, the increase of passenger demand during the corresponding stages is proposed to be coped with increasing the number of passenger coach in a passenger train, maintaining the number of passenger train in a day. In the 3rd Stage, the number of passenger train will be increased to accommodate the expected passenger demand of about 2 times of the current level, because the line capacity in the 3rd Stage will have enough volume by the double-tracking work.

(3) Facility Improvement Measures

Storage of 100 thousand ton is possible for the capability of the coal loading yard located adjacent to the Sukachinta station judging from a field survey and collected data, and it is performing 1,280 t (about 0.46MTPA) by rail with 2 sets of train per day. However, the present condition is that even the target amount of 2.5MTPA in the 1st Stage of the project will not be achieved. Therefore, capability reinforcement of the coal stockyard is needed.

Coal loading volume is restrained by the number of a train and the size of the barge in the coal stockyard of the Kertapati. It becomes possible to increase barge loading capacity by introducing high performance conveyor belt and loader.

The basic concept of coal loading and unloading equipment reinforcement is as follows. As for the short term solution to instantaneously increase the capacity are the expansion of the existing storage facilities and equipment. As for the mid and long-term solution, they are to newly build loading equipment in a place near the coal mine, to build a coal loading and unloading facility and to build a dedicated line along the river for barge transportation.

On the other hand, in view of operation diagram, the present freight train operation number is 8 between Lahat and Muaraenim section, 55 - 58 per day between Muaraenim and Prabumulih X6 section, and 34 - 38 per day between Prabumulih X6 and Kertapati section. It turns out that at least operation of the freight train exceeds the appropriate track capacity as compared with the theoretical track capacity (0.6) between Niru and Prabumulih X6. Although there is some margin in the other sections, since the increase of the train number to be planned in this project cannot be accommodated, some actions are needed.

Although track number increase is the principal solution to increases traffic capacity in general, it requires a long construction period and it can not be a timely solution. Therefore, in order to implement this project with safety and efficient manner, it is proposed to plan a incremental implementation of traffic capacity expansion. This is a solution to quickly increase the transportation capacity in the early stage of the project and, in the mean time, achieve the target capacity in the long run. Since the commercial transportation can be started in the early stage of the implementation, it is effective in terms of financial point of view.

The initial measures of the gradual transportation capacity expansion are speed up of train operation and extension of train length. However, judging from the observation of a field survey, the present track doesn't comply with these measures. Priority must be given to repair and reinforcement of the track of about 108km section excluding between Muaraenim and Prabumulih X6 section where the double tracking work is under way by PT. KAI as shown in the [Fig. 3-2-1]. [Appendix 3-2-2] and [Appendix 3-2-3] show the project location and construction schedule respectively.

The next measures are the extension of clear-length and increase of signaling-station for track capacity expansion.

Final measures are the expansion and reinforcement of coal loading and unloading facility and modernization of signaling and telecommunication system with adding of new track.

3.2.2. Assets of SPC

(1) Coal Loading / Unloading Facilities

With respect to the assets to be owned by SPC, it is proposed to be wheel loader, reach stacker to freight wagon and self-propelled belt conveyer. Fixed facilities to the ground such as conventional belt conveyer is proposed to be owned by either GOI or PT. KAI in the same concept as railway facilities such as track and signaling system instead of SPC, because they are considered to be fixed asset.

Other facilities and assets than the ones mentioned above are proposed to be owned by DGR in basic. The following tables show the ownership distribution of facilities and asses between SPC and GOI at each stage of the project implementation.

① The 1st Stage (2.5MPTA Target Volume) (Improvement of Existing Single Track)

[Table 3-2-1] Necessary Assets for the 1st Stage

Ownership	Target volume	2.5MTPA
Assets of SPC	Diesel Locomotive (Type CC205)	11 units (8 for main line + 2 for shunting and 1 for backup)
	Freight Wagon (2 unit of 20 ton size container for 1 unit of wagon)	210 units (equivalent to 420 pieces of container)
	Wheel loader	1 unit
	Self-propelled belt conveyer	1 set in Kertapati
	Reach stacker	1set in Kertapati
Assets of DGR financed by SPC	● Track from reinforcement between Prabumuli X6 Sta. and Kertapati Sta. (Replacement of 42kg rail to 54kg rail) ● Improvement and rehabilitation of signaling system ● Extension of station yard-line to accommodate 25 unit wagon train in Kertapati Station ● Construction of Locomotive Depot in Lahat Area for periodic inspection and crucial parts inspection equipped with repairing facilities	

(Source: Study Team)

② The 2nd Stage (5.0MPTA Target Volume)

[Table 3-2-2] Necessary Assets for the 2nd Stage

Ownership	Target volume	5.0MTPA
Assets of SPC	Diesel Locomotive (Type CC205)	15 units (13 for main line + 1 for shunting and 1 for backup)
	Freight Wagon (2 unit of 20 ton size container for 1 unit of wagon)	420 units (equivalent to 840 pieces of container)
	Wheel loader	1 unit
	Self-propelled belt conveyer	2 sets in Kertapati
	Reach stacker	3 sets in Kertapati
Assets of DGR financed by SPC	● Branch line construction from Merapi to main line of approx. 700m distance and belt conveyer ● Branch line in to PT. BAU stock yard in Kertapati Sta. ● Extension of station yard-line to accommodate 40 unit wagon train in Kertapati Station	

(Source: Study Team)

③ The 3rd Stage (20.0MPTA Target Volume)

[Table 3-2-3] Necessary Assets for the 3rd Stage

<table>
<tr><th>Ownership</th><th>Target volume</th><th>20.0MTPA</th></tr>
<tr><td rowspan="5">Assets of SPC</td><td>Diesel Locomotive (Type CC205)</td><td>36 units (27 for main line + 6 for shunting and 3 for backup)</td></tr>
<tr><td>Freight Wagon (50 ton capacity)</td><td>840 units</td></tr>
<tr><td>Wheel loader</td><td>2 unit</td></tr>
<tr><td>Self-propelled belt conveyer</td><td>4 sets in Kertapati</td></tr>
<tr><td>Reach stacker</td><td>6 sets in Kertapati</td></tr>
<tr><td>Assets of SPC financed by SPC</td><td colspan="2">● Branch line construction from Merapi to main line of approx.700m distance and belt conveyer
● Branch line in to PT. BAU stock yard in Kertapati Sta.
● 3 units of belt conveyer connecting east side of Kertapati station and stock yard along Musi river
● Double tracking between Lahat and Kertapati</td></tr>
</table>

(Source: Study Team)

(2) Facilities for Train Operation

Station building, platform and bridge maintenance facility are the major infrastructure for train operation but they are just among conventional railway infrastructures which should not be owned by SPC.

(3) Facilities for Track Maintenance

① Maintenance Depot

Although PT. KAI owns 2 sets of MTT for the project line section, the number will become insufficient after the completion of double-tracking. Since it is desirable to minimize the variety of railway facilities to be owned by SPC, it is proposed that MTT should buy additional unit. But, if it is not possible, alternative idea is to lease the MTT bought by SPC.

② Rail Welding Base and Transportation Car of Continuous Welded Rail

Currently rail welding is done by field welding (Thermit welding method) in PT. KAI, lot of welding faulty points are observed in the site inspection. Therefore, it is proposed to install continuous pre-welded R54 rails by flush vat welding method of the length of about 150m at a welding base after transporting the set to the site instead of on site welding, because it can expect better welding quality and cost effectiveness. The welding base and long rail transportation car will be necessary to realize this method, and these facilities are recommended to be owned by PT. KAI, but it is also possible that SPC owns them and lease them out to PT. KAI.

(4) Facilities for Signaling and Telecommunication

The facility ownership responsibility principle is proposed to be that SPC owns minimal size of facilities to be used for the coal transportation in the long run, PT. KAI owns facilities relevant to general railway operation and maintenance, and DGR owns other railway infrastructure.

In case where SPC operates its train by itself, it is proposed that SPC owns minimal size of facilities to be used for the coal transportation in the long run too, which means that SPC owns Kertapati Operation Control Center (OCC) so that SPC can monitor the accurate departure and arrival time of trains at Kertapati station. In this addition SPC can coordinate train operation with PT. KAI.

Also in case where SPC owns facilities relevant to signaling and telecommunication system maintenance, it is recommended that a new company dedicated to the system maintenance should be established and the company should implement the maintenance work not only SPC facilities but also PT. KAI facilities in a contract basis so that better working efficiency and quality control will be achieved.

3.2.3. Necessity for Loading/ Unloading Facility Construction

In order to expand coal transportation capacity, not only the expansion of railway facilities but also improvement of coal loading/ unloading facilities is necessary, because the coal handling efficiency at the both ends of the railway line will also control in measuring the total transportation capacity of the coal.

It is observed that the present loading facility to coal freight wagon in Sukacinta, unloading facility from coal freight wagon in Kertapati, and coal transporting facility from stock yard to barge in Kertapati are not able to achieve the targeted volume of 2.5MTPA or 20.0MTPA in the project. The present condition of the capacity and the proposal of measures to achieve the project target amount in accordance with the step-by-step implementation of the project are summarized as below.

- Sukacinta/ Merapi: Presently, coal loading method to container cargo wagon employs a kind of primitive method such as to load the coal by wheel loader. The method is good for coal loading volume of 2 trains a day, but 1 additional wheel loader will be necessary to achieve the 2.5MTPA transportation target. In order to achieve the next stage target of 5.0MTPA, it will be necessary to construct a branch line linking to trunk line from Merapi, expand coal stock yard, and establish more efficient loading system using belt conveyer and silo. Furthermore, in order to achieve the 20.0MTPA target, another 2 set of conveyer will be necessary.

- Kertapati Station: Presently, only 1 reach stacker is being operated to transfer coal filled containers from wagons to trucks and transfer vacant containers from the trucks to the wagons which takes about 3 hours. The loading/ unloading capacity of this method with 2 times of freight trains a day comes to 1,280 ton a day. In order to achieve the project target of 2.5MTPA, additional 1 reach stacker will be necessary. In order to achieve the next stage target of 5.0MTPA, additional 1 branch line for coal train and additional 2 reach stacker will be necessary. Furthermore, in order to achieve the 3rd Stage target of 20.0MTPA, the reach stacker forwarding method will not be enough and alternative method such as expanding the stock yard up to 20 ha of space and installing 6 sets of belt conveyer to directly reach barges will be necessary.

- Loading site to Barge in Kertapati: At present, since an old fashioned belt conveyer system of which the head can not be tilted is employed, not only the coal forwarding capacity to the barges is limited but also flattening work of coal piled up at the same spot is necessary, which resulted in the forwarding capacity of 400 to 500 ton an hour. Furthermore, the space of the stockyard is limited and barges have to be moved back and forth in order to adjust the position of the belt conveyer head so that the height of piled up coal mountain can be even. In order to achieve the project target volume of 2.5MTPA, additional 1 set of self propelled type belt conveyer equipped with swing head will be necessary so that it can select best position for the efficient coal forwarding work. In order to achieve the target of 5.0MTPA, additional 1 set of the same type of conveyer will be necessary.

Chapter 4

Project Planning

4.1. Review of Planned Construction Site and Existing Facilities

The following describes the present condition of facilities based on the field survey and data collection between Sukacinta and Kertapati.

Earthwork consists of cutting and embankment and civil engineering and railway structures consist of station platforms, bridges, small-scale pipes and culverts, and level crossing. Schematic drawing of double tracking project between Muara Enim and Prabumulih conducted by PT. KAI is shown in [Fig. 4-1-1].

(Source: Study team)

[Fig. 4-1-1] Route Sketch

The distance between stations and effective length are shown in [Table 4-1-1]. Almost all stations have track effective length of less than 700 m. Therefore, when the number of hauling freight wagons of a train is increased to expand transportation capacity, the necessary track effective lengths to accommodate freight train will not be enough. From long-term viewpoint, it is necessary to provide about 1 km of track effective length for each station. Although almost all stations were constructed in level gradient, track gradient between stations from Lahat to Kertapati is down-slope of about 5‰ to 10‰. Therefore, consideration of slope change and detailed investigation is necessary to extend track effective length. In addition, interference with level crossing around each station also shall be closely investigated.

The maximum design speed is 70 km/h for all sections as shown in [Table 4-1-2]. However, according to visual inspection, the actual operation of train speed is about 45 km/h. Detailed investigation on the causes of low-speed operation shall be conducted, whether the track, rolling stock or outdated signal facilities. Improvement and removal of the aforementioned causes will possibly increase train operation speed of about 65 km/h.

As shown in [Table 4-1-3], there are many level crossings without crossing gate equipment which shall be improved. Moreover, as shown in [Table 4-1-4], there are also many curves with radius of less than 500 m which subject to speed limitation. In order to increase train operation frequency, improvement of curve and particular location which become bottleneck is indispensable.

As shown in [Table 4-1-5], many of bridges are steel type bridge. Since many steel bridges were already reconstructed, bearing force problem will not be a problem. According to the field survey observation, although sleeper and girder must be fixed together for open-floor type bridges, it was found that there are many missing fastening bolts and unfastened parts. Although reason of these problems is unclear, it can be assumed that track maintenance on the bridges is not carried out properly.

Moreover, many mud-pumping has been found near level crossings, which also become obstacle of high speed operation of train. Track material is not replaced for long time period, and all rails and sleepers are outdated, thus replacement is necessary.

Signal equipment is old mechanical type. Although embrocating by oil lubrication is performed, disorder of diagram still occurred, mostly by failure of locomotive and signal equipment. Taking into consideration of the present situation, increase of transport capacity will become possible by introducing of electrical signaling system to shorten block section and introducing of security equipment by ATS, ATC, etc.

[Table 4-1-1] Distance Between Stations and Track Effective Length

No	Station		Kilometer Point	Distance (m)	Track Effective Length(m)	
					Main Track	Side Track
1	Lahat	LT	434+159	10,527	402	342
2	Sukacinta	SCT	423+632	16,781	175	137
3	Banjarsari	BJI	406+581	10,758	263	225
4	Muara Enim	ME	396+093	8,198	402	342
5	Muaragula	MRL	387+895	6,366	1,283	1,284
6	Ujanmas	UJM	381+529	7,929	1,490	1,491
7	Penanggiran	PGR	373+600	6,561	1,000	1,000
8	Gunungmegang	GNM	367+039	12,695	1,550	1,550
9	Blimbingpendopo	BIB	354+344	10,090	1,415	1,415
10	Niru	NRU	344+254	10,832	1,114	1,114
11	Penimur	PNM	333+422	7,913	1,335	1,335
12	Prabumulih X6	X6	325+512	3,407		
13	Prabumulih	PBM	322+105 (To LT) 322+295 (To KPT)	15,893	452	508
14	Lembak	LEB	338+188	7,406	661	661
15	Karangendah	KED	345+594	8,228	461	461
16	Glumbang	GLB	353+822	9,657	700	700
17	Serdang	SDN	363+479	9,856	700	700
18	Payakabung	PYK	373+335	15,165	493	493
10	Simpang	SIG	388+500	11,602	706	706
20	Kertapati	KPT	400+102		1,335	1,335

(Source: Study team)

[Table 4-1-2] Maximum Design Speed by Section

Section	Maximum Design Speed(km/h)
LT - ME	70
ME - PBM	70
PBM - KPT	70

(Source: Study team)

[Table 4-1-3] Number of Level Crossing by Section

Section	With Gate Equipment	Without Gate Equipment
LT - ME	7	9
ME - PBM	11	20
PBM - KPT	9	16

(Source: Study team)

[Table 4-1-4] Number of Curves by Section

Section	R ≤ 200m		200m < R < 500m		R ≥ 500m		Total	
	No	Length (m)	No	Length (m)	No	Length (m)	No	Length (m)
LT - ME	1	211	23	6.758	16	5.206	40	12.175
ME - PBM	0	-	23	4.923	65	19.629	88	24.552
PBM - KPT	0	-	0	-	32	10.428	32	10.428

(Source: Study team)

[Table 4-1-5] Number of Bridges by Section

Section	Steel Bridges	Concrete Bridges	Sub Structure		Number of Bridges	Box Calvert etc.
			Abutment	Pier		
LT - ME	9	2	12	5	6	125
ME - PBM	10	8	34	1	17	177
PBM - KPT	16	0	32	0	16	76

(Source: Study team)

4.1.1. Current Condition of Track Structure and Track Material

Condition of railway facilities investigated during field survey is shown in [Table 4-1-6]. Photographs of site conditions are shown in the [Pic. 4-1-1].

[Table 4-1-6] Present Condition of Railway Facilities Inspected during Field Survey

Section	Survey point	Kilometerage	Rail	Condition of Track
Prabumulih - Kertapati	Kertapati	400+102	R42	● Sleeper is hidden by the ballast. ● Ballast is contaminated by soil.
	Simpang	388+500	R42	● Aging PC sleeper, about 30% of sleepers is cracked, and exposed steel bar was found. ● Although grain refined coal is settled on ballast surface from sleeper edge to ballast shoulder, it seems not mixing inside the ballast.
	Near a level crossing (Kerangenda)	350+000	R42	● About 5% of the PC sleeper is cracked and exposed steel bar was found. ● Ballast condition is not maintained well (insufficient ballast)
	Near a level crossing (Prabumulih)	320+000	R42	● No cracking in PC sleeper ● Ballast condition is not maintained well (insufficient ballast)
	Prabumulih	322+706	R42	● Fastening device is aging, some part of fastening devices are loss. ● The sleeper is hidden by the ballast. ● Ballast is contaminated by soil. ● Ballast condition is not maintained well (insufficient ballast)
Lahat - Prabumulih	Near a level crossing (Prabumulih-X6)	330+000	R54	● Mud-pumping has occurred in rail weld location. ● No cracking in PC sleeper. ● Under double-tracking construction (roadbed is under construction)
	Near a level crossing (Niru)	360+000	R54	● Mud-pumping has occurred near level crossing.
	Gunungmegang	367+039	R54	● Ballast is washed-out by rain water. ● Fastening devices is aging; original elasticity of rail-pad is missing; and some part of fastening devices are missing. ● Some parts of PC sleepers are cracked.
	Near a level crossing (Gunungmegang)	367+500	R54	● About 10% of PC sleeper is cracker and exposed steel bar was found. ● The mud pumping has occurred near level crossing and in rail weld location.
	Steel Bridge (Gunungmegang)	367+500	R54	● Sleeper on bridge (wooden sleeper) is aging and broken. ● All fixing bolt to fasten sleeper with L type girder are missing.
	Near a level crossing (Sukacinta)	423+000	R54	● The mud pumping has occurred near level crossing ● Thickness of ballast is insufficient.
	Sukacinta	423+632	R54	● Cracking is not found because new PC sleeper is installed,. ● New replacement of ballast. ● Turnout for main track line is still use R42.

(Source: Study team)

PC Sleeper is hidden by the ballast.

(Simpang Station toward Kertapati)

PC sleeper is cracked

(Near the level crossing on the starting point of Karangendah Station, 350+)

Ballast volume is insufficient

(Near the level crossing on the starting point of Karangendah Station, 350+)

Ballast volume is insufficient

(Near the level crossing on the ending point of Prabumulih Station, 320+)

Ballast is contaminated by soil

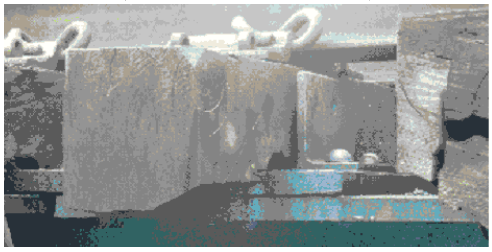
(Prabumulih Station,323+)

Fastenings is aging

(Prabumulih Station,323+)

Mud-pumping near a rail weld position

(Near the level crossing on the ending point of Prabumulih(X6), 330+)



Bridge sleeper is aging

(Steel Bridge on the ending point of Gunungmegang Station 368+)

Ballast is washed-out by rain water and fastening device is missing

(Gunungmegang Station, 368+)

Rail pad is aging

(Gunungmegang Station, 368+)

(Source: Study team)

[Pic. 4-1-1] Condition of Facilities Inspected during Field Survey

The track structure and track material between Lahat and Kertapati are shown in [Table 4-1-7]. Refer [Appendix 4-1-1] for the existing track structure between Lahat – Kertapati and [Appendix 4-1-2] for a sample of inventory list of track materials.

[Table 4-1-7] Present Condition of Track Structure and Track Material

Length of section (km)	Ton-nage (million ton/year)	Track Class	Minimum curve radius (m)	Maximum axle road (kN)	Rail classi-fication	Con-struction year	Continuaus Welded Rail (CWR)	Depth of ballast (cm)	Ballast shoulder width (cm)	Sleeper classi-fication	Fastening device	Turnout type
PBM・KPT (77.4)	16.1	2	600	180	R42	1963	CWR	30	40	PC	EG	R42
ME・PBM (73.8)	43.8	1	234	180	R54	1970	CWR a part is Standard rail	30	50	PC	EG	R42
LT・ME (38.1)	2.9	4	264	180	R54	2007	CWR or Standard rail	30	50	PC	EG	R42

*KPT: Kertapati, PBM: Prabumulih, ME: Muara Enim, LT: Lahat

*EG: Double elastic fastening *PC: Pre-stressed concrete

*The track category was classified on the basis of the tonnage.

(Source: Study team)

- Width of ballast shoulder in Lahat - Muara Enim section (38.1km) and Muara Enim - Prabumulih section (73.8km) is 50cm. Thus, track structure of these sections can be classified into Class 1 and 2 respectively. In addition, track structure of Prabumulih - Kertapati section is classified into Class 3 because width of ballast shoulder is 40cm (refer [Appendix 4-1-3]).
- According to the tonnage, as shown in [Table 4-1-2], track class is determined Lahat - Muara Enim section (2.9MTPA) is classified into Class 4, Muara Enim - Prabumulih section (43.8MTPA) is classified into Class 1, and Prabumulih - Kertapati section (16.1MTPA) is classified into Class 2 (refer [Appendix 4-1-2]).
- The track of Lahat - Muara Enim section was constructed in 2007, Muara Enim - Prabumulih section in 1970, and Prabumulih - Kertapati section in 1963. Thus, Muara Enim - Kertapati section was constructed 40-50 years ago (refer [Appendix 4-1-2]).
- The rail classification of Lahat - Muara Enim section and Muara Enim - Prabumulih section is R54 rail (UIC 54 rail). Additionally, Prabumulih - Kertapati section is still use R42 (refer [Appendix 4-1-4]).

- Continuous Welded Rail (CWR) is laid for track with radius of 600m or more, and the standard rail is laid for track with radius of 600m or less. CWR is laid along section of Prabumulih - Kertapati section. More than half of Lahat - Kertapati section is used standard rail because of many sharp curves in this section. In addition, some parts in Muara Enim - Prabumulih section is used standard rail. Rail length of CWR and standard rail are shown in [Table 4-1-8].

[Table 4-1-8] Rail Length by Curve Radius

Curve radius	Rail length (m)	Note
R≧600m	300	Without intermediate rail
R＜600m	100	-

(Source: Study team)

- Double elastic fastening (e clip) is used for rail fastening (refer [Appendix 4-1-5]).
- Post-tensioned PC sleeper is used for general section of main track (refer [Appendix 4-1-5]), but wooden sleeper is also used for rail-joint section. Additionally, besides PC sleeper, iron and wooden sleeper are also used for siding track.
- The pitch between sleepers is 60cm and sleeper arrangement for rail-joint section is based on suspended joint.
- Direct fastened track of bridge sleeper (wooden sleeper) is adopted for steel bridges (non-ballasted bridge).
- R42 rail turnout is used for turnout of main track line.

4.1.2. Present Condition of Civil Structures

(1) Earthwork (Cutting and Embankment)

Mud pumping most likely caused by foundation ground characteristics as well as poor roadbed and drainage conditions could be observed at many locations along the track. Thus, rehabilitation of roadbeds and drainage systems is necessary when the track is rehabilitated.

(2) Station Platforms

Platform of Kertapati, Prabumulih and Sukacinta stations are concrete slab structure with height between 500mm and 700mm. Based on the field observation, improvement of platform condition is not required. The platforms could be lengthened and widened as part of the alignment plan to accommodate longer train formations.

(3) Bridges

There are 27 bridges in the railway section covered by this study. Bridge types consist of RC girder (K300) and I-shaped steel girder (SS400) for bridges with length shorter than 10m, plate girder (SS400) for bridges with length between 10m and 20m, as well as truss (SS400) for bridges with length longer than 20m. Because the bridges with old girders that were designed for an axle load of 13t (in accordance with the 1911 design standard) were redesigned and renewed between 1991 and 2003 (in accordance with the 1921 design standard, see [Fig. 4-5-9] (P. 4-69)), they can withstand the 18t axle load of new locomotives without problems.

The substructure piers (K350) and abutments (K250) were also reinforced at the same time as the superstructures to be able to withstand an axle load of 18t. There should be no problem because the frameworks have already been reinforced and the foundations were widened with concrete jackets. It was impossible to check the condition and construction figures of all bridges as part of this study, so everything will still have to be reviewed carefully before making detailed design plans.

(4) Small-Scale Pipes and Culverts

As shown in [Table 4-1-10], there are 208 locations with different types of culverts, pipes and water conduits that cross the railway line on the section covered by this study. In the same way as the bridges, the box culverts were redesigned and rebuilt to withstand an axle load of 18t (in accordance with the 1921 design standard) between 1996 and 2003, so they should not have a problem. Because the other pipes were designed in accordance with the 1911 design standard (axle load 13t) and have not been changed since 1913, careful review shall be conducted before making detailed design plans.

(5) Level Crossings

The level crossings examined in this study have a simple structure consisting of asphalt pavement and H-steel arranged to fit the level crossings. The rails are covered by soil and sand and leave only top parts of rail visible. Rail and road level is differenct and has not been properly maintained. Thus, improvement of level crossing is necessary when the track is rehabilitated. Moreover, many of level crossings are also without crossing gates.

(Source: Study team)

[Pic. 4-1-2] Mud Pumping on Tracks

Kertapati Station

Simpang Station

Prabumulih Station

Sukacinta Station

(Source: Study team)

[Pic. 4-1-3] Present Condition of Existing Stations

(Source: Study team)

[Pic. 4-1-4] 367k461m BH No. 837 Truss Bridge (L=50m)

[Table 4-1-9] Summary of Existing Bridges

DLJ.No.52			LINTAS : PRABUMULIH - LAHAT							
No Urut	B H No	Letak Km	Bentang (m) hulu	hilir	Emp	MACAM B A	No. Seri	Berat Jemb baja kg	Vol.Jemb Bet.m3	Volume Pa/Pi m3
		MUARAENIM KM. 396 + 091								
	915	396+427	25			Dd.rk.llb	B.no.872/B.77	49,824	-	
			50			Dd.rk.ttp	B.no.880/B.101	127,417	-	2,470
			25			Dd.rk.llb	B.no.872/B.77	49,824	-	
	935	401+161	30			Dd.rk.ttp	B.no.874/B.78b	57,996	-	540
	953	406+316	10			Bet.Com	B.Com.	-	31	340
		Banjarsari Km. 406 + 831								
	958	407+628	6			Bet.bert	Byb.no.812	-	13	106
	987	416+902	20			Ras.rk	B.no.871/B.82	28,258	-	131
	998	419+893	60			Dd.rk.ttp	B.no.882/B.79a	193,527	-	
			40			Dd.rk.ttp	B.no.878/B.92	88,258	-	
			30			Dd.rk.ttp	B.no.874/B.78b	57,996	-	
			30			Dd.rk.ttp	B.no.874/B.78b	57,996	-	
		Sukacinta Km. 423 + 632								
		L A H A T KM. 434 + 159								

DLJ.No.51			LINTAS : PRABUMULIH - KERTAPATI							
No Urut	B H No	Letak Km	Bentang (m) hulu	bj	Emp	MACAM B A	No. Seri	Berat Jemb baja kg	Vol.Jemb bet m3	Volume Pa/Pi m3
		Gelumbang Km. 353 + 833								
	686	358+875	15	15		Ras.dl	B.no.410 Aus	18,722	-	288
		S e r d a n g Km. 363 + 479								
		Payakabung Km. 373 + 335								
	714	382+325	8	8		Ras.dl	B.no.386/Ab.8-8	7,039	-	260
	715	383+121	13	13		Ras.dl	B.no.443c/Aus	16,282	-	275
	716	383+835	15	15		Dind.pel	B.no.438 Aus	33,927	-	269
	717	385+753	12	12		Dind.pel	B.no.415 Aus	24,488	-	228
	718	387+038	40	40		Dd.rk.ttp	B.no.428 Aus	135,650	-	408
		S i m p a n g Km. 388 + 500								
	720	389+872	8	8		Ras.dl	B.no.386/B.8-8	9,900	-	163
	721	390+786	12	12		Dind.pel	B.no.415 Aus	24,488	-	212
	722	392+765	20	20		Dind.pel	B.no.483 Aus	47,440	-	504
	723	393+609	12	12		Ras.dl	B.no.443 Aus	13,318	-	280
	724	394+259	8	8		Ras.dl	B.no.386/Ab.8-8	7,039	-	292
	725	394+757	15	15		Ras.dl	B.no.410 Aus	18,722	-	330
	726	395+574	15	15		Dind.pel	B.568/B.719 Ais	25,166	-	332
	727	396+192	8	8		Ras.dl	B.no.386/B.8-8	9,900	-	259
	728	397+047	8	8		Ras.dl	B.no.386/Ab.8-8	7,039	-	322
	729	397+609	8	8		Ras.pel	B.no.563	5,975	-	308
		KERTAPATI KM. 399 + 915								

(Source: PT. KAI)

[Table 4-1-10] Summary of Lateral Drainages and Small-Scale Culverts

Lahat - Muaraenim, Pbm X6 - Prabumulih Total		
Crossing conduit and others	Boxculvert	1
	Duiker	17
	Saluran turbuka,Opendoorlat	0
	Pipa besi	2
	Bis beton,Beton buis	0
	Koker	41
	Armuco	6
	Pelat beton	17
	Gorong-gorong	14
	Pasangan batu	33
	Lt - Pbm Total	**131**

Prabumulih - Kertapati Total		
Crossing conduit and others	Boxculvert	6
	Duiker	32
	Saluran turbuka, Opendoorlat	7
	Pipa besi	1
	Bis beton, Beton buis	15
	Koker	15
	Armuco	1
	Pelat beton	0
	Gorong-gorong	0
	Pasangan batu	0
	Pbm - Kpt Total	**77**

(Source: PT. KAI)

(Source: Study team)

[Pic. 4-1-5] Present Condition of Lateral Drainages and Small Scale Culverts

(Source: Study team)

[Pic. 4-1-6] Present Condition of Level Crossings

4.1.3. Geological Condition

The geological condition of the section covered by this study is estimated from the geological map as shown in [Fig. 4-1-2] (Geological Map of the Lahat Quadrangle, South Sumatra 1986). According to this, the geological condition of the Lahat - Kertapati section can be classified into the 3 types as below. Since geological survey data is unavailable, it is necessary to re-examine the geological data and conduct additional surveys before making detailed design plans.

(1) Lahat - Muara Enim Section, Gunungmegang - Prabumulih Section

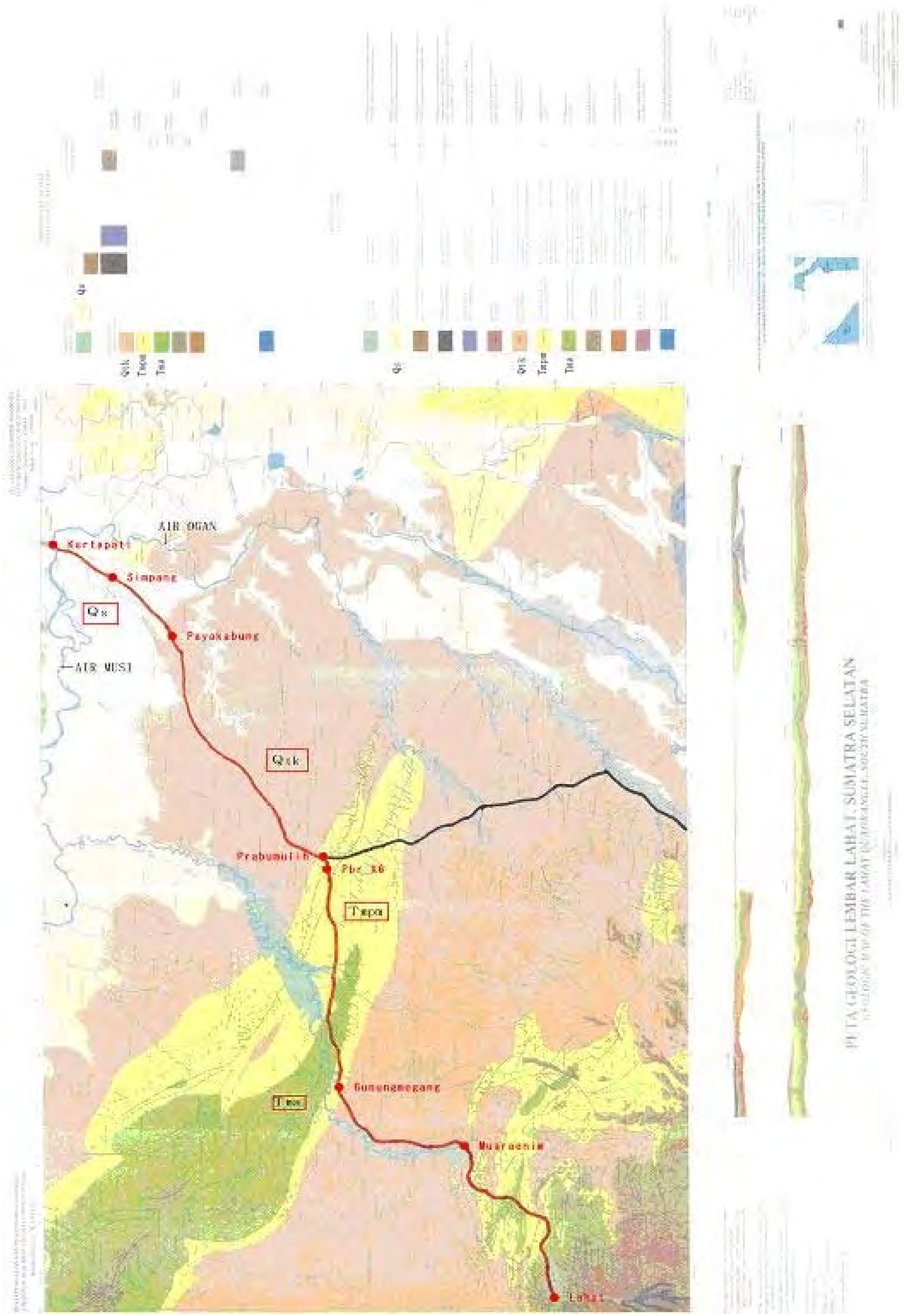
Sedimentary rock of Air Banakat (Tma) and Muara Enim layers (Tmpm) is distributed. Most of the Air Banakat layer (Tma) consists of alternate strata with lime, carbon-rich slate and shale. The Muara Enim layer (Tmpm) consists of tuffaceous slate interspersed with coal deposits, siltstone and sandstone.

(2) Muara Enim - Gunungmegang Section, Prabumulih - Payakabung Section

Sedimentary rock of Kasai layer (Qtk) is distributed. The Kasai layer (Qtk) consists of strata with pumiceous tuff, sandy tuff and tuffaceous sandstone.

(3) Payakabung - Kertapati Section

The alluvium (Qs) is located in the delta between the Musi and Ogan rivers and consists of swampy sedimentary soil distributed in table-like strata. The alluvium (Qs) is a soft layer consisting of mud, silt and sand sediments.



(Source: Study team)

[Fig. 4-1-2] Geological map of Lahat, South Sumatra

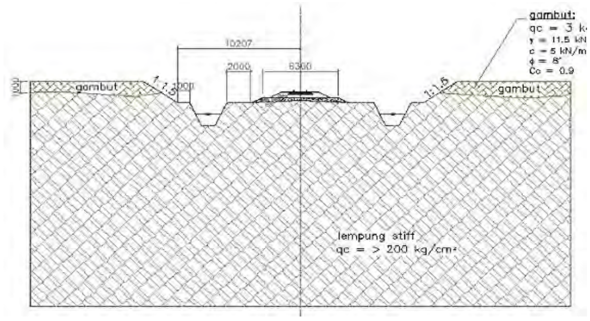
The soil bearing capacity shown in [Fig. 4-1-3] taken from the "Railroad Coal Transport System of PT. Bara Alam Utama/ Sojitz Corporation South Sumatra 2009" can be a reference.

Bearing capacity of foundation

・Alluvium (Qs) : 0,80-6,40t/m^2

・Muara Enim layer (Tmpm) : 10,40t/m^2

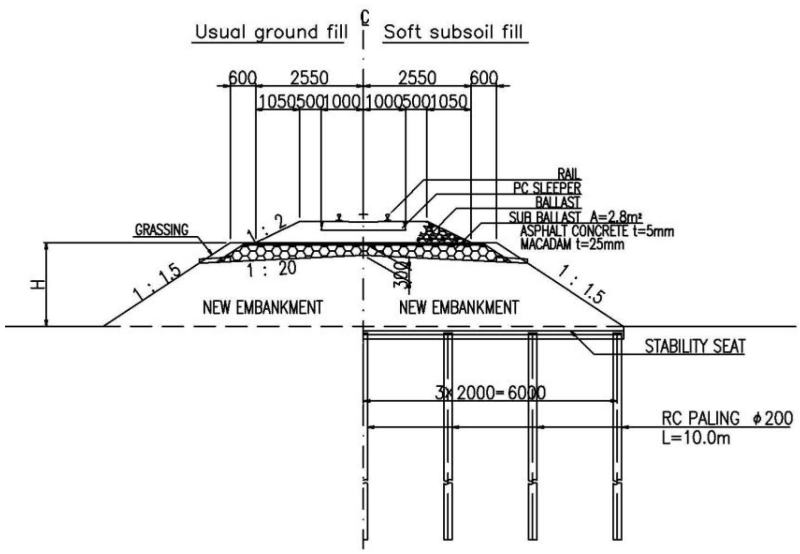
・Air Banakat layer (Tma) : 0,40-13,60t/m^2



(Source: Study team)

[Fig. 4-1-3] Soil Conditions at Simpang and Keramasan Stations

The embankment and cutting land are the majorities in the civil structures of study section, and the shape of embankment heavily depends on the ground condition. Soil of Payakabung - Kertapati section is assumed as soft subsoil because several meters of alluvial formation (Qs) is accumulated in surface layer. In order to prevent subsidence and ensure stability, appropriate construction method for embankment is necessary. Construction method which considered subsidence prevention and stabilization measurement will give little influence to the vicinity structures. As shown in [Table 4-1-11], pile net construction method is considered as the most appropriate method.



(Source: Study team)

[Fig. 4-1-4] Typical Cross Section of Embankment

[Table 4-1-11] Selection of Construction Method for Soft Ground

Construction method for Soft Ground / Design condition			Soft Ground Improvement Method												
			Substitution Method		Loading Method			Compression Piling Method		Consolidation Method			Industrial Method		
			Digging substitution	Compulsion substitution	Preloading	Atmospheric pressure industrial method	Underground water level lowering method	Crabel compaction	Sand compaction	Stir mixture piling	Lime pile	Chemical injection	Pile slab	Pile net	Sheet piling
Purpose	Subsidence		○	○	○	○	○	○	○	◎	○	○	◎	○	○
	Stability measures		○	○	○	○	○	○	○	◎	○	○	◎	○	○
	Road bed strengthening		◎	○	×	×	○	×	×	×	×	×	×	×	×
	liquefaction		×	×	×	×	×	◎	○	○	×	○	×	×	○
Effect	Subsidence	Promotion	×	×	◎	◎	◎	△	△	×	×	×	×	×	×
		Control	◎	◎	×	×	×	○	○	◎	○	○	◎	○	△
	Stability	Strength an increase	○	○	×	×	×	○	○	◎	○	○	○	○	○
		Strength promotion	×	×	○	○	○	△	△	×	△	×	×	×	×
		Load reduction	×	×	×	×	×	×	×	×	×	×	×	×	×
	Road bed improvement		○	○	×	×	×	×	×	×	△	△	×	×	×
	liquefaction		×	×	×	×	×	◎	○	△	×	○	×	×	○
Construction condition	Nature of soil	Cohesive soil	○	○	○	○	○	○	○	○	○	×	○	○	○
		Corrosion soil	○	○	○	○	○	×	×	○	○	×	○	○	○
		Sandy soil	×	×	×	×	×	◎	○	○	×	○	×	×	○
	Thickness of weak layer	<3m	○	○	○	○	○	○	○	○	○	○	△	△	○
		3～10m	×	×	○	○	○	○	○	○	○	×	○	○	○
		10m≦	×	×	○	○	○	△	△	○	×	×	○	△	△
	Influence on adjacent structure		○	×	×	×	×	×	×	◎	△	△	◎	◎	○
	Influence of noise vibration		◎	×	◎	○	○	×	×	○	△	○	△	△	△
	Fill amount	Low fill	◎	○	○	○	○	○	○	○	○	○	○	○	○
		High fill	○	○	○	○	○	○	○	○	○	○	○	○	○
	Work efficiency (term of works)		△	△	×	×	×	○	○	△	○	△	△	○	×

(note) ◎ :It especially suits the condition. ○: It suits the condition in principle.

△ :To suit the condition, the examination is required. ×: As a rule, it doesn't suit.

(Source: Study team)

4.1.4. Electric Power, Signal, and Telecommunication

(1) Existing Electric Power System

There is photovoltaic power generation equipment in Simpang Station. If it is the mechanical signal system which does not consume an especially large amount of electricity, it is satisfied with the current electric power system. However, due to its aged deterioration, the capacity expansion is necessary to modernize the equipment.

Signal and telecommunications house at Prabumulih Station and level crossing near Prabumulih Station were using the commercial power system.

(Source: Study team)

[Pic. 4-1-7] Power Generation at Simpang Station and Commercial Power System on Signal and Telecommunication House at Prabumulih Station

(2) Existing Signaling System

Mechanical interlocking system has been installed for South Sumatra Railway (Railway line between Lahat and Kertapati) excluding Prabumulih station. There is no special trouble with the small number of the train. However, the equipment needs to be updated due to the low equipment maintenance update frequency and the aged deterioration of essential equipment.

It was the situation that a class-1 electric relay interlocking device and telecommunication system would begin to be used soon at Prabumulih main signal and telecommunication house.

Signal system diagram at South Sumatra Railway (Railway line between Lahat and Kertapati) is attached to [Appendix 4-1-6] for reference.

(Source: Study team)

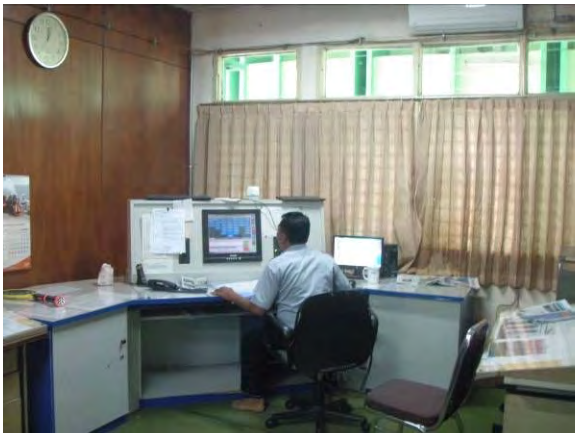
[Pic. 4-1-8] Signal and Telecommunication Equipment House at Prabumulih and Mechanical Interlocking Equipment of Gunungmegang Station

(3) Existing Telecommunication System

As for a communication line for traffic control, train radio was used from Palembang Operation Control Center (OCC) in each station. A level crossing house also had been using a metallic communication cables from the stations.

As in other equipments, the equipment needs to be updated due to the low equipment maintenance update frequency and the aged deterioration of essential equipment.

A Telecommunication system diagram (VHF wave and micro wave) is attached to [Appendix 4-1-6].



(Source: Study team)

[Pic. 4-1-9] Telecommunication System of Palembang Operation Control Center and Telecommunication System at Kertapati Signal House

4.1.5. Coal Loading/ Unloading Facilities

(1) Sukacinta Side

The coal loading/ unloading facilities in Sukacinta Station, Kertapati Station and stockyard nearby riverside of Musi are explained as follows:

In Sukacinta station, PT. BAU prepared 7.2ha of stockyard, which can store maximum 100,000tons of coal. In addition, service line was constructed from coal stock yard to main track of Sukacinta station where coal can be loaded directly to freight container. The coal is carried by trucks from coal mining place in Merapi area to coal stock yards with the distance of about 10km. While the coal stored in the stockyard is loaded by wheel loader to container freight wagon, the coal carried by container from Merapi is loaded on top of the freight wagon without being stored in the yard. At the current stage, 1,280tons (640 tons × 2 train sets) per day are loaded to containers for carriage to Kertapati.

Stockyard nearby Sukacinta station.

Truck running from Merapi to Sukacinta

(Source: Study team)

[Pic. 4-1-10] Present Condition of Sukacinta Side

(2) Kertapati Side

As for the unloading of coal in Kertapati station, PT. BA uses the dedicated wagons (hopper type wagon) for coal loading of which both sides are opened for unloading from there. The coal from the wagons is dumped directly to belt conveyer and transferred to a barge when the barges are in riverside, or stored in a stockyard. At this stage, only 1 belt conveyer (oscillation type) is working. Its loading capacity to barges is 1,000 ton per hour.


Loader by belt conveyer to barge


Unloading facilities

(Source: Study team)

[Pic. 4-1-11] Present Condition of Kertapati Side

As for the coal of PT. BAU which amounts to 1,280 tons per day, PT. KAI Logistics (KALOG) handles all loading/ unloading process from freight unloading, coal carriage until river side by truck as well as loading by belt conveyor to barges. The detailed process is as follows:

① When a train-set having containers with coal enters into container yard nearby Kertapati station, reach stacker grasps container and put each container to truck.


Unloading container from wagon


Loading container to truck

② Truck carries coal from the container yard to a coal stockyard by using public road of approximately 100m distance, and then unloads coal. The width of this coal stockyard is around 1ha.


Truck carrying container with coal


Coal stockyard in the riverside

③ The coal stored in the stockyard is loaded to barge by wheel loader and belt conveyer.


Wheel Loader in the Stockyard


Stockyard and Wheel Loader


Belt Conveyer installed in the Stockyard


Coals being load to barge

(Source: Study team)

[Pic. 4-1-12] Present Condition of PT. BAU Facility

4.2. Technical Measures to Demand Forecast

4.2.1. Technical Challenges to Determine the Project Size

Capacity expansion of railway can be achieved by increasing the number of train and increase the number of coaches in a train set, but it requires improvement of track structure as well. Conventionally, the improvement work is double-tracking and the double tracked rail can expect drastic capacity expansion which is much bigger than the two times of the number of rail because it contributes to make train operation planning easier, unless otherwise the operation is parallel single track type. However the double-tracking work requires big amount of construction cost as well as takes longer time before the construction work is completed.

With regard to this project, as it is discussed in 3.1.3. (P. 3-20), the capacity expansion of the railway for coal transportation is the urgent necessity and quick action is required even before the double-tracking work is completed. As such, this study considers it practical to gradually expand the railway capacity starting from maximum use of the existing single track toward the double-tracking by improving railway infrastructure and facilities.

The existing single track railway has various shortcomings as it was detailed in 1.2.1. (P. 1-24) which resulted in making the actual transportation capacity less than theoretical railway capacity. This state of condition is exemplified by running speed of train. Theoretically, railway capacity can be increased by increasing train running speed because travel time of higher speed train is shorter than that of slow train, thus number of train in a day will be bigger. In order to increase train speed, it is necessary to improve horizontal and vertical railway line alignment such as having bigger curve radius. The alignment improvement will not be necessary for the project section because, according to the design standard, design speed is set to 70km/h. In this addition, it will be necessary to have strong track bed and replacement of rail to heavier type in order for a train to run safe and stable.

Another measure to expand transportation capacity is to increase the number of wagon in a train. In a single track railway operation, one of two trains running opposite direction must stop and wait in a place to allow another train to pass. The waiting place must have enough length of rail for a train to park. The parking rail length must be extended to accommodate longer trains with bigger number of wagons (extension of effective length). Transportation capacity can be increased by allowing trains to pass each other at their convenient spots. Therefore, it is an effective measure to increase the number of the waiting place (signaling station) for transportation capacity expansion. It is also effective to establish a rational and practical train operation planning based on run-curve in which locomotive performance, horizontal and vertical alignment, location of signaling stations and so forth are incorporated.

No matter how much the transportation capacity is increased at the railway side, if loading capacity at train departure side and unloading capacity at train terminal side are short, waiting train cue will be developed at both sides of the railway thus transportation capacity as a whole will not be expanded.

As it was overviewed above, measures to expand railway transportation capacity is summarized as below. It should be noted that the listing is not a logical one but just a reference for the better understanding in the subsequent description, because the measures listed below are interrelated each other. As for the detailed capacity expansion measure, it is elaborated in (4) of 4.3.1. (P. 4-28).

- Increase the traction power of locomotives, thus increase the number of wagon in a train.
- Increase the number of rolling-stock (locomotive and wagon), thus increase the number of train in a railway line.
- Expand the capacity of rolling-stock depot, thus increase the capacity utilization of rolling-stock.
- Deploy high performance locomotive in acceleration, deceleration and running speed.
- Improve horizontal and vertical alignment of the railway line to facilitate high speed running of the train.
- Establish rational and practical train operation plan, thus increase train density of a railway line.
- Increase the number of signaling station in a single track section, thus allow a trains to pass each other in a timely manner.
- Strengthen the track bed, thus allow a trains to run with higher speed and bigger number of wagons.
- Replace the existing rail with a heavier type, thus allow a train to run with higher speed and bigger number of wagons.
- Modernize signaling system, thus reduce opportunity of train schedule disorder and facilitate quick restoration from the disorder.
- Modernize signaling system, thus facilitate punctual train operation.
- Modernize safety facilities, thus reduce opportunity of train accident.
- Enhance maintenance quality performance, thus reduce opportunity of train accident and speed saving operation.
- Expand coal loading facility, thus facility coal train to depart loading site on schedule.
- Expand coal unloading facility, thus facilitate coal train not to wait before arriving at the coal unloading site.
- Expand coal dumping site at both ends of a railway line, thus facilitate loading and unloading work quickly.

4.2.2. Technical Options for Transport Capacity Expansion

It was proposed in 4.2.1 that the project shall be implemented in a step-by-step manner under the current circumstances of urgent necessity of transportation capacity expansion, and described technical measures to expand the capacity. The measures to be taken into the project are summarized in the following 3 options by symbolizing with each track improvement work.

① Single Track Option: This option is to make maximum use of the existing single track railway, thus increase the number of operating train a day.

② Partial Double-Tracking Option: This option is to add signaling stations for trains to pass each other, thus further increase the number of operating train a day.

③ Whole Double-Tracking Option: This option is to build additional railway track in the entire stretch of the existing single track railway line and introduce modern signaling system to facilitate effective train operation control, thus ultimately increase the number of train a day.

This study proposes to implement the above mentioned 3 options in sequence in line with the increase of coal transportation demand. In the mean time, the facilities other than railway infrastructure will be deployed with a scale in balance with the target transportation volume of each option. Here, "in sequence" means that the construction work itself excluding procurement process of the 2nd Stage shall be carried out immediately after the completion of the 1st Stage construction work, and in the same way, the 3rd Stage construction work shall be carried out immediately after the 2nd Stage construction work overlapping procurement process of the 3rd Stage work with the 2nd Stage construction work process, so that there shall be no idle time of construction work between each stage.

The prospected client of the Project is all the coal mine companies, but the total sum of the demand is already 10.0MTPA excluding track transportation in 2014 which is not achievable in a short run. Therefore, this study picks up PT. BAU transportation demand in determining target transportation volume. The transportation volume target at each stage is basically set as to cope with the PT. BAU demand growth. However, each target must be checked whether or not the measure taken at each option corresponding to each step can comply with the target volume. Therefore, the final target volume is set through confirmation process described below.

In the ①Single Track Option, the target volume of the 1st Stage was checked out if a transportation volume calculated by increasing train speed, by increasing number of wagon of a train and by increasing number of train a day based on maximum density of train operation plan which is practically acceptable, will exceed the target volume. As for the ② Partial Double-Tracking Option, the target volume of the 2nd Stage was checked out if a transportation volume calculated by increasing least number of signaling station, by increasing number of wagon of a train and by increasing number of train a day based on maximum density of train operation plan which is practically acceptable, will exceed the target volume. In the case of ③Whole Double-Tracking Option, since the whole double-tracking measure can accommodate substantial volume increase of transportation, the target volume of the 3rd Stage was set in compliance with the growth of transportation demand and the capacity of loading and unloading facility at the 3rd Stage. As a result, the figures in the table below were adopted as the target volume of each stage.

[Table 4-2-1] Target Transportation Volume and Calculation Basis (The 1st Stage & The 2nd Stage)

Step	Target	Calculation Basis
The 1st Stage	2.5MTPA	● The coal transportation demand of PT. BAU in the year 2014 will reach 4.0MTPA (total sum for private mines is 12.2MTPA), but a part of the amount will be by truck. It is estimated that the maximum amount by truck will be 1.5MTPA considering the congestion of road traffic and damage of the road. Therefore the balance the two figures of 2.5MTPA is set as a target volume for the rail. If the road condition was further aggravated and additional road traffic restriction was imposed, the amount expected for the rail will exceed 2.5MTPA and the coal production will be restrained. ● Regarding passenger transportation, since the train schedule will be congested by the increased number of coal freight train, the increase of passenger demand is proposed to be coped with increasing the number of passenger coach in a passenger train, maintaining the number of passenger train in a day.
The 2nd Stage	5.0MTPA	● The coal transportation demand of PT. BAU in the year 2014 will reach 4.0MTPA, but stable transportation by road will not be expected because road rehabilitation plan is not expected while damage may be aggravated further more, and imposition of road traffic restriction will be strengthened. Therefore, it is projected that PT. BAU will shift the coal transportation mean for its whole production from road to rail of which stable transportation is assured. In this addition, since other private mines are willing to transport their coal by train, 1.0MTPA is added and the total sum is calculated to 5.0MTPA. Minimal amount of coal produced by other small coal mines will still be transported by road. ● Regarding passenger transportation, since the train schedule will be congested by the increased number of coal freight train, the increase of passenger demand is proposed to be coped with increasing the number of passenger coach in a passenger train, maintaining the number of passenger train in a day.

(Source: Study team)

[Table 4-2-2] Target Transportation Volume and Calculation Basis (The 3rd Stage)

Step	Target	Calculation Basis
The 3rd Stage	20.0MTPA	● The present coal transportation demand in Sukacinta area is already 12.2MTPA as it is shown in [Table 3-1-11] of 3.1.3. The demand increase in the years to come hinges on railway transportation capacity expansion, but according to a demand forecast for the east route in 2020 made by PT. KAI is 20.0MTPA. Here, the target demand for this project is set to 20.0MTPA. It should be noted that the transportation capacity for the whole double track line is far bigger than this amount. ● Regarding passenger transportation, the number of passenger train will be increased to accommodate the expected passenger demand of about 2 times of the current level, because the line capacity in the 3rd Stage will have enough volume by the double-tracking work.

(Source: Study team)

In this study, a stage to which the project should be implemented will be proposed in terms of economic and financial point of view, because the project is targeting private investment in the PPP framework. The yardstick to make the decision will be elaborated in the Chapter 7 of Economic and Financial Analysis.

4.3. Operation Plan

4.3.1. Precondition

(1) The Present Operating Conditions

From the train diagram dated October 1, 2011, the current operating conditions of the train between Kertapati and Lahat are summarized in [Table 4-3-1].

[Table 4-3-1] Train Operation Condition (Oct 1, 2011)

Type of train	Number of trains					
	LT-ME	ME-NUR	NUR-X6	X6-PBM	PBM-PYK	PYK-KRT
Passenger	4	4	4	4	8	12
Freight	16	70	71	32	38	38
Total	20	74	75	36	46	50

LT : Lahat NRU : Niru PYK : Payakabung
ME : Muara Enim PBM : Prabumulih KPT : Kertapati

(Source: PT. KAI)

According to [Table 4-3-1], the trains are concentrated mainly between Muara Enim and Prabumulih X6, and this is because the coal trains for PT. BA which is operated in the section between Muara Enim and Tanjung Karang.

(2) Line Capacity

The line capacity in the single track section is calculated by the following formula.

$$N = \frac{1{,}440}{(t+s)} \times d \quad \cdots\cdots\cdots\cdots (4\text{-}1)$$

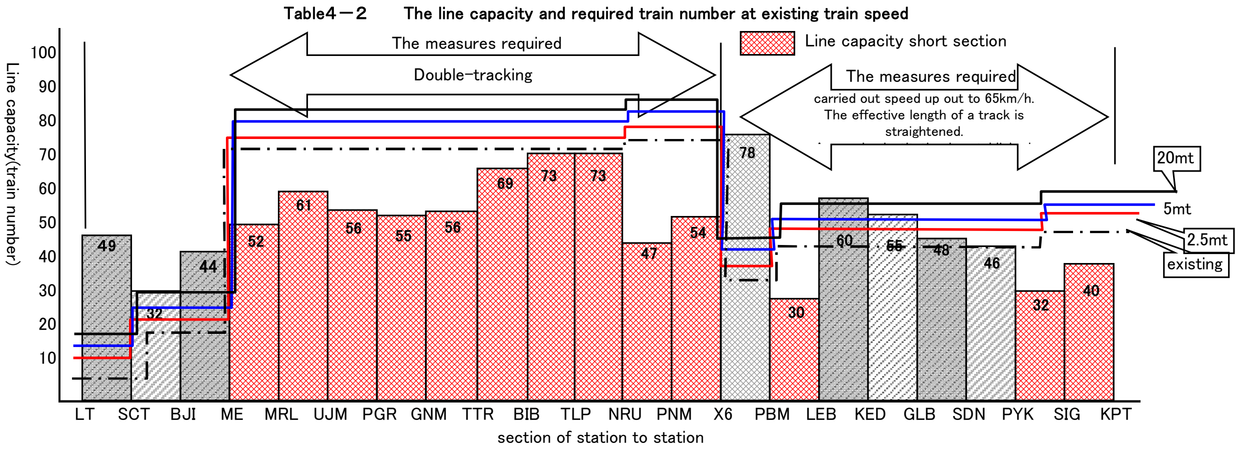
t: Average train running time station to station (minute)
s: Operation service time in a station (minute)
d: Line utilization ratio

Here, operation service time "s" is the time until it can leave a train which turnout is switched, a route is constituted, and a proceed signal is displayed on the starting signal to the direction, and actually goes to the opposite direction, after the train from a certain direction arrives at a station. It is assumed that 2.5minutes is the standard operation service time in the non automatic block section.

Line utilization ratio "d" is the rate of time zone for which a line is actually used in 24hours per day. This rate is approximately 55% - 75% depending on restrictions of time zone allocated for track maintenance work and train schedule. However, the line utilization ratio of the line on which trains with different service speeds are operated is generally set as 60%.

[Fig. 4-3-1] shows the result of investigation comparing line capacity by section based on the formula (4-1) with train number based on present train diagram, present transportation volume and planned ones. According to this figure, it can be read that the line capacity is already short in seven sections. Since train diagram will be easily jeopardized if line capacity is in short, the following problems are expected to arise.

- Since the opportunity of crossing station and passing station increase, the scheduled train speed may fall. Moreover, it may become easy to cause train delay.
- Train delay cannot be restored once operation diagram is jeopardized. In this case, such delay may affect the following train and incoming train, and it becomes a cause of chronic delay.
- Since there is no margin in the diagram, implementation of line maintenance work etc. becomes difficult.



(Source: Study team)

[Fig. 4-3-1] The Line Capacity and Required Train Number at Current Train Speed

(3) Transport Capacity Increase

In order to satisfy the coal production increase by PT. BAU, SPC plans the transport capacity increase between Kertapati and Lahat. In order to increase transportation capacity, although there are 2 ways, namely "adding wagons" which generally increases the number of wagons of train set, and "increase the number of train" which increases train number without adding wagons, however, there are also the following shortcomings.

- The track improvement work by extending track effective length of stations is needed. In addition, in order to increase the traction of a locomotive, it becomes necessary to improve slope gradient.
- Even though the number of train is increased, there is no effect in increasing the transportation capacity because the train is already dispatched up to the limit of line capacity.

(4) Method to Increase the Line Capacity with Single Track Operation

The fundamental solution to increase transport capacity is to increase the line capacity. The following methods can be considered in order to increase the line capacity in the single track section.

① Shorten the Distance between Stations.

- Construct sidetracks in the intermediate stations in which the sidetrack is not prepared.
- Construct crossing and passing stations in the sections where the distance between stations is long.

- Implement partial double-tracking in the sections in which line capacity is short.

② Raise Train Running Speed in order to Shorten the Average Operation Time between Stations,.

③ Shorten Operation Service Time.

- Introduce automatic signal control system.
- Introduce relay interlocking system in station yards.

④ Implement Double-tracking in the Whole Line as a Drastic Measure.

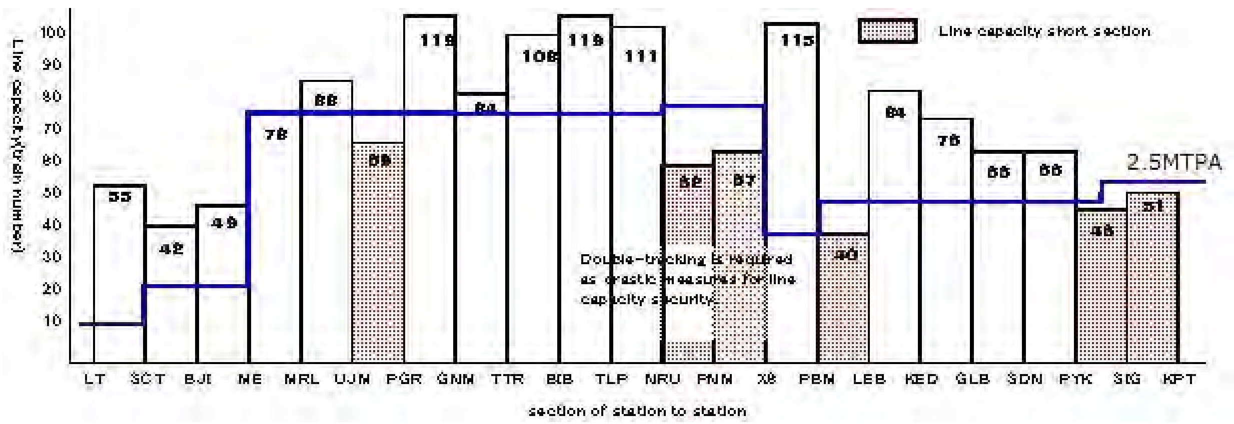
(5) Transportation Planning

The transportation planning of SPC to comply with the coal production plan of PT. BAU, and the necessary measures to fulfill the demand are shown in [Table 4-3-2].

[Table 4-3-2] Transportation Planning of SPC

<table>
<tr><th colspan="2">Year</th><th colspan="4">The 1st Stage</th><th colspan="4">The 2nd Stage</th><th colspan="4">The 3rd Stage</th></tr>
<tr><td colspan="2">The annual production target of BAU</td><td colspan="4">2.5MTPA</td><td colspan="4">5.0MTPA</td><td colspan="4">20.0MTPA</td></tr>
<tr><td colspan="2">Annual transportation target</td><td colspan="4">2.5MTPA</td><td colspan="4">5.0MTPA</td><td colspan="4">20.0MTPA</td></tr>
<tr><td colspan="2">The number of freight wagons per train (train length)</td><td colspan="4">25(395m)</td><td colspan="4">40(615m)</td><td colspan="4">60(930m)</td></tr>
<tr><td colspan="2">Required train number</td><td colspan="4">8</td><td colspan="4">10</td><td colspan="4">21</td></tr>
<tr><td colspan="2">Annual transport maximum</td><td colspan="4">2.6MTPA</td><td colspan="4">5.2MTPA</td><td colspan="4">20.4MTPA</td></tr>
<tr><td rowspan="6">Required train number</td><td rowspan="2">Locomotive</td><td>Line</td><td>shunting</td><td>spare</td><td>total</td><td>Line</td><td>shunting</td><td>spare</td><td>total</td><td>Line</td><td>shunting</td><td>spare</td><td>total</td></tr>
<tr><td>8</td><td>0</td><td>3</td><td>11</td><td>9</td><td>3</td><td>3</td><td>15</td><td>26</td><td>5</td><td>5</td><td>36</td></tr>
<tr><td rowspan="2">Freight wagon</td><td colspan="2">Use</td><td>Spare</td><td>Total</td><td colspan="2">Use</td><td>pare</td><td>Total</td><td colspan="2">Use</td><td>Spare</td><td>Total</td></tr>
<tr><td colspan="2">200</td><td>10</td><td>210</td><td colspan="2">400</td><td>20</td><td>420</td><td colspan="2">840</td><td>20</td><td>860</td></tr>
<tr><td rowspan="2">Container</td><td colspan="2">Use</td><td>Spare</td><td>Total</td><td colspan="2">Use</td><td>pare</td><td>Total</td><td colspan="2">Use</td><td>Spare</td><td>Total</td></tr>
<tr><td colspan="2">400</td><td>20</td><td>420</td><td colspan="2">800</td><td>40</td><td>840</td><td colspan="2">*****</td><td>***</td><td>***</td></tr>
<tr><td colspan="2" rowspan="3">Measure required for transport capacity increase</td><td colspan="8">Train length is less than the effective length of each station except ME.</td><td colspan="4">Extension is required in the effective length of each station between KRT-X6.</td></tr>
<tr><td colspan="4">Diagram setup is possible for between KRT-X6 without speed up.</td><td colspan="8">The speed up is required for 65km/h in the all section.</td></tr>
<tr><td colspan="12">Between X6 and GNM, double-tracking is requiredA crossing facility is required for the middle between PGR and UJM.</td></tr>
</table>

(Source: Study team)



(Source: Study team)

[Fig. 4-3-2] Line Capacity with Train Speed Increase up to 65km/h (8 Extra Trains of SPC train)

[Fig. 4-3-2] shows the comparison of line capacity and train number with upgraded traveling speed between KRT-ME and to comply with the 2.5MTPA transportation. According to this figure, the shortage of line capacity between KPT and PBM will improve, when train running speed is improved to 65km/h. However, since shortage is not improved as for the capacity between X6 and GNM, double-tracking of the section will be necessary.

4.3.2. Run Curve

In preparing operation plan, a train hauling 1,400t with one CC205 type locomotive between LT and KPT, and another empty freight train hauling 1,100t with one CC201 type locomotive on the way back both of which the maximum speed is set to 65km/h is set. Run curve, minimum train running time table and train operation diagram are reviewed based on the upgraded speed. As a result, it has been confirmed that the extra train of 10 round trips would be possible per day by raising running speed of trains in the section. Therefore, it proves that the transportation planning of [Table 4-3-3] is reasonable, and it is highly likely that this can be realized.

[Table 4-3-3] Minimum Running Time

Odd Number Train						Section		Even Number Train					
Ruling Grade (‰)	Freight Train					Station	Distance (Km)	Coal Train					Ruling Grade (‰)
	CC201					Type of Locomotive		CC205					
	1100 ton					Hauling Capacity		1400 ton					
L		13·15 =	— 12·00			Kertapati (KPT)	11.6		— 12:00		13:45 =		L
-0.9		17·00 =	— 15.30	16·00 —	14·30	Simpang (SIG)	15.2	14:00	— 15:00	15:15 —	16:15 =		0.9
L		12·15 =	— 11·00	10·45 —	9·30	Payakabung (PYK)	9.9	9:00	— 10·15	10·30 —	12·00 =		L
-0.5		14·45 =	— 12·30	11·45 —	10·30	Serdang (SDN)	9.7	9·15	— 10·30	10·45 —	12·00 =		0.5
L		10·45 =	— 9.30	9·00 —	7·45	Gelumbang (GLB)	8.2	8:00	— 9·15	9·15 —	10·30 =		L
0.2		9·15 =	— 8·15	7·45 —	7·00	Karangendah (KED)	7.4	7·15	— 8·30	8·30 —	10·00 =		-0.2
-1.6		18·15 =	— 16·45	16·00 —	14·30	Lembak (LEB)	15.9	15·00	— 16·15	16·30 —	17·30 =		1.6
2			— 4·15		3·00	Prabumulih (PBM)	3.4	3·30	— 4·30				-2
8.6				14·45 —	12·15	X6 (Pbrx6)	7.9	7·15		8·00 —			-8.6
2.5		12·30 =	— 11·00	12·15 —	10·45	Penimur (PNM)	10.8	10·30	— 12·00	11·45 —	13.15 =		-2.5
-0.1		12·15 =	— 11·00	11·00 —	9·45	Niru (NRU)	10	9·30	— 12·00	10·15 —	13·00 =		0.1
4		17·15 =	— 16·30	15·45 —	15·00	Blimbingpendopo(BIB)	12.7	12·30	— 14.30	13·30 —	15·15 =		-4
7.6		12·15 =	— 11·15	11·00 —	9·45	Gunungmegang(GNM)	6.5	6·30	— 8·00	7·45 —	8·45 =		-7.6
7.6		15·45 =	— 13·45	15·15 —	13·30	Penanggiran(PGR)	7.9	8·00	— 9·45	9·00 —	10·45 =		-7.6
-4.7		8·45 =	— 6·45	8·15 —	6·15	Ujanmas (UJM)	6.4	6·45	— 8·30	8·45 —	10·00 =		4.7
4.8		12·00 =	— 11·00	10·30 —	9·15	Muaragula (MRL)	8.2	7·45	— 9·15	9·00 —	10·45 =		-4.8
9.3		22·00 =	— 21·00	19·15 —	18·15	Muaraenim (ME)	10.8	10·30	— 11·45	11·30 —	13·00 =		-9.3
1.8		19·15 =	— 18·30	18·30 —	17·45	Banjarsari (BJI)	16.8	16·00		17·00 —	18·15 =		-1.8
-1.8		13·00 =		11·30 —		Sukacinta (SCT)	10.5			11·30 —	12·15 =		1.8
						Lahat (LT)							
						Total	189.8						
						Mean Speed	===						

(Source: Study team)

The transport capacity increase measures depending on the transportation planning is shown in [Table 4-3-4].

[Table 4-3-4] The Transportation Planning of SPC and Necessary Measure

<table>
<tr><th>Year</th><th>The 1st Stage</th><th>The 2nd Stage</th><th>The 3rd Stage</th></tr>
<tr><td>The annual production target of BAU</td><td>2.5MTPA</td><td>5.0MTPA</td><td>20.0MTPA</td></tr>
<tr><td>Annual transportation target</td><td>2.5MTPA</td><td>5.0MTPA</td><td>20.0MTPA</td></tr>
<tr><td>The number of freight wagons per train (train length)</td><td>25（395m）</td><td>40（615m）</td><td>60（930m）</td></tr>
<tr><td>Required train number</td><td>8</td><td>10</td><td>21</td></tr>
<tr><td>Annual transport maximum</td><td>2.6MTPA</td><td>5.2MTPA</td><td>20.4MTAP</td></tr>
<tr><td rowspan="3">Measure required for transport capacity increase</td><td colspan="2">Train length is less than the effective length of each station except ME.</td><td>Extension is required in the effective length of each station between KRT-X6.</td></tr>
<tr><td>Diagram setup is possible for between KRT-X6 without speed up.</td><td colspan="2">The speed up is required for 65km/h in the all section.</td></tr>
<tr><td colspan="3">Between X6 and GNM, double-tracking is requiredA crossing facility is required for the middle between PGR and UJM.</td></tr>
</table>

(Source: Study team)

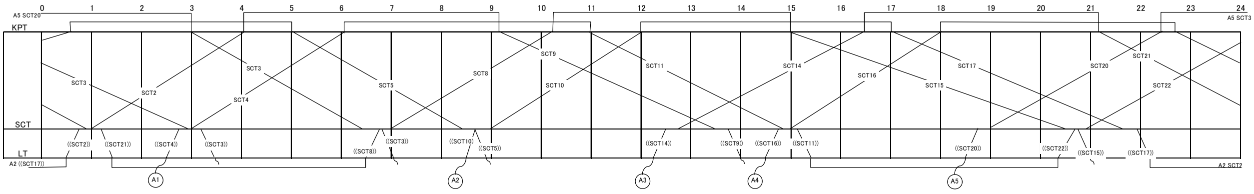
The 5.0MTPA transport volume will be achieved by partial double tracking, adding wagons to train, and having extra trains. However, double tracking of the whole line would be needed in order to secure line capacity when the demand exceeds 5.0MTPA.

4.3.3. Rolling Stock Operation Scheduling Plan

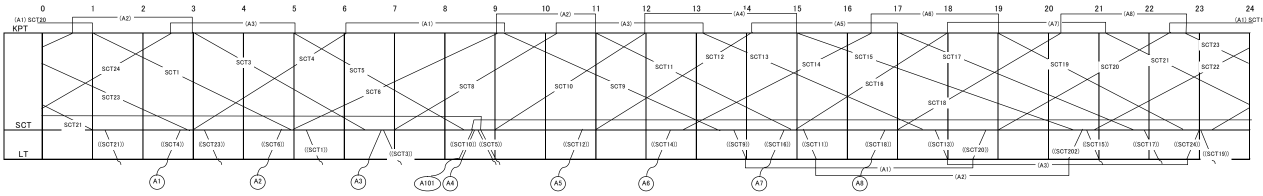
(1) Locomotive Operation

The trains of up to 40 freight wagons formation can be hauled with one CC205 type locomotive. However, when the necessity of adding freight wagons occurs, it is necessary to increase the number of locomotive to 2. Although the locomotive will be procured by SPC, it would be reasonable to have technical unification with PT. KAI in the service of rolling stock and maintenance and repair as well as in consideration of rolling stock operation scheduling and the necessary crew, etc. From the above viewpoint, the locomotives being procured by SPC would be CC205 and this may bring efficiency, less environmental impact, commercial benefit and technical standard. Both for main line and for shunting use, CC205 type locomotive can be used, and this may bring unification of maintenance management. Locomotive operation scheduling model at each stage is shown in [Fig. 4-3-3].

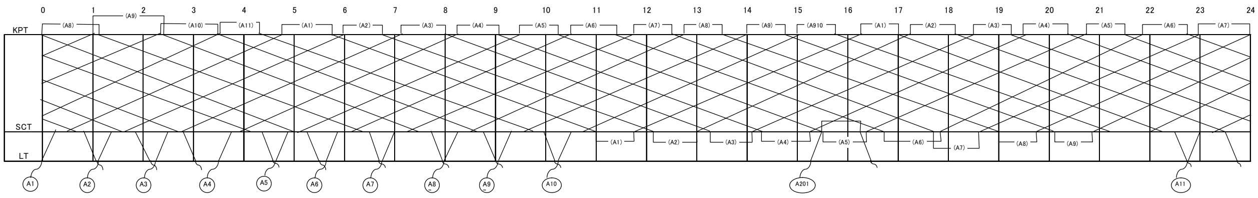
1st Stage



2nd Stage



3rd Stage



（Source：Study team）

[Fig. 4-3-3] Locomotive Operation Scheduling Diagram

According to [Fig. 4-3-3], the locomotive operation pattern in the 1st Stage and the 2nd Stage between Sukacinta and Keratapati will be loaded train, while between Lahat and Sukacinta is empty train. In the 3rd Stage, since the number of train will be increased to 21 trains, for higher operation efficiency, locomotives are based on turning at Sukacinta station. Locomotives will be returned to Lahat depot only for the purpose of water refilling, refueling, and inspection.

(2) Freight Wagon Operation Scheduling

In the 1st Stage and the 2nd Stage, the same container freight wagons as the existing transportation style would be used. In the 3rd Stage, the freight wagons specialized for coal transport of 50ton loading could be used.

4.3.4. Rolling Stock Planning

The necessary number of the rolling stock is shown in [Table 4-3-5].

(1) Locomotive

Locomotives will be principally located in the locomotive depot of Lahat judging from operating efficiency and operation and maintenance contract with PT. KAI. Since there is a rolling stock workshop in Lahat, it would be possible to entrust important parts inspection and general inspection. Although the locomotives to be procure by SPC will be 36 cars at the 3rd Stage, expansion of the facility and increase of the number of crew and maintenance staff would be needed. It was informed by PT. KAI official in Lahat that the outsourcing of the maintenance of CC205 type locomotives is under consideration by PT. KAI. In such a case, the maintenance of locomotives owned by SPC may also be outsourced.

Loading-and-unloading facility of coal would be newly built in the shore of the Musi river, which is about 7km away from Simpang to the north, and there would be an option to construct a coal private siding from Simpang to a unloads facility. In this case, the locomotive and freight wagon depot dedicated to SPC would be constructed in a private siding, and there would be also an option to carry out important parts inspection and general inspection there. Important parts inspection and general inspection of CC205 type locomotive of PT. KAI would be also undertaken as an option.

Up to the volume of 1.0MTPA, the main line locomotives can act as shunting locomotives, however if it goes over 2.5MTPA, dedicated shunting locomotives would be necessary at Lahat station and Kertapati station.

(2) Freight Wagon

Transportation of coal follows the existing loading-and-unloading and transportation style, therefore container style transportation is applied. Since the number of wagon is large and operating conditions is expected to be severe, container freight wagons shall be stationed at Lahat and Kertapati stations in order to keep the condition good. It would be necessary to also place containers at both stations and proper maintenance should be given.

[Table 4-3-5] Rolling Stock Input Plan

<table>
<tr><th colspan="2">Year</th><th colspan="4">The 1st Stage</th><th colspan="4">The 2nd Stage</th><th colspan="4">The 3rd Stage</th></tr>
<tr><td colspan="2">The annual production target of BAU</td><td colspan="4">2.5MTPA</td><td colspan="4">5.0MTPA</td><td colspan="4">20.0MTPA</td></tr>
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<tr><td colspan="2">Annual transport maximum</td><td colspan="4">2.6MTPA</td><td colspan="4">5.2MTPA</td><td colspan="4">20.4MTPA</td></tr>
<tr><td rowspan="6">Required train number</td><td rowspan="2">Locomotive</td><td>Line</td><td>shunting</td><td>spare</td><td>total</td><td>Line</td><td>shunting</td><td>spare</td><td>total</td><td>Line</td><td>shunting</td><td>spare</td><td>total</td></tr>
<tr><td>8</td><td>0</td><td>3</td><td>11</td><td>9</td><td>3</td><td>3</td><td>15</td><td>26</td><td>5</td><td>5</td><td>36</td></tr>
<tr><td rowspan="2">Freight wagon</td><td colspan="2">Use</td><td>Spare</td><td>Total</td><td colspan="2">Use</td><td>pare</td><td>Total</td><td colspan="2">Use</td><td>Spare</td><td>Total</td></tr>
<tr><td colspan="2">200</td><td>10</td><td>210</td><td colspan="2">400</td><td>20</td><td>420</td><td colspan="2">840</td><td>20</td><td>860</td></tr>
<tr><td rowspan="2">Container</td><td colspan="2">Use</td><td>Spare</td><td>Total</td><td colspan="2">Use</td><td>pare</td><td>Total</td><td colspan="2">Use</td><td>Spare</td><td>Total</td></tr>
<tr><td colspan="2">400</td><td>20</td><td>420</td><td colspan="2">800</td><td>40</td><td>840</td><td colspan="2">-</td><td>-</td><td>-</td></tr>
</table>

(Source: Study team)

4.4. Proposal of Facility Scale

4.4.1. Site Condition and Technical Problem

Railroad between Lahat and Kertapati is going down from altitude of 78m of Sukachinta towards altitude of 2m of Kertapati via altitude of 43m of Prabumulih. Topographically, it is classified mountainous area between Lahat and Muara Enim, hilly area between Muara Enim and Payakabung, and plains area between Payakabung and Simpang.

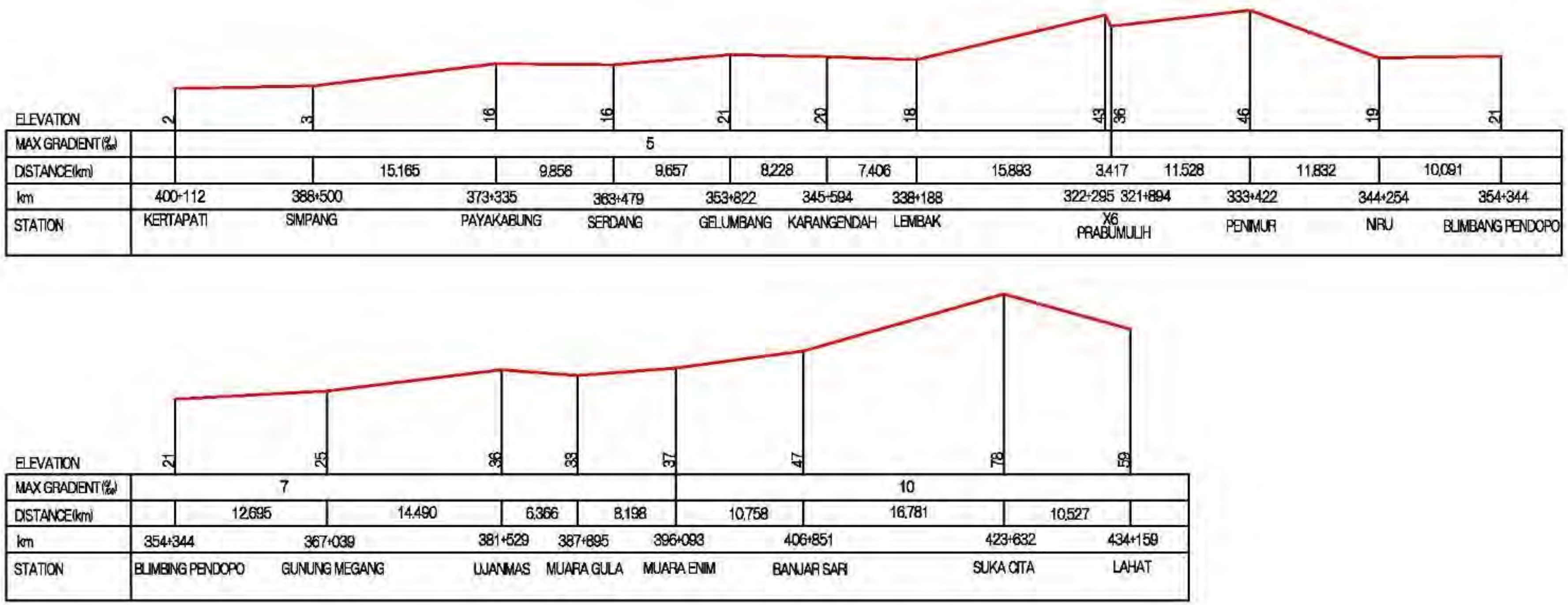
There are many slope sections of 10‰ which is the maximum steep grade between Lahat and Muara Enim, and there are many curves of 500m or less in radius. As for geology, Sedimentary rock of Air Banakat layer (Tma) and Muaraenim layer (Tmpm) is distributed by ordinary ground. Although cities and villages are formed around major stations, there are few houses observed in between.

Up and down vertical alignment with average grade of 5‰ with loose curve more than 1,000m in radius in line with topographic land shape is going on between Muaraenim and Payakabung. In terms of geology, ordinary ground and sedimentary rock of Kasai layer (Qtk) is distributed. Although cities and villages are formed around major stations, there are few houses observed in between.

As for Payakabung - Kertapati section, it is located in alluvial fan inserted into Musi river and Ogan river and it is running on a flat ground with an altitude of 2m or 3m with many loose curves more than 1,000m in radius. In terms of geology, the swampy sedimentary soft soil of

Anuvium (Qs) is surfacing over the bed ground. Although there are few houses in the swampy sedimentary soil section, Kertapati is urbanized and is crowded with private houses.

All the sections between Lahat and Kertapati are the earthwork sections (cut and embankment), and civil structure and railroad structures to be observed are station home, bridge, small-scale lateral viaduct, and crossing.



(Source: Study team)

[Fig. 4-4-1] Slope between Stations

Judging from these field conditions, in order to make in-depth plan for the alignment and facility, it is necessary to create station yard plan view, plane alignment view, and vertical alignment view based on topographic survey. When extending clear length, due to the limitation of slope in the station yard to be less than 2.5‰, it is necessary to conduct a study to secure the slope gradient of 2.5‰ for the extension line, while intense field survey will be necessary to determine the location of new line.

According to the result of field survey, wear of rail head and side, breakage or damage to concrete sleeper presumably caused by either train derailment or shortage of track-bed ballast were detected. It was explained by PT. KAI official in the field survey that damage of up to 3 pieces of sleepers has no problem for the train operation, but it is baseless and very questionable.

Rehabilitation of track is a pressing issue, because many problems are observed such as shortage of maintenance, poor arrangement of sleepers, and lack of fastening will affect safety and stable transportation.

Crossing must be improved in the mean time because as it is exemplified that crossing is not equipped with crossing gate and maintenance of road surface is not suitable.

Signaling and telecommunication system is superannuated. It seems difficult to speed up train. Updating to modernistic electric equipment is required.

In the section where track rehabilitation is needed, the work includes all rail, sleeper, track bed (ballast supplement), turnout, and weak track-bed improvement. But, if the work is implemented in one single project, it will require not only huge project cost and time necessary for completion, but also require extra cost because major track materials have to be supplied from abroad. It is proposed to make an practical plan in terms of fund raising and implementation phasing.

Although improvement of track bed is performed simultaneously, embankment material selection should be conducted in advance of construction in order to use appropriate materials with good drainage performance.

Although there are many problems as described above in the facilities, it is proposed to implement the project starting from the higher priority component in the upgrading of track structure and signal facilities rather than implement it in one project for the total stretch of the project line, because it requires huge project cost and time which hinder the rapid expansion of transportation capacity.

If maintenance is not performed by optimum method in a timely manner, the facilities rehabilitated in the project will be rapidly deteriorated and high speed train operation will not be possible. Therefore, education of maintenance people based on the scheduled maintenance concept must be introduced.

The subjects which should be taken into consideration in the rehabilitation of facilities are summarized as below.

(1) Replacement of a Track Material

① Rail Replacement

- The rail weight between Prabumulih and Kertapati is R42 rail laid more than 50 years ago. The standard replacement period of 40kg class rail due to detritions or fatigue using is about every 300 million ton in accumulated tonnage. Since the tonnage has reached in 16MTPA now, the track is considered to reach rail replacement timing.
- Since the line is classified as 2nd class in terms of tonnage, the new rail to be laid should be heavier with rail classification of R54.
- Destruction of track (track irregularity) is expected to be eased by use of heavier rail in which rail life will be extended (extension of a rail-replacement cycle length) and train load impact with high speed running will be distributed more widely.
- The rail classification between Muara Enim and Prabumulih is R54 rail laid about 40 years ago. The standard replacement period of 50kg class rail due to detrition or fatigue is about 300 - 400 million ton in an accumulated tonnage. It seems that the rail is in a marginal condition since the present tonnage is 43MTPA.

② Replacement of Sleeper and Fastening

- As for the pre-stressed concrete sleeper between Prabumulih and Kertapati section, since 50 years have passed since it was laid, aging is progressing considerably as exemplified in the exposure of steel bar with the defect rate of 30%. Moreover, the elasticity of the rail pad of fastenings is lost mostly in all parts. Omission of a rail clip also appears here and there. Sleepers and Fastenings have a function of distributing train load equally, transmitting it from rail to ballast, and resisting against track buckling. However, if they are not replaced as it is, the function will be lost and accidents, such as a rail overhang and a rail failure in the end and it will lead to a serious trouble for train operation. Therefore, replacement is needed.
- If the existing rail of R42 is used even after the replacement of sleepers, the fastenings for pre-stressed concrete sleepers should be so selected as to compatible for different types of rail of R42 rail and R54 rail just by replacing rail insulator pad between fastening and rail clip to prepare for the future rail replacement.
- Since over 40 years has passed since the track between Muara Enim and Prabumulih was laid, the sleepers and the fastenings of the section are over used and the replacement of broken PC

sleepers and rail fastenings are necessary. Besides, rail pads of which elasticity was lost should be replaced as well.

- Cracked pre-stressed concrete sleepers and rail fastening without rail clip are neglected for maintenance at present, but once after they are replaced, track materials inventory should be controlled properly, replaced in a preventive maintenance concept, maintain the track in sound condition, and make effort to efficient track maintenance in order to counter against railway accident.

③ Ballast Renewal

- Altitude is low (2 - 3m) between the 375+000 in the vicinity and Kertapati, and its ground is soft. The state of a sub-grade is considered that it is bad, and ballast caves in into a sub-grade or earth and sand are mixing into ballast.
- Moreover, as for the weak-ground part (refer [Appendix 4-4-1]) including the vicinity of level crossing between Lahat and Simpang, the ballast has caved in into the sub-grade. In the part which caved in, due to the rigidity of the rail, it became a loose sleeper, and the mud pumping failure has occurred.
- The function of ballasts (such as the resistance to the rail overhang at the time of a rise in temperature, distribution of the train load to sub-grade, sleeper position keeping, securing track drainage) is lost by mud pumping failure and the soil mixes in ballast. As a result, since a rail overhang accident is induced or it has a big possible adverse effect on the maintenance frequency, a ballast renewal is required.
- In the ballast renewal of the existing line, in order to reduce bearing pressure of roadbed, it is effective to make ballast depth increase to about 35 - 40cm from the present 30cm (refer [Appendix 4-4-2]).
- To set ballast depth before and behind a level crossing to 35 - 40cm (A rail level is heighten 5 cm to 10cm), it is necessary to also unite the level of a level crossings with it.

④ Addition of Ballast

- There are presumed spots which are not maintained ballast depth in place. For the reason that ballast sinks into the roadbed due to weak roadbed strength. In that case, it is necessary to focus on performing a sampling survey of ballast depth and ballast state (Grain refining of ballast or soil mixes in ballast) is carried out. After the result of the survey, in the case ballast depth is insufficient, it is the necessity of performing an addition of ballast.
- The addition of ballast is carried out from the width of ballast shoulder of present 40cm to 50cm designed for the installation of heavier rails between Prabumulih and Kertapati.
- The ballast is insufficient in the center of ballast shoulder section between Lahat and Prabumulih. It is the necessity of performing an addition of ballast to maintain the width of ballast shoulder of 500mm occurring lateral resistance of ballast and prevention of the track

buckling of a continuous welding rail.

- It is necessary to survey that the drainage function is satisfied with the capacity demand in the location where the ballast is spilt out of the track by rain water. In the case the drainage function is not satisfied, improvement or installation of facilities for drainage is required.

⑤ Replacement of a Bridge-Sleeper

- The wooden sleeper for non-ballast bridges (truss bridge) is aging and cracked. Moreover, all the bolts for being fixed to a bridge girder are omitted and the track panel (a rail and sleeper) is in the state where it floated completely from the bridge. For this reason, it is necessity of the construction for exchanging sleepers and fixing a sleeper to a bridge girder using bolt.

⑥ Maintenance of a Fishplate

- There are fishplates slacked and having no bolt. Maintenance is necessary to secure the bolts fixed in view of controling proper rail joint gap and preventing fishplate fall out in a continuous welding rail.

⑦ Rail Welding

- In a rail weld position, rail head corner failure above mud pumping spots are observed due to poor welding. For this reason, it is necessary to raise the quality of an on-site rail welding (Thermite welding). Moreover, it is necessary to ensure the quality control of the rail welding using a nondestructive inspection.

⑧ Others

- Different-unit weight rails must be connected using compromise rail. It was observed in the field inspection that different-size of rails were connected by direct welding on site.
- The length of a short size rail must be 5m or more (The rails of 5m or less is used on site).
- Three spans of buffer rails of 25m length must be equipped at the both sides of a continuous welding rail following the “Indonesian Railway Technical Standard on Track Design, Installation and Maintenance (IMO)”.

(2) Construction Materials

Construction materials used is following the material type provided in "Consulting Engineering Service for Improvement of Maintenance and Operation (April, 2006)”.

Materials other than the steel bridge of civil engineering works materials are procured domestically, and the one produced outside the country is assembling constructed about the steel bridge.

① Reinforcing Bar and Steel

● Steel Bar

[Table 4-4-1] Type of Reinforcing Bar

Category	Type	Yield Strength (N/mm^2)	Tensile Strength (N/mm^2)
Deformed bars	SD345	345	490
	SD390	390	560

(Source: Study team)

● Steel Strand

[Table 4-4-2] Type of Steel Strand

Type	SS400 SM400 SMA400	SM490
Basic strength (N/mm^2)	235	315

(Source: Study team)

② Concrete and Aggregate

[Table 4-4-3] Type of Concrete

Type	Structure	Design Strength (N/mm^2)	Cement Type	Maximum Dimensions of Coarse Aggregate (mm)	Upper Limit of Water-cement Ratio (%)
Reinforced Concrete	Abutment	21	Normal	25	60
	Pier	24	Normal	25	60
	Cast-in-place Pile	30	Normal	25	50
	Box Culvert	24	Normal	25	55

(Source: Study team)

③ Roadbed Material

[Table 4-4-4] Type of Roadbed Material

Reinforced Roadbed	Material	Thickness (mm)	Grain Size (mm)	Composition
Upper Layer	Asphalt Concrete	150	Maximum Grain Diameter 20	Asphalt Content 4.5-6.0%
Lower Layer	Crushed Stone (to adjust grain size) M-40	300	40-0	---

(Source: Study team)

④ Embankment Material

[Table 4-4-5] Type of Embankment Material

Group	Soil and Rock Quality
Group A (K_{30} value ≧ 110MN/m^3)	Gravel, gravel mixed with silt, gravel mixed with clay, gravel mixed with volcanic soil, silt gravel, sand mixed with silt, sand mixed with clay, hard rock waste (without noticeable peel)
Group B (K_{30} value ≧ 110MN/m^3)	Gravel mixed with organic soil, clay gravel, sand mixed with volcanic soil, sand mixed with organic soil, sand, silt sand, clay sand, hard rock waste, soft rock waste (with noticeable peel), brittle rock waste

(Source: Study team)

(3) Electric Power, Signal, Telecommunication, and Mechanical System

① Electric Power Supply System

In the 1st Stage and the 2nd Stage, except for newly built signaling stations, power system is good with the existing system.

In the 3rd Stage, since electric power of big capacity is needed along with the modernization of a signal and telecommunication system, the purchased power from the electric power company will be need.

② Signaling System

In the 1st Stage, there is no problem in existing signaling system because of sufficient maintenance condition of the existing system.

In the 2nd Stage, due to the expansion of a train, extension of track effective length in stations become necessary further, some of signals and point machines must be relocated. When the extension of effective length of a station exceeds the length of the controllable length for a mechanical interlocking system, it is necessary to build additional signal houses.

An existing level crossing with gatemen controlling car and motorcycle passing, because the traffic is heavy and it pass the level crossing just in front of a train. But considering the working load of the gateman at a level crossing, it is fine with the present system as long as the train frequency is as it is now, but when the train frequency gets heavier in the future, the signaling system must be upgraded to an automatic signaling system. The transition of the system should be started in a step-by-step manner starting depending on the traffic increase. However, gatemen must be positioned temporarily for the time being for the level crossing where the system was automated in order for the passengers to get used to the new system and for the personnel training.

③ Telecommunication System

The optical fiber network which can reduce communication trouble between train conductor and dispatcher is necessary as early as possible. The optical fiber cable will not only raise the quality of communication but also it can be used for other purposes such as train seat reservation by mobile phone and transmission of big size image data for remote monitoring (CCTV).

This image monitoring system will enable not only monitoring of train schedule, but also the congestion condition of stations and protection of assets from robbery and vandalism by installing video monitoring camera.

④ Mechanical System

Seat reservation of a train will be possible via internet by mobile phone, when the optical fiber cable was laid along the line for the railway communication network.

(4) Coal Loading / Unloading Facilities

① Loading Facilities

Presently, in the stockyard adjacent to Sukacinta station, only 1 wheel loader is stationed for loading coal to containers on wagons, which is sort of a primitive measure. It will not be a problem so far as to load only 1,280tons of coal per day, however, when the coal loading amount is increased in the future, more effective and capable facilities will be necessary.

So, the points to be considered for the selection of a new coal loading system are as follows;

- The amount of coal stored in the stockyard is limited to 7.2hr in Sukacinta station. In this case, it is better to install belt conveyer and silo at the inside of the stockyard for more effective alternative to load the coal to wagons.
- Dedicated road for truck passage should be constructed and between Merapi and the stockyard in Sukacinta station. Currently, trucks are running at will no matter where inside of the stockyard, however, the road for the trucks should be restricted for the transportation efficiency and accident prevention purposes, when the amount of loading coal is increased.
- As for belt conveyer to be installed in the stockyard, oscillation (swing type) belt conveyer has to be installed, because the area of the stockyard is limited and the coal put in wagon has to be flatted evenly.

② Unloading Facilities

There are some kinds of unloading facilities in stockyards constructed in the riverside of Musi, so each company takes its own loading method from wagon to coal. Followings are the points to be considered in upgrading coal loading facilities in the stockyard of PT. BAU;

- As for the unloading capacity of container from wagon, it will be possible to load 2.5MTPA by just increasing the number of reach stacker without increasing the number of service line in the yard. However, if it goes up to 5.0MTPA, one more bay-line has to be constructed at the inside of Kertapati station where unused warehouse exist at present. In this case, since 1 train set consists of 40 wagons, it must be divided into 2 parts consisting of 20 wagons each then each wagon uses the 2 different lines where 1 reach stackers is allocated independently. Also, the warehouse has to be demolished to give space for the new line on condition that permission for the demolition from the Government of South Sumatra to be given.
- Presently, the trucks loaded with coal are running on a public road with the distance of 100m from Sukacinta station to the stockyard at the riverside. But for the purpose of more efficient transportation, there are plans to construct much larger stockyard than current one from Sukacinta station to the stockyard on the riverside by converting this public road to stockyard, and to equip belt conveyer from Sukacinta station to the stockyard on riverside. In this case, it is necessary to obtain permission from the Government, because the road is for public use and some there are some houses identified in this area. Also, the dust of coal could be a problem when installing belt conveyer from Sukacinta station to the stockyard on riverside.
- Barges can harbor along the riverside stockyard waiting for the coal to be loaded. However, since the length of the barge is more than 50m, it is difficult for all side of the barge to be come along with the stockyard. The stockyard of PT. BAU is sandwiched in between a mosque and the stockyard of another coal company called PMSS which is not under our control. So, it is necessary to discuss and collaborate with other mining companies, local inhabitants and the Government of South Sumatra for expansion of the stockyard.

(5) Operation Management

It is possible for the system in Palembang OCC to perform more reliable communication by laying optical fiber cable network system. Furthermore, visual confirmation of train operational condition at some stations and level crossings becomes possible by using CCTV at the Palembang OCC.

4.4.2. Project Size Determining Policy

The basic project size discussed above is based on DGR opinion that Yen loan will not be used for this project before the year 2014, which means that the cost for the 1st Stage shall be born by SPC. Therefore, the partial rail replacement work which is advisable to be implemented in the 1st Stage is planned to be implemented in the 2nd Stage, thus the 1st Stage project cost is reduced. Even though this operation will not reduce the target transportation volume in the 1st Stage of 2.5MTPA increase, it creates a impending issue of securing a stable long term transportation during 20 years of project period.

The 2nd Stage works are planned to be implemented immediately after the completion of the 1st Stage works. Since the track bed improvement work is completed in the 1st Stage period, it is possible to minimize the period for trains to run on the track where the rail replacement work is not completed by allocating the rail replacement work schedule in the front part of the 2nd Stage working schedule. According to 5.5.2. (P. 5-36), the rail replacement work will be completed within 2 years without waiting for 2 years of the 2nd Stage working schedule. Therefore careful operation of trains during the 2 years period is required.

As discussed above, it is strongly recommended that the project should be implemented up to the 2nd Stage in order for the railway to secure stable transportation. The measures to be taken at each stage of 3 are summarized in the table below.

[Table 4-4-6] Capacity Expansion Measures at Each Stage (The 1st Stage and The 2nd Stage)

Stage	Capacity expansion measures
The 1st Stage	● Target transportation volume = 2.5 MTPA ● Increase the number of train in a day. → Number of train to be increased = 8 trains/day(one direction) → Needs capacity expansion of rolling-stock depot ● Increase the number of freight wagon in a train. → The length of a train = 395m = Locomotive (1) + Freight wagon (25) → Extend the effective length of existing line to accommodate 395m of a train. ● Increase the running speed of a train. → Velocity of a train = 65km/h ● Increase the capacity of coal loading facility. → Capacity expansion at Sukacinta station area. ● Increase the capacity of coal unloading facility. → Capacity expansion at PT. BAU site in Kertapati. ● Increase the space for coal stock piling. → No change as it is.
The 2nd Stage	● Target transportation volume = 5.0 MTPA ● Increase the number of train in a day. → Number of train to be increased = 10 trains/day(one direction) → Needs capacity expansion of rolling-stock depot → Complete double tracking between Muaraenim and Prabumulih X6 section → Number of signaling station to be increased = 2 stations ● Increase the number of freight wagon in a train. → The length of a train = 615m = Locomotive (1) + Freight wagon (40) → Extend the effective length of existing line to accommodate 615m of a train. ● Increase the running speed of a train. → No change from the 1st Step. → **<u>Track bed improvement and partial replacement of rail.</u>** ● Increase the capacity of coal loading facility. → Branch line construction between Merapi near Sukacinta station and the main line of about 700m long. ● Increase the capacity of coal unloading facility. → Coal handling area development and unloading facility construction at the north end of Kertapati station area. ● Increase the space for coal stock piling. → Coal handling area development at the north end of Kertapati station area.

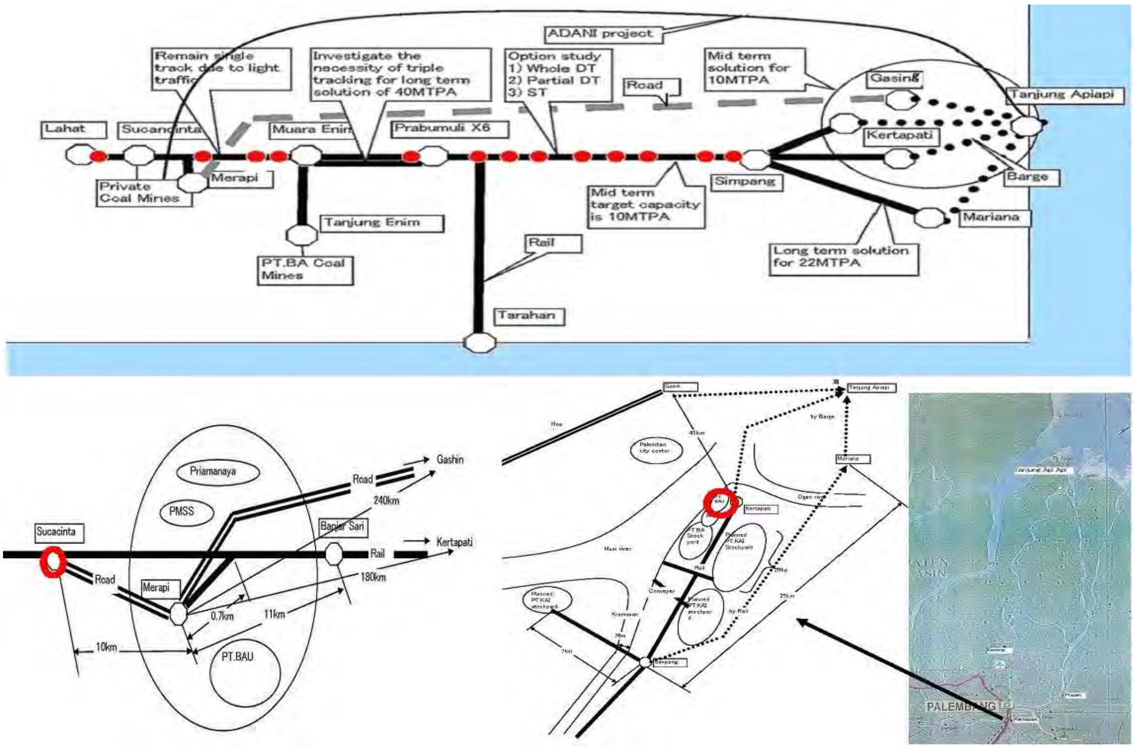
(Source: Study team)

[Table 4-4-7] Capacity Expansion Measures at Each Stage (The 3rd Stage)

Stage	Capacity expansion measures
The 3rd Stage	● Target transportation volume = 20.0 MTPA ● Increase the number of train in a day → Number of train to be increased = 21 trains/day(one direction) → Needs capacity expansion of rolling-stock depot → Complete double tracking between Sukacinta and Kertapati section → Introduction of electrified signaling system ● Increase the number of freight wagon in a train. → The length of a train = 930m = Locomotive (2) + Freight wagon (60) ● Increase the running speed of a train. → No change from the 2nd Step. ● Increase the capacity of coal loading facility. → No change from the 2nd Step. ● Increase the capacity of coal unloading facility. → Development of coal handling area of 20ha space in the west side of the Kertapati station area and construction of belt conveyer facility to Musi river. ● Increase the space for coal stock piling. → Development of coal handling area of 20ha space in the west side of the Kertapati station area.

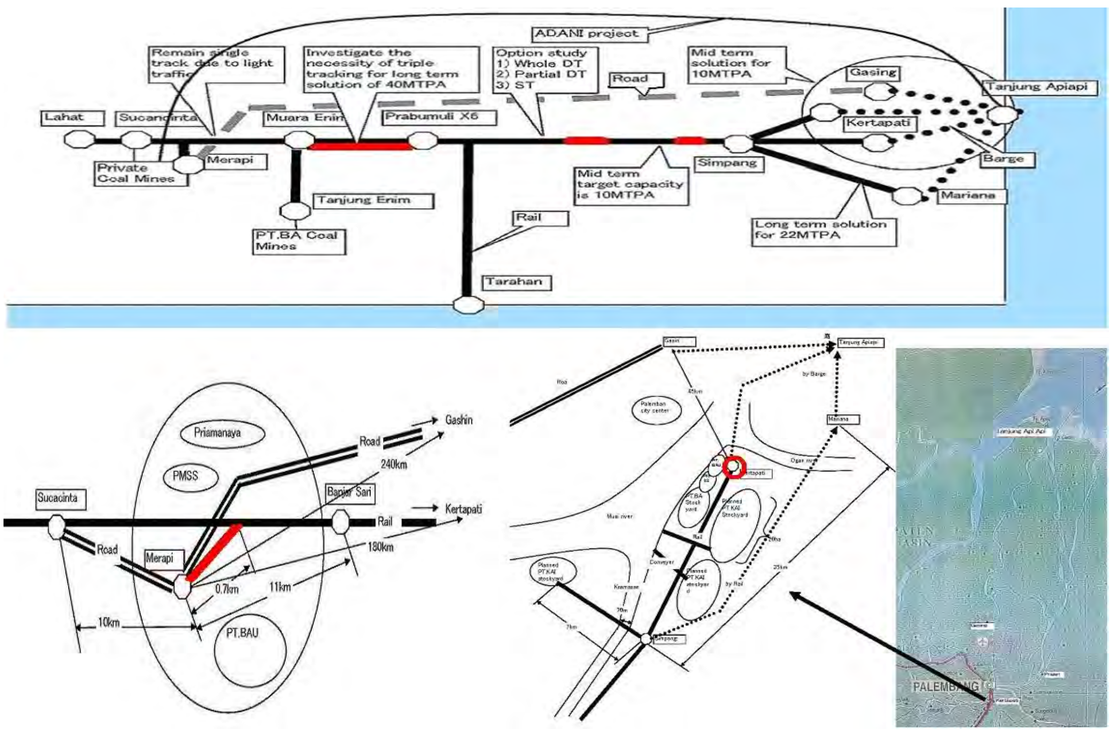
(Source: Study team)

The schematic diagram of infrastructure improvement at each stage of the implementation is shown in the figures below.



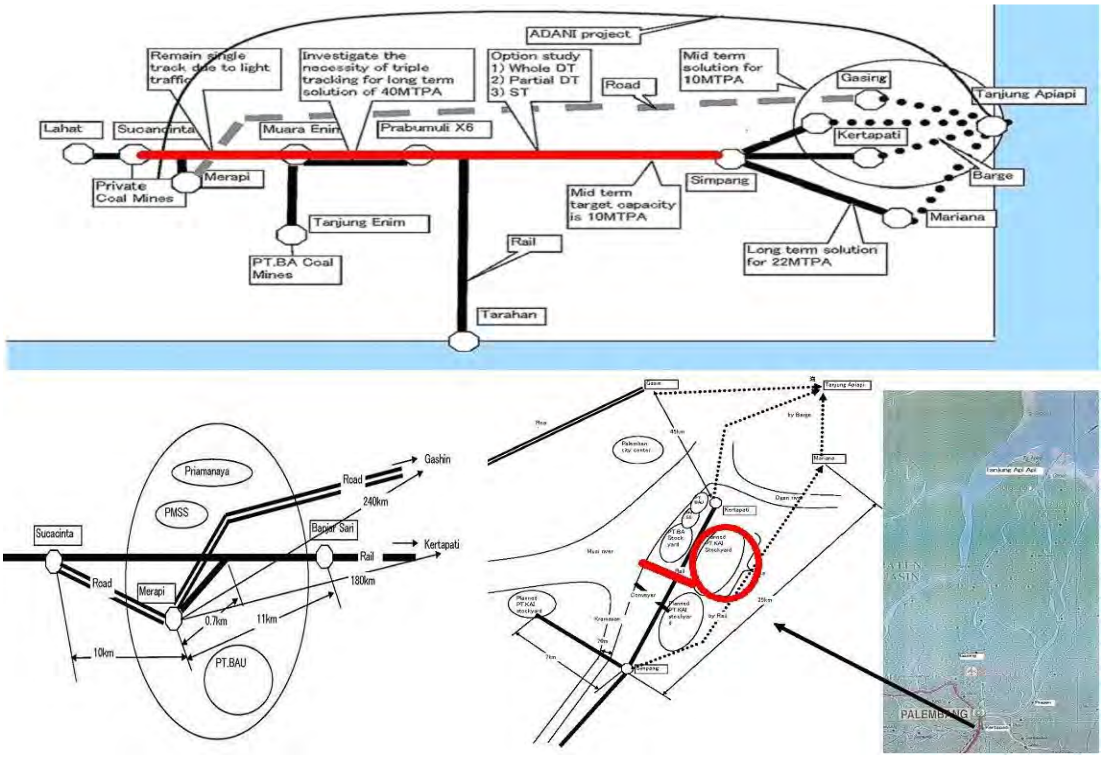
(Source: Study team)

[Fig. 4-4-2] Schematic Image of the 1st Stage Measures



(Source: Study team)

[Fig. 4-4-3] Schematic Image of the 2nd Stage Measures



(Source: Study team)

[Fig. 4-4-4] Schematic Image of the 3rd Stage Measures

4.4.3. Points to be considered for the Facility Specification

Principle for facilities to improve and build is as follows.

- Cost effectiveness of initial investment: Propose specification appropriate in expense.
- Cost effectiveness of maintenance management planning: Although track maintenance-free is recommended, consider balance with expense and choose specification.
- Acquisition of spare part: Carry out continuous supply in Indonesia about consumable part, and consider it as specification which can be maintained.
- Communalization of maintenance-management-planning method with adjacent railroad sections: Don't apply specification extremely different from adjacent railroad sections.
- Possibility of applying Japanese specification: When considering it as Japanese specification, explain superiority.

Hereafter, individual review of study result is explained.

(1) Track

- The sleeper for turnouts uses the pre-stressed concrete sleeper which can be produce ddomestically and is durable from a wooden sleeper.
- The sleeper for ballast-less bridges uses a plastic sleeper (refer [Appendix 4-4-3]). Although

an initial cost increases from a wooden sleeper, a plastic sleeper is durable just like pre-stressed concrete sleeper, and also when carrying out a maintenance, it is advantageous (it can economize).

- A special fastening dedicated for ballast-less bridges which has low rail prevention force shall be used in order to reduce the continuous welding rail longitudinal load to a girder.
- While side wear is evident at the outside rail in a sharp curved section compared with a general section, reduction of the amount of maintenance as well as pertaining are expected by using the head hardened rail of which the hardness is increased by heat-treatment. Generally a head hardened rail is used by the right and left rail or outside rail of a sharp curve of 300 - 500m or less of curve radiuses.
- In order to operate train stably, the present R42 rail should be replaced with R54 rail (UIC54 rail). The replacement of the rail is recommended to be carried out in the 1st Stage, but if not, it should be carried out as soon as possible after the 2nd Stage construction inauguration at the latest.

(2) Civil Engineering Structure

- Because the major materials such as cement, aggregates, and reinforcing bar for concrete structure can be procured easily at low price in Indonesia, Indonesian specification should be applied.
- The use of reinforcing bar of SD390 type for RC structure with high strength will enable to reduce the size of the structure and reduce the weight of the reinforcing bar.
- The SM490 of high strength steel should be used for the steel material of upper structure of steel bridge which enables to reduce the bridge height and reduce the weight of the steel material, and weather proof steel plate should be used to prevent corrosion.
- As for the production and the material supply of steel plate with the plate thickness of 12mm for a large-scale bridge of the span of about 12m or more, it is proposed to procure from abroad due to production technology concerns. The design and production should be made in the same country to integrate the design method and the production method.
- The pile type used for the pile net construction method of the fill reinforcement measure for soft subsoil, it is proposed to use a RC pile that becomes cheap compared with PC pile and H-steel.

(3) Electric Power, Signaling, Telecommunication, and Machine System

① Electric Power System

The existing electric power system can be used up to the 2nd Stage in order to reduce the initial investment and to perform easy maintenance.

At the 3rd Stage, since the signal and telecommunications system will be modernized, it will require large power supply and electric power should be supplied by its own power facilities instead of commercial power supply from the power company, because it can reduce cost and it can unify the maintenance system.

However, presently since there are some facilities that are not subject to commercial power, it is necessary to examine if a power transmission line from a power company to a station is necessary or not.

Also, it is necessary to check out whether it is possible to use domestically produced electric appliances can be used for the new system.

② Signaling System

It is a precondition that a same system must be adopted for the entire section of the project line. As a result, maintenance can be easily shared. Spare parts can be easily obtained up to the 2nd Stage by using refurbished signal system taken from Java Island where the mechanical interlocking system is not in use.

The class 1 electric relay interlocking device in the 3rd Stage is proposed to be identical to the signaling system that begins to be used in Prabumulih. In this way, easy maintenance will be possible and it can reduce the amount of spare parts.

As for the class 1 electric relay interlocking device, Japanese specification which conforms to the international performance standard and the system guarantee standard including Electromagnetic Compatibility (EMC) is proposed, because it is equipped with measures on safety, humidity, and moisture, etc.

③ Telecommunication System

Optical communication network will be used based on the optical fiber cable in the 3rd Stage. The optical fiber cable must comply with the performance requirement of the optical communication system. For this purpose, it is proposed to use Japanese product because it has high standard for quality assurance.

In addition, the system enables the use of Closed-circuit Television (CCTV) to monitor train operation, passenger move, and level crossing condition, etc.

④ Mechanical System

Mass data can be transmitted by using the optical fiber cable based network system in the 3rd Stage and under the system, seat reservation by mobile phone will be available.

(4) Coal Loading/ Unloading Facilities

- The reach stacker in Kertapati station has to be able to load containers on 4 piles from ground level and its spreader is able to grasp each type of 20ft and 40ft containers. Also, since the space of Kertapati station is very small so that the reach stacker cannot be installed easily, reach stacker has to be assembled at the inside of Kertapati station.

- The belt conveyer for the stockyard in the riverside of Musi has to be oscillation type because coal needs to be evenly loaded in a barge. Also, this belt conveyer should be self-propelled type in order to move properly and easily inside of the stockyard by itself.
- The belt conveyers in Kertapati station at the 3rd Stage has to be covered in order to prevent from scattering coal dust.

4.5. Overview of the Design Plan

4.5.1. Layout Plan

(1) Conditions of Current lines

① Track Layout

The track layout between Lahat and Kertapati is indicated in [Fig. 4-5-1]. Each station is equipped with passing lines so that trains can pass each other. The distance between stations and effective length of track for each station between Lahat and Kertapati are indicated in [Table 4-5-1].

The effective length of track between Lahat and Muara Enim is set to be between 130m and 400m because the number of operating trains is small with 8 trains per day and passenger trains pass each other only once a day at Banjarsani.

The effective length of track between Muargula and Prabumulih X6 is longer with more than 1,000m because of the large number of operating freight trains transporting coal from Tanjung Enim to Tarahan. Also, it is necessary to secure space for long and large freight trains to pass each other.

The effective length of track between Prabumulih and Kertapati is between 400m and 600m so that current freight trains can pass each other.

② Vertical Alignment

The vertical alignment between Lahat and Kertapati is indicated in [Fig. 4-5-2]. The vertical alignment for the whole line is descending from an altitude of 110m at Lahat to an altitude of 2m at Kertapati. For the intermountain section between Lahat and Muara Enim and the hillside section between Muara Enim and Payakabung, the route has a repetition of ups and downs since the tracks are laid down following the shape of the land. Especially, the section between Lahat and Muara Enim has slopes with the route's steepest gradient of 10‰ in many places. Additionally, from the vicinity of 380km in the section between Payakabung and Simpang to easily, reach stacker has to be assembled at the inside of Kertapati station.

- The belt conveyer for the stockyard in the riverside of Musi has to be oscillation type because coal needs to be evenly loaded in a barge. Also, this belt conveyer should be self-propelled type in order to move properly and easily inside of the stockyard by itself.
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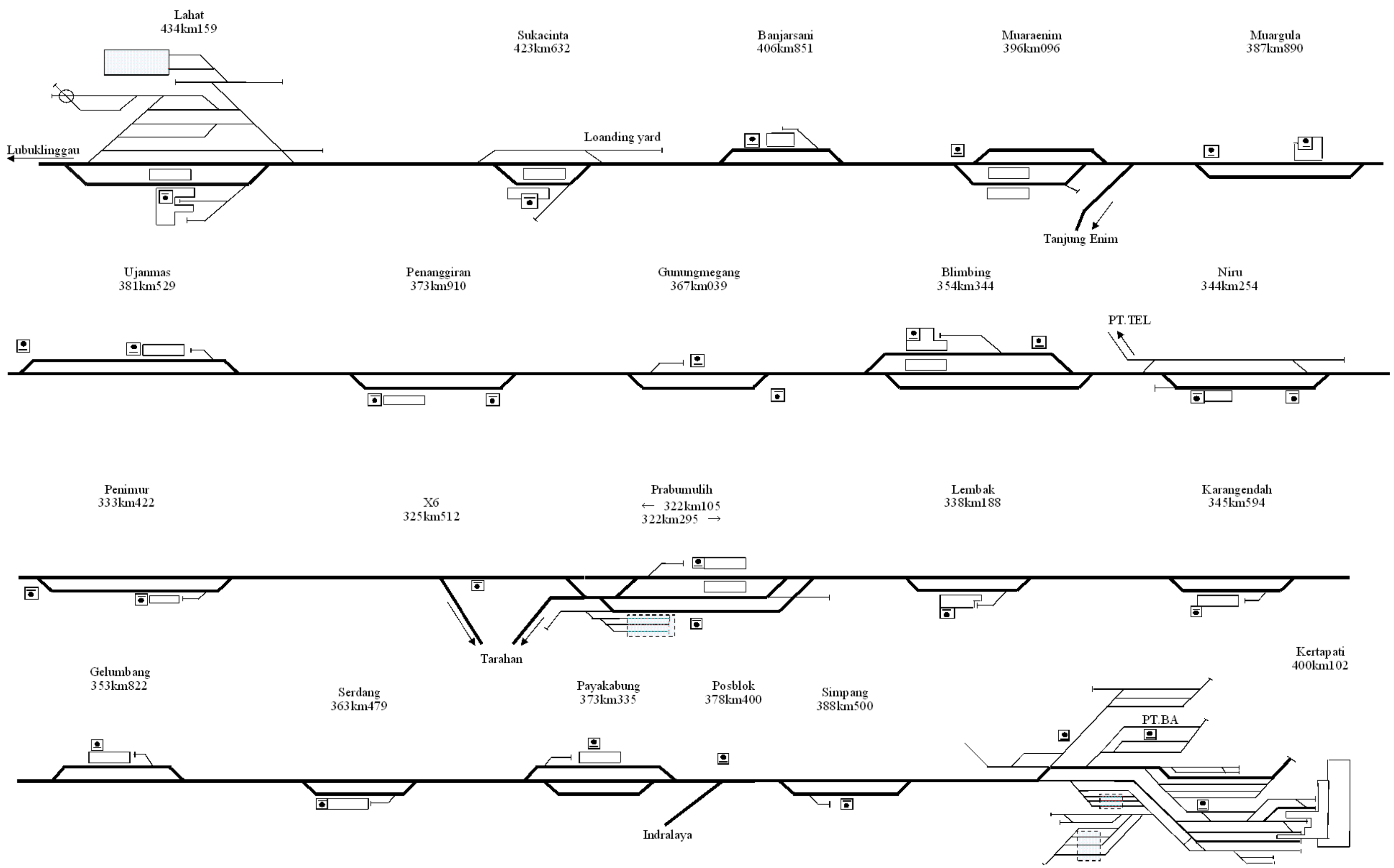
Kertapati is plain field with a constant gradient of an altitude of 2m to 3m.

③ Alignment

As for the alignment at intermountain and hillside sections between Lahat and Prabumulih, since tracks are laid to suit land forms in the same way as for vertical alignment, the route has many curves with curve radius of less than 500m. The minimum radius curvature for this section is 234m at the vicinity of 364km between Gunungmegang and Blimbing. For the plain section between Prabumulih and Kertapati, the route has many gentle curves with a radius of more than 1,000m.

Curve radius, transition curve and curve length for the section between Lahat and Kertapati are shown in [Appendix 4-5-1].



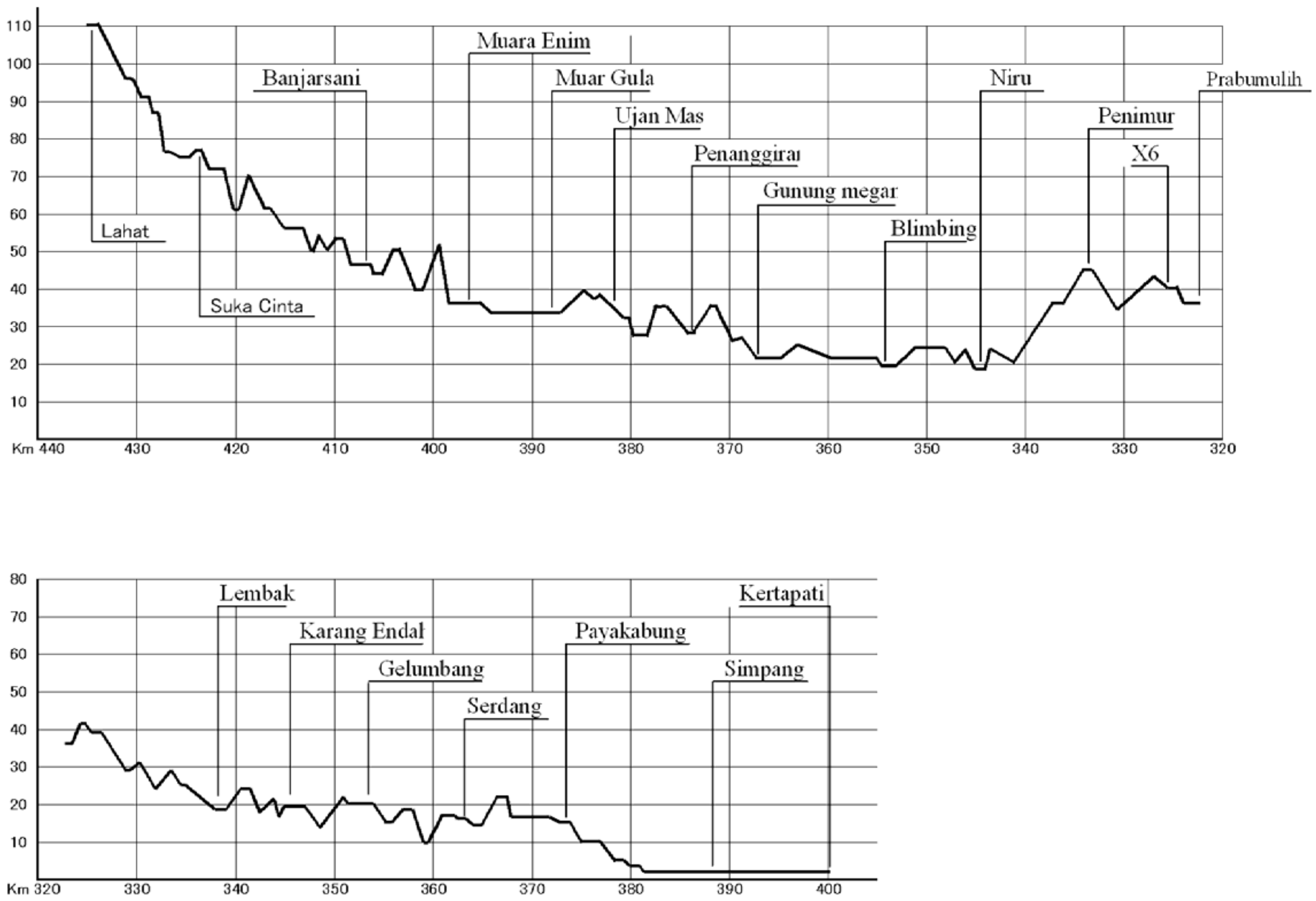
(Source: Study team)

[Fig. 4-5-1] Track Layout for the Section between Lahat and Kertapati

[Table 4-5-1] Distance between Stations and Effective Length of Track between Lahat and Kertapati

Station name	Location	Distance between Stations (m)	Effective Length (m)	
			Main Track	Siding
Lahat	434km159		402	402
Sukacinta	423km632	10,527	173	132
Banjarsani	406km851	16,781	263	225
Muara Enim	396km096	10,755	347	347
Muargula	387km890	8,206	1,197	1,197
Ujanmas	381km529	6,361	1,380	1,380
Penanggiran	373km910	7,619	1,000	1,000
Gunungmegang	367km039	6,871	1,443	1,443
Blimbing	354km344	12,695	1,212	1.285
Niru	344km254	10,090	1,070	1,070
Penimur	333km422	10,832	1,332	1,332
Prabumulih X6	325km512	7,910	—	—
Prabumulih	322km105 322km295	3,407	450	500
Lembak	338km188	15,893	603	603
Karangendah	345km594	7,406	461	461
Gelumbang	353km822	8,228	580	580
Serdang	363km479	9,657	580	580
Payakabung	373km335	9,856	440	440
Simpang	388km500	15,165	434	434
Kertapati	400km102	11,602	485	492

(Source: Study team)



(Source: Study team)

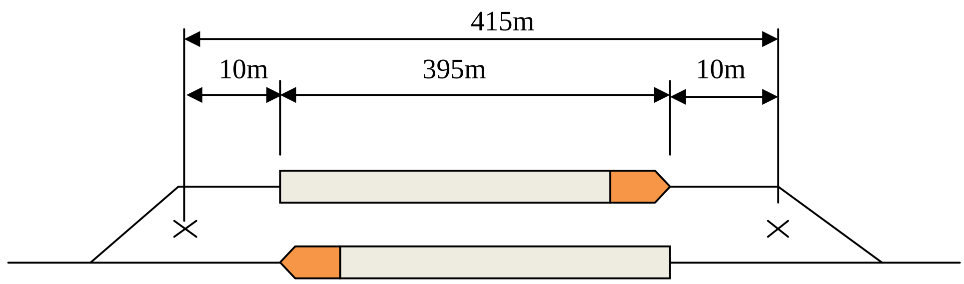
[Fig. 4-5-2] Vertical Alignment of the Section between Lahat and Kertapati

(2) Layout Improvement Plan

① The 1st Stage

The 1st Stage includes a train operation plan with a train set of 1 locomotive and 25 freight wagons for 8 round trips per day. It is necessary to consider the extension of passing tracks at passing stations so that extended freight trains can pass each other as well as new construction of signal stations between stations with a long distance where it is difficult to secure planned train operations of 8 round trips per day.

The train set length for a train with 1 locomotive and 25 freight cars is 395m. The effective length of track with current signaling facilities is more than 415m including 10m at each end of the train for safety margin for over-running, and so forth.



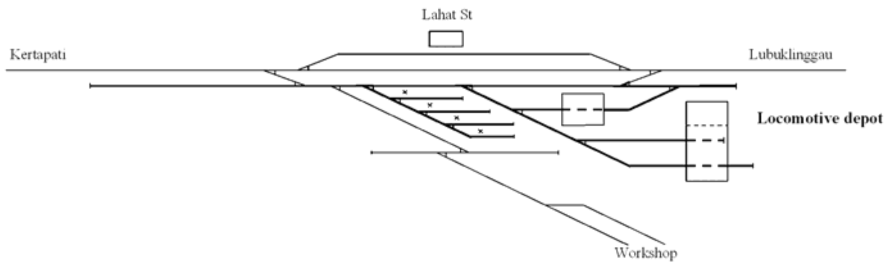
The × indicates vehicle contact gauge.

(Source: Study team)

[Fig. 4-5-3] Train Set Length and Effective Length of Track

The section under consideration is the one between Sukacinta and Kertapati with freight train operations. Of this, in the section between Sukacinta and Muara Enim, the number of operating trains is small and freight trains do not need to pass each other at stations on the way to the destination. As for the section between Muargula and Kertapati, as indicated in [Table 4-5-1] (P. 4-56), the effective length of track of more than 415m is already secured. Additionally, as a result of the consideration of train operational plans at current station locations, it is possible to secure the planed number of trains. For this reason, in the 1st Stage, current effective length of track will not be extended.

In the 1st Stage, 1 locomotive depot will be newly constructed inside Lahat station yard to inspect locomotives in order to cope with the increased number of operating freight trains. The track layout of the locomotive depot is indicated in [Fig. 4-5-4].



(Source: Study team)

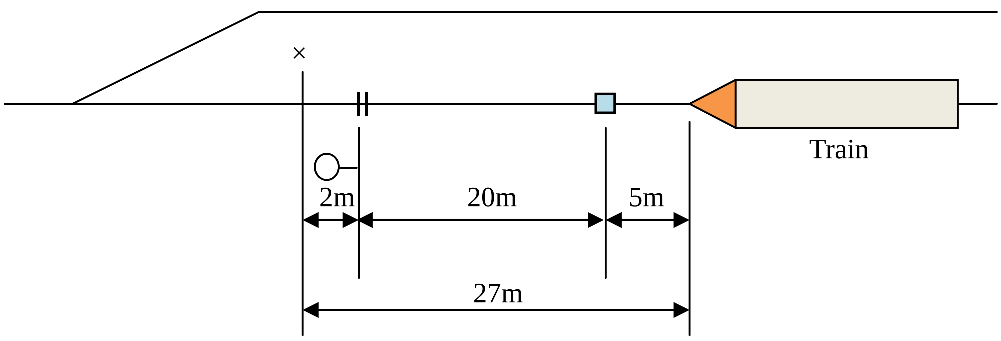
[Fig. 4-5-4] Track Layout for Lahat Locomotive Depot

② The 2nd Stage

The 2nd Stage includes a train operation plan with a train set of 1 locomotive and 40 freight cars for 10 round trips per day. In the same way as in the 1st Stage, it is necessary to consider the extension of passing tracks and new construction of signal stations.

The effective length of track will be approximately more than 670m for the train length of 615m with 1 locomotive and 40 freight cars, including 27m for each end of the train for safety margin for over-running in consideration of future introduction of automatic train stop systems (ATS).

The relationship between a train stop location and its effective length of track at a stopping station is indicated in [Fig. 4-5-5].



The ×: Vehicle contact gauge

‖ : Signal location

□ : ATS wayside coil

(Source: Study team)

[Fig. 4-5-5] Relationship between Train Stopping Location and Effective Length of Track

The section under consideration is the one between Sukacinta and Kertapati. Of this, in the section between Sukacinta and Muara Enim, in the same way as in the 1^{st} Stage, freight trains do not need to pass each other. As for the section between Muargula and Prabumulih X6, as a step in improving coal transport capacity between Tanjung Enim and Tarahan, double tracking work has been implemented and is planned to be completed by the 2^{nd} Stage. As for the section between Prabumulih and Kertapati, since the section does not have enough effective length of track, it will be extended. Additionally, as a result of the consideration of its track capacity in its train operation plan, signal stations will be newly constructed in the section between Prabumulih and Lembak and the section between Payakabung and Simpang with long distance and long traveling time between stations.

Track layout conditions for locations to install new signal stations are as follows: the alignment for locations to install turnouts is a straight line and its vertical pitch is below 2.5‰. Effective length of track extension and locations for newly constructing signal stations between Prabumulih and Kertapati are indicated in [Table 4-5-2] and [Fig. 4-5-6].

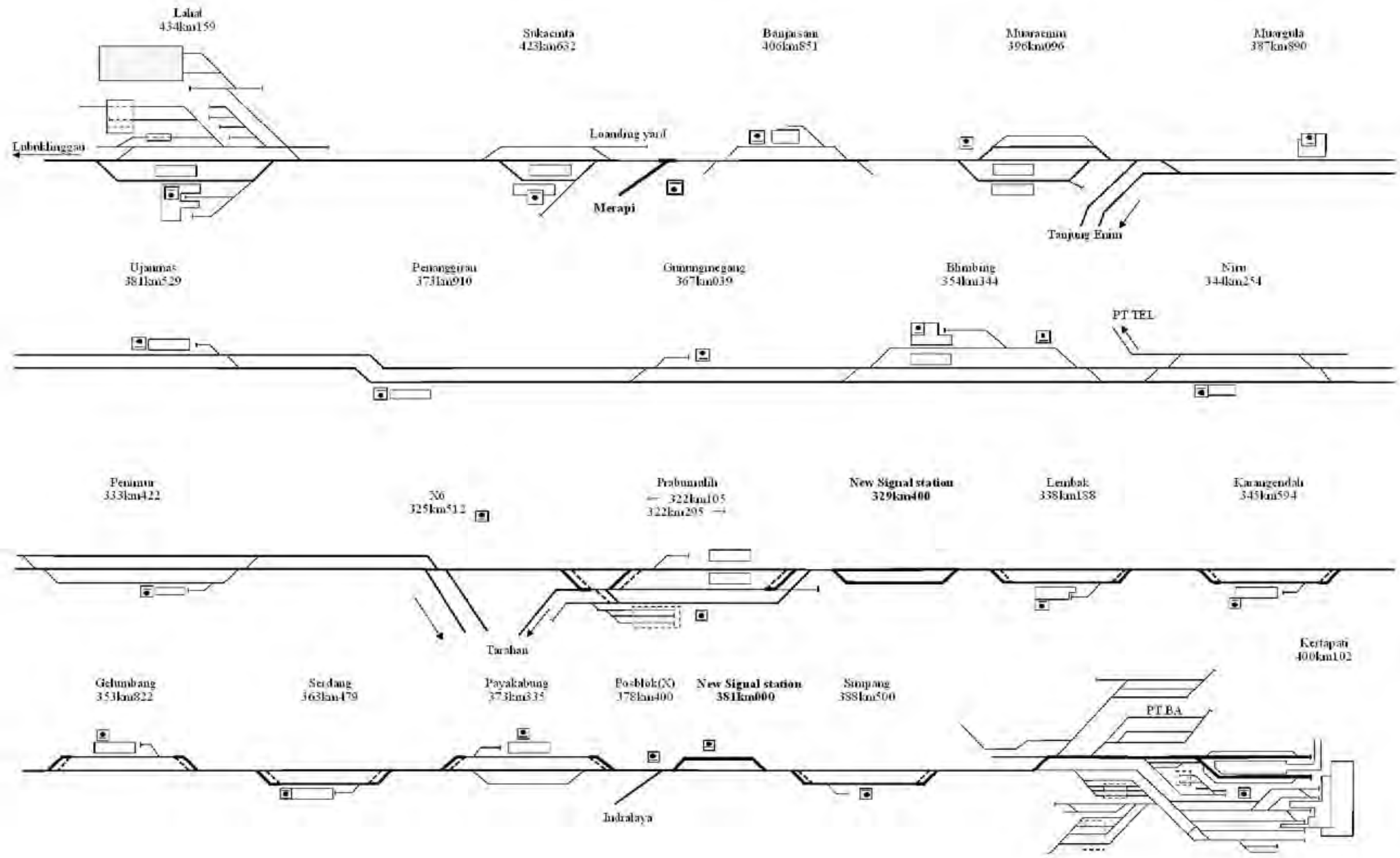
As for the facility for coal loading, in the middle of the section between Sukacinta and Banjarsani, a signal station will be installed to divide the side track from the main track and the facility will be newly installed in Merapi area where the coal mine is located.

The facility for loading and unloading coal will be installed after remodeling the site for current freight line in Kertapati station yard. Simplified floor plan for coal loading and unloading facilities at Kertapati station is indicated in [Fig. 4-5-7].

[Table 4-5-2] Location for New Installation of Signal Stations and Extension of Effective Length of Track between Prabumulih and Kertapati

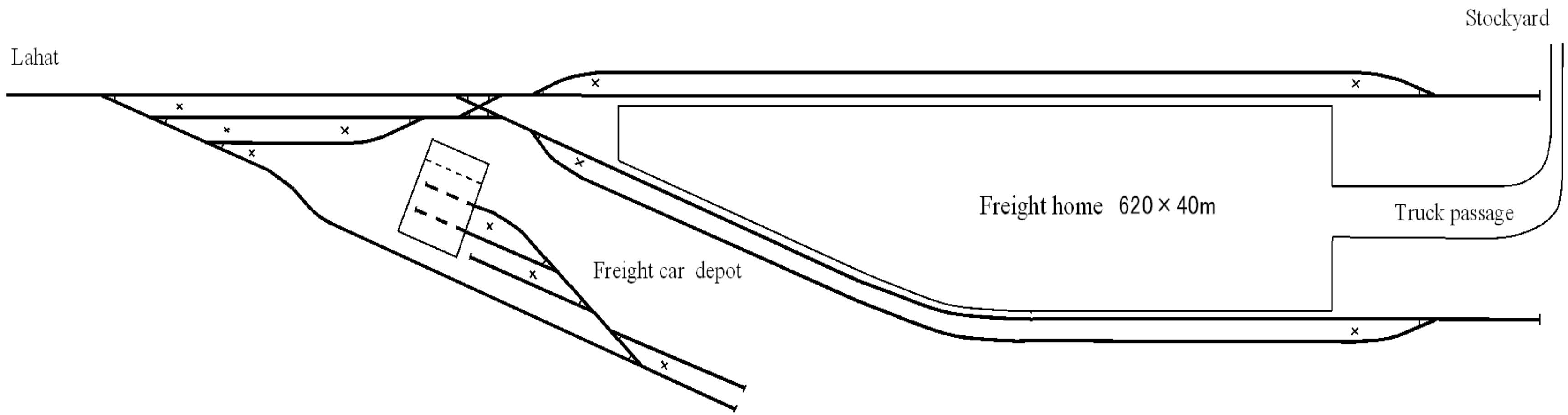
Station name	Location	Distance between Stations (m)		Effective Length (m)		
		Current	Plan	Current	Plan	Extension
Prabumulih	322km295			450	670	220
New signal station	329km400	—	7,105	—	670	—
Lembak	338km188	15,893	8,788	603	670	67
Karangendah	345km594	7,406	7,406	461	670	209
Gelumbang	353km822	8,228	8,228	580	670	90
Serdang	363km479	9,657	9,657	580	670	90
Payakabung	373km335	9,856	9,856	440	670	230
New signal station	381km000	—	7,665	—	670	—
Simpang	388km500	15,165	7,500	434	670	236
Kertapati	400km102	11,602	11,602	485	670	185

(Source: Study team)



(Source: Study team)

[Fig. 4-5-6] Track Layout for the 2nd Stage



(Source: Study team)

[Fig. 4-5-7] Simplified Floor Plan for Coal Loading and Unloading Facilities at Kertapati Station

③ The 3rd Stage

In the 3rd Stage, train operation plan includes train sets of 2 locomotives and 60 freight cars for 21 round trips per day. Effective length of track is more than 984m for the train length of 930m for 2 locomotives and 60 freight cars with a safety margin for over-running of 27m at each end of the train.

The section under consideration is between Sukacinta and Kertapati. Of this, double tracking work will be completed by the 2nd Stage in the section between Muara Enim and Prabumulih X6.

In the train operation plan, as a result of the consideration of track capacity, the following sections will be double tracked: approximately 30km between Sukacinta and Muara Enim; and approximately 80km between Prabumulih X6 and Kertapati.

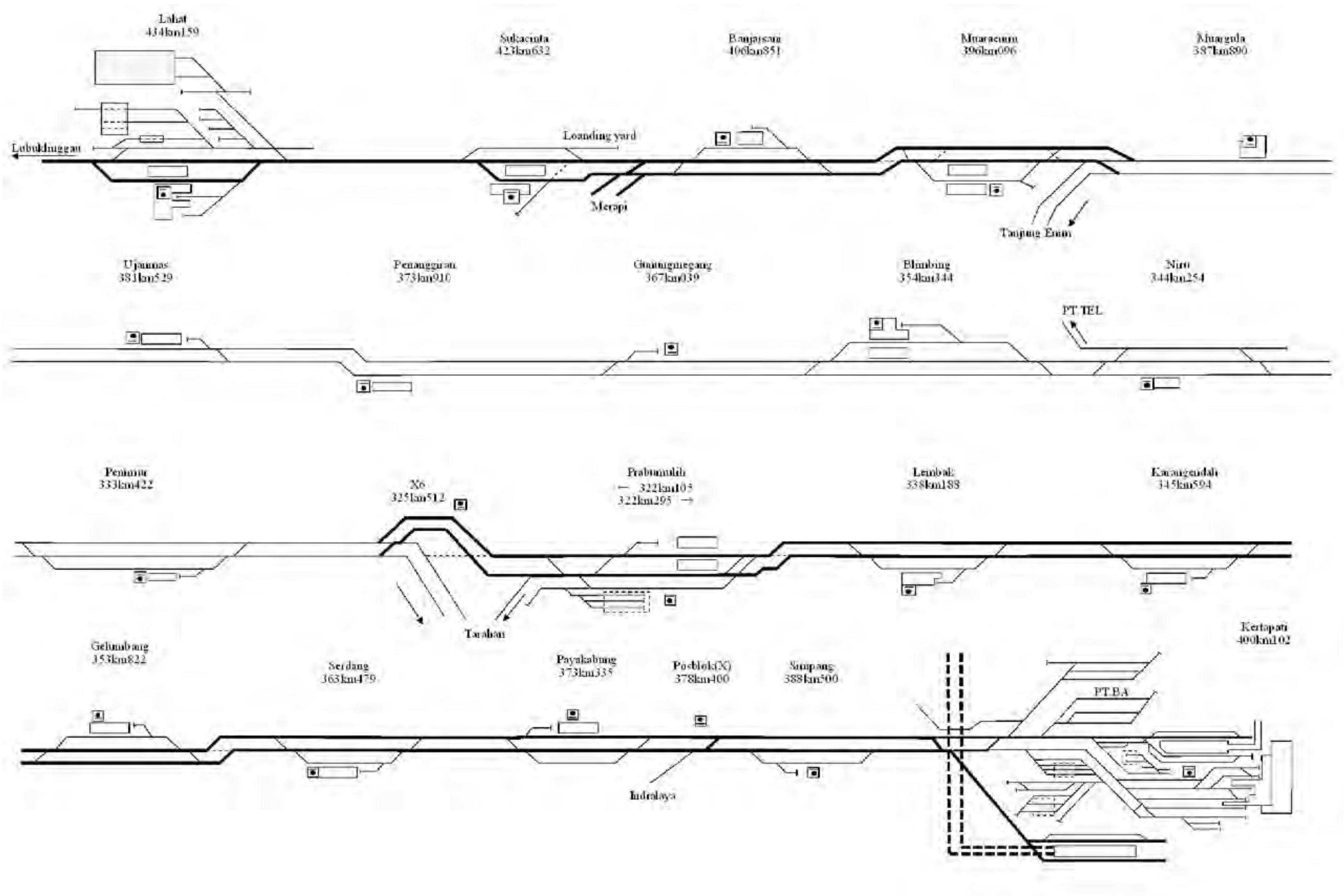
The track layout for double tracks between Lahat and Kertapati is indicated in [Fig. 4-5-8].

The tracks to be newly installed for double tracking will be 5 - 6m distanced from the current track in order to avoid interfering with train operations during the construction since planned lot is wide. Additionally, for bridge sections, when a new bridge is built for the new track, it is necessary to secure enough distance to prevent the construction from affecting the current bridge.

As for plane and vertical alignment, they should be equal or better than the current standard so that they will not interfere with the train operation plan.

As for coal loading facility, the facility installed in Merapi area in the 2nd Stage will be used.

As for coal loading and unloading facility, by installing a side track from the main track at the planned site for the development at the east side of Kertapati station yard, switching arrival, loading and unloading siding and a freight platform will be newly constructed.



(Source: Study team)

[Fig. 4-5-8] Track Layout for Double Tracks between Sukacinta and Kertapati

4.5.2. Track Planning

(1) Track Improvement Plan of the Existing Line Accompanying Traffic-volume Reinforcement

Track improvement plan of the existing line is shown in [Table 4-5-3]. The prerequisites for an improvement plan are as follows:

① Between Prabumulih and Kertapati

- Pre-stressed concrete sleeper is replaced with the type corresponding to R54 rail.
- Although it is necessary to change to R54 rail in the future, during the time that the present R42 rail is continued to be used, it is adjusted by the magnitude of the insulator of Fastenings (refer [Appendix 4-1-6]).
- Ballast shoulder width is set to 50cm according to the installation of heavier rails.
- At the location where there is a lack of ballast, ballast will be added.
- At the line sections (mainly between 375k and Kertapati) where earth and sand are mixed in ballast, ballast will be changed and ballast depth will be increased to 35 - 40cm.

② Between Muara Enim and Prabumulih

- Pre-stressed concrete sleepers developed with crack will be completely replaced.
- Superannuated rail pads will be completely replaced.
- Clips of superannuated fastenings will be changed and at the part where clips are missing, re-tightening should be conducted.
- At the location where amount of ballast is insufficient, ballast will be refilled.
- At the mud-pumping locations near level crossings or locations where earth and sand are mixed in ballast near level crossings, ballast will be changed and ballast depth will be increased to 35 - 40cm.

③ Between Lahat and Muara Enim

- At the location where amount of ballast is insufficient, ballast will be refilled.
- At the mud-pumping locations near level crossings or locations where earth and sand are mixed in ballast near level crossings, ballast will be changed and ballast depth will be increased to 35 - 40cm.

④ Turnout

- Turnouts will be changed to R54 rail as in the case of general section.
- Turnouts will be changed to No. 12 simple turnout (refer [Appendix 4-5-2]) in line with sidetrack passing speed of 45 km/h as a result of raise train speed.

⑤ Continuous Welded Rail

- A buffer line section composed of 3 of 25m unit rails will be laid at the both ends of continuous welded rail.
- Continuous welded rail length is set to 1,000m for the line section of 600m or more of curve radiuses. Standard rail (100m of rail length) is applied for the line section of 600m or less of curve radiuses.

⑥ Sleepers for Steel Bridge (Non-Ballasted Bridge)

- Sleeper for steel bridges (non-ballasted bridge) will be upgraded to plastic sleeper.

[Table 4-5-3] Tracks Improvement Plan of the Existing Line Accompanying Traffic Volume Expansion

Section (extension) (km)	Rail replacement	CWR	Prestressed concrete sleeper replacement	Bridge Sleeper replacement	Rail clip exchange	Rail-pad exchange	Ballast replacement	Ballast supplement	Turnout exchange
375k～KPT (25.1)	◎	◎	◎	◎	◎	◎	◎	◎	◎
PBM～375k (52.7)	◎	◎	◎	◎	◎	◎	5% of all extension (appraisal)	◎	◎
X6～PBM (2.8)	---	---	10% of all extension (appraisal)	---	10% of all extension (appraisal)	◎	5% of all extension (appraisal)	◎	◎
ME～X6 (70.6)	---	---	10% of ★ (appraisal)	★	10% of ★ (appraisal)	★	5% of ★ (appraisal)	★	★
SCT～ME (27.5)	---	---	---	---	---	---	30% of all extension (appraisal)	◎	◎
LT～SCT (10.5)	---	---	---	---	---	---	5% of all extension (appraisal)	◎	◎

* KPT: Kertapati, PBM: Prabumulih, ME: Muaraenim, SCT: Sukacinta, LT: Lahat
* CWR: Continuous welded rail
* ◎: Entire interval, ★: The line section non-started construction work

(Source: Study team)

(2) Track Improvement Method of the Existing Line

Since the improvement of the existing line is considered as construction of an operating line, its method is investigated in consideration of time between trains, field condition, available equipments, etc.

① Ballast Replacement

Since working hour was restricted according to the conditions of time between trains when ballast renewal and the installation of heavier rails are conducted simultaneously, rail replacement and sleeper replacement are implemented separately. In the case that time between trains is approximately 1.5 hours, ballast renewal and sleeper replacement can be conducted at the same time, but rail replacement can’t be conducted simultaneously.

② Rail Replacement

Rail welding of continuous welded rails are primarily carried out at a base or a factory to form the rails with a length of approximately 150m. They are then transported to the site and the secondary welding is conducted. If a time between trains of about 3 hours is securable, replacement of the rail with about 150m in length is possible.

③ Rail Welding

As for the rail welding method, since the primary welding performed on a base etc. has a high reliability, flash butt welding that posses excellent workability is recommended. Besides, the secondary welding carried out on-site has a great mobility and the Thermit-welding with simple welding work is considered.

④ Bridge Sleeper Replacement

The sleeper which was re-shaped to the form that can be laid on bridge girder is put on a temporary place (installing scaffold) on a bridge. If a time between trains of about 1.5 hours can be secured, sleeper replacement, tie plate replacement and rail conclusion can be conducted, but rail replacement needs to be implemented separately.

(3) Double-tracking Track Construction

The line sections of double-tracking track construction are the following 3 sections:

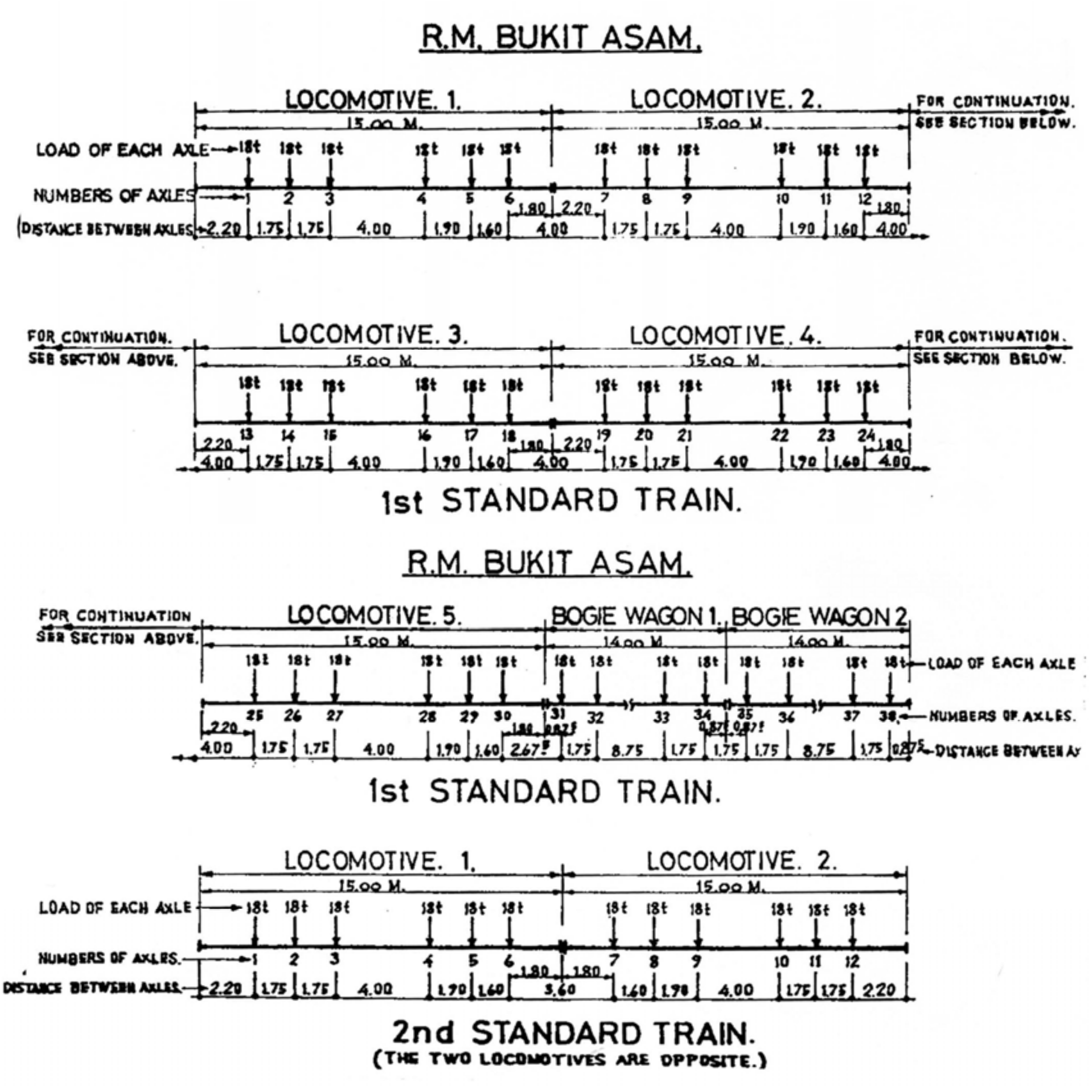
- Between Sukacinta and Muara Enim (approximately 28km)
- The section in the large section between Muara Enim and Prabumulih X6 (approximately 71km) where double-tracking construction has not started
- Between Prabumulih X6 and Kertapati (approximately 81km)

Double-tracking track construction can be conducted without being influenced by the train operation of existing line in principle; after sub-grade is completed, track will be laid.

4.5.3. Infrastructure Plan

(1) Design Load

The plan for the capacity expansion of coal transportation proposes a train formation consisting of 2 locomotives and 60 freight wagons. The design load of civil structures is based on the locomotives and freight cars (axle load of 18t) shown in [Fig. 4-5-9].



(Source: RENCANA MUATAN 1921)

[Fig. 4-5-9] Train Design Load

(2) Infrastructure plan

Because the final goal is to increase the coal transport capacity to 20MTPA, the project has been divided into the following 3 stages: The 1st Stage (Single track improvement), The 2nd Stage (Partial double tracking), and The 3rd Stage (Whole line double tracking). The effective length at stations will be increased according to the proposed train formation length at each stage and new stations and tracks will also be constructed.

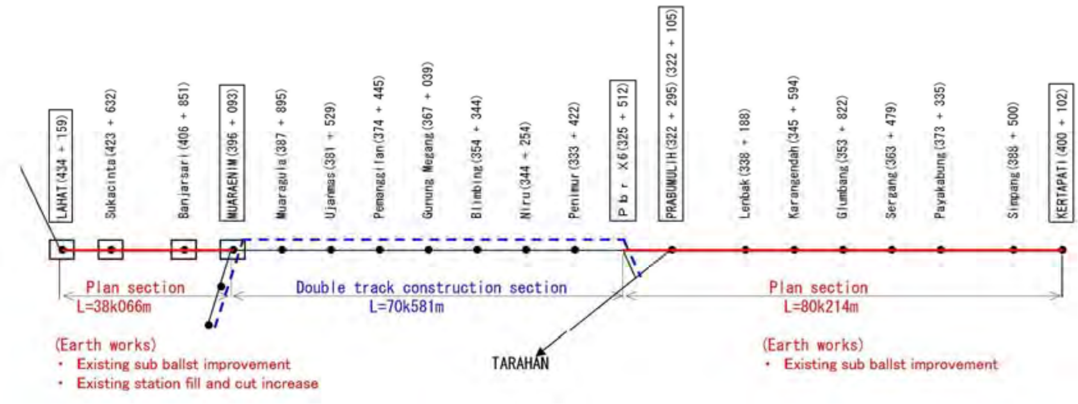
[Table 4-5-4] Plan for Increasing the Effective Length at Stations

No	Station		Existing Siding Length	The 1st Stage	The 2nd Stage	The 3rd Stage
				Train formation L=395m ＜400m	Train formation L=615m ＜700m	Train formation L=930m ＜1000m
1	Kertapati	KPT	1,335m	---	---	---
2	Simpang	SIG	706m	---	---	+294m
	New station	Assumed	---	---	700m	+300m
3	Payakabung	PYK	493m	---	+207m	+300m
4	Serdang	SDN	700m	---	---	+300m
5	Gelumbang	GLB	700m	---	---	+300m
6	Karangendah	KED	461m	---	+239m	+300m
7	Lembak	LEB	661m	---	---	+339m
	New station	Assumed	---	---	700m	+300m
8	Prabumulih	PBM	508m	---	---	---
9	X6	Prabumul	---	---	---	---
10	Penimur	PNM	1,335m	---	---	---
11	Niru	NRU	1,114m	---	---	---
12	Blimbingpendopo	BIB	1,415m	---	---	---
13	Gunungmegang	GNM	1,550m	---	---	---
14	Penanggiran	PGR	1,000m	---	---	---
15	Ujanmas	UJM	1,491m	---	---	---
16	Muaragula	MRL	1,284m	---	---	---
17	Muara Enim	ME	342m	+58	+300m	+300m
18	Baniarsari	BJl	225m	+175	+300m	+300m
19	Sukacinta	SCT	137m	+263	+300m	+300m
20	Lahat	LT	342m	+58	+300m	+300m

(Source: Study team)

① The 1st Stage (Single Track Improvement)

In order to achieve the final goal of increasing the coal transport capacity to 20MTPA, the train formation during the 1st Stage should be expanded to cope with the 2.5MTPA transportation (1 locomotive + 25 freight wagons, formation length=395m). Also, the existing track should be improved to be able to handle an increased number of trains per day (8 round trips /day).

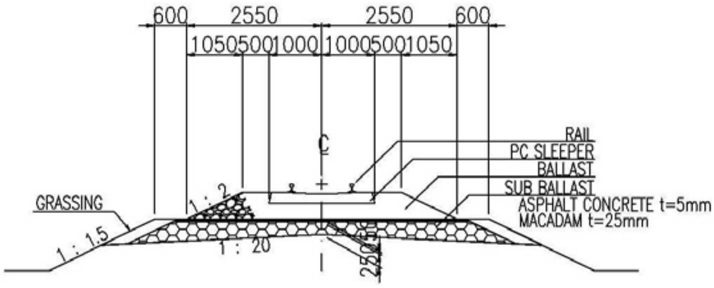


(Source: Study team)

[Fig. 4-5-10] Outline of the 1st Stage (Single Track Improvement)

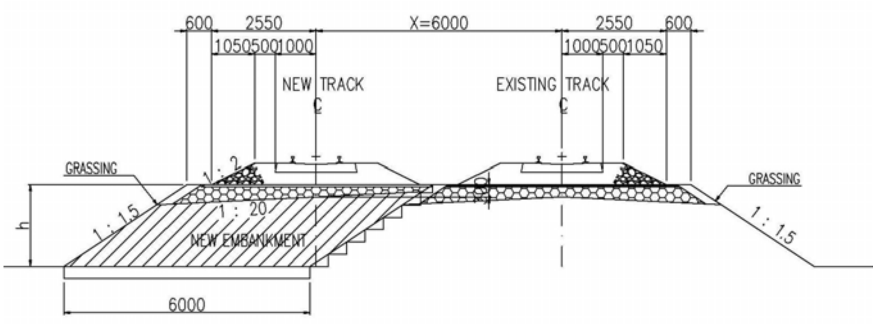
As explained in 4.1.2. (P. 4-8), present condition of civil engineering structures, bridges do not have to be rehabilitated as part of the improvement of the existing line because they have already been reinforced and upgraded to cope with an axle load of 18t. Also, since pipes and culverts that cross the track are buried into the ground and thus cannot be checked, they will be excluded from the improvement works. Instead, detailed surveys shall be conducted when the plans are implemented and required measures will be re-evaluated.

Therefore, at the 1st Stage, damaged sleepers and mud pumping will be dealt with and roadbeds improved as part of the track rehabilitation work. In addition, the effective length at stations will be increased where sidings are less than the train formation length of 395m (refer [Table 4-5-4]).



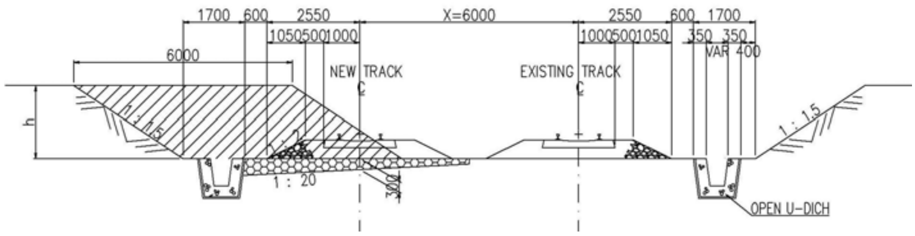
(Source: Study team)

[Fig. 4-5-11] Drawing Showing Improvement of Existing Roadbed



(Source: Study team)

[Fig. 4-5-12] Standard Drawing of Embankment for Increasing Effective Length at Stations



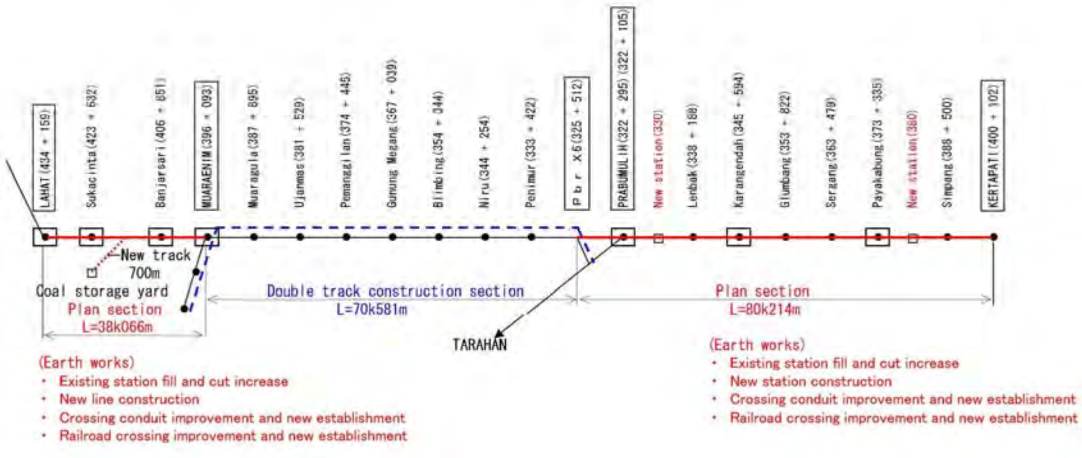
(Source: Study team)

[Fig. 4-5-13] Standard Drawing of Cutting for Increasing Effective Length at Stations

② The 2nd Stage (Partial Double Tracking)

In order to achieve the final goal of expanding the coal transport capacity to 20MTPA, the train formation during the 2nd Stage should be extended to cope with a yearly transport volume of 5.0MTPA (1 locomotives + 40 freight wagons, formation length=615m). Also, the effective length at stations should be improved to be able to handle an increased number of trains per day (10 round trips/day).

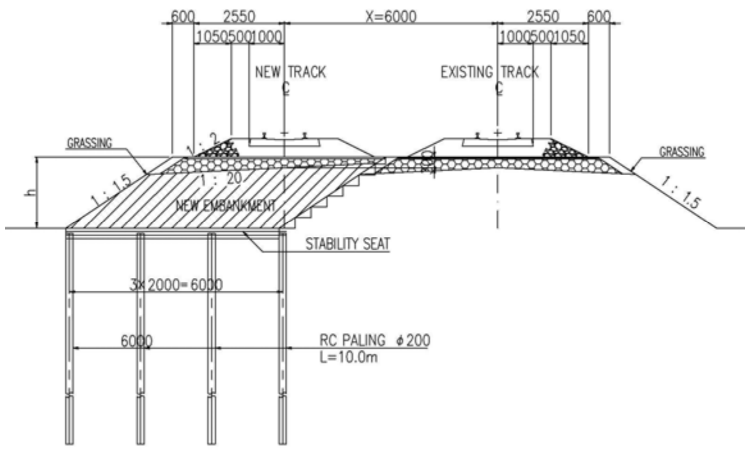
Moreover, 2 more stations (signal stations) will be added and an approximately 700m long sidetrack from Merapi to the coal yard will be constructed.



(Source: Study team)

[Fig. 4-5-14] Outline of the 2nd Stage (Partial Double Tracking)

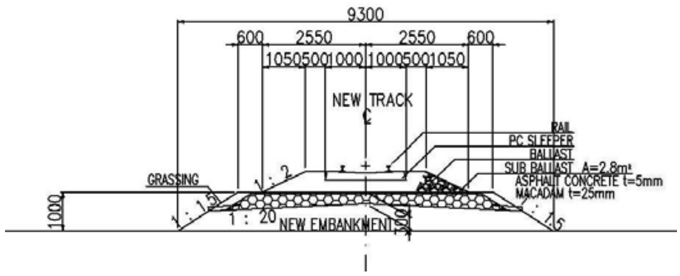
The existing railway structures will be treated in the same way as during the 1st Stage: bridges will not be reinforced and detailed surveys of pipes and culverts crossing the track will be conducted when the plans are implemented and necessary measures will be re-evaluated. Therefore, at the 2nd Stage, damaged sleepers and mud pumping will be dealt with and roadbeds improved as part of the track rehabilitation work. In addition, the effective length at stations will be increased where sidings are less than the train formation length of 615m (refer [Table 4-5-4] (P. 4-70)) and two new stations (signal stations) will also be constructed. New stations and sidings will be constructed in the Prabumulih - Lembak section (about 16km) and the Payakabung - Simpang section (about 15km) section. Embankments and cuttings will be used on the Prabumulih - Lembak section and reinforced piled embankments will be employed in the Payakabung - Simpang section as a countermeasure against soft soil.



(Source: Study team)

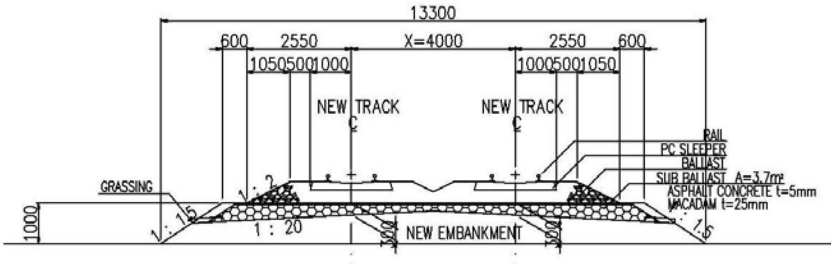
[Fig. 4-5-15] Construction Method for New Piled Embankment on the Pyk - Kpt Section

A single-track embankment (L=700m) will be used for the new track between Merapi and the coal yard while the coal yard station will use a double-track embankment.



(Source: Study team)

[Fig. 4-5-16] Standard Drawing of Embankment at New Line between Merapi and Coal Yard

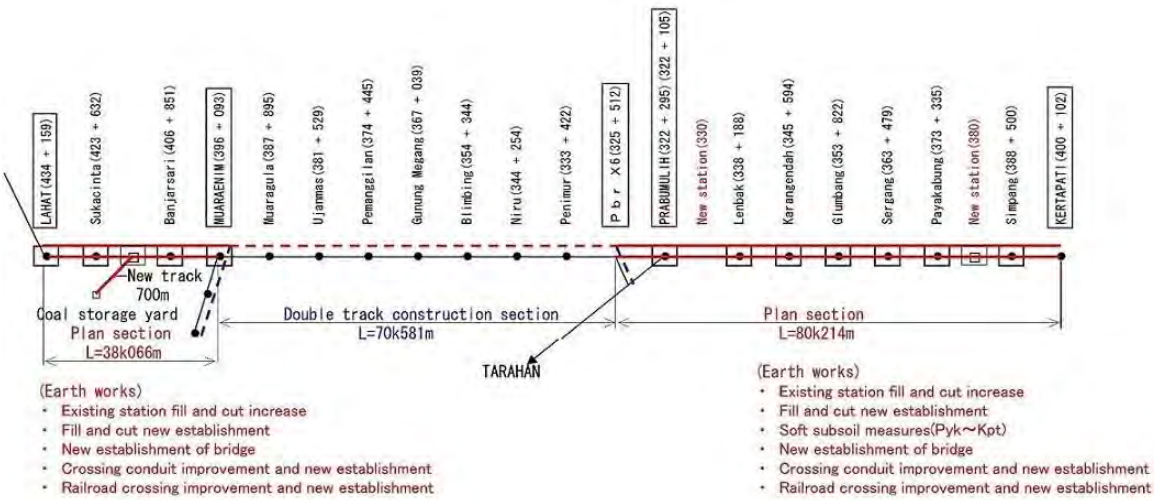


(Source: Study team)

[Fig.. 4-5-17] Standard Drawing of Embankment at New Station between Merapi and Coal Yard

③ The 3rd Stage (Whole Line Double Tracking)

In order to achieve the final goal of increasing the coal transport capacity to 20MTPA, the train formation during the 3rd Stage should be lengthened to cope with the 20.0MTPA transportation (2 locomotives + 60 freight wagons, formation length=930m). Also, the effective length at stations should be improved to be able to handle an increased number of trains per day (21 round trips/day) and the Lahat - Muara Enim and Prabumulih X6 - Kertapati sections will be double-tracked.



(Source: Study team)

[Fig. 4-5-18] Outline of the 3rd Stage (Whole line Double Tracking)

The existing railway structures will be treated in the same way as during the 1st Stage; bridges will not be strengthened and detailed surveys of pipes and culverts crossing the track will be conducted and necessary measures will be re-evaluated. Therefore, at the 3rd Stage, the effective length at stations will be increased where sidings are less than the train formation length of 930m (refer to [Table 4-5-4] (P. 4-70)). The new structures will be constructed in accordance with the following drawings for the 2nd Stage (refer [Fig. 4-5-12] (P. 4-72), [Fig. 4-5-13] (P. 4-72), and [Fig. 4-5-15] (P. 4-74)).

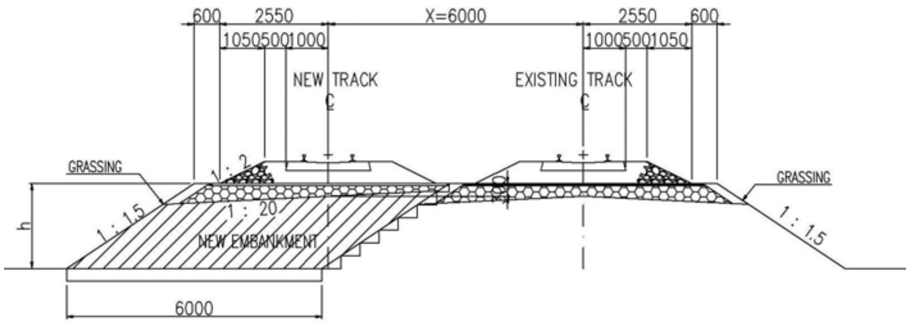
The following paragraphs provide additional information on the plans for the civil engineering structures related to the double-tracking of the Lahat - Muara Enim and Prabumulih X6 - Kertapati sections.

1) Construction of New Embankments

In the Lahat - Payakabung section which consists of sedimentary rock, a new embankment and track will be constructed 6m beside the existing track (refer [Fig. 4-5-19]). The embankment on the swampy silt portion of the Payakabung - Kertapati section will be reinforced with piles in order to control settlement and ensure the safety of the embankment (refer [Fig. 4-5-20]).

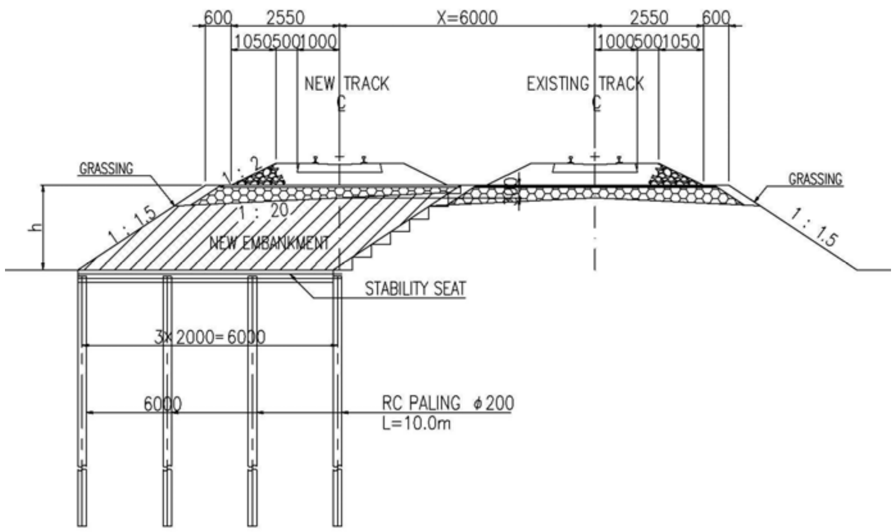
2) Construction of New Cuttings

Cutting structure will be constructed for the new track 6m beside the existing track (refer [Fig. 4-5-21]).



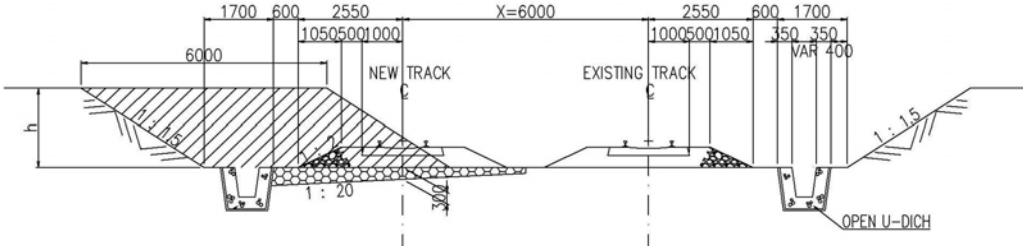
(Source: Study team)

[Fig. 4-5-19] Standard Drawing of Double-track Section with Embankment



(Source: Study team)

[Fig. 4-5-20] Construction Method for Double-track Section with Piled Embankment



(Source: Study team)

[Fig. 4-5-21] Standard Drawing of Double-track Section with Cutting

3) New Construction of Bridges (refer [Fig. 4-5-22])

It is possible to construct superstructure next to the substructure of the existing line. Girders of the same structural type as the existing girders that were upgraded to cope with the 18t axle load will be constructed at the location 10m from the existing line. Using steel girders (SS400) and RC girders (K300) as construction materials is no problem since these materials are of the same type as those currently used in Japan.

As for the substructure, for construction adjacent to the foundation of existing line, check the construction capacity, 10m apart from, because the existing substructure is a reinforced structure, abutments and piers redesigned to tolerate the 18t axle load will be installed.

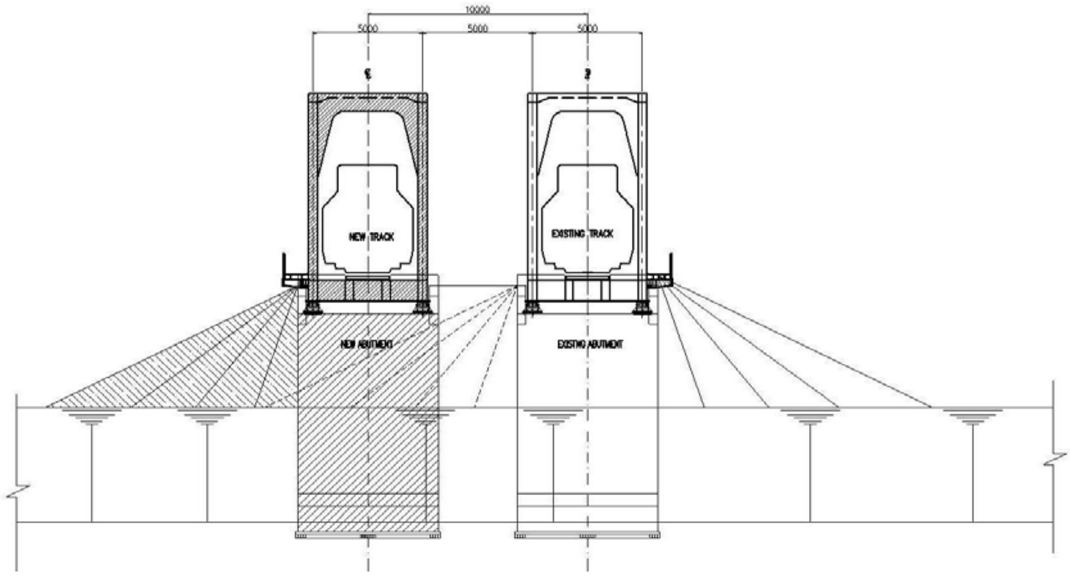
The construction materials for abutments (K250) and piers (K350) do not pose a problem because they have high concrete design strength (240kg/cm^2) and are the same as those currently used in Japan.

4) Additional Transverse Pipes and Culverts

Pipes and culverts suitable for the 6m wide enlarged part of new embankments and cuttings will be constructed.

5) Additional Level Crossings

The 6m wide enlarged part of the new track will be covered with asphalt.

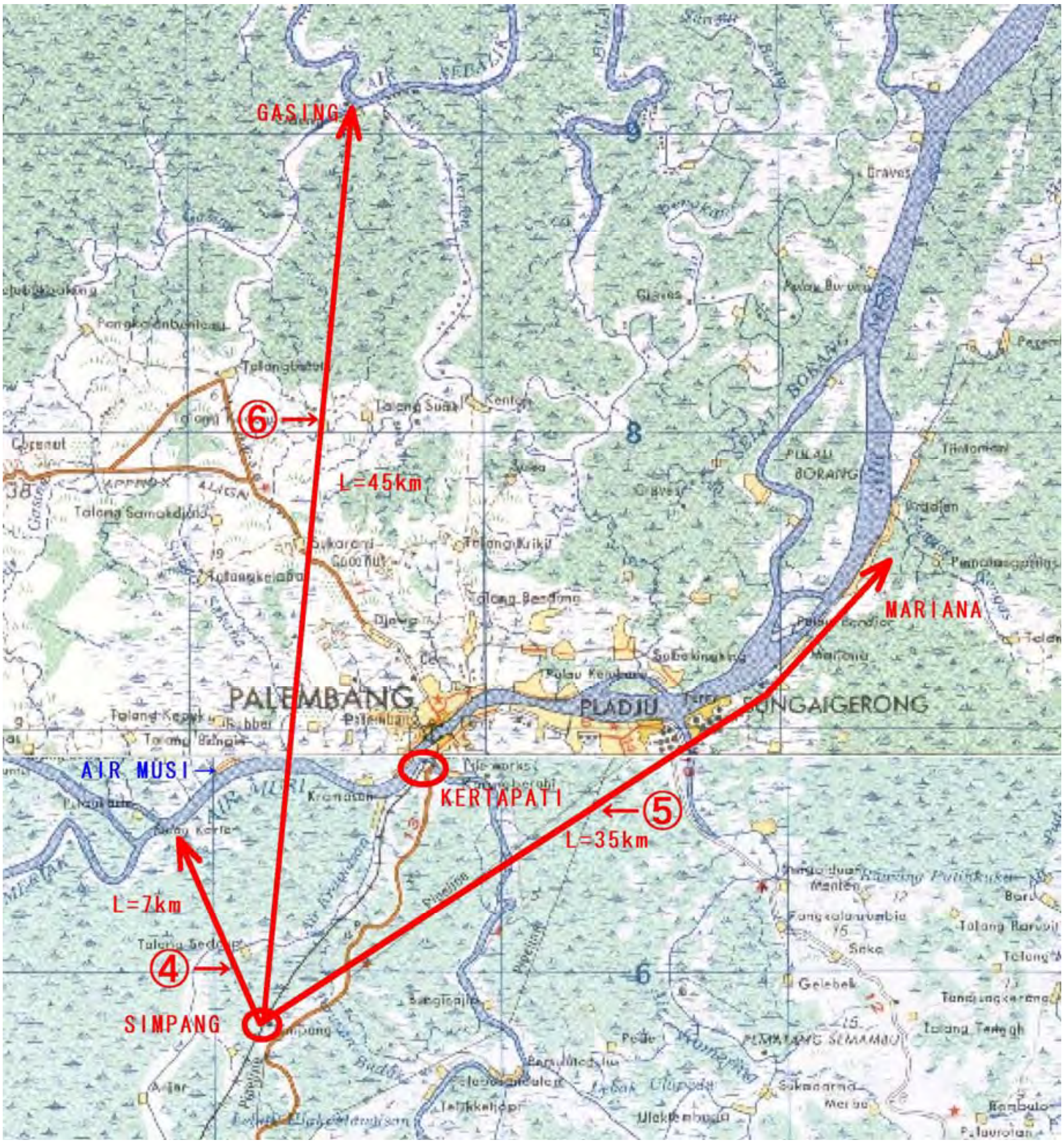


(Source: Study team)

[Fig. 4-5-22] Working Drawing of Double-track Bridge Section

The following 3 routes are also planned from Simpang to the coal loading area just for reference only.

- New station and track for the Musi river located about 7km from Simpang
- New station and track for Mariana located about 35km from Simpang
- New station and track for Gasing located about 45km from Simpang



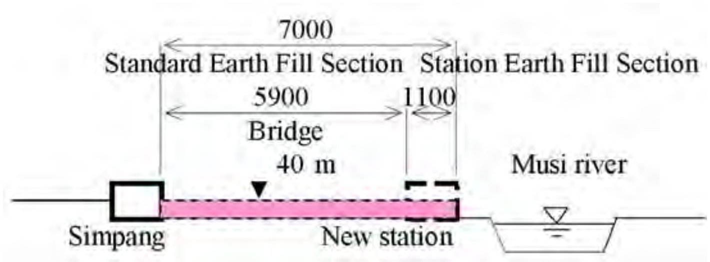
(Source: Study team)

[Fig. 4-5-23] Map Showing Location of Extension Routes

④ New Station and Track for the Musi River Located about 7km from Simpang

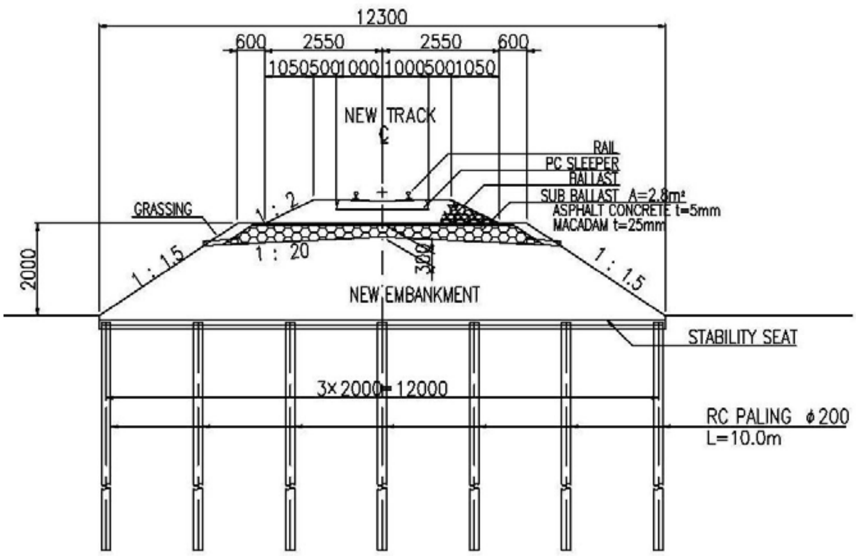
This extension route will have to be constructed on the swampy silt area between Simpang and the Musi river. Because the area consists of soft soil, it would be optimal to construct a girder viaduct that is not affected by settlement although this is more expensive than constructing an embankment. However, since the existing embankment does not show any significant deformation, a piled embankment will be used to prevent settlement and ensure safety.

Therefore, the construction cost will be calculated based on the following assumptions; the general section of the new line will use a single-track embankment (refer [Fig. 4-5-11] (P. 4-72)), the station area will use a double-track embankment (refer [Fig. 4-5-12] (P. 4-72)), and the intermediate section with river and road crossings will be constructed according to [Fig. 4-5-23]. Also, there will be 1 bridge consisting of a 40m truss (superstructure) and semi-gravity abutments (substructure).



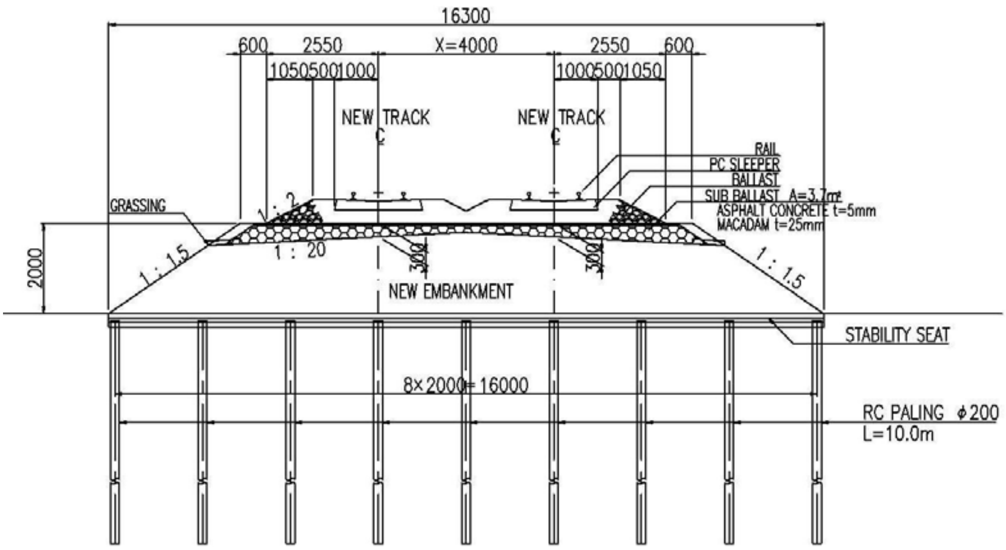
(Source: Study team)

[Fig. 4-5-24] Outline of the Musi River Extension Route



(Source: Study team)

[Fig. 4-5-25] Standard Drawing of New Embankment on General Section



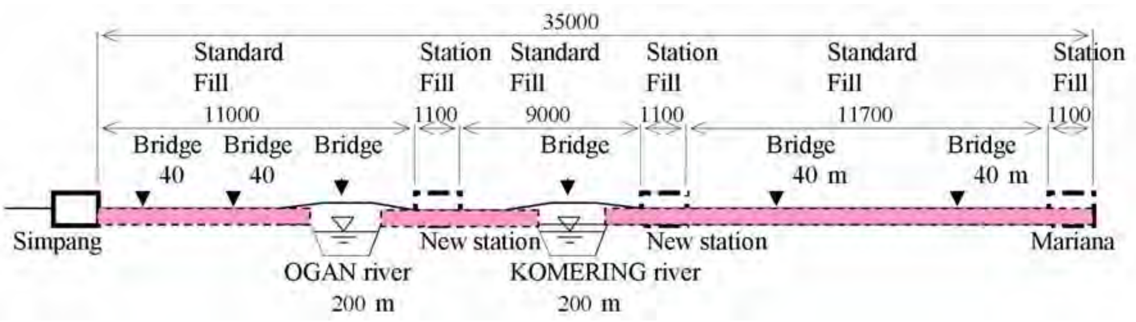
(Source: Study team)

[Fig. 4-5-26] Standard Drawing of New Embankment in Station Area

⑤ New Stations and Track for Mariana Located about 35km from Simpang

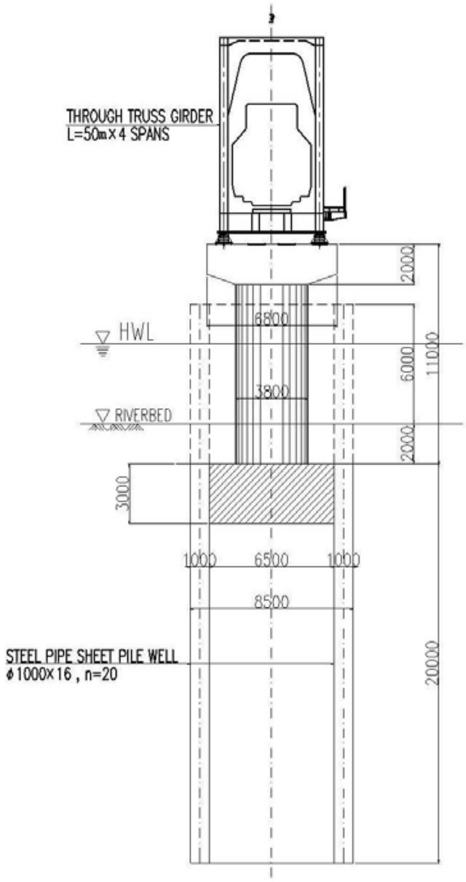
This 35km long extension route begins at Simpang and follows the Musi river downstream to Mariana, crossing the Ogan and Komering rivers on the way. Because this route will have to be constructed on swampy silt in the same way as route ④, it will be constructed on a piled embankment as a countermeasure against soft soil.

Therefore, the construction costs will be calculated based on the following assumptions; the general sections of the new line will use single-track embankments (refer [Fig. 4-5-11] of the route ④ (P. 4-72)), the station areas will use double-track embankments (refer [Fig. 4-5-12] of the route ④ (P. 4-72)), and the intermediate sections with river and road crossings will be constructed according to [Fig. 4-5-23] (P. 4-79). Also, there will be two large bridges with 4 spans consisting of 50m trusses (superstructure), semi-gravity piers and sunk-well steel pipe sheet-piles (substructure) as well as 4 other bridges with 40m trusses (superstructure) and semi-gravity abutments (substructure). There will also be 2 new stations on the intermediate sections.



(Source: Study team)

[Fig. 4-5-27] Outline of the Simpang - Mariana Extension Route



(Source: Study team)

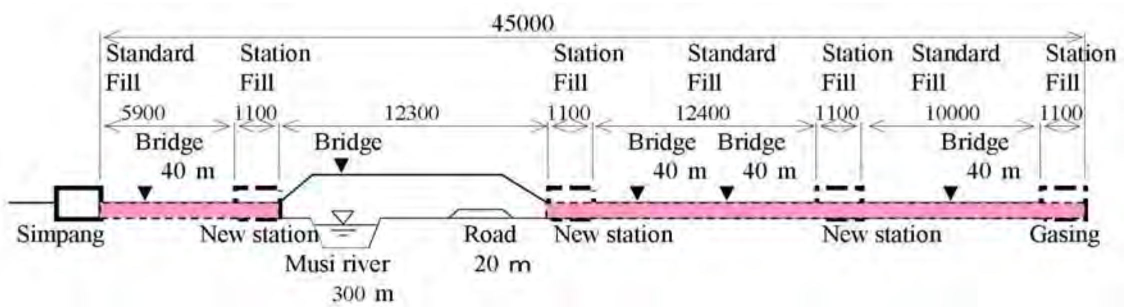
[Fig. 4-5-28] Cross-section of the Ogan and Komering River Bridges

⑥ New Stations and Track for Gasing Located about 45km from Simpang

This approximately 45km long extension route will cross the Musi river north of Simpang and pass through the suburbs of Palembang before arriving at Gasing. On the way, it will cross the

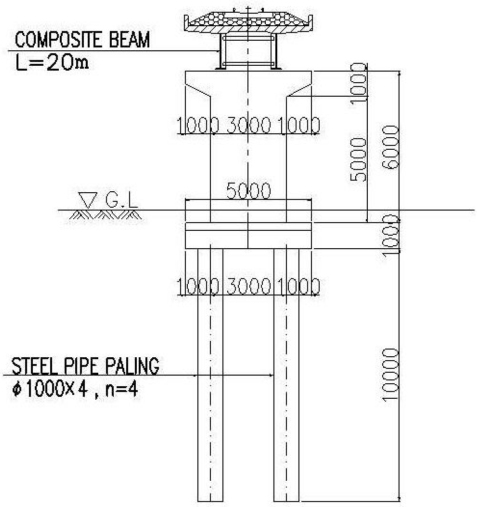
Musi river and a main road as well as pass through the suburbs of Palembang which are dotted with private houses. Because this route will have to be constructed on swampy silt in the same way as the route ④, it will be constructed on a piled embankment as a countermeasure against soft soil. The Musi river requires a large-scale bridge because it is a route frequented by big ships. Therefore, a girder viaduct will be constructed on the approximately 12km long section starting before the Musi river and ending after the main road crossing in the suburbs of Palembang.

Therefore, the construction costs will be calculated based on the following assumptions; the general sections of the new line will use single-track embankments (refer [Fig. 4-5-11] of the route ④ (P. 4-72)), the station areas will use double-track embankments (refer [Fig. 4-5-12] of the route ④ (P. 4-72)), and the intermediate sections with river and road crossings will be constructed according to [Fig. 4-5-23] (P. 4-79). Also, there will be 1 large bridge with 5 spans consisting of 60m trusses (superstructure), semi-gravity piers and sunk-well steel pipe sheet-piles (substructure) as well as 4 other bridges with 40m trusses (superstructure) and semi-gravity abutments (substructure). There will also be 1 girder viaduct with 20m composite I-girders (superstructure), wall-type semi-gravity piers and pile foundations (substructure), as well as 3 new stations on the intermediate sections.



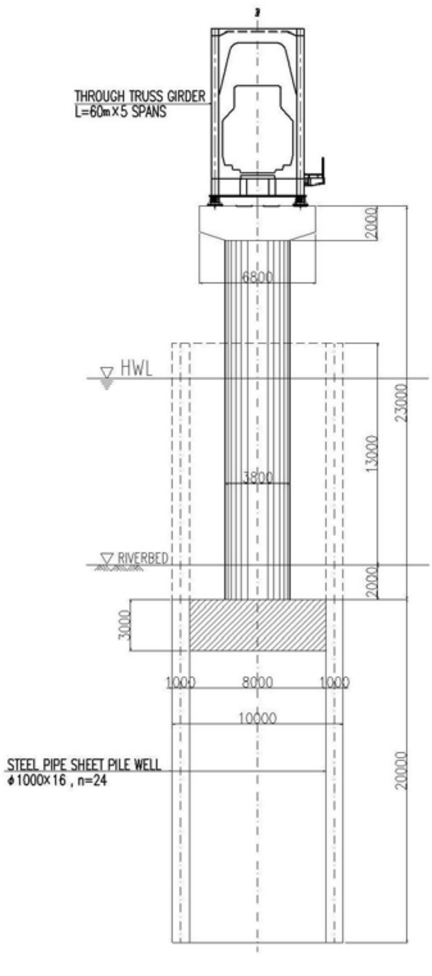
(Source: Study team)

[Fig. 4-5-29] Outline of the Simpang - Gasing Extension Route



(Source: Study team)

[Fig. 4-5-30] Cross-section of Girder Viaduct



(Source: Study team)

[Fig. 4-5-31] Cross-section of the Musi River Bridge

4.5.4. Station and Signal Station Plan

It installs with a signal station based on the train operation plan.

(1) The following will be examined at the 1st Stage.

- Expansion of coal stockyard and coal unloading facility of PT. BAU in Kertapati.

(2) The following will be examined at the 2nd Stage.

- Construction of branch line between main line and Merapi of 700m.
- Expansion of coal stockyard and coal unloading facility by converting container yard in Kertapati station.
- Relocation of existing signal system due to the extension of effective length.
- Increase of signal houses in 2 places.

(3) The following are examined at the 3rd Stage.

- Development of coal stockyard in Kertapati station area of 20ha and installation of belt conveyer system to reach Musi river.

(4) The Followings are examined as a Reference Plan.

- Expansion of Simpang station due to the construction of new line to Gasing and construction of new stations or signal stations at intervals of 10km for trains to wait while passing another train from the opposite direction in the construction of new line of 45km.
- Expansion of Simpang station due to construction of new line to Mariana and construction of new stations or signal stations at intervals of 10km for the train to wait while passing another train from the opposite direction in the new line of 35km.

4.5.5. Electrical Power and Mechanical Plan

Capacity of existing electrical equipment by mechanical control method shall be considered whether it is enough or not at stations where arrival/ departure lines will be improved. Purchase of commercial power from electric power supplier shall be considered for stations, signal cabin and coal stockyard of the new line.

(1) The following matter shall be considered at the 1st Stage.

- Existing electricity equipment shall be used at existing stations basically.

(2) The following matters shall be considered at the 2nd Stage.

- Existing electricity equipment shall be used at existing stations basically.
- Purchase of commercial power from electric power supplier shall be considered at locations where 2 signal cabins are installed.

(3) The following matters shall be considered at the 3rd Stage.

- Purchase of commercial power from electrical power supplier shall be considered for all electrical equipment, including existing stations.
- In the mechanical facility plan, taking advantage of the information communication system via optical line network installed at the 3rd Stage, seat reservation system for passenger train by mobile phone will be installed.

(4) The following matters shall be considered in the Reference Stage.

- In the new line going to Gasing, as a part of modification of electrical and mechanical equipments at Simpang station, building of new station or signaling station and installation of mechanical and electrical equipments at every 10 km will be considered.
- In the new line going to Mariana, as a part of modification of electrical and mechanical equipments at Simpang station, building of new station or signaling station and installation of mechanical and electrical equipments at every 10 km will be considered.

4.5.6. Signaling Plan

Standardized system and functions which can maximize outcome are equipped based on a operation plan.

In addition, installation of ATS system shall be considered in the early stage.

(1) The following matters shall be considered at the 1st and 2nd Stages.

- Due to the extension of train-set, signal equipment and point machines are relocated in accordance with extension of platform.
- In case that mechanical interlocking device cannot control the signaling system due to the extension of platform length, number of signal cabin is increased.
- Installation of 1st class electric relay interlocking device shall be considered for signal facilities at signal cabins where the increased number is more than 2.

(2) The following matters shall be considered at the 3rd Stage.

- The 1st class electric relay interlocking device is installed at each station (ex. signal and telecommunication facilities in Prabumulih station),
- Existing mechanical interlocking system whose control method is economical and the system

is standardized is continued to be used. However, Installation of ATS (backup equipment which operates brake automatically and prevents from accidents derailments in advance) is considered at the new line section and the section between Kertapati and Lahat, in order to counter the situation that signal ignorance and operation mistake may occur.

(3) The following matters shall be considered at the Reference Stage.

- In the new line going to Gasing, as a part of modification of electrical and mechanical equipments at Simpang station, building of new station or signaling station at every 10 km will be considered.
- In the new line going to Mariana, as a part of modification of electrical and mechanical equipments at Simpang station, building of new station or signaling station at every 10 km will be considered.

4.5.7. Telecommunication Plan

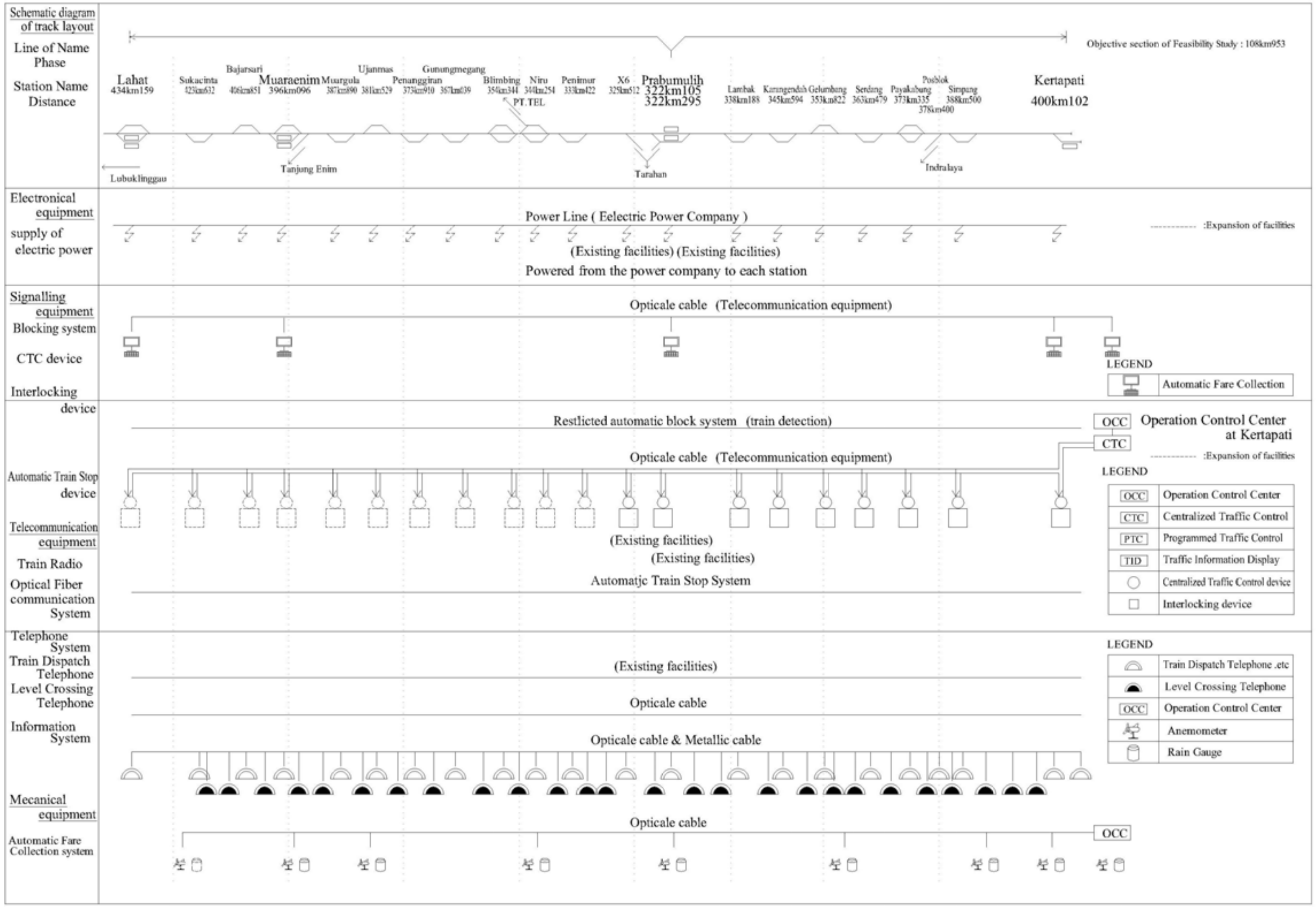
Installation of optical carrier system using optical fiber cable along all the lines shall be considered in order to realize clear voice transmission and large data transfer from operation center to each station and level crossing cabin.

(1) The following matters shall be considered at the 3rd Stage.

Installation of optical carrier system at operation center in Palembang station which covers the section between Kertapati Station and Lahat Station, and Merapi coal stockyard loading facikities shall be considered.

(2) The following matters shall be considered as at the reference stage.

- Installation of optical carrier system at a new line between Simpang Station and coal stockyard at the Musi River shall be considered.
- Installation of optical carrier system at a new line between Simpang Station and Mariana shall be considered.
- In case the optical carrier system has excess capacity, the unused capacity may be open for public use collecting user charge.
- Existing wireless communication system is leaved as backup of line network.



(Source: Study team)

[Fig. 4-5-32] System Outline Chart of Electric Power, Machine, Signal, and Telecommunication

4.5.8. Rolling Stock Plan

(1) Locomotive

PT. KAI operates CC202 (G26MMC-2) type locomotives made by EMD for coal transportation of PT. BA. PT. KAI has a plan to replace GT38 C-AC locomotives made by EMD with CC205 type. The performance comparison with CC205 type locomotive and CC202 type locomotive is shown in [Table 4-5-5].

(Source: Sojitz Co.)

[Pic. 4-5-1] CC202 (G26MMC-2) Type Locomotive Made by EMD

[Table 4-5-5] Performance Comparison of Locomotives

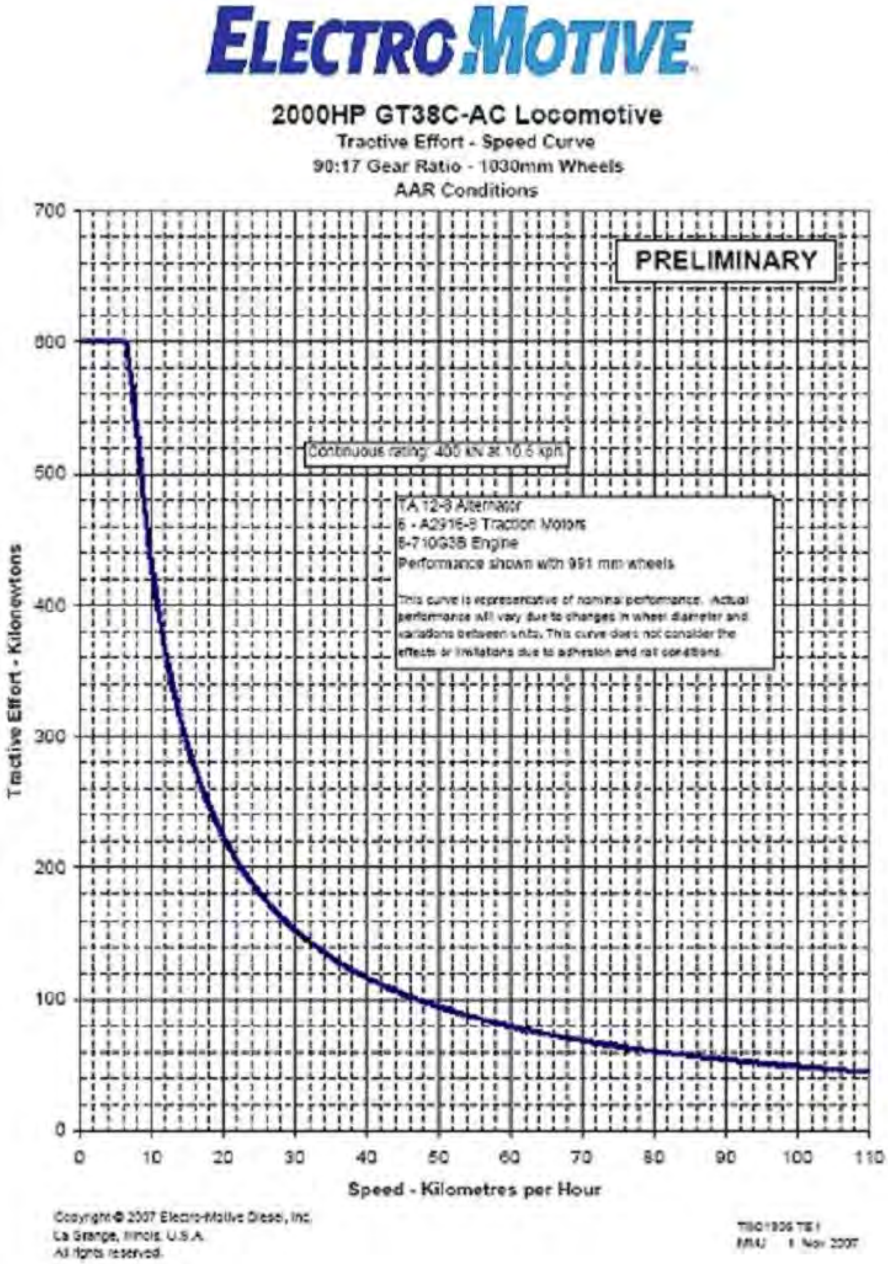
Item	CC202 (G26MC-2)	CC205 (GT38C-AC)	Increase
Power	2,000 HP	2,000 HP	—
Adhesion Coefficient	0.18	0.36	100%
Continuous Rating Tensile Force	228KN	370KN	62%
Track Tensile Force	474KN	556KN	17%
Electric Generation Brake Force	186KN	235KN	25%
Electric Motor Drive	AC	DC	—

(Source: Sojitz Co.)

From the comparison table, it can be recognized that the performance of CC205 type locomotive has been improved considerably compared with CC202 type locomotive. The traction performance in up-gradient slope section of 10‰ has been also improved approximately by 75% compared with CC202 type locomotive. It is recommended to use CC205 type locomotives to be procured by SPC from the view point of fuel consumption, maintenance cost and operating efficiency. However, considering the fact that GE is currently used although the number is small, GE is interested in this project as a supplier as well as investor and GE maintains good relationship with PT. KAI, CC204 type of GE can be considered as a option.

As shown in [Table 4-5-6], it is reasonable to consider the number of locomotives in accordance with transportation volume. The important points in maintaining locomotives are as follows.

- Attaching flange lubricator in order to reduce flange direct friction to be developed in shape curve section.
- Attaching sanding device in order to prevent wheel slip when heavy train accelerate and decelerate.



(Source: EMD)

[Fig. 4-5-33] Characteristic Curve of CC202 Type Locomotive

(2) Wagon

It is reasonable to use freight wagon with container type transportation as it is used presently. It is proposed to use PCW type container wagons made by PT. INKA which is the Indonesian domestic rolling stock manufacturer, in accordance with the stage-wise project implementation schedule.

(Source: Study team)

[Pic. 4-5-2] PPCW Type Container Wagon

Since container transportation of coal is not used in Indonesia except for PT. BAU, DGR expressed concern on the safety aspect, but as it can be evidenced in [Pic. 4-5-3] to [Pic. 4-5-6], it is one of the common mode of transportation for bulk cargo including coal recognized up by ISO standard.

(Source: container.pro.tok2.com.SANPAI.html)

[Pic. 4-5-3] Japan Case

(Source: blog.yahoo.co.jp/nam_winger/847416.html)

[Pic. 4-5-4] Taiwan Case

(Source: http://www.wbrinc.com)

[Pic. 4-5-5] USA Case

(Source: http://www.wbrinc.com)

[Pic. 4-5-6] Coal Container Loading by Reach-stacker in USA

[Table 4-5-6] Rolling-stock Mobilization Plan

Stage		The 1st Stage				The 2nd Stage				The 3rd Stage			
BAU Annual Production Target		2.5MTPA				5.0MTPA				20.0MTPA			
Annual Transport Vol. Target		2.5MTPA				5.0MTPA				20.0MTPA			
Number of Wagon（Length）		25 (395m)				40 (615m)				60 (930m)			
Number of Train		8				10				12			
Annual Max Transport Vol.		2.6MTPA				5.2MTPA				20.4MTPA			
Number of Car	Locomotive	Line	shunting	spare	total	Line	shunting	spare	total	Line	shunting	spare	total
		8	0	3	11	9	3	3	15	26	5	5	36
	Wagon（Container）	Use		Spare	Total	Use		pare	Total	Use		Spare	Total
		200		10	210	400		20	420	840		20	860
	Container	Use		Spare	Total	Use		pare	Total	Use		Spare	Total
		400		20	420	800		40	840	-		-	-

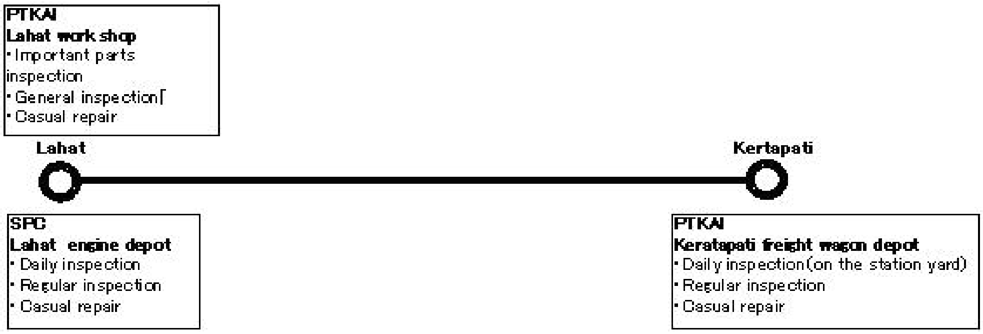
(Source: Study team)

4.5.9. Rolling Stock Depot Planning

The basic principle is to use existing PT. KAI depots. The maintenance for locomotives will be done by expanding facilities of Lahat depot. For the expansion, 1 pit track which can accommodate 2 locomotives and 2 siding tracks which can accommodate 3 locomotives will be required. Building an inspection facility which has equipment for engine overhaul will be required for for regular inspection.

Important part inspection and general inspection should be outsourced at workshop in Lahat.

Wagon and container depots are built in Kertapati station area. Regular inspection is conducted mainly at the depots, and minor rehabilitation and maintenance of travel device such as wheels and axles are also implemented. Daily inspection is implemented while staying at inside of station.



(Source: Study team)

[Fig. 4-5-34] Allocation of Depot and Work Share

4.5.10. Coal Loading/ Unloading Plan

As a coal loading/ unloading plan, loading facilities are constructed near the coal mine. Also, unloading facilities are constructed along the river where barge transportation is conducted.

(1) The following matters shall be considered at the 1st Stage.

- Coal loading capacity to wagon is increased by purchasing wheel loader for coal loading near Sukacinta Station. Currently, 7.2ha land in Sukacinta station is secured where 100,000ton of coal can be stored. Therefore, expansion of the space is not considered in the short-term plan, and only allocation of wheel loader makes it possible to transport 2.5MTPA.
- 1 more reach stacker to relocate containers in the container yard is allocated without touching the space of coal stockyard at Kretapati, and a self-propelled belt conveyer is equipped at the coal stockyard. Installation of the belt conveyer makes it possible to load 100,000ton of coal to a barges per hour.

(2) The following matters shall be considered at the 2nd Stage.

- A new branch-line between Merapi where coal mines are located and main line is constructed with the distance of approximately 700 m, and a belt conveyer is equipped for coal loading to containers at Merapi. 2,500,000tons of coal from Sukacinta and the same amount from Merapi, and the conbined amount of 5,000,000tons is loaded.
- In Kertapati station, a warehouse in the station is demolished, and a new service-line is constructed. 2 more reach stacker are added which are stationed at each service line. 1

train-set with 40wagons is split to 2 train-sets with 20wagons each, and the 2 trains drive into each service line. Then, containers are unloaded from wagons using reach stacker. All of the containers can be unloaded within 40 or 50minutes per 1 train-set.

- Barge loading of 5,000,0000tons/year is achieved by equipping 1 set of self propelled belt conveyers at a coal stockyard along river.

(3) The following matters shall be considered at the 3rd Stage.

- At Sukacinta, expansion and purchase of new equipments are not considered, and instead, loading facilities equipped at the 2nd Stage will be fully used. However, 1 more belt conveyer is equipped at Merapi to realize more efficient coal loading work.
- The east side area of 20ha in Kertapati station is developed for coal stock yard. Then, 3 belt conveyers are equipped connecting the stockyard and the Musi river. Coal is loaded directly from the stockyard to barges with the belt conveyers.

(4) The following matters shall be considered at the Reference Stage.

- Coal loading facilities are equipped in Gasing along with the construction of the new line between Kertapati Station and Gasing. 1 belt conveyer to transfer coal from coal stockyard of 0.4million ton capacity to barge is under construction. The number is increased by 1.
- Stockyard is constructed around Mariana station along with the construction of the new line between Simpang station and Mariana (Prajen) with distance of approximately 35km. In addition, coal loading facilities such as belt conveyers and loader to transfer the coal to barges are equipped.

Chapter 5

Project Implementation Plan

5.1. Construction Plan

5.1.1. Site Condition

[Table 5-1-1] summarizes the site conditions for construction work of the South Sumatra Railways based on the field surveys described in 4.1. (P. 4-1).

[Table 5-1-1] Site Conditions for Construction

	Lahat to Muaraenim section	Muaraenim to Prabumulih X6 section	Prabumulih X6 to Kertapati section
Total Distance	189.26km		
Distance of the Section	38.07 km	70.58 km	80.6 km
Topographic Feature	Mountainous/ hills	Mountainous/ hills	Mountainous/ hills 60.61km Lowland/ wetlands 20.0 km
Road Access	Close and parallel to national road	Close and parallel to national road	Away from national road without access
Ground Condition	Normal ground	Normal ground	Normal ground and soft ground
Houses	Partially urban and village area	Partially urban and village area	Dotted with villages in mountains area and a few houses in wetland area
Line Operation	Single track operation	Single track operation but double tracking work is under way (scheduled to be completed in 2014)	Single track operation
Track Condition	R54 rail is laid but roadbed and sleepers are often damaged by mud pumping	R54 rail is laid but roadbed and sleepers are often damaged by mud pumping	R42 rail remains and roadbed and sleepers are often damaged by mud pumping
Signal and Telecom Facility	Mechanical	Mechanical	Mechanical
Bridges (all comply with K18 live loads instead of K13)	● 1 truss bridge of 160 m in length with 4 spans ● 1 truss bridge of 100 m in length with 3 spans ● 1 simple truss bridge in 30 m in length	● 2 simple truss bridges in length of 40-50 m ● 2 simple pony truss bridges in length of 20 m ● 5e simple plate-girder bridges in length of 15-30 m ● -1 simple RC T-girder bridge in length of 8.0 m	● 1 simple truss bridge in length of 40 m (in wetland area) ● 15 simple plate-girder bridges in length of 8-20 m (all in wetland area except 1 bridge)
Lateral Drainage	Many	Many	Many

(Source: Study team)

5.1.2. Conditions for Construction Planning

[Table 5-1-2] shows project overview of each option planned based on the site construction conditions. Since operation condition analysis of the existing infrastructure shows the difficulty of implementing immediate whole double tracking work, step-by-step transportation expansion approach will be taken in the following stages:

(1) Short-term Plan (The 1st Stage)

This stage is still a single track operation as it is now. The immediate target of coal transportation capacity is to 2.5MTPA as a short-term goal, and the target will be achieved by sharing coal transportation with truck on road. The measures to be taken includes improvement of the existing track, expansion of loading and unloading equipment, modernization of equipment, increase of number of train, and expansion of rolling-stock depot.

(2) Mid-term Plan (The 2nd Stage)

This stage is a partial double tracking option. The target transportation capacity is set to 5.0MTPA as a mid-term target. The target will be achieved by measures such as improvement of existing track, expansion of unloading equipment (in Merapi Area), modernization of equipment (relay interlocking signaling system in particular), increase of number of train, and expansion of rolling-stock depot.

(3) Long-term Plan (The 3rd Stage)

This stage is a whole double tracking option. The target transportation capacity is set to 20.0MTPA or more.

(4) Super Long-term Plan (This is just a reference only and out of the study scope)

Furthermore, construction of new lines, such as between Simpang and Gasing section of 45km distance and between Simpang and Mariana section of 35km distance, will be studied for reference in a super long-term plan.

[Table 5-1-2] Project Overview

	Lahat - Muaraenim	Muaraenim - Prabumulih X6	Prabumulih X6 - Kertapati
[The 1st Stage] Short-Term Plan ● Capacity target: 2.5 MTPA ● Number of train: 8 round trips per day ● Length of train: 395 m ● Train travel speed: 65 km/h	● Track work ● Existing roadbed improvement ● Improvement civil engineering structure ● Modernization of signal and telecom system ● Reinforcement of rolling stock repair facilities ● Rolling stock procurement ● Reinforcement of loading and unloading equipment (on the Sukacinta side)	● Track work ● Existing roadbed improvement	● -Track work ● Existing roadbed improvement ● Improvement of civil engineering structure ● Modernization of signal and telecom system ● Reinforcement of rolling stock repair facilities ● - Rolling stock procurement ● Reinforcement of loading and unloading equipment (on the Kertapati side)
[The 2nd Stage] Mid-Term Plan ● Transportation target: 5.0 MTPA ● Number of trains: 10 round trips per day ● Length of trains: 615 m ● Train travel speed: 65 km/h	● -Improvement of civil engineering structure ● Branch line construction (between Merapi and coal storage yard) ● Modernization of signal and telecom system ● Reinforcement of rolling stock repair facilities ● Rolling stock procurement ● Reinforcement of loading and unloading equipment	● Double tracking for unimproved sections	● Track work ● Improvement of civil engineering structure ● Modernization of signal and telecom system ● Reinforcement of rolling stock repair facilities ● Rolling stock procurement ● Reinforcement of loading and unloading equipment (improvement of a container yard facility in Kertapati station yard, and new installation of coal unloading and barge loading facility)
[The 3rd Stage] Long-Term Plan ● Transportation target: 20.0 MTPA ● Number of trains: 21 round trips per day ● Length of trains: 930 m ● Train travel speed: 65 km/h	● Track work (double tracking) ● Civil engineering work for double tracking (except between Lahat and Sukancinta) ● Modernization of signal and telecom system (signal relay interlocking) ● Reinforcement of rolling stock repair facilities ● Rolling stock procurement		● Track work (double tracking) ● Civil engineering work for double tracking ● Modernization of signal and telecom system (signal relay interlocking) ● Reinforcement of rolling stock repair facilities ● Rolling stock procurement ● Reinforcement of loading and unloading equipment (belt conveyor at Kertapati side)
[Stage for reference] Super Long-Term Plan ● Construction of new lines	● New line, extended by 45 km between Simpang and Gasing, will be built to increase transportation capacity. (Single track) ● New line, extended by 35 km between Simpang and Mariana, will be built to increase transportation capacity. (Single track)		

(Source: Study team)

Working items described in [Table 5-1-2] are articulated in [Table 5-1-3] shown below.

[Table 5-1-3] Details of Works

	Name of Options			
	① Single Track	② Partial Double Tracking	③ Whole Double Tracking	④ New Lines Construction
	The 1st Stage	The 2nd Stage	The 3rd Stage	For Reference
	Short-term Plan	Mid-term Plan	Long-term Plan	Super Long-Term Plan
Track work	○	○	○	○
- Track rehabilitation	○			
- Sleeper & rail replacement	○	○		
- Double tracking		○	○	
Roadbed improvement	○			
Civil structure improve	○	○	○	
- Effective length extension	○	○	○	
- Additional signal station		○		
New line construction		○		○
- Merapi - coal yard		○		
- Simpang - Gasing				○
- Simpang - Mariana				○
Double tracking		○	○	
- Muaraenim - Prabumulih X6※		○		
- Sukacinta - Kertapati (except the above section)			○	
Additional crossing		○	○	
Signal & telecom system	○	○	○	○
- Signal and telecom equipment	○	○	○	○
- Electromechanical equipment		○	○	○
Rolling stock repair facility	○	○	○	○
Rolling stock procurement project	○	○	○	
- Locomotives	○	○	○	
- freight wagons	○	○	○	
Loading and unloading equipment	○	○	○	

※: Double tracking work is under way except for completed section of Nilu and X6. Since the work is expected to be behind the schedule, the remaining work will be handled by this section in the 2nd Stage.

(Source: Study team)

5.1.3. Construction Method

In order to promptly expand coal transportation capacity of the South Sumatra Railway, the project will be implemented by stepwise approach in 3 stages in which transportation target is set at 3 levels of 2.5MTPA, 5.0MTPA, and 20.0MTPA. As for construction planning, a basic policy is set to achieve the transportation capacity target at each stage with certainty, to plan the shortest construction period, and to employ construction method in such a way that works of each stage are certainly finished within a predetermined work period and works of the next stage can be carried out continuously. Therefore, the principle is that procurement procedure for consultant employment, contractor tendering, etc. for the next stage project shall be finished within the period of the current stage project so that the work for the next stage can be started immediately after the completion of the current stage. An overview of construction method of each stage based on the plan is shown below:

(1) The 1st Stage

The measure to achieve the transportation capacity target of 2.5MTPA in the 1st Stage is to increase the number of services by increased train running speed and to increase the number of freight wagon of a train. This measure requires to repair defects of existing track and to extend effective length of station which can accommodate a train length of 395m. In this addition, improvement and new installation of signal and telecom equipment, reinforcement of rolling stock repair facilities, procurement of rolling stock (locomotives and freight wagons), and reinforcement of loading and unloading equipment are required. Improvement works of the 1st Stage will be implemented by the following guidelines and procedures based on the above requirements:

① Improvement Work of Track and Existing Roadbed

- Track rehabilitation is carried out along the whole line to improve defective spots of the existing track.
- Replacement of sleeper and ballast, and replenishment of ballast are carried out in sections of all of the R42 rail between Prabumulih and Kertapati to prepare for replacement of rail to R54.

② Improvement of Civil Engineering Structure

- Extension of effective length is carried out in stations having an insufficient effective length of 395m as part of station facility improvement.

③ Improvement and New Installation of Signal and Telecom Equipment

- Improvement of defective parts of existing signal equipment is carried out. This work is scheduled in the latter half of the work period.

- Due attention should be paid to the timing of purchase order of the equipments and materials to avoid the 1st Stage schedule disorder.

④ Reinforcement of Rolling-stock Repair Facility and Procurement of Rolling-stock

- Since procurement of rolling stock needs a period of about 2 to 3 years from order to delivery and this process will be a critical path in the working schedule, rolling stock should be ordered immediately after the 1st Stage project is started.
- Due attention should be paid to the timing of order for the equipment and material associated with reinforcement work of rolling stock repair facilities, and the work is planned to be started in the middle of the project period of this stage.

⑤ Reinforcement of Loading and Unloading Facility

- Due attention should be paid to the timing of order of equipment and material associated with reinforcement work of loading and unloading equipment to avoid the 1st Stage schedule disorder.

(2) The 2nd Stage

The measures to achieve the transportation capacity target of 5.0MTPA in the 2nd Stage is, as it is the case for the 1st Stage, is to increase the number of service by increasing train running speed and to extend the number of freight wagon of a train. This measure requires to repair defects of existing track in sections where the 1st Stage did not cover, to extend effective length of stations which cannot accept a train length of 615m, and to install additional signal stations. It is also required to complete the double-tracking work now under construction between Muaraenim and Prabumulih X6. Furthermore, improvement and new installation of signal and telecom equipment, reinforcement of rolling stock repair facilities, procurement of rolling stock (locomotives and freight wagons), and reinforcement of loading and unloading equipment are also required. Improvement works of the 2nd Stage will be implemented by the following guidelines and procedures based on the above requirements:

① Double-tracking between Muaraenim and Prabumulih X6 (referred to hereinafter as "Double tracking work (1)").

- Double tracking work in sections where within "Double tracking work (1)" failed to complete. Work period of about 2 years is assumed due to bridge work and vehicle procurement involved.
- Construction procedure by work item is identical to the double tracking work in the 3rd Stage.

② Track Improvement

- Replacement of rail from R42 to R54 for section where track improvement such as replacement of PC sleeper, replacement of track bed and replenishment of ballast in Prabumulih – Kertapati section at the 1st Stage.

③ Improvement Work of Civil Engineering Structures

- New installation of two signal stations that handle trains traveling in opposing directions to each other. 1 signal station between Prabumulih and Lembak, and 1 signal station between Payakabung and Simpang.
- Extension of effective length in the stations having an insufficient effective length to accommodate a train of 615m in length as part of station facility improvement work.

④ Branch Line Construction between Merapi and Coal Storage Yard

- Construction of incoming line of 700m in length to the coal storage yard.

⑤ Improvement and New Installation of Signaling and Telecommunication Equipment

- Improve defective parts of existing signal equipment. This work is scheduled in the latter half in the 2nd Stage project schedule.
- Due attention should be paid to order timing of equipment and material not hinder the working schedule.

⑥ Reinforcement of Rolling-stock Repair Facility and Procurement of Rolling-stock

- Since procurement of rolling stock needs a period of about 2 to 3 years from order to delivery and the process can be a critical path in the 2nd Stage project schedule, rolling stock should be ordered immediately after the work is started.
- Due attention should be paid to order timing of equipment and materials associated with reinforcement work of rolling stock repair facilities, and the work scheduled to be started in the middle of the 2nd Stage project schedule.

⑦ Reinforcement of Loading and Unloading Facility

- Due attention should be paid to order timing of equipment and material associated with reinforcement work of loading and unloading equipment not hinder the working schedule.

(3) The 3rd Stage

The measures to achieve the transportation capacity target of 20.0MTPA in the 3rd Stage is, as it is the case for the 1st and the 2nd Stages, to increase the number of service by increasing train running speed and increasing the number of freight wagon hauled by a train. Since the 3rd Stage works need long working period mainly due to double tracking work, the first thing to do is to extend the effective length capable of accommodating train length of 930m by which the transportation capacity will be expanded gradually from 5.0MTPA, then it should be proceeded to double tracking work between Sukacinta and Muaraenim and between Prabumulih X6 and Kertapati. Furthermore, in the same way as the 1st and the 2nd Stages, improvement and new installation of signal and telecom equipment (relay interlocking), reinforcement of rolling stock repair facility, rolling stock procurement (locomotive and freight wagon), and reinforcement of loading and unloading equipment are also implemented. Improvement works of the 3rd Stage will be implemented by the following guidelines and procedures based on the above requirements:

① Improvement of Civil Engineering Structures

- Extension of effective length in the stations incapable of accommodating 930m of train length as a part of station facility improvement work.
- The works mentioned above are also carried out in the 2 signal stations newly installed in the 2nd Stage.

② Double-tracking Work between Sukacinta and Muaraenim (referred to hereinafter as "Double tracking work (2)") and double tracking work between Prabumulih X6 and Kertapati (referred to hereinafter as "Double tracking work (3)")

- Access road to the construction site is constructed between Payakabung and Kertapati, where no available approach road exists. Since national road is nearby and running parallel to the construction sites in other sections, construction sites are used as pilot roads.
- Ground improvement of soft ground sections between Payakabung and Kertapati.
- In the embankment sections, drainage work is carried out before proceeding to embankment work, while in the cut sections, cut work is carried out in advance to proceeding into drainage work.
- For the bridge work, temporally pier and cofferdam are set at the bridge foundation site before proceeding to substructure work and then superstructure work.
- Roadbed work is carried out after earthwork and bridge work are completed.

③ Double-tracking and Installation of Additional Crossing

- Track and additional crossing are laid after roadbed work is completed.

④ Improvement and New Installation of Signaling and Telecommunication Equipment

- Modernization work (signal relay interlocking) of signal and telecom system is carried out along the whole line. This work is scheduled in the latter half of the 3rd Stage project schedule.
- Due attention should be paid to the order timing of equipment and material not to hinder the working schedule.

⑤ Reinforcement of Rolling-stock Repair Facility and Procurement of Rolling-stock

- Since rolling stock procurement needs a period of about 2 to 3 years from order to delivery, the order should be made early so as not to hinder the working schedule for commissioning and so forth.
- The same mentioned above is also true to the reinforcement work of rolling stock repair facility.

⑥ Reinforcement of Loading and Unloading Equipment

- Due attention should be paid to order timing of equipment and material associated with reinforcement work of loading and unloading equipment not to hinder the 3rd Stage project schedule.

(4) Reference Stage

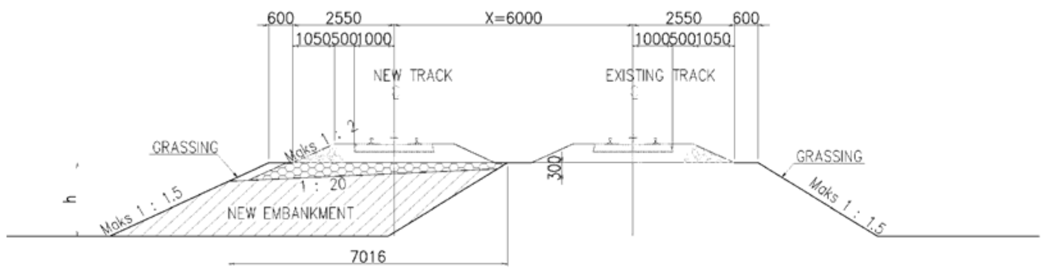
The following two construction plans for the new lines are proposed as a super long-term plan. This plan should be implemented with due attention to construction method and foundation work to cope with-soft ground, because both lines are located in soft ground area. Since the construction method of the new lines are the combination of the same working items in the 1st to 3rd Stage projects, the construction method is taken from them in the following descriptions.

① New line construction between Simpang and Mariana with the distance of 35km
② New line construction between Simpang and Gasing with the distance of 45km

5.1.4. Construction Guidelines

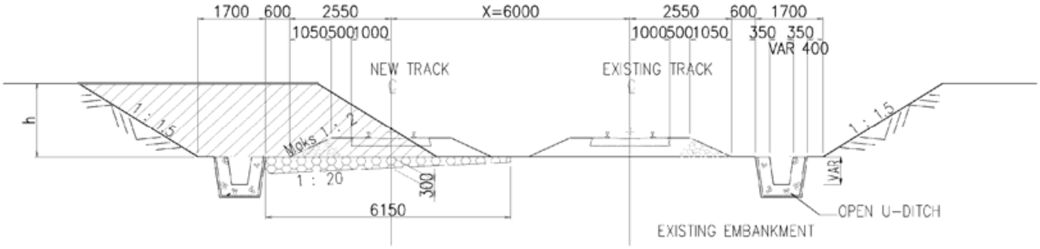
(1) Standard Cross-section Views of Earthwork

Standard cross-section views of embankment and cut work which consist major part of the construction work in the double tracking work are shown in [Fig. 5-1-1] and [Fig. 5-1-2].



(Source: Study team)

[Fig. 5-1-1] Standard Cross-Section View of Embankment Work

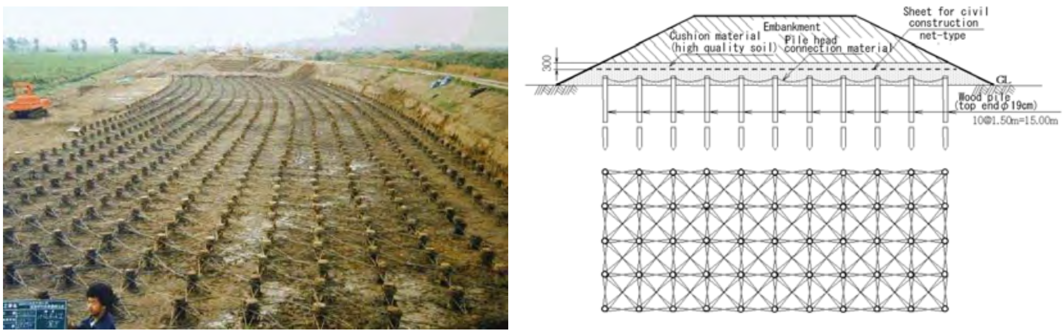


(Source: Study team)

[Fig. 5-1-2] Standard Cross-Section View of Cut Work

(2) Ground Improvement Work (Pile Net Method)

The foundation work between Payakabung and Kertapati where the base ground is soft is implemented using Pile Net Method which can widely distributed the load into deep layers of soil, prevent ground failure, and prevent lateral flow of embankment foundation by a effect of pile group. [Fig. 5-1-3] shows the overview of the method.

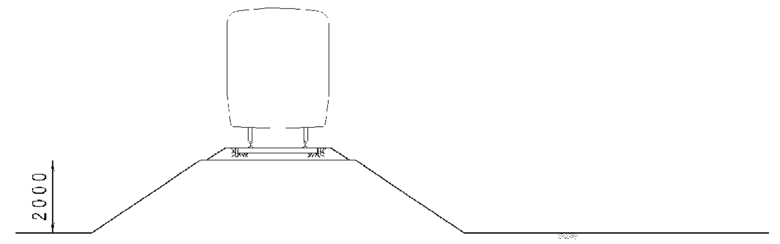
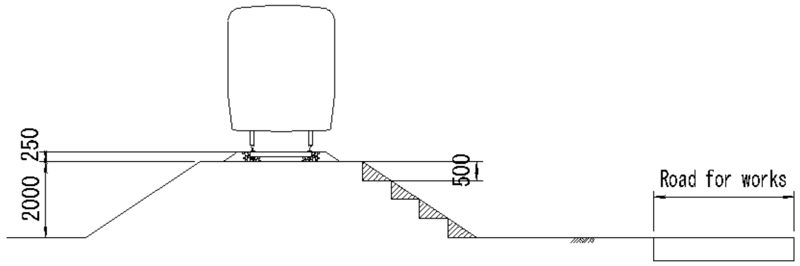
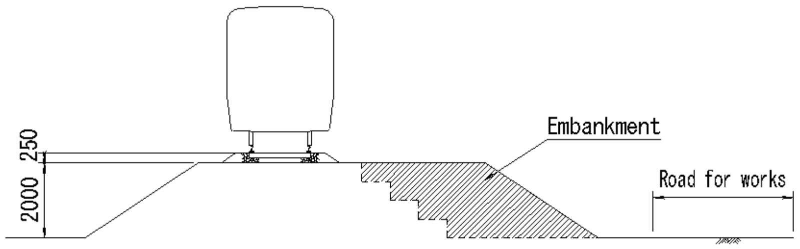
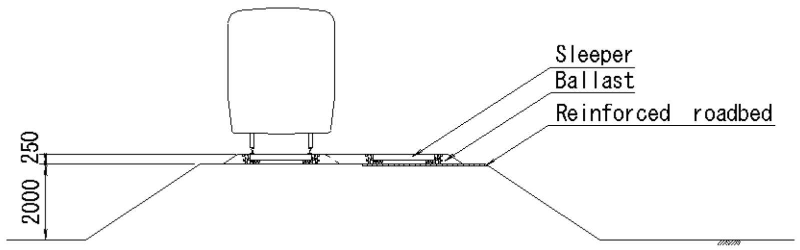
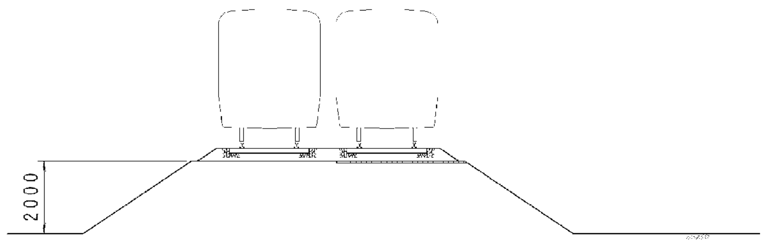


(Source: Study team)

[Fig. 5-1-3] Overview Diagram of Method of Pile-Net

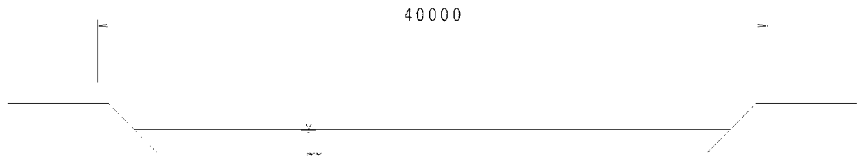
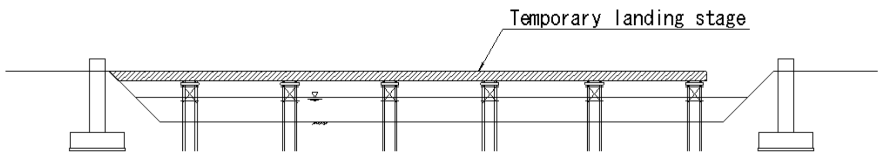
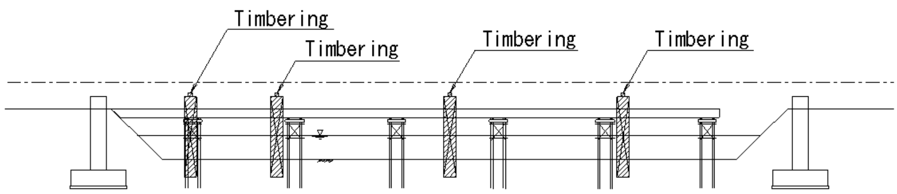
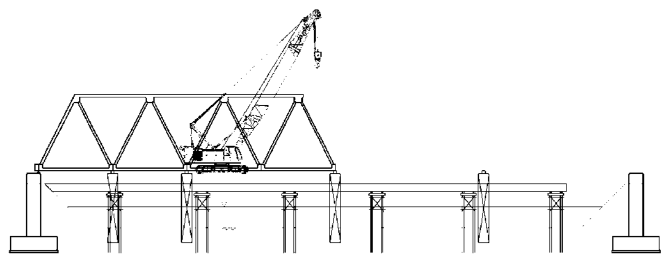
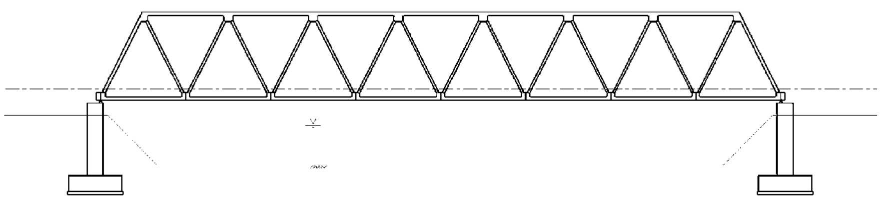
(3) Schematic Diagrams of Construction Process

Schematic diagrams of earthwork and bridge work are shown in [Fig. 5-1-4] to [Fig. 5-1-6], respectively.

At Present	
Bench Cut	
Embankment	
Installation of Roadbed, Ballast and Sleepers	
Completion	

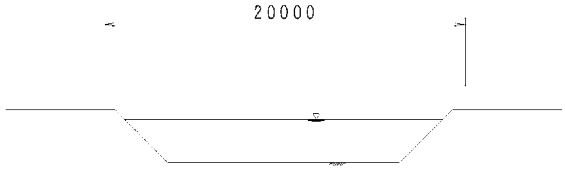
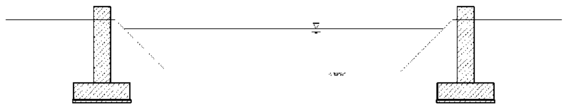
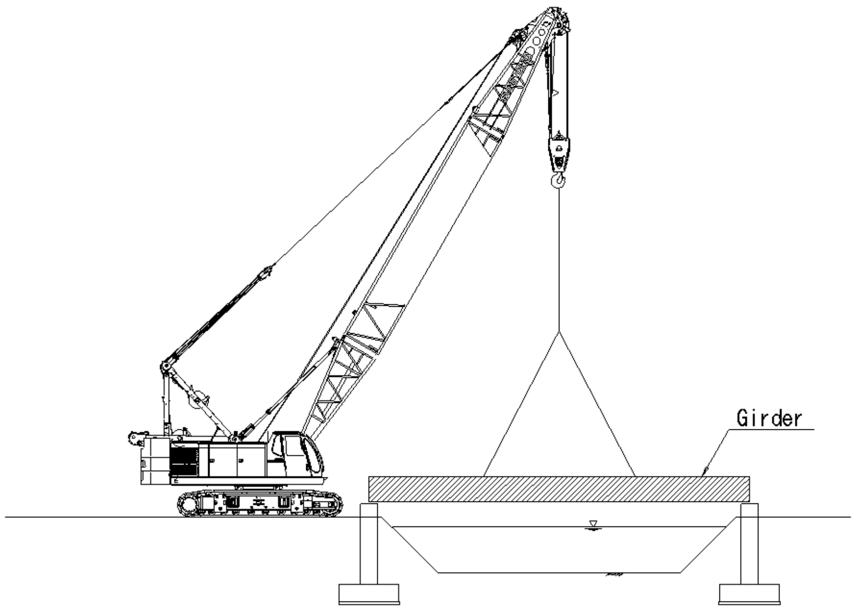
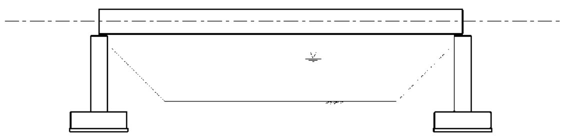
(Source: Study team)

[Fig. 5-1-4] Schematic Diagram of Embankment Work

At Present	
Abutment Installation	
Temporary Landing Stage Installation	
Timbering Installation	
Erection by Crane	
Removal and Completion	

(Source: Study team)

[Fig. 5-1-5] Schematic Diagram of Erection of Through Truss Bridge

At Present	
Abutment Installation	
Erection by Crane	
Removal and Completion	

(Source: Study team)

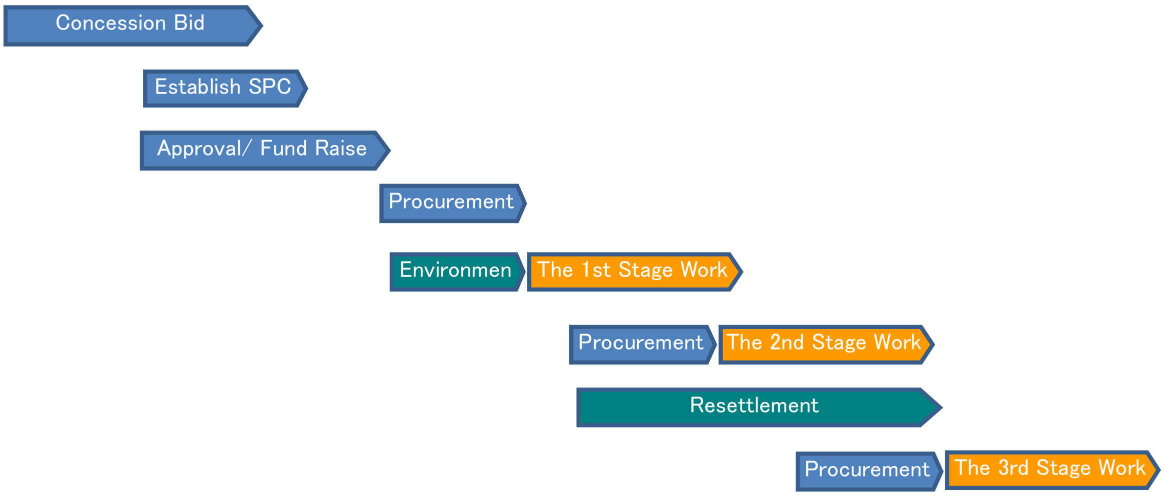
[Fig. 5-1-6] Schematic Diagram of Erection of Plate Girder

5.2. Implementation Schedule

(1) Basic Schedule

Considering the urgent necessity of transportation capacity expansion, the schedule is set to achieve the transportation capacity of 2.5MTPA as a short-term target in this project. Then, the target capacity is set to 5.0MTPA as a mid-term target. Finally, it is set to 20.0MTPA and more than 20.0MTPA as a long-term and super long-term targets respectively. Here, the super long-term plan is made just for reference and no detailed site condition is investigated in the field survey conducted by the study team.

The basic schedule for the Project as a whole is shown in the chart below. No exact time spans are mentioned in the chart, but they will be determined in the 5.2.1 and thereafter.



(Source: Study team)

[Fig. 5-2-1] Basic Schedule

(2) Project Implementation in the 1st Stage

Since the implementation of whole double tracking is not considered to be possible in a short run, the 1st Stage capacity expansion target is planned to be achieved by single track operation supported by measures such as improvement of the existing track, improvement of track in station yard, reinforcement of loading and unloading equipment, modernization of equipment, increase of train, and expansion of rail yard. The amount of transportation demand bigger than 2.5MTPA is planned to be supplemented by truck transportation on road.

(3) Project Implementation in the 2nd Stage

The target capacity expansion of 5.0MTPA is planned to be achieved by partial double tracking. The measures taken in this stage are improvement of track in station yard, installation of additional signal station, reinforcement of loading and unloading equipment, modernization of equipment, increase of trains, and expansion of rail yards, etc. Here, if the on-going double tracking work between Muaraenim and Prabumulih X6 is not implemented on schedule, it is planned to be expedited under this project and complete the whole double tracking of the section and expand the transportation capacity in the end of the 2nd Stage.

(4) Project Implementation in the 3rd Stage

The target capacity expansion of 20.0MTPA is planned to be achieved by whole double tracking. In this addition, the target capacity expansion of more than 20.0MTPA is studied just for a reference without any in-depth study.

Project implementation schedule is prepared based on work volume of the planned project and standard time obtained from past experiences. The implementation schedule of the project is shown in the following tables of [Table 5-2-1] to [Table 5-2-4].

[Table 5-2-1] Procurement Schedule

(Number of months passed after conclusion of L/A)

	The 1st Stage	The 2nd Stage	The 3rd Stage
Project Preparation	(*1)12 month		
<u>Consultant Selection</u>	6 month	9 month	9 month
Site Investigation & D/D	12 month	18 month	18 month
Contractor Selection	6 month	17 month	17 month
Construction Period	To be set at each Stage.		
Warranty Period	12 month for Civil Work and 24 month for Signal & Telecom.		

(*1) Breakdown

Bid Preparation	3 month
P/Q to Bidding	5 month
SPC Foundation （定款作成・役員選定）	3 month
Approval (Licensing from BKPM)	6 month 4 month
Fund Raising Procedure (Bank account, Tax office registration)	6 month
Negotiation with PT. KAI and DGR	8 month

(Source: Study team)

The implementation schedule for each stage is shown below. The schedules shown here, except the 1st Stage, are corresponding to the additional works after the completion of the previous stage works.

5.2.1. Implementation Schedule for the 1st Stage

[Table 5-2-2] Implementation Schedule for the 1st Stage

	1st Year	2nd Year	3rd Year	4th Year	5th Year	6th Year	7th Year	8th Year	9th Year	10th Year	11th Year
Project Preparation											
Consultant Selection											
Site Investigation & D/D											
Bidding (Contractor Selection)											
Preparation Work											
Roadbed improvement											
Track rehabilitation											
- Rehab for A and B sections											
- R54 Replacement for C Section											
Civil Structure Improvement											
- Extension of Effective Length											
- Addition of Signaling Station											
Signal & Telecom Improvement											
Electric & Mechanical Improve											
Depot Expansion											
Coal Handling Facilities											
Site Clearance											
Rolling-Stock (Loco & Freight)											

(Source: Study team)

5.2.2. Implementation Schedule for the 2nd Stage

[Table 5-2-3] Implementation Schedule for the 2nd Stage

	1st Year	2nd Year	3rd Year	4th Year	5th Year	6th Year	7th Year	8th Year	9th Year	10th Year	11th Year
Project Preparation											
Consultant Selection											
Site Investigation & D/D											
Bidding (Contractor Selection)											
Roadbed improvement											
Track rehabilitation											
Track rehabilitation											
- Rehab for A and B sections											
- R54 Replacement for C Section											
Civil Structure Improvement											
- Extension of Effective Length											
- Addition of Signaling Station											
Service Line to Merapi											
Double Tracking (1) for Section B											
- Site Access Road											
- Ground Improvement											
- Drainage											
- Earth Work (Cut & Fill)											
- Temporally Work (Pier)											
- Bridge (Substructure)											
- New Road Bed											
- New Track											
Crossing Improvement											
Signal & Telecom Improvement											
Electric & Mechanical Improve											
Depot Expansion											
Coal Handling Facilities											
Site Clearance											
Rolling-Stock (Loco & Freight)											
Commissioning											

(Source: Study team)

5.2.3. Implementation Schedule for the 3rd Stage

[Table 5-2-4] Implementation Schedule for the 3rd Stage

	1st Year	2nd Year	3rd Year	4th Year	5th Year	6th Year	7th Year	8th Year	9th Year	10th Year	11th Year
Project Preparation											
Consultant Selection											
Site Investigation & D/D											
Bidding (Contractor Selection)											
Roadbed improvement											
Track rehabilitation											
Track rehabilitation											
Civil Structure Improvement											
- Extension of Effective Length											
- Addition of Signaling Station											
Service Line to Merapi											
Double Tracking (1) for Section B											
Double Tracking (2)&(3) for Section A & C											
- Site Access Road											
- Ground Improvement											
- Drainage											
- Earth Work (Cut & Fill)											
- Temporally Work (Pier)											
- Bridge (Substructure)											
- New Road Bed											
- New Track											
Crossing Improvement											
Signal & Telecom Improvement											
Electric & Mechanical Improve											
Depot Expansion											
Coal Handling Facilities											
Site Clearance											
Rolling-Stock (Loco & Freight)											
Commissioning											
AMDAL											
Land Acquisition & Resettlement											

(Source: Study team)

The detailed construction schedule is shown in [Appendix 5-2-1].

5.3. Procurement Package of Materials and Equipment

5.3.1. Division into Procurement Packages

In the project, facility improvement will be implemented by dividing into 3 stages and therefore procurement package will be set by dividing into the 3 stages. Though domestic and international tender classification of civil engineering works is required to be handled flexibly based on adequate survey and examination about results of international tender, in this project amount in which foreign companies may have interests is assumed to be about 220 billion Rp. (2 billion yen) at the present stage. Meanwhile, each component of the equipment-related works such as signal and telecom equipment, electromechanical equipment, rolling stock repair facilities, rolling-stock, loading and unloading equipment, etc., most of which may be procured from abroad, are assumed to be about 110 billion Rp. (1 billion yen). If there is no domestic bidder for a small size contract package opened for domestic tendering, the package may be combined with other package so that the package size will be big enough for international tendering and it will be called for international tendering.

(1) Stage-wise Project Cost

Project cost of each stage is shown in [Table 5-3-1]. Procurement packaging of each stage will be proposed based on the amount of the table.

[Table 5-3-1] Construction Cost by Stage

(Unit: million Rp.)

	The 1st Stage	The 2nd Stage	The 3rd Stage
Track work cost (including rehabilitation)	243,539	402,899	508,398
Improvement work cost of existing roadbed	48,053	0	0
Improvement work cost of civil engineering structures	1,765	35,595	42,894
Construction cost of new line between Merapi and coal storage yard	0	10,608	0
Double tracking work (1) cost	0	249,861	0
Double tracking work (2) and (3) costs	0	0	1,126,593
Installation work cost of additional crossing	0	2,700	12,900
Improvement and new installation work cost of signal and telecom equipment	14,870	99,060	1,447,260
Improvement and new installation work cost of electromechanical equipment	0	15,585	13,970
Reinforcement work cost of rolling stock repair facility	49,610	24,860	37,290
Rolling stock cost (procurement cost of locomotives and wagons)	507,650	272,800	1,184,150
Reinforcement work cost of loading and unloading equipment	14,740	24,420	144,760
Total construction cost	880,227	1,138,388	4,518,215

Note: Monetary units of foreign currency and local currency are tentatively represented by Rp.
(Conversion: 1 yen = 110 Rp.)

(Source: Study team)

(2) Procurement Package of the 1st Stage

Procurement package size should be decided in consideration of procurement factors such as location of construction site, extension of the construction site, equipment and materials, etc. Accordingly, [Table 5-3-2] shows construction cost breakdown classified based on the factors before deciding procurement package.

[Table 5-3-2] Construction Cost by Section (The 1st Stage)

(Unit: million Rp.)

	Civil engineering work cost			Equipment -related work cost
	Section A	Section B	Section C	
	38 km	71 km	81 km	
Track work cost (including rehabilitation)	11,843	16,395	215,301	0
Improvement work cost of existing roadbed	9,673	17,924	20,456	0
Improvement work cost of civil engineering structure	1,765	0	0	0
Improvement and new installation work cost of signal and telecom equipment	0	0	0	14,870
Reinforcement work cost of rolling stock repair facility	0	0	0	49,610
Rolling stock cost (procurement cost of locomotives and wagons)	0	0	0	507,650
Reinforcement work cost of loading and unloading equipment	0	0	0	14,740
Total construction cost	23,281	34,319	235,759	586,870

Note 1: Currency conversion is estimated to be at a rate of 1 yen = 110 Rp.
Note 2: Section A indicates a length of 38.1 km between Lahat and Muaraenim.
Note 3: Section B indicates a length of 70.6 km between Muaraenim and Prabumulih X6.
Note 4: Section C indicates a length of 80.6 km between Prabumulih X6 and Kertapati.

(Source: Study team)

Judging from cost classification and cost scale factor of the above table in comprehensively, procurement package of the 1st Stage is proposed as shown in [Table 5-3-3].

[Table 5-3-3] Procurement Package of the 1st Stage

Package name	Package contents	Planned price (Unit: million Rp.)	Tender classification		Opportunity for Japanese contractor
			Domestic tender	International tender	
Package 1	Track work for Section A, B and C	243,539		○	○
Package 2	Improvement of existing roadbed and civil engineering structure of Section A, B and C	49,818	○		
Package 3	Improvement and new installation of signal & telecom equipment Reinforcement of rolling stock repair facilities Reinforcement of coal handling equipments	79,220	○		○
Package 4	Rolling-Stock (locomotives and wagons)	507,650		○	○
Total		880,227			

Note: Regarding the opportunity of bidding for Japanese firms, working items are selected with the mark of "possible (○)" based on not only work scale but also the applicability of Japanese products.

(Source: Study team)

(3) Procurement Package of the 2nd Stage

As is the case with the 1st Stage, section wise construction cost breakdown is shown in [Table 5-3-4].

[Table 5-3-4] Construction Cost by Section (The 2nd Stage)

(Unit: million Rp.)

	Civil engineering work cost			Equipment -related work cost
	Section A	Section B	Section C	
	38 km	71 km	81 km	
Track work cost (including rehabilitation)	26,515	149,886	226,498	0
Improvement work cost of civil engineering facilities	9,016	0	26,579	0
Construction cost of new line between Merapi and coal storage yard	10,608	0	0	0
Double tracking (1) cost	0	249,861	0	0
Installation work cost of additional crossings	1,350	0	1,350	0
Improvement and new installation work cost of signal and telecom equipment	0	0	0	99,060
Improvement and new installation work cost of electromechanical equipment	0	0	0	15,585
Reinforcement work cost of rolling stock repair facilities	0	0	0	24,860
Rolling stock cost (procurement cost of locomotives and wagons)	0	0	0	272,800
Reinforcement work cost of loading and unloading equipment	0	0	0	24,420
Total construction cost	47,489	399,747	254,427	436,725

(Note) - Currency conversion is estimated to be at a rate of 1 yen = 110 Rp.
- Section A indicates a length of 38.1 km between Lahat and Muaraenim.
- Section B indicates a length of 70.6 km between Muaraenim and Prabumulih X6. (Work for double tracking (1) is intended only for unconstructed sections.)
- Section C indicates a length of 80.6 km between Prabumulih X6 and Kertapati.

(Source: Study team)

Judging from cost classification and cost scale factor of the above table in comprehensively, procurement package of the 2nd Stage is proposed to be as shown in [Table 5-3-5].

[Table 5-3-5] Procurement Package of the 2nd Stage

Package name	Package contents	Planned price (Unit: million Rp.)	Tender classification		Opportunity for Japanese contractor
			Domestic tender	International tender	
Package 1	Track work for Section A, B and C Improvement of civil engineering structure of Section A and C Construction of new line between Merapi and coal storage yard Installation of additional crossings of Section A and C Double tracking (1) work	701,663		○	○
Package 2	Improvement and new installation of signal, telecom and electromechanical equipments	114,645		○	○
Package 3	Building of new rolling stock repair facilities Reinforcement coal handling equipments	49,280	○		○
Package 4	Rolling stock (locomotives and wagons)	272,800		○	○
Total		1,138,388			

Note: Regarding the opportunity of bidding for Japanese firms, working items are selected with the mark of "possible (○)" based on not only work scale but also the applicability of Japanese products.

(Source: Study team)

(4) Procurement Package of the 3rd Stage

As is the case with the 1st and the 2nd Stages, section wise construction cost breakdown is shown in [Table 5-3-6].

[Table 5-3-6] Construction Cost by Section (The 3rd Stage)

(Unit: million Rp.)

	Civil engineering work cost			Equipment -related work cost
	Section A	Section B	Section C	
	38 km	71 km	81 km	
Track work cost	131,622	0	376,776	0
Improvement work cost of civil engineering structure	17,658	0	25,236	0
Double tracking work (2) and (3) cost	420,643	0	705,950	0
Installation work cost of additional crossing	6,450	0	6,450	0
Improvement and new installation work cost of signal and telecom equipment	0	0	0	1,447,260
Improvement and new installation work cost of electromechanical equipment	0	0	0	13,970
Building work cost of new rolling stock repair facility	0	0	0	37,290
Rolling stock cost (procurement cost of locomotives and wagons)	0	0	0	1,184,150
Reinforcement work cost of loading and unloading equipment	0	0	0	144,760
Total construction cost	576,373	0	1,114,412	2,827,430

Note 1: Currency conversion is estimated to be at a rate of 1 yen = 110 Rp.
Note 2: Section A indicates a length of 38.1 km between Lahat and Muaraenim. (Double tracking work (2) is intended for a region between Sukacinta and Muaraenim.)
Note 3: Section B indicates a length of 70.6 km between Muaraenim and Prabumulih X6.
Note 4: Section C indicates a length of 80.6 km between Prabumulih X6 and Kertapati. (Double tracking work (3))

(Source: Study team)

Judging from cost classification and cost scale factor of the above table in comprehensively, procurement package of the 2nd Stage is proposed to be as shown in [Table 5-3-7].

[Table 5-3-7] Procurement Package of the 3rd Stage

Package name	Package contents	Planned prices (Unit: million Rp.)	Tender Classification		Opportunity for Japanese contractor
			Domestic tender	International tender	
Package 1	Track work for Section A and C Improvement of civil engineering structure and installation of additional crossings for Section A and C Double tracking work (2) (Section A) Double tracking work (3-1) (Section C (1)) Double tracking work (3-1) (Section C (2))	1,690,785		○	○
Package 2	Improvement and new installation of signal, telecom and electromechanical equipments	1,461,230		○	○
Package 3	Building of new rolling stock repair facilities Reinforcement coal handling equipments	182,050		○	○
Package 4	Rolling stock (locomotives and wagons)	1,184,150		○	○
Total		4,518,215			

Note 1: Regarding the opportunity of bidding for Japanese firms, working items are selected with the mark of "possible (○)" based on not only work scale but also the applicability of Japanese products.

(Source: Study team)

5.3.2. Opportunity for Japanese Firm

Guiding principle for the opportunity of Japanese firms to participate at each stage of the tendering was discussed already in classifying procurement package into civil engineering works and equipment works, and considering from the aspect of work scale and product. Meanwhile, in the 2nd and the 3rd Stages of the implementation where the JICA yen loan is the option, from the viewpoint of project fund raising aspect, STEP type yen-loan-may be applicable, which increase the opportunity of Japanese firms participation, and by which low-interest loan is available if the procurement rate of Japanese products is equal to or more than 30%. Accordingly, approximate value of items to be procured from overseas out of foreign currency cost as shown in [Table 5-3-8] in each stage is calculated at first, then the availability of Japanese products is chosen, and finally procurement rate of Japanese products are calculated to explore the applicability of STEP type yen loan.

[Table 5-3-8] Foreign Currency Amount of Each Stage

(Unit: million Rp.)

	The 1st Stage	The 2nd Stage	The 3rd Stage
Track work cost	4,556	273,526	198,020
Double tracking work (1) cost	0	25,000	0
Double tracking work (2) and (3) cost	0	0	113,187
Improvement and new installation work cost of signal and telecom equipment	13,706	64,752	815,406
Improvement and new installation work cost of electromechanical equipment	0	1,596	10,314
Reinforcement work cost of rolling stock repair facility	49,610	24,860	37,290
Rolling stock cost (procurement cost of locomotives and wagons)	507,650	272,800	1,184,150
Reinforcement work cost of loading and unloading equipment	14,740	24,420	144,760
Total amount of foreign currency	590,262	686,954	2,503,127

Note: Monetary units of foreign currency and local currency are tentatively represented by Rp.

(Conversion: 1 yen = 110 Rp.)

(Source: Study team)

(1) Head-hardened Rail/Turnout

Transportation capacity expansion target for the super long-term is more than 20.0MTPA which is equivalent to transportation capacity of Japanese 1st class track. This volume of traffic is classified to be the 1st class railway section in Japan, which means rapid progressive damage of track, in particular rails is expected. Therefore, in order to prevent future decline in transportation capacity, it is considered essential to adopt Japanese-made head hardened rail and turnout superior in quality and durability.

(2) Weatherproof Steel Plate

Since the South Sumatra Railway is located in an inland area and rarely affected by sea breeze, steel bridge will be good for choice in general. However, if maintenance and repair works are neglected for years in South Sumatra of high temperature and humidity, materials will be damaged and the bridge life will be shortened. In the case of Japanese railway, steel bridges are repainted with a cycle of about 7 to 13 years, whereas painting cycle in the case of the South Sumatra Railway is observed to be much longer than that. However, repainting work is indispensable in the steel bridges made of general type steel material, which is a factor to increase the maintenance cost. Therefore, building steel bridges made of weatherproof steel plate in an initial investment will enable to reduce the maintenance cost considerably. The quality of Japanese products in this material is outstanding and reputable in the international market.

(3) Signal System

High reliability of Japanese domestic signal technology is endorsed by accident-free bullet train operation during a long period. It reached an extremely high level of SIL 4 (Safety Integration Level 4) measured by the international standard, which means erroneous operation probability of once in 11,500 years. Although the train operation schedule of this project is not considered to be a level of congested railway, it is required to introduce a high quality safety control system which is equipped with auxiliary signals in order to cope with poor visibility condition of signal for a train operator due to long sidings in a station precincts for an opposing train. Accordingly, introduction of high-performance signaling system will enable Japanese firms to win in the tender.

(4) Rolling Stock Repair Machinery

Japanese technology of vehicle repair machinery is far ahead of other countries because of their working accuracy and lower failure rates. The following shows some examples:

- Inner race induction heater: In checking an axle for a flaw, this apparatus heats a bearing's inner race inductively. It fits onto the exterior of the inner race, turns on to heats it to approximately 150ºC, and detaches it from the axle. It is superior in the setting and operation of heating temperatures compared with those manufactured in other countries.
- Bogie frame washing machine: This apparatus is designed to detach a bogie frame from a vehicle body, and to wash the exterior of the bogie frame alone or with wheels attached. Its high washing effect is highly regarded.
- Wheel press fitting machine: This is an NC type press for pressing a wheel onto an axle. These machines are of the same types as those used for the vehicles of the Japanese bullet trains. They are favorably accepted as world-class machines in accuracy.

(5) Procurement Rate of Japanese Products

The materials, systems and repair machineries having advantages in Japanese firms are mentioned above. In addition, products such as sheet piles and H-beam steel for temporary use in civil engineering works supplied by Japanese firms also have high reliability. [Table 5-3-9] to [Table 5-3-11] show items for each implementation stage to be possibly procured from Japanese firms together with procurement rate against total construction cost.

[Table 5-3-9] Items Applicable for Japanese Product (The 1st Stage)

Item	Unit	Quantity	Unit Cost	Total Amount (million yen)
Steel bridge manufacturing	set	0		0
Temporary structural steel (steel sheet pile and timbering material)	set	0		0
Track component (rail, turnout, etc.)	set	1		41
Signal and telecom equipment	set	1		125
Electromechanical equipment	set	1		0
Rolling stock maintenance machinery (repair workshop)	set	1		451
Loading and unloading equipment	set	1		134
Rolling stock (procurement of locomotives and wagons)	set	1		4,615
Total				5,366

Note: Rolling stock procurement cost is listed above because the supplier is not known at this moment.

(Source: Study team)

- Total project cost is 9,877 million yen and out of which procurement cost from Japan: is estimated to be 5,366 million yen (it is 751if the cost of rolling stock is excluded)
- The ratio of material and equipment to be possibly supplied by Japan against total project cost in the 1st Stage is 54% (8% without rolling-stock).

[Table 5-3-10] Items Applicable for Japanese Product (The 2nd Stage)

Item	Unit	Quantity	Unit Cost	Total Amount (million yen)
Steel bridge manufacturing	set	1		182
Temporary structural steel (steel sheet pile and timbering material)	set	1		45
Track products (rail, turnout, etc.)	set	1		2,528
Signal and telecom equipment	set	1		713
Electromechanical equipment	set	1		15
Rolling stock maintenance machinery (repair workshop)	set	1		677
Loading and unloading equipment	set	1		356
Rolling stock (procurement of locomotive and wagon)	set	1		7,095
Total				11,611

Note: Rolling stock procurement cost is listed above because the supplier is not known at this moment.

(Source: Study team)

- Total project cost is 22,688 million yen and out of which procurement cost from Japan: is estimated to be 11,611 million yen (it is 4,516 if the cost of rolling stock is excluded).
- The ratio of material and equipment to be possibly supplied by Japan against total project cost in the 1st Stage is 51% (20% without rolling-stock).

[Table 5-3-11] Items Applicable for Japanese Product (The 3rd Stage)

Item	Unit	Quantity	Unit Cost	Total Amount (million yen)
Steel bridge manufacturing	set	1		908
Temporary structural steel (steel sheet pile and timbering material)	set	1		348
Track products				4,328
Signal and telecom equipment	set	1		8,126
Electromechanical equipment	set	1		108
Rolling stock maintenance machinery (repair workshop)	set	1		1,016
Loading and unloading equipment	set	1		1,672
Rolling stock (procurement of locomotives and wagons)	set	1		17,860
Total				34,366

Note: Rolling stock procurement cost is listed above because the supplier is not known at this moment.

(Source: Study team)

- Total project cost is 74,437 million yen and out of which procurement cost from Japan: is estimated to be 34,366 million yen (it is 16,506 if the cost of rolling stock is excluded).
- The ratio of material and equipment to be possibly supplied by Japan against total project cost in the 1st Stage is 46% (22% without rolling-stock).

5.4. Project Cost Estimation

Total project cost of each implementation stage is shown in [Table 5-4-1], [Table 5-4-2] and [Table 5-4-3]. As for the calculation basis, [Appendix 5-4-1], [Appendix 5-4-2] and [Appendix 5-4-3] show that of civil work, [Appendix 5-4-4] show that of track work, [Appendix 5-4-5] shows that of signaling and telecommunication work, [Appendix 5-4-6] shows that of rolling-stock and coal handling system, and [Appendix 5-4-7] shows that of the cost of coal loading and unloading facilities.

5.4.1. Project Cost of the 1st Stage

[Table 5-4-1] Total Project Cost of the 1st Stage

(Unit: million Rp.)

	Foreign Cost	Local Cost	Total
Track rehabilitation work cost	4,556	238,983	243,539
Improvement work cost of existing roadbed	0	48,053	48,053
Improvement work cost of civil engineering structure	0	1,765	1,765
- Improvement work cost of station facilities (effective length extension)	(0)	(1,765)	(1,765)
- Installation work cost of additional signal stations	(0)	(0)	(0)
Improvement and new installation cost of signal and telecom equipment	13,706	1,164	14,870
Improvement and new installation cost of electromechanical equipment	0	0	0
Reinforcement work cost of rolling stock repair facilities	49,610	0	49,610
Rolling stock cost (procurement cost of locomotives and coal wagons)	507,650	0	507,650
Reinforcement work cost of loading and unloading equipment	14,740	0	14,740
Total construction cost: (A)	590,262	289,965	880,227
Consultant service: (A) ×3%	17,708	8,699	26,407
Tax: (A) × 10%	0	28,997	28,997
General administrative expense: (A) × 3%	0	8,699	8,699
Land acquisition cost	0	0	0
Compensation cost	0	0	0
Price escalation: (A) × 3%	17,708	8,699	26,407
Project cost: (B)	625,678	345,058	970,736
Contingency budget: (B) × 10%	62,568	34,506	97,074
Interest during Construction	12,044	6,642	18,687
Total project cost	700,290	386,207	1,086,496

Note: Monetary units of foreign currency and local currency are tentatively represented by Rp.
(Conversion: 1 yen = 110 Rp.) (Source: Study team)

5.4.2. Project Cost of the 2nd Stage

Project cost of the 2nd Stage includes project cost of the 1st Stage because the 2nd Stage is implemented immediately after the completion of the 1st Stage.

[Table 5-4-2] Total Project Cost of the 2nd Stage

(Unit: million Rp.)

	Foreign Cost	Local Cost	Total
Track work cost (including rehabilitation)	278,082	368,356	646,438
Improvement work cost of existing roadbed	0	48,053	48,053
Improvement work cost of civil engineering structures	0	37,360	37,360
- Improvement work cost of existing stations (effective length extension)	(0)	(19,797)	(19,797)
- Installation work cost of additional signal stations	(0)	(17,563)	(17,563)
Construction cost of new line between Merapi and coal storage yard	0	10,608	10,608
Work cost for double tracking (1)	25,000	224,861	249,861
Installation work cost of additional crossings	0	2,700	2,700
Improvement and new installation work cost of signal and telecom equipment	78,458	35,472	113,930
Improvement and new installation work cost of electromechanical equipment	1,596	13,989	15,585
Reinforcement work cost of rolling stock repair facilities	74,470	0	74,470
Rolling stock cost (procurement cost of locomotives and wagons)	780,450	0	780,450
Reinforcement work cost of loading and unloading equipment	39,160	0	39,160
Total construction cost: (A)	1,277,216	741,399	2,018,615
Consultant service: (A) × 3%	38,316	22,242	60,558
Tax: (A) × 10%	0	74,140	74,140
General administrative expense: (A) × 3%	0	22,242	22,242
Land acquisition cost	0	0	0
Compensation cost	0	0	0
Price escalation: (A) × 3%	38,316	22,242	60,558
Project cost: (B)	1,353,849	882,265	2,236,114
Contingency budget: (B) × 10%	135,385	88,226	223,611
Interest during Construction	23,718	12,238	35,955
Total project cost	1,512,952	982,729	2,495,681
The 2nd Stage project cost alone	812,662	596,522	1,409,185

Note: Monetary units of foreign currency and local currency are tentatively represented by Rp.
(Conversion: 1 yen = 110 Rp.) (Source: Study team)

5.4.3. Project Cost of the 3rd Stage

Project cost of the 3rd Stage includes project cost of the 1st Stage and the 2nd Stage because the 3rd stage is implemented immediately after the completion of the 2nd Stage.

[Table 5-4-3] Total Project Cost of the 3rd Stage

(Unit: million Rp.)

	Foreign Cost	Local Cost	Total
Track work cost (including rehabilitation)	476,102	678,734	1,154,836
Improvement work cost of existing roadbed	0	48,053	48,053
Improvement work cost of civil engineering structures	0	80,254	80,254
- Improvement work cost of existing stations (effective length extension)	(0)	(55,113)	(55,113)
- Installation work cost of additional signal stations	(0)	(25,141)	(25,141)
Construction cost of new line between Merapi and coal storage yard	0	10,608	10,608
Work cost for double tracking (1)	25,000	224,861	249,861
Work cost for double tracking (2), (3)	113,187	1,013,406	1,126,593
- Temporary work cost (road for works, cofferdam, and pier)	(33,379)	(42,015)	(75,394)
- Ground improvement work cost (method of pile-net)	(0)	(192,734)	(192,734)
- Earthwork cost (ground leveling, embankment, cut, and planting)	(0)	(289,411)	(289,411)
- Roadbed work cost	(0)	(145,535)	(145,535)
- Drainage work cost	(0)	(292,170)	(292,170)
- Bridge work cost (superstructure work and substructure work)	(79,808)	(51,541)	(131,349)
Installation work cost of additional crossings	0	15,600	15,600
Improvement and new installation work cost of signal and telecom equipment	893,864	667,326	1,561,190
Improvement and new installation work cost of electromechanical equipment	11,910	17,645	29,555
Reinforcement work cost of rolling stock repair facilities	111,760	0	111,760
Rolling stock cost (procurement cost of locomotives and wagons)	1,964,600	0	1,964,600
Reinforcement work cost of loading and unloading equipment	183,920	0	183,920
Total construction cost: (A)	3,780,343	2,756,487	6,536,830
Consultant service: (A) × 3%	113,410	82,695	196,105
Tax: (A) × 10%	0	275,649	275,649
General administrative expense: (A) × 3%	0	82,695	82,695
Land acquisition cost	0	0	0
Compensation cost	0	52,000	52,000
Price escalation: (A) × 3%	113,410	82,695	196,105
Project cost: (B)	4,077,164	3,332,220	7,339,383
Contingency budget: (B) × 10%	400,716	333,222	733,938
Interest during Construction	69,230	45,571	114,801
Total project cost	4,477,110	3,711,013	8,188,123
The 3rd Stage project cost alone	2,964,158	2,728,284	5,692,442

Note: Monetary units of foreign currency and local currency are tentatively represented by Rp.
(Conversion: 1 yen = 110 Rp.) (Source: Study team)

5.4.4. Project Cost to Address Super Long-Term Issues

The super long-term issues will be addressed only after the 3rd Stage project is completed, therefore the cost calculated hereunder is not going to the detail.

[Table 5-4-4] Total Project Cost of the Super Long-Term Stage (Simpang - Mariana of 35km)

(Unit: million Rp.)

	Foreign Cost	Local Cost	Total
Track equipment work cost	88,976	118,958	207,934
Civil engineering structure work cost (earthwork, bridges, drainage work, etc.)	157,300	910,719	1,068,019
Signal facility work cost	198,660	94,048	292,708
Building facility work cost (including five stations as 400 million yen per station)	66,000	154,000	220,000
Total construction cost: (A)	510,936	1,277,725	1,788,661
Consultant service: (A) × 3%	15,328	38,332	53,660
Tax: (A) × 10%	0	127,773	127,773
General administrative expense: (A) × 3%, land cost: 3,000 yen per m^2	0	38,332	38,332
Land acquisition cost (20 m × 35,000 m = 700,000 m^2)	0	231,000	231,000
Price escalation: (A) × 3%	15,328	38,332	53,660
Project cost: (B)	541,592	1,751,494	2,293,086
Contingency budget: (B) × 10%	54,159	175,149	229,308
Total project cost	595,751	1,926,643	2,522,394

Note 1: Monetary units of foreign currency and local currency are tentatively represented by Rp. to prevent a mistake. (Conversion: 1 yen = 110 Rp.)

Note 2.: Costs such as rolling stock procurement cost, loading and unloading facility cost, etc. are not included.

(Source: Study team)

- Unit length cost is 72.1 million Rp./m (equivalent to about 660 thousand yen per meter).
  (Note: Unit length cost is the total project cost divided by the line length of 35,000 m)

[Table 5-4-5] Total Project Cost of the Super Long-Term Stage (Simpang - Gasing of 45km)

(Unit: million Rp.)

	Foreign Cost	Local Cost	Total
Track equipment work cost	112,945	152,803	265,748
Civil engineering structure work cost (earthwork, bridges, drainage work, etc.)	1,148,500	1,192,432	2,340,932
Signal facility work cost	949,080	101,894	1,050,974
Building facility work cost (including six stations as 400 million yen per station)	79,200	184,800	264,000
Total construction cost: (A)	2,289,725	1,631,929	3,921,654
Consultant service: (A) × 3%	68,692	48,958	117,650
Tax: (A) × 10%	0	163,193	163,193
General administrative expense: (A) × 3%, land cost: 3,000 yen per m2	0	48,958	48,958
Land acquisition cost (20 m × 45,000 m = 900,000 m2)	0	297,000	297,000
Price escalation: (A) × 3%	68,692	48,958	117,650
Project cost: (B)	2,427,109	2,238,996	4,666,105
Contingency budget: (B) × 10%	242,711	223,900	466,611
Total project cost	2,669,820	2,462,896	5,132,716

Note 1: Monetary units of foreign currency and local currency are tentatively represented by Rp. to prevent a mistake. (Conversion: 1 yen = 110 Rp.)

Note 2.: Costs such as rolling stock procurement cost, loading and unloading facility cost, etc. are not included.

(Source: Study team)

- Unit length cost is 114.1 million Rp./m (equivalent to about 1 million yen per meter).

  (Note: Unit length cost is the total project cost divided by the line length of 45,000 m)

5.5. Consultant Employment Plan

5.5.1. Scope of the Work

In order for a project to be implemented efficiently, implementing agency of the project is required to have sufficient technical knowledge and experience in the railway facility building and its maintenance. In this project, particularly in the 1st Stage of the implementation, the implementing agency is planned to be SPC which is not necessarily the railway operator in nature. In such a case, consultant employment will be crucial. However, the necessity of the consultant is up to the discretion of SPC.

The purpose of having consulting engineering service is to implement the project safely and economically by taking expertise on advanced railway engineering as assistant to the implementing agency in the implementation process of the project in such aspects as technical decision making, basic design, detailed design and tender document preparation.

The terms of reference (TOR) of consultants to assist the implementing agency in the project is summarized as follows. A sample consultant TOR is attached in [Appendix 5-5-1] for reference.

- Basic design: Technical review-of-technical documents, schematic diagram, quantity calculation
- Detailed design: Design report, design calculation basis, work drawing, quantity calculation
- Tender-documents for procurement and construction: Pre-qualification documents, tender document, contract document
- Tendering procedure assistance
- Construction supervision
- Commissioning of rolling-stock , various equipments and system performance
- Performance test inspection: Supervise the commissioning service provided by suppliers for rolling-stock and other equipments and systems
- SPC selection assistance
- Assistance in compiling documents concerning SPC selection and its evaluation work

Reports to be prepared by the engineering services are expected to be as follows.

- Basic design documents: Technical report, basic design drawing, and technical specification
- Detailed design documents: Detailed design drawing, calculation basis document, quantity calculation document, cost estimation document
- Pre-qualification documents, construction plan, construction specifications, material specification
- Specification for materials, tender document, contract document
- Business condition for SPC, tender document for the selection of SPC, tender evaluation criteria, SPC contract document

5.5.2. Implementation Schedule of Consulting Services in the 1st Stage

[Table 5-5-1] shows the outline of implementation schedule of consulting services in the 1st Stage.

[Table 5-5-1] Implementation Schedule of Consulting Services in the 1st Stage

	1st Year	2nd Year	3rd Year	4th Year	5th Year	6th Year	7th Year	8th Year	9th Year	10th Year	11th Year	12th Year
Project Preparation												
General supervision												
Consultant selection												
Tender (construction firm selection)												
Environment plan												
Social program												
Transportation plan												
Maintenance management plan of operation												
Maintenance management plan of rolling stock												
Maintenance management plan of building civil engineering tracks												
Maintenance management plan of power maintenance management plan												
Maintenance management plan of signal and telecommunication												
Maintenance management plan of mechanical equipment												
Detailed design (rolling stock and workshop)												
Detailed design (civil engineering)												
Detailed design (building and equipment)												
Detailed design (tracks)												
Detailed design (Power)												
Detailed design (signal and telecommunication)												
Detailed design (machinery)												
Construction supervision (civil engineering, tracks, and facilities)												
Construction supervision (machinery and workshop)												
Construction supervision (Power, signal and telecommunication)												

(Source: Study team)

5.5.3. Implementation Schedule of Consulting Services in the 2nd Stage

[Table 5-5-2] shows the outline of implementation schedule of consulting services in the 2nd Stage.

[Table 5-5-2] Implementation Schedule of Consulting Services in the 2nd Stage

	1st Year	2nd Year	3rd Year	4th Year	5th Year	6th Year	7th Year	8th Year	9th Year	10th Year	11th Year	12th Year
Project Preparation												
General supervision												
Consultant selection												
Tender (construction firm selection)												
Environment plan												
Social program												
Transportation plan												
Maintenance management plan of operation												
Maintenance management plan of rolling stock												
Maintenance management plan of building civil engineering tracks												
Maintenance management plan of power maintenance management plan												
Maintenance management plan of signal and telecommunication												
Maintenance management plan of mechanical equipment												
Detailed design (rolling stock and workshop)												
Detailed design (civil engineering)												
Detailed design (building and equipment)												
Detailed design (tracks)												
Detailed design (Power)												
Detailed design (signal and telecommunication)												
Detailed design (machinery)												
Construction supervision (civil engineering, tracks, and facilities)												
Construction supervision (machinery and workshop)												
Construction supervision (Power, signal and telecommunication)												

(Source: Study team)

5.5.4. Implementation Schedule of Consulting Services in the 3rd Stage

[Table 5-5-3] shows the outline of implementation schedule of consulting services in the 3rd Stage.

[Table 5-5-3] Implementation Schedule of Consulting Services in the 3rd Stage

	1st Year	2nd Year	3rd Year	4th Year	5th Year	6th Year	7th Year	8th Year	9th Year	10th Year	11th Year	12th Year
Project Preparation												
General supervision												
Consultant selection												
Tender (construction firm selection)												
Environment plan												
Social program												
Transportation plan												
Maintenance management plan of operation												
Maintenance management plan of rolling stock												
Maintenance management plan of building civil engineering tracks												
Maintenance management plan of power maintenance management plan												
Maintenance management plan of signal and telecommunication												
Maintenance management plan of mechanical equipment												
Detailed design (rolling stock and workshop)												
Detailed design (civil engineering)												
Detailed design (building and equipment)												
Detailed design (tracks)												
Detailed design (Power)												
Detailed design (signal and telecommunication)												
Detailed design (machinery)												
Construction supervision (civil engineering, tracks, and facilities)												
Construction supervision (machinery and workshop)												
Construction supervision (Power, signal and telecommunication)												

(Source: Study team)

5.5.5. Scale of Consulting Services

[Table 5-5-4] shows staff configuration for engineering services, wherein Pro A, Pro B, and S represent, according to the JICA appraisal manual, foreign expert, Indonesian expert with technical level of equivalent to international engineer, and staff other than engineer, respectively.

[Table 5-5-4] Staff Configuration for Engineering Services

No.	Assignment	Pro A	Pro B	S
A01	Project Manager	○		
B01	Deputy Project Manager		○	
A02	Chief Contract Specialist	○		
B02	Contract Administration Engineer		○	
A03	Cost Estimate Expert	○		
B03	Quantity Survey Engineer		○	
A04	Safety Control Expert	○		
B04	Safety Control Engineer		○	
A05	Quality Control Expert	○		
B05	Quality Control Engineer		○	
A06	Alignment Specialist	○		
B06	Alignment Engineer		○	
A07	Environment Expert	○		
B07	Environment Engineer		○	
A08	Resettlement Expert	○		
B08	Resettlement Engineer		○	
B09	Geotechnical Engineer		○	
B10	Surveyor		○	
B11	Traffic Management Engineer		○	
A09	Operation Planning Specialist	○		
B12	Train Operation Engineer		○	
A10	Locomotive Expert	○		
B13	Rolling Stock Engineer		○	
B14	Depot Engineer		○	
B15	Workshop Engineer		○	
A11	Chief Civil Engineer	○		
A12	Steel Structure Expert	○		
B16	Civil Engineer 1		○	
A13	RC Structural Expert	○		
B17	Civil Engineer 2		○	
B18	Soil Engineer		○	
A14	Track Facility Expert	○		
B19	Track Engineer		○	
A15	Chief Architect	○		
B20	Facility Engineer		○	
A16	Power System Expert	○		
B21	Power System Engineer		○	
A17	Signal System Expert	○		
B22	Signal Engineer		○	
A18	Telecom System Expert	○		
B23	Telecom Engineer		○	
A19	Utility System Expert	○		
B24	Utility Facility Engineer		○	
S01	Computer Administrator			○
S02	CAD Operator			○
S03	Office Manager			○
S04	Executive Secretary			○
S05	Secretary			○
S06	Typist			○
S07	Office Boy			○
	Total	19	24	7

(Source: Study team)

Chapter 6

Project Implementation and Operation Body

6.1. Project Implementation

6.1.1. Legal Status of Implementing Agency

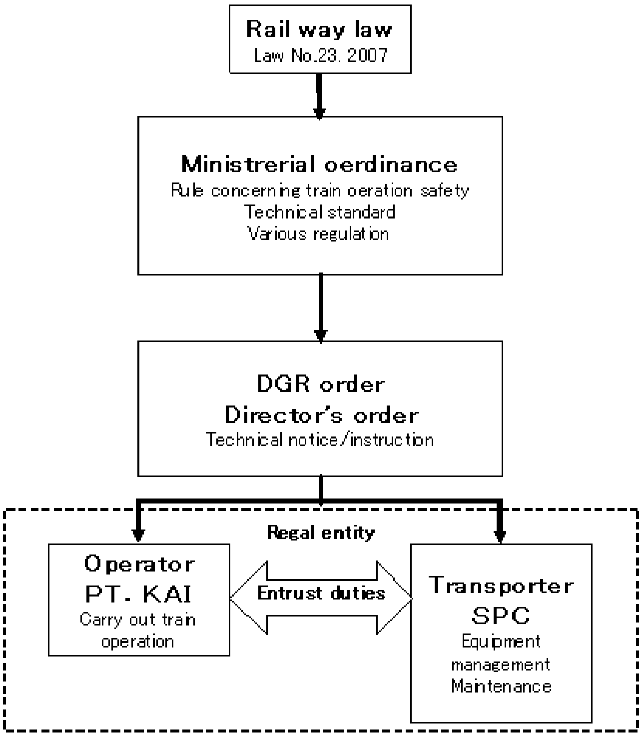
The implementing agency in this project will be changed through each stage from the 1st Stage to the 3rd Stage. That is, in the 1st Stage, SPC assumes to implement all the works including railway infrastructure improvement by its private investment.

On the other hand, in the 2nd Stage and the 3rd Stage, the conventional public investment scheme by Japanese ODA loan is assumed for improvement and new construction of railway infrastructure. Therefore, an implementation organization will be DGR. Moreover, an implementing agency can be PT. KAI when Two-Step Loan (TSL) through the Ministry of Finance is arranged. Legal status about the relation between SPC, DGR, and PT. KAI is described below.

According to the railway law of Indonesia No23/2007, legal status of SPC can be defined as a part of railway operator which owns railway facilities including rolling-stock and gives maintenance to the facilities. Since train operation and maintenance management of rolling-stock and other facilities are planned to be entrusted to PT. KAI, there is no responsibility for train operation itself in PSC. However, as long as SPC has a responsibility in maintenance management of the rolling-stock, it will be under the control of DGR.

However, the section between the bank of Musi river and Simpang station can be defined as a exclusive line attached to coal shipment facilities even thought it is a new line constructed by SPC. According to the low No. 23, since through operation between general purpose line and exclusive line is possible, PSC shall follow governmental control.

The governments control aside from the law No.23 includes railway operational regulation given by DGR, technical standards on infrastructure, facility, rolling-stock and so forth. These are all important for the safety of railway operation and any railway company has to follow in good faith.



(Source: Study team)

[Fig. 6-1-1] Regal Relationship

6.1.2. Division of Duties

SPC entrusts train operation and equipment including rolling-stock for the purpose of railway service to PT. KAI. Even though SPC is not a train operator, SPC shall carry out maintenance management necessary to safety train operation.

Maintenance managements is basically periodic inspection and/or repair of rolling-stocks, but it should includes establishment of the management system such as building work shop, recruiting maintenance staff and so forth. In this addition, SPC must establish internal rules on technical standards necessary for maintenance management..

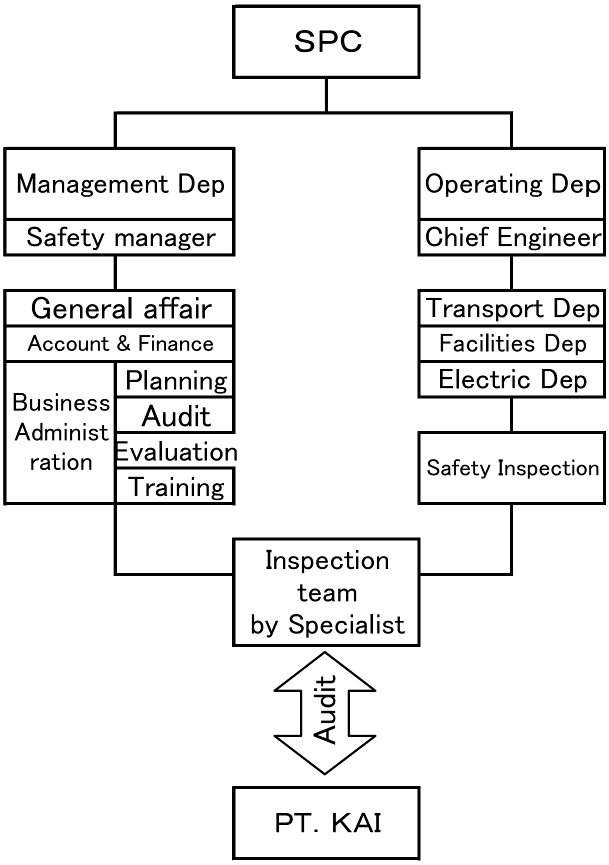
When SPC entrust these duties to PT. KAI, establishment of the regulation for technical standards and information service shall discuss with PT. KAI to define the division of duties.

SPC does not take responsibility on maintenance management of the railway facility owned and maintained by PT. KAI. However, it is SPC's responsibility to carry out maintenance to the facilities for loading and unloading of coal.

6.1.3. Organizational Structure

In all stages, the primary party to conduct railway operation will be PT. KAI. Therefore, the size of SPC organization can be as small as possible because it will not be a party to operate railway. However, it will be important for SPC that it is so structured as to be able to ensure and monitor the proper operation carried out by PT. KAI.

In this context, [Fig. 6-1-2] proposes a model SPC organization structure. In order to establish this structure, a preparatory office should be established at very early timing of the 1st Stage, and to start comprehensive study on the SPC's operation.



(Source: Study team)

[Fig. 6-1-2] Structure Model of SPC

6.1.4. Personnel and Structure

SPC needs to secure necessary personnel and arrange the personnel properly to undertake transport business. The structure should be divided into administration section and operation section, in which the size and balance of the personnel depends on the scale of facility and scope of operation contract with PT. KAI.

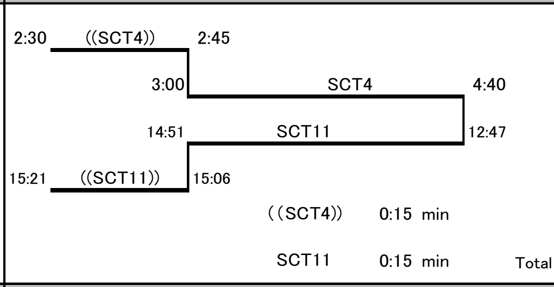
The number of necessary personnel in the outset of the 1st Stage based on the organization model shown in [Fig. 6-1-2] will be approximately 12, excluding management, in which 1 to 4 personnel is assigned in Management Departments under 1 Safety Manager and 1 Chief Engineer person at each Operating Department.

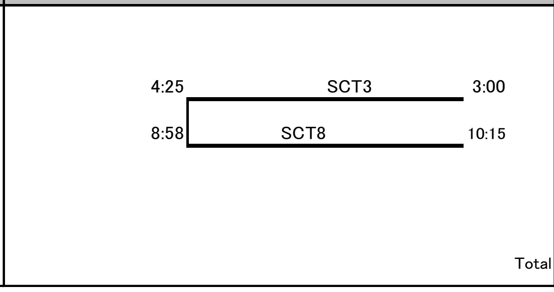
The number of personnel needs to be expanded in the 2nd Stage and the 3rd Stage as the scale of the operation expands. In the mean time, however, since the 1st Stage is implemented under "B to B scheme", it is important to have an efficient cost structure acceptable to PT. KAI.

Inspection team is an ad hoc section to be organized depending on the classification of audit, such as business and/or safety management audit, and security inspection consisting of external third-party organization and specialists. Management Department of SPC gives advice to parties concerned based on the audit and evaluation made by the inspection team in a timely manner, and implements education and training program if it finds necessary.

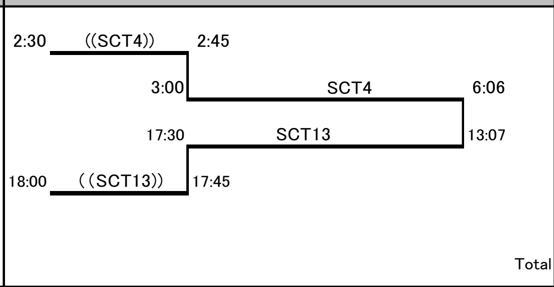
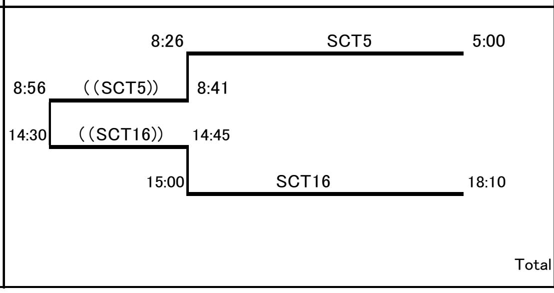
PT. KAI, as implementing agency of railway operation, needs to secure locomotive crew and maintenance staff for train operation. Since PT. KAI already purchased CC205 type locomotive, it can be assumed that training of maintenance staff can be done in house education and training by OJT etc. However, since training of the locomotive crew may require long time, it is necessary to start schedule the staff training program for the 2nd and the 3rd Stage during the implementation of the 1st Stage in advance to the arrival of the locomotives. Crew assignment route model by depot based on [Fig. 4-3-3] (P. 4-33) is shown in [Fig. 6-1-3].

Crew's track chart (1st stage. 2nd stage)

DEPOT	Track: LT – SCT – PBM	Main	Shunt	Dep	turn	prep	ather	total
Lahat		0:15	0:15	0:15		1:00		1:45
		1:40						1:40
		2:04	0:15		8:07			10:26
		0:15		0:15		0:30		1:00
								0:00
	Total	4:14	0:30	0:30	8:07	1:30	0:00	14:51

DEPOT	Track: PBM – KPT	Main	Shunt	Dep	turn	prep	ather	total
Kertapati		0:00	0:00	0:00		0:00		0:00
		1:25	0:00	0:00		0:30		1:55
		1:17	0:00	0:00	7:15			8:32
		0:00	0:00	0:00		0:30		0:30
								0:00
	Total	2:42	0:00	0:00	7:15	1:00	0:00	10:57

Crew's track chart (3rd stage)

DEPOT	Track: LT – SCT – KPT	Main	Shunt	Dep	turn	prep	ather	total
Lahat		0:15	0:15	0:15		0:30		1:15
		3:06						3:06
		4:23	0:15		7:01			11:39
		0:15		0:15		0:30		1:00
								0:00
	Total	7:59	0:30	0:30	7:01	1:00	0:00	17:00
Kertapati		3:26	0:00	0:00		0:00		3:26
		0:15	0:15	0:15		0:30		1:15
		0:15	0:15	0:15	5:34			6:19
		3:10	0:00	0:00		0:30		3:40
								0:00
	Total	7:06	0:30	0:30	5:34	1:00	0:00	14:40

(Source: Study team)

[Fig. 6-1-3] Model of Crew's Track Chart

A case study of necessary number of crew in the 1st Stage and the 2nd Stage is shown in [Table 6-1-1] in which a crews belongs to Kertappati (KPT) and Lahat (LT) transfer locomotives at Prabumulih. This calculation is based on locomotive operation schedule shown in [Fig. 4-3-3]

(P. 4-33). As a result the number of crew is as large as 88, 156 and 236 for the 1st Stage, the 2nd Stage and the 3rd Stage respectively which signifies a big increase of crew number.

Now, it is proposed to assign one crew team to operate train between KPT and LT as it is shown at the lower line of [Fig. 6-1-3] setting standard that one crew team can operate about 180km of travel distance. If this proposal is acceptable for PT. KAI, the cost for crew training can be minimized because the number of crew will be reduced by half of the afore mentioned numbers.

[Table 6-1-1] Necessary Number of Locomotive Crews

			1st stage			2nd stage			3rd stage		
			LT	KPT	Total	LT	KPT	Total	LT	KPT	Total
Driver	main line	scheduled	17	17	34	22	22	44	31	31	62
		spare	5	5	10	8	8	16	8	8	16
		total	22	22	44	30	30	60	39	39	78
	shunting	scheduled	0	0	0	6	6	12	15	15	30
		spare	0	0	0	3	3	6	5	5	10
		total	0	0	0	9	9	18	20	20	40
	Driver total		22	22	44	39	39	78	59	59	118
Asistanr driver	main line	scheduled	17	17	34	22	22	44	31	31	62
		spare	5	5	10	8	8	16	8	8	16
		total	22	22	44	30	30	60	39	39	78
	shunting	scheduled	0	0	0	6	6	12	0	0	0
		spare	0	0	0	3	3	6	0	0	0
		total	0	0	0	9	9	18	0	0	0
	Asist driver total		22	22	44	39	39	78	39	39	78
All total			44	44	88	78	78	156	98	98	196

LT: Lahat Depot, KPT: Kertapati Depot

(Source: Study team)

6.1.5. Technical Capabilities

In the 1st Stage, SPC will be a party for the supply and construction, however, since SPC will be a private sector selected through competitive bid process, it cannot be assessed the technical capabilities of SPC at present. Therefore, in this study, it assumes that such activities will be performed by consultants.

In the 2nd Stage and the 3rd Stage, DGR or PT. KAI will be a party for the procurement and construction. It is the fact that DGR has a lot of experience to be a party to implement Japanese ODA Loan, however PT. KAI has not directly involved in the ODA projects but rather on operation & maintenance activities.

However, since private sectors can be a party for the development of railway infrastructure by revision of railway law in 2007, PT. KAI is acting as an implementation agency of double-track construction of the line between the Tanjung Enim - Prabumurih X6 in the south Sumatra district. The construction concerned was due to be completed in the original plan in 2009. However, construction is still continuing and the section of Niru - Prabumurih X6 is completed in January, 2012.

According to PT. KAI, the cause was related to technical issues, however according to a study team's on-site survey, any work involves difficult construction work is not observed, but budget restriction or less experiences in bridge construction is assumed. Therefore, the support by the consultants will be necessary for this purpose.

6.1.6. Technical Assistance to an Implementation Agency

SPC will be a new entity, and it will need to acquire technical capabilities. Especially, CC205 type locomotive proposed by this study uses induction motor and inverter control system, therefore many advanced technologies including computerized control system, are used. Since the same type of locomotive is planned to be introduced to PT. KAI in coming years, therefore PT. KAI also needs to upgrade its technical capabilities on the advanced technologies. Although detailed technology transfer must be performed by the locomotive supplier, SPC must carry out maintenance management once operation is started. SPC needs to cooperate with EMD, PT. KAI, PT. INKA, and so forth in upgrading technical capabilities.

Japan is one of the most advanced countries in the field of rolling-stock with inverter control system technology; in particular the DF200 type locomotive currently used in Hokkaido division of JR Freight co. has ample track record on maintenance technology of inverter control locomotive. Therefore, use of maintenance management engineering of the abundant inverter locomotives of Japan is proposed to be the most effective measure in asking technical cooperation for SPC by transferring technology on necessary maintenance equipments and creating training materials.

6.2. Operation and Maintenance Structure

6.2.1. Maintenance Planning

(1) Railway Infrastructure

Train operation and facility maintenance has been the responsibility of PT. KAI. Existing facility upgrading work to be planned in the 1st Stage is undertaken by SPC, but the operation and maintenance of the facilities is to be undertaken by PT. KAI in contract basis. It was observed in the study team site inspection that these works are not properly done as it was described in 4.1. (P. 4-1). If there will be no change in the maintenance system for the facilities upgraded in the project, it is expected that the condition of those facilities will soon be the same. Therefore, the current maintenance method must be improved for the project line via quality improvement activities in cooperation with the technical section of SPC.

Organizational chart of present PT. KAI Sumatera Selatan (Divisi Regional III) is shown in [Fig. 6-2-1]. Organizational chart of PT. KAI Kertapati (Sub Divisi Regional III.1) is shown in [Fig. 6-2-2].

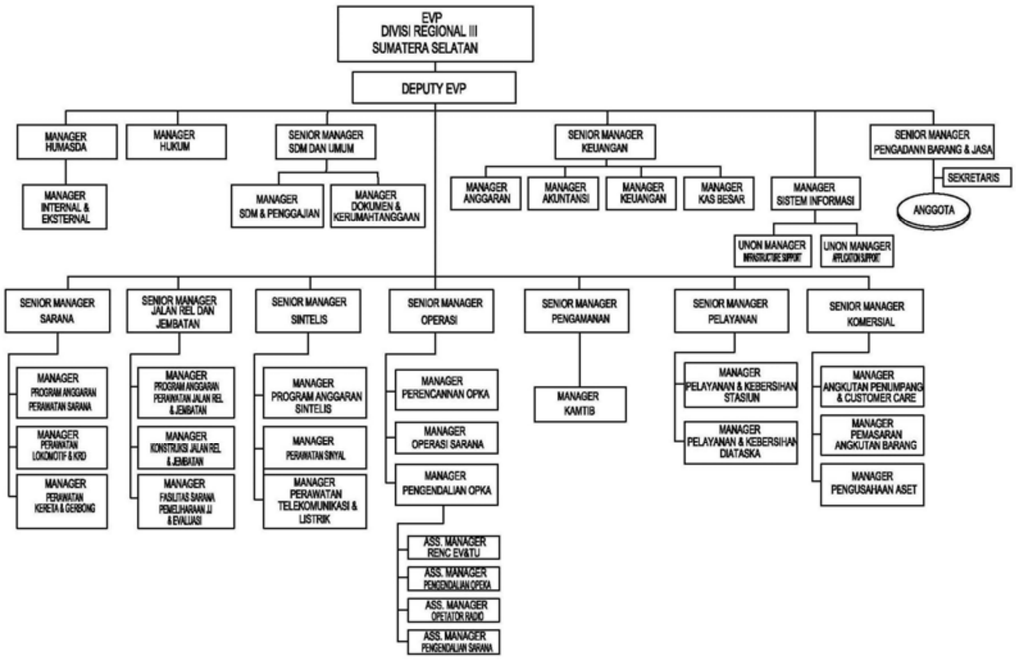
In Divisi Regional III, Rolling-stock section (Sarana), Track and Bridge section (Jalan Rel dan Jembatan), and Signaling section (Sintellis) are responsible for maintenance management planning. There are also sections in Sub Divisi Regional III.1 corresponding to the sections and each section has site office (Kantor Sub Divre) actually implementing maintenance work.

As for track maintenance work, it is undertaken in site offices responsible for maintenance work and planning. The maintenance work includes HTT (hand held tie tamper) system for on the spot repair works and MTT (multiple tie tamper) system for planned repairs.

It was observed, according to the site hearing, that HTT system work is undertaken by a team consisting of 10 clews of out-sourced personnel and quality of the maintenance work is not high. The MTT system work is scheduled to be undertaken every half a year or 2 years, but actual performance is observed to be much behind the schedule. [Appendix 6-2-1] and [Appendix 6-2-2] show the track maintenance plan for 2010 and the sample of field worksheet respectively.

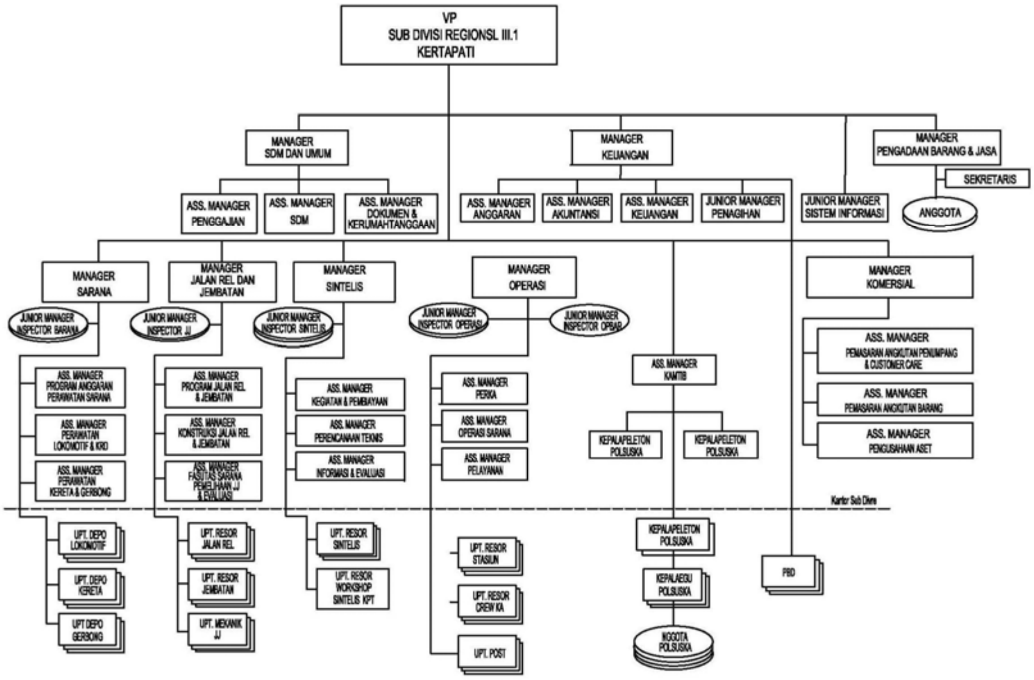
[Table 6-2-1] shows the list of maintenance facility in PT. KAI Sumatera Selatan. There are 5 MTTs in total, out of which 2 units in Sub div III.1 (Kertapati), 2 units in Sub div III.2 (Tanjung Karang), and 1 unit in Prabumulih depot. It looks that the number of MTT is in short considering the length of railway section for maintenance work, but since the machine is mobilized in a flexible manner there is no problem according to the site hearing. Whatever the present condition, the number of MTT to be needed in the 3rd Stage of the project will be definitely in short.

The signaling and telecommunication system was an old model of mechanical type except for Prabumulih signaling station. Maintenance work looks to be done properly by ocular site inspection and there will be no serious problem so far as the traffic volume is not high as it is now. At some stations, although photovoltaic power generation is used for electric power supply, commercial power supply is needed when the traffic volume was increased. When the transportation capacity expansion project is implemented in the future, a new system different from present system will be employed which is much more complicated and the current maintenance method employed is not applicable any more. Therefore, a measure should be taken to prepare for the transition to the new system from the beginning of the project.



(Source: PT. KAI)

[Fig. 6-2-1] Organizational Chart of PT. KAI Sumatera Selatan (Divsi Regional III)



(Source: PT. KAI)

[Fig. 6-2-2] Organizational Chart of PT. KAI Sumatera Selatan (Sub Divisi Regional III.1)

[Table 6-2-1] List of Maintenance Equipments

	Name of Equipment	Type	Location
1	Multiple Tie Tamper	08-16 GS	Subdivre Ⅲ.2 Tnk, Subdivre Ⅲ.1 Kpt
2	Multiple Tie Tamper	08-16 GS	Subdivre Ⅲ.2 Tnk, Subdivre Ⅲ.1 Kpt
3	Multiple Tie Tamper	08-75 GS	Dipo Mekanik Pbm
4	Ballast Regulator	400	Subdivre Ⅲ.1 Kpt
5	Ballast Regulator	400	Subdivre Ⅲ.2 Tnk, Subdivre Ⅲ.1 Kpt
6	Ballast Regulator	303	Subdivre Ⅲ.2 Tnk
7	Way Motor Vehicle	80-4	Dipo Mekanik Pbm
8	Consolidating (VDM)	800 GS	Rusak di Dipo Mekanik Pbm
9	Consolidating (VDM)	800 GS	Rusak di Dipo Mekanik Pbm
10	Flash But Welding	K 355 APT	Dipo Mekanik Pbm
11	Ballast Cleaner (BC)	RM 62	Rusak di PKLG LT

(Source: PT. KAI)

[Table 6-2-2] shows the inventory of various documents such as standard, manual and ledger for track, bridge and electricity and signal facilities relevant to inspection and maintenance. Thought the details were not confirmed, they look to be not widely used according to the site visit.

It is urgently necessary to prepare a set of on-site manuals for maintenance work simultaneously when compiling maintenance standard.

[Table 6-2-2] Inventory of Maintenance Documents

Subject	Specification / Standard	Manual	Ledger
Track	Yes	Yes	Yes
Bridge	None	None	Yes
Electricity and Signal	None	None	None

(Source: PT. KAI)

The basic principle for the improvement of current maintenance method of the railway facilities are summarized in the 3 subjects as follows.

① Data Keeping

Inspection record, repair record, and failure record (quantity and frequency, contents, primary reason, method of repair measure) for every facility must be kept to measure the soundness of facilities and upgrade the quality of maintenance. It can be realized by introducing I.T. technology for maintenance record data management as well as establishing accident restoration technology, facility oriented accident prevention method, and maintenance material inventory control. The site inspection of the study was not able to confirm them.

② Understanding of Appropriate Equipment and Cost

The maintenance cost record should be classified in expenses for personnel, materials, and administration and it should be used to plan the appropriate size of maintenance expenses at work site operation. The site inspection of the study was not able to identify such data management except for maintenance facilities including MTT.

Appropriate size of maintenance crew including out-sourced personnel at each work site should be evaluated by establishing technology standard and inspection and maintenance standard for the MTT and HTT works.

③ Enhancement of Maintenance Crew Training

Maintenance crew training program such as measures to cope with train diagram disorder and unusual situation should be implemented so that technical standard of railway facilities and maintenance manuals will be observed properly and the effective maintenance will be realized. Inspection and maintenance manuals for various facilities and infrastructure should be compiled in Indonesian language so that they are understood at the working site level and properly applied. The training program should be implemented using the practical text books.

(2) Maintenance management of the rolling-stock

The body which carries out maintenance management is carrying out the periodic inspection based on the inspection standard by type of a rolling-stock of PT. KAI in each depot, such as Kertapati and Tarahan. General inspection, inspection of a wheel axle, and extra repair are carried out at the Lahat rolling-stock workshop.

The system which carries out control of maintenance is inspecting by deciding upon an inspection plan on each depot under control of a Sumatra Third Division Kertapati office. Planned repair is carried out by teams, such as the body, bogies, an engine, and an electric system, with the inspection period defined as each depot took rolling-stock operation into consideration. Although the required equipment for maintenance suits the present rolling-stock maintenance work, they are superannuated and the thing corresponding to the new technology of CC205 type locomotive is not fixed.

According to the interview at a Lahat rolling-stock workshop, the inspection of CC205 type locomotive is planned to be carried out in Tarahan locomotive depot after preparing all necessary equipments. And the hearing suggested the possibility of outsourcing of the work. However, when this point was confirmed to the vice president responsible for locomotive at PT. KAI head office in Bandung, it was found that general inspection is carried out at a Lahat workshop and outsourcing is not in the view, which means that there is inconsistency of policy between the management side and the field side.

The discussion either own maintenance or out souring is up to the discretion of PT. KAI, but PT. KAI is required to start preparing for the maintenance management planning for the new technology associated with the introduction of CC205 type of locomotive as soon as possible

. .Basic policy for SPC regarding the locomotive operation and maintenance is to entrust them to PT. KAI, SPC also needs to have engineering section responsible for technical aspects of the locomotives so that safety and stable coal transportation will be secured.

6.2.2. Legal Framework Corresponding to Operation and Maintenance Entities

Basic law regarding railway is the law No. 13 in 1992 (Railway Law) which specifies the responsibility among the government, state-owned firm, and private enterprises as follows.

- Railway development policy planning, policy implementation supervision, and provision of major railway infrastructure and its maintenance management are the responsibility of the government (Directrate General of Land Transportation of MOT (presently DGR)).

- Railway business is the responsibility of a railway corporation (or corporations) which is/are fully owned by the government.
- Maintenance and management of railway infrastructure is entrusted to PT. KAI by the government. Private enterprises are able to participate in the railway business by having cooperation with PT. KAI.

The present PT. KAI is the government owned enterprise inaugurated its operation in June 1999 as a result of privatization and operation and infrastructure separation policy of the government.

Railway infrastructures owned by the government are track, bridge, tunnel, signal and telecommunication facility, electric facilities, and land, while PT. KAI owns infrastructures such as station building, platform, garage, repair plant, and other land. Construction of railway facilities and improvement plan are implemented by the government, the government entrust railway facility maintenance work to PT. KAI and pay the cost. But the new law constitutes a mixed form of "Railway business" and "Railway operation" which are usually separated in other countries such as Japan. Therefore, it fails to identify the responsibility sharing between the government and railway operators.

The article 11 of the law defines that the government has a responsibility for railway policy formation and give guidance to railway operators, while article 14 of the law defines that the government is entitled to be a railway operator, which means that there is no clear line between railway policy guidance giver and the follower.

As it is defined in the article 14 of the law, private enterprises are allowed to participate in the railway business in Indonesia on condition that concession agreement between the operator and the government shall be reached. However, there are no articulations on the contents of the agreement and any comprehension is possible. The similar ambiguity lies on the possibility of infrastructure design and specification setting by the railway operator because the infrastructure development planning is in the hand of the government.

However, in reality, some potential operators such as Adani of India and Trans Pacific Railway of China acquired concession to build and operate a new line to transport coal in South Sumatra and the infrastructure design is under way right now. PT. KAI also is working on the double tracking project between Tanjung Enim and the Prabumulih X6 section even though DGR insists that it has not approved.

In the following, outline of Republic of Indonesia law No.23 (April 25, 2007) is shown.

- Railway line is comprised of general railway and special railway and general railway is classified into national railway, state railway, and prefecture/ city railway (Article No. 4).

- Government has an authority in railway policy making and the government gives guidance to planning, control, construction, utilization and maintenance management (Article No. 11).
- Construction and installation of railway facilities are implemented by central government and local government (Article No. 14).
- Central government and local government can cooperate with state owned company, local government owned company, or private company in concession formation. The concession agreement can cover railway facility management, facility maintenance management, and railway operation (Article No. 14).
- The cooperation must comply with the concession agreement, the railway network master plan and the technical requirement of railway facilities (Article No. 15).
- Management of railway facilities is usually undertaken by central government, local government, government owned company, local government owned company, or private company (Article No. 16).
- Railway management and operation permissions are required to undertake railway facility management (Article No. 20).
- Operation of special railway must obtain construction and operation permissions (Article No. 21).

6.2.3. Scope of the Work

As described above, while government implements construction and improvement plan of railway facilities, a railway company is responsible for railway service under the guidance of government. Infrastructure and facility maintenance work is undertaken by PT. KAI entrusted by government, and the cost is paid by the government. Legal scope of the work of SPC is presumed to be in par with PT. KAI.

Actual scope of the work of SPC may diverse including railway operation in the extreme case, but the basic idea is to entrust train operation and maintenance of railway facilities to PT. KAI under the permission of DGR, because PT. KAI has enough experience of the works. This set up is possible under the new railway law and the rest of the work is to conclude an operation contract between SPC and PT. KAI.

The advantage of the proposed scheme for PT. KAI is that it can expand transportation capacity in south Sumatra where coal transport demand is huge without expending its fund resource for rolling-stock while PT. KAI is in need of allocating resources for various field of transportation capacity and upgrading service quality. In addition, PT. KAI will increase revenue by train operation and facility maintenance services under a contract with SPC. Furthermore, PT. KAI will have a stake in competing with other proposed projects in expanding coal transportation capacity such as private companies of India, Chinese and Korea.

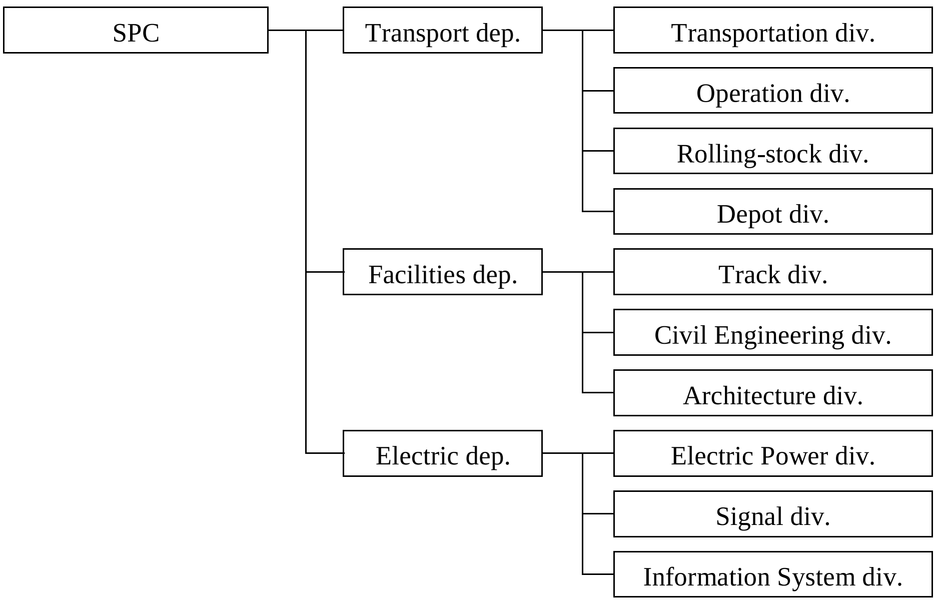
6.2.4. Organizational Structure

As it was proposed above, in case where train operation and facility maintenance are contracted out from SPC to PT. KAI, the organizational structure of SPC can be minimal size for administrative works only. [Fig. 6-2-3] shows an example of the organizational structure which constitutes “Operating Department” of [Fig 6-1-2] (P. 6-3). Here, the offices necessary for the work are supporting work for the management regarding transportation, asset and electricity supply, and administration on the train operation and maintenance contract.

The transport department consists of transportation in charge of coal transportation planning, operation in charge of train operation planning, freight car in charge of freight car operation plan, depots in charge of locomotive and freight car maintenance.

The facilities department consists of track maintenance which in charge of track maintenance, civil engineering in charge of civil structure maintenance and architecture in charge of management and maintenance of building.

Electric department consists of electric power in charge of electric power supply plan to equipment, signal in charge of railway maintenance of signal machine, and system in charge of information control.



(Source: Study Team)

[Fig. 6-2-3] Operation and Maintenance Organization Outline

6.2.5. Staffing

As it was described above, since SPC contracts out all the field works to PT. KAI, the number of personnel belongs to each division can be as small as 2 to 3 including division chief.

As for the staffing of PT. KAI, according to the hearing conducted by the study team, there is no problem in terms of equipment, man power and budget. This response is not compliance with the field survey by the study team on track maintenance work in particular which is behind the schedule. For the moment, since PT. KAI has a track record of implementing the work so far, there is no denying for its performance. However, considering the fact that the number of train will greatly increase in the future if the project was implemented, the number of maintenance clew is needed to be increased and improvement of train operation control to secure a time space for maintenance work is needed.

6.2.6. Technical Capabilities

(1) Railway Infrastructure Maintenance

In order to maintain railway facilities for years to come in good condition, allocation of budget for operation and maintenance, inspection to know the condition of facilities accurately, and allocation of sufficient number of stuff for repair and improvement work with sufficient technical ability are required. Although, it was explained by PT. KAI officials in the field survey conducted by the study team, that human resources and budget are sufficiently allocated, but it is not sure whether the newly constructed infrastructure will be properly maintained or not if the present maintenance practice is applied. In particular, since all the on-the-spot maintenance work is implemented by out sourced personnel, it is questionable if the workers actually doing the job are keeping enough level of technical ability. It is proposed that SPC shall collaborate with PT. KAI to conduct training program for the maintenance stuff to keep up with the technical ability.

(2) Rolling-stock Maintenance

In this project, the newly established SPC will possess equipment for transportation, such as a locomotive, and staff required for maintenance management in principle. In order to carry out maintenance management of the locomotive and container freight wagon which SPC supplies, maintenance staff's security, education and training are required.

Since, as for the rolling-stock, PT. KAI also possesses the same type of rolling-stock, it is proposed to entrust staff education and training to PT. KAI. It is also proposed to have technical cooperation with EMD which is a locomotive manufacturer and PT. INKA which is a domestic railway rolling-stock manufacturer in Indonesia, and ask for the training of engineers in order to step up the technical capabilities required.

As for such facility as civil engineering structure, track, and electricity, the project use the existing ones owned by DGR or PT. KAI. And PT. KAI carries out the maintenance management as it is now. The training institution for infrastructure maintenance is in Bandung, and it is explained that staff training is carried out there.

In order to maintain the railway facilities over the future in a good condition, the budget required for maintenance must be secured, and enough number of staff and technical capability to carry out the inspection to assess the right condition of facilities and give repair and improvement work are required.

Education and training on the locomotive of PT. KAI is carried out in the locomotive workshop in Yogyakarta. There, each unit in the workshop provides working manuals and collects technical information and information sharing system is established. However, as it is described in 6.2.3, since the CC205 type locomotive to be introduced by PT. KAI in South Sumatra from now on requires variety of equipments for new technology, it is necessary to review the present education and training facility and manuals. On this subject, it is PT. KAI's opinion that it is ready. However, the study team failed to have any evidence. As for such general technical aspect as body, bogie, and coupler, no technical problem in particular was recognized by the study team at the rolling-stock workshop in Lahat. However, it is necessary to study further the inspection and repair technology corresponding to the new type locomotive. PT. KAI has already procured 6 CC205 type locomotives, and is planning to procure 44 more locomotives. Although 6 cars arrived on site now, it is still in a verification running process. If substantial number of locomotive come to operate fully in the trunk line, it is inevitable to upgrade the technical capability for the new type of locomotives.

Regarding maintenance management skill of a freight wagon, since the freight wagon which SPC uses is the same as the freight wagon which PT. KAI uses, no technical difficulties in the maintenance capability is foreseeable. As for personnel training, it is implemented in ad hoc basis according to PT. KAI.

6.2.7. Accounting Analysis of PT. KAI

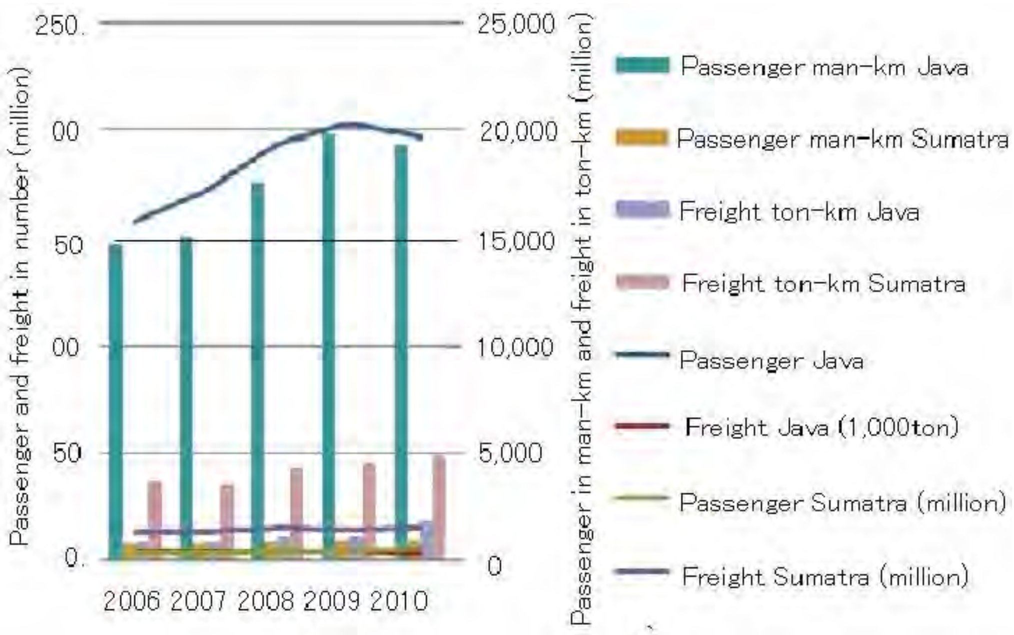
Accounting analysis of PT. KAI is given below by Profit Loss Statement, Balance Sheet, Cash flow Statement (Statement of Change in Financial Position) and accounting ratios.

(1) Railways Service Operation

Over the long stretch of Indonesia railways of 5,040km in operation, around a quarter (26.6%, 1,340km) of the all runs in Sumatra with rolling-stocks of locomotive (50) and wagons (1,380) in Divre III (South Sumatra Region). Of the aggregate 19.0 million ton of freight and 202.2 million passenger transport, Didre III accounted for, respective of, 81.1% (15.4 million ton) and

2.6% (5.2million passengers) in 2010. Average annual growth rates of freight and passengers in Region III over 5 years of 2006-10 stood at 3.2% and 12.1%, as against those in Java of -2.4% and 5.7%, in that order[1].

Alternatively by the units of ton-km and man-km, Java and South Sumatra dominate in passenger and freight transport services, while each of these accounting for 95.5% (19,367 million man-km) in Java and 72.7% (4,869 million ton-km) in South Sumatra. This numerical trend explicitly demonstrates growth trend of railway transportation in South Sumatra, and depicted in [Fig. 6-2-4] below[2].Note 65% of operating revenue emanated from passenger services in 2009.



(Source: PT. KAI Audited Annual Reports 2006 - 2010)

[Fig. 6-2-4] Passenger and Freight Transport in Java and South Sumatra (2006 - 2010)

(2) Profit Loss Statement

On the financial front, of PT. KAI posted net profit of Rp. 216.3billion (JY1.7 billion)3 in 20104., arising from Rp. 14.2billion (JY 0.11 billion) in 2006. Average annual growth rates in nominal and real term over the period of 2006 through 2010 stood at 97.5% and 85.5%

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1 Number of rolling stocks comprising locomotives and wagons in 9 DAOP (Java) is counted at respective of 100 and 1,810, respectively.

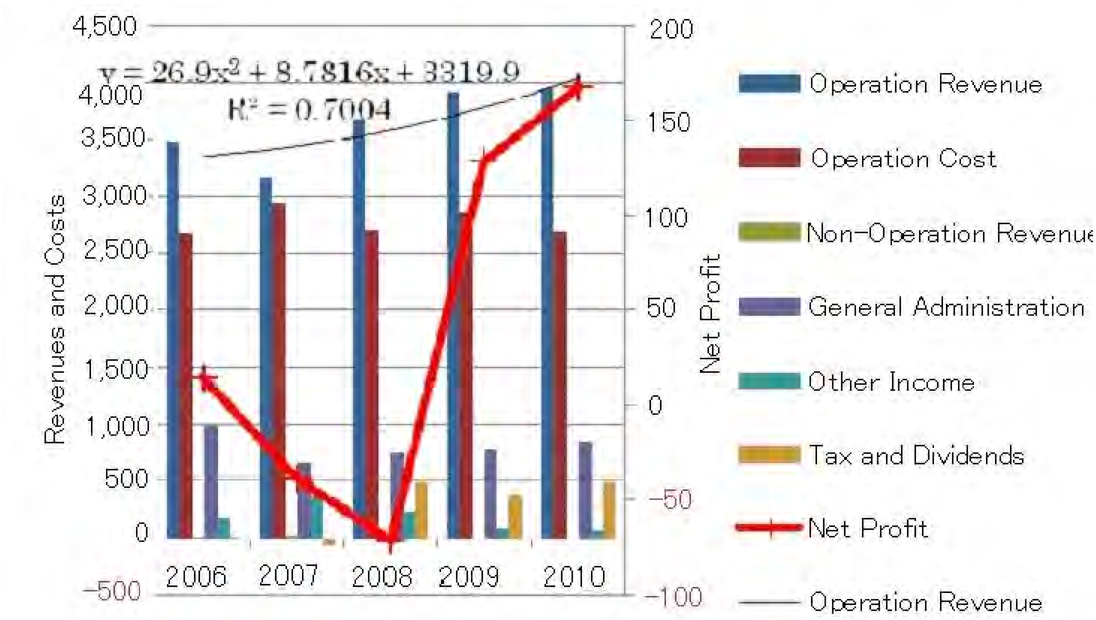
2 Source: The Ministry of Transport, T*ransportation Statistics*, 2011

3 Foreign exchange quotation is set at JY 0.0078125 per Rupee, as per November 2011 price.

4 Source: PT. KAI, *Laporan Manajemen Perusahaan (Annual Audit Report)*, 2010, 2009, 2008, and 2007

respectively5. Uprising financial performance of the entity in the light of net profit in the past two years (2009 - 10) is noteworthy, while considering two consecutive years of deficits in 2007 and 2008. Nonetheless, gross asset turnover rate remains still very low of 2.2%6 in 2010; managerial and technical effort for efficiency would further be in need.

Breakdown of Profit-Loss Statement during the said 5 years (2006 - 2010) is summarized in the following. ([Fig. 6-2-5], [Table 6-2-3] and [Table 6-2-4]). Note that public service obligation (government subsidy to economy class passengers, PSO) is categorized in operation revenue, whereas track access charge (TAC), infrastructure maintenance and operation (IMO) in indirect operation cost. Further to note in this regard, IMO which is revenue to PT. KAI is totally cancelled out by TAC. Summary Profit Loss statement 2006 - 2010 is shown in [Table 6-2-4].



(Source: PT. KAI Audited Annual Reports 2006-2010)

[Fig. 6-2-5] Revenues, Costs, and Net Profit (Nominal 2006 - 2010)

[5] Inflation rates in 2007 through 2010 are assumed at 5.4, 11.4, 2.8, and 7.0%s, in descending order.(Source: IMF, *World Economic Outlook*, 2011)

[6] Current profit was Rp. 126.0 billion whereas gross asset amounting to Rp. 5,583 billion in 2010.

[Table 6-2-3] Summary Profit Loss Statement (2006 - 2010)

(Unit: Rp. billion, JY billion)

	2006 Nominal	2007 Nominal	2008 Nominal	2009 Nominal	2010 Nominal	Nominal Growth Rate annual	Real Growth Rate annual
Operation Revenue (+)	3,476.5 (27.2)	3,341.2 (26.1)	4,319.7 (33.7)	4,724.4 (36.9)	5,082.9 (39.7)	10.0	3,2
of which PSO	535.0 (4.1)	425.0 (3.3)	544.7 (4.3)	504.1 (3.9)	534.8 (4.2)	0.0	-6.1
Operation Cost (-)	2,669.1 (20.8)	3,098.9 (24.2)	3,164.8 (24.7)	3,434.5 (26.8)	3,461.0 (27.0)	6.7	0.2
of which TAC	746.5 (5.8)	824.4 (6.4)	859.1 (6.7)	922.4 (7.2)	1,175.2 (9.2)	12.0	5.2
of which IMO	-746.5 (-5.8)	-824.4 (-6.4)	-859.19 (-6.7)	-922.4 (-7.2)	-1,175.2 (-9.2)	12.0	5.2
Net Operation Revenue	807.6 (6.4)	242.3 (1.9)	1,154.9 (9.0)	1,289.9 (10.1)	1,621.9 (22.7)	19.0	11.8
Net Non-Operation Revenue (+)	17.1 (0.1)	24.7 (0.2)	14.3 (0.1)			-8.6	-15.6
Administration and Sales Cost (-)	990.3 (7.7)	705.5 (5.5)	878.5 (6.9)	935.0 (7.3)	1,088.6 (8.5)	2.4	-13.3
Current Profit	-165.4 (-1.3)	-438.5 (-3.4)	252.4 (2.0)	57.7 (0.5)	126.0 (1.0)	115.2	68.7
Net Other Income (+)	171.8 (1.3)	365.3 (2.9)	277.4 (2.2)	100.5 (0.8)	85.7 (0.7)	-16.0	-21.1
Current Tax (-)	3.4 (0.03)	34.6 (0.4)	120.2 (0.9)	60.6 (0.07)	66.7 (0.04)	195.7	184.6
Retained Tax (+)	11.0 (0.09)	82.5 (0.6)	235.1 (1.8)	51.5 (0.4)	20.5 (0.1)	16.9	9.7
Dividends (-)	0.3 (0.002)	1.9 (0.01)	0.8 (0.006)	0.9 (0.007)	0.2 (0.002)	-4.5	-10.4
Net Profit	14.2 (20.8)	-40.5 (20.8)	-83.5 (20.8)	154.8 (20.8)	215.3 (20.8)	97.5	85.5

(Source: PT. KAI Audited Annual Reports 2006 - 2010)

[Table 6-2-4] Summary Profit Loss Statement in Real and Nominal Terms (2006 - 2010)

(Unit: billion Rp.)

	Audited	Base yerar	Audited	Real term	Audited	Real term	Audited	Real term	Audited	Real term
				6.4%		10.3%		4.9%		5.1%
	2006	2006	2007	2007	2008	2008	2009	2009	2010	2010
Revenue from Passenger Transport Services										
Executive Class	718,350	718,350	773,274	726,733	1,036,144	882,781	1,080,242	877,403	1,015,540	784,638
Business Class	450,807	450,807	408,302	383,727	513,440	437,444	626,934	509,213	868,904	671,342
Economy Class	548,641	548,641	571,154	536,778	713,363	607,776	790,867	642,365	846,307	653,884
Supporting of Operational Passenger Transport	86,348	86,348	71,949	67,618	89,762	76,476	87,459	71,037	83,564	64,564
Total	**1,804,146**	**1,804,146**	**1,824,679**	**1,714,857**	**2,352,709**	**2,004,478**	**2,585,501**	**2,100,018**	**2,814,315**	**2,174,428**
Revenue from freight transport services										
Negotiation goods	903,072	903,072	855,592	804,096	1,164,596	992,221	1,533,455	1,245,516	1,686,109	1,302,741
Non Negotiation goods	234,283	234,283	236,047	221,840	257,756	219,605	99,767	81,034	29,202	22,562
Supporting of Operational Passenger Transport	-	-	-	-		-	1,492	1,212	18,458	14,261
Total	**1,137,355**	**1,137,355**	**1,091,639**	**1,025,937**	**1,422,352**	**1,211,826**	**1,634,714**	**1,327,761**	**1,733,769**	**1,339,564**
Government subsidies	**535,000**	**535,000**	**425,000**	399,420	**544,665**	464,048	**504,168**	409,499	**534,798**	413,202
Total Revenue from Transport Services	**3,476,501**	**3,476,501**	**3,341,318**	**3,140,214**	**4,319,726**	**3,680,351**	**4,724,383**	**3,837,278**	**5,082,882**	**3,927,194**
Cost fo Sales										
Direct Operating Cost										
Fuel & Electricity	646,688	646,688	616,897	579,768	798,897	680,650	718,585	583,655	753,574	582,235
Maintenance of Motion Facility	551,877	551,877	534,245	502,090	666,461	567,817	906,141	735,993	1,087,653	840,354
KSO				-	38,370	32,691		-		-
Operational employee	411,704	411,704	517,845	486,677	494,814	421,575	581,858	472,602	547,710	423,178
Depreciation of motion facility	121,240	121,240	344,367	323,640	232,602	198,174	197,656	160,542	170,317	131,593
Extra Charge	73,154	73,154	57,871	54,388	72,663	61,908	46,013	37,373	5,536	4,277
Advanced transportation	9,477	9,477	13,968	13,127	18,867	16,074	29,492	23,954	31,300	24,183
Operational of container terminal	1,992	1,992	1,786	1,678	240	204	936	760	1,534	1,185
Total	**1,816,132**	**1,816,132**	**2,086,977**	**1,961,368**	**2,322,913**	**1,979,092**	**2,480,680**	**2,014,879**	**2,597,624**	**2,007,005**
Indirect Operating Cost										
maintenance of basic infrastructure	340,508	340,508	385,554	362,348	220,467	187,835	463,272	376,283	424,429	327,927
employee of basic infrastructure	280,398	280,398	368,169	346,010	192,551	164,051	212,987	172,994	191,945	148,302
employee of operating in basic infrastructure		-		-	144,825	123,389	211,634	171,895	200,494	154,908
employee of planning and supervision	69,293	69,293	52,141	49,003	65,022	55,398	77,582	63,015	75,652	58,451
maintenance of supporting infrastructure	21,998	21,998	21,478	20,186	48,891	41,655	78,969	64,141	43,278	33,438
depreciation of supporting infrastructure	10,191	10,191	9,987	9,386	8,577	7,308	9,206	7,477	9,087	7,021
general station yard	126,389	126,389	158,276	148,750	72,330	61,624	80,672	65,524	68,645	53,038
employees of station operation and yard		-		-	111,421	94,929	149,546	121,465	188,067	145,307
K3	1,771	1,771	15,956	14,995	1,677	1,428	30,223	24,548	48,619	37,564
employee of container terminal	1,996	1,996	1,004	943	2,672	2,277	930	755	1,726	1,333
lease of infrastructure (TAC)	746,531	746,531	824,381	774,764	859,076	731,922	922,388	749,190	1,175,188	907,987
		-	(461)	(433)		-		-		-
Total	**1,599,074**	**1,599,074**	**1,836,486**	**1,725,953**	**1,727,509**	**1,471,816**	**2,237,408**	**1,817,286**	**2,427,128**	**1,875,275**
Government of subsidies	(746,531)	(746,531)	(824,381)	(774,764)	(859,076)	(731,922)	(922,388)	(749,190)	(1,175,188)	(907,987)
Overhead of company subsidiary		-	-	-	11,791	10,046	37,669	30,596	142,912	110,418
Total Cost of Sales	**2,668,675**	**2,668,675**	**3,099,082**	**2,912,557**	**3,203,136**	**2,729,031**	**3,833,369**	**3,113,571**	**3,992,477**	**3,084,712**
Gross Profit (Loss)	**807,826**	**807,826**	**242,236**	**227,657**	**1,116,589**	**951,320**	**891,014**	**723,707**	**1,090,406**	**842,482**
Other Operating Income										
Property lease	-	-	-	-	60,729	51,741	88,124	71,577		-
Warehouse / station space lease	6,790	6,790	4,668	4,387	7,765	6,616	11,877	9,647		-
Land lease advertising	4,990	4,990	4,714	4,430	1,291	1,100	9,195	7,468		-
Buffet & stall lease	1,594	1,594	1,032	970	1,138	970	1,427	1,159		-
Others	3,779	3,779	14,309	13,448	4,127	3,516	3,197	2,596		-
Total Other Operating Income	**17,154**	**17,154**	**24,723**	**23,235**	**75,050**	**63,942**	**113,820**	**92,448**	**108,671**	**83,963**
Operating Expense										
Sales Expense	8,422	8,422	9,187	8,634	14,860	12,661	48,559	39,441	14,303	11,051
General and Administration Expense	981,940	981,940	696,344	654,433	1,554,176	1,324,138	898,597	729,866	1,058,739	818,014
Total Operating Expense	**990,362**	**990,362**	**705,531**	**663,067**	**1,569,036**	**1,336,799**	**947,156**	**769,307**	**1,073,042**	**829,066**
Operating Profit (loss)	**(165,383)**	**(165,383)**	**(438,572)**	**(412,175)**	**(377,396)**	**(321,537)**	**57,677**	**46,847**	**126,035**	**97,379**
Total Other Income (Expense)	171,856	171,856	365,296	343,310	174,595	148,753	158,727	128,923	156,762	121,120
Extraordinary loss	392	392								
Earning (loss) before taxes	**6,865**	**6,865**	**(73,276)**	**(68,866)**	**(202,802)**	**(172,784)**	**216,405**	**175,770**	**282,798**	**218,498**
Taxes	7,626	7,626	34,656	32,570	120,169	102,382	(60,680)	(49,286)	(66,698)	(51,533)
Earning (loss) before minority interest	**14,492**	**14,492**	**(38,620)**	**(36,296)**	**(82,633)**	**(70,402)**	**155,724**	**126,484**	**216,099**	**166,965**
Minority Interest	(285)	(285)	(1,886)	(1,772)	(854)	(727)	(924)	(750)	237	183
Net Income (loss)	**14,207**	**14,207**	**(40,506)**	**(38,068)**	**(83,487)**	**(71,130)**	**154,800**	**125,733**	**216,336**	**167,148**

(Source: PT. KAI Audited Annual Reports2006 - 2010)

(3) Balance Sheet

Aggregate assets of PT. KAI was Rp. 5,583.6 billion (JY 50.76 billion) in 2010 very slightly arising from Rp. 5,546.5 billion (JY 50.42 billion) in 2006, with the average annual growth rate of 0.18% in nominal term, and oppositely downsizing of -8.1% in real term as per 2006 price level. This contracting scale of operation emanates largely from the compression of fixed liabilities, with the average growth rates in nominal and real terms are respective of -12.8% (from Rp. 1,435.6 billion-JY 13.05 billion in 2006 to Rp. 830.1 billion – JY 8.09 billion in 2010) and -18.2% (Rp. 641.3 billion-JY 5.83 billion). Current liability of Rp. 839.5 billion (JY 7.63 billion) in 2006 downsized by -2.6% to Rp. 755.7 billion (JY 6.87 billion) in nominal and -8.7% per annum to Rp. 583.9 billion (JY 5.30 billion) in real term in 2010. Meanwhile, owner's equity was Rp. 3,232.3 billion (JY 29.38 billion) in 2006 to slightly grow 5.2% to Rp. 3,953.2 billion (JY 35.94 billion) in nominal term and actually decrease by 1.4% to Rp. 3,054.4 billion in real terms.

Owner's equity comprise ① shares (3.5 million) of Rp. 2,470.0 billion (JY 22.45 billion) with the face value of Rp. 1.0 million per share, and ② Government subsidy of Rp. 1,072.9 billion (Jy 9.75 billion) being allotted to electric locomotive (53.8%), passenger trains (31.0%), spare parts (4.9%), Diesel locomotives (4.2%), and others (6.1%) in 2010. The Ministry of State owned Enterprises (MOSOE) holds 100% of PT. KAI shares, and hence administratively controls PT. KAI through Board of Directors. As previously noted, annual operation plan and other decisions including tariff issues need to get approval of or concurrence from MOSOE.

Meanwhile, PT. KAI has since 2009 posted profits in tandem with commencing own investments to infrastructure and facilities in South Sumatra. The entity has at this moment in time little sign of typical state-budget dependency on finance and operation, with the symptoms including chronicle deficit and state fund inflows, accumulated debts inclusive of contingent liabilities and heavy burden of debt services, and inefficient operation and management due to staff redundancy. With this, PT. KAI would not be categorized as typical public-owned enterprises heavily depending on the State.

[Table 6-2-5] Summary Balance Sheet (2006 - 2010)

	2006	2007	2008	2009	2010
Assets					
Current Assets					
Cash and Equivalent		1,348,157	1,602,459	1,215,230	735,138
Shorterm Investment		50,000	64,928	3,200	
Trade Receivable		117,926	129,333	174,679	161,485
Other Receivable		18,182	16,480	48,016	13,152
Inventory		302,887	393,335	463,673	519,975
Accured Income		148,353	140,882	135,743	139,109
Advance		15,173	67,765	35,844	42,940
Prepaid tax		10,752	-	92,033	102,683
Other Current Assets		399,757	232,947	83,454	265,790
Total Current Assets	**-**	**2,411,188**	**2,648,130**	**2,251,870**	**1,980,273**
Non Current Assets					
Deffered Tax		40,152	275,298	223,772	203,238
Fixed Assets		2,377,775	2,632,990	2,846,600	2,842,432
Construction in Progress		88,405	98,545	40,656	433,809
Slow Moving equipment & spareparts		40,112	39,945	43,779	50,430
Non Productive fixed assets		19,347	21,498	18,965	18,878
Deffered charges		1,355,032	4,204	2,639	2,394
Employment benefit		127,161	53,252	116,222	52,144
Total Non Current Assets	**-**	**4,047,983**	**3,125,731**	**3,292,633**	**3,603,326**
Total Assets	**-**	**6,459,171**	**5,773,861**	**5,544,503**	**5,583,599**
Liability & Equity					
Liability					
Current Liability					
Shorterm Loan		-	-	-	161,824
Trade Payable		161,122	262,782	207,018	219,621
Deffered Charges		334,416	374,231	396,491	141,065
Tax payable		205,735	278,401	83,889	114,318
Advance		102,738	118,376	87,262	100,037
Other Liability		16,246	104,679	11,549	18,842
Pension loan - mature in 1 year		79,500			
Total Current Liability	**-**	**899,757**	**1,138,469**	**786,208**	**755,707**
Non Current Liability					
Employment benefit	-	468,333	955,346	45,199	43,175
Pension loan - all	1,156,182	1,272,000	-	814,263	734,763
Deffered tax	42,308				
Pension loan - Swakelola	20,162	127,161	53,252	116,222	52,144
Subsidiary loan	216,933				
Total Non Current Liability	**1,435,585**	**1,867,494**	**1,008,598**	**975,684**	**830,082**
Minority Interest	40,504	42,602	43,916	44,932	44,569
Equity					
Shares	2,370,000	2,470,000	2,470,000	2,470,000	2,470,000
Government subsidies	696,820	1,055,893	1,072,941	1,072,941	1,072,941
Differences in liquidation	968	968	968	968	968
Retained earning	164,562	122,457	38,970	193,770	409,332
Total Equity	**3,232,349**	**3,649,318**	**3,582,879**	**3,737,679**	**3,953,241**
Total Liability & Equity	**4,708,439**	**6,459,171**	**5,773,861**	**5,544,503**	**5,583,599**

(Source: PT. KAI Audited Annual Reports2006 - 2010)

(4) Ratio Analysis

In line with what has currently been in practice for accounting analysis in JICA, following 5 accounting ratios[7] and debt sustainability ratio in the past 5 years have been picked up from the entity's financial documents. Subsequently, financial performance as borne out by these ratios is evaluated, while comparing those to the benchmarked ratios[8] of private sector business entities in Japan's transportation sector (refer [Table 6-2-6]). Summary cash-flow statement is seen in [Table 6-2-7].

Financial performance of PT. KAI in aggregate seems profoundly sound in terms of profitability, stability, and debt solvency. As seen from the figures of return on sales, equity ratio, current ratio, and debt service coverage ratio (DSCR), the entity has a high profile of profitability (efficiency), stable capital structure, least external borrowings and burden, and solvency. Incredible performance is the ratio of non-cash revenue, namely, account/note receivables and promissory notes, out of sales or current assets. In the light of this, together with DSCR, the entity is free from debt and cash burdens that most of the public entities in developing economies suffer from.

Meanwhile, good but lesser efficiency results as given by current ratio as well as quick ratio (193.2% in 2010), return on assets, and fixed assets to own and long-term capital (owner's equity and borrowings) imply ① over liquidity, and ② lesser investment to fixed assets. With this in view, PT. KAI would preferably be enhancing the basis of gross sales by more investing to infrastructure and newer rolling-stocks.

As regards the cash-flow statement (the statement of change in cash position), cash inflows from operation, investment, and finance activities in 2010 stood at Rp. 48.7 billion (JY 0.4 billion), Rp. -689.5 billion (JY -6.2 billion), and Rp. -160.7 billion (JY -1.5 billion), revealing somewhat unsound cash position. With this, it would be noted that the financial structure posting cash from finance activities well exceeds that from operation is one of the symptoms of "bubble" economy, generally speaking, though. It would not be appropriate herewith to place the PT. KAI cash position as "bubble economy" due to ① newly started investment activities in return of interest-borne borrowings from commercial banks, and ② insufficient descriptive and numerical information on PT. KAI financial activities from annual reports and financial statements. Nonetheless, careful eyes on the 2nd Stage of cash position of the entity in the days that come would be in need. Meanwhile, the amount of contingent liabilities as borne out by the entity was not figured out due to a lack of note to financial statements.

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7 JICA Institute for International Cooperation training course on Financial Analysis

8 Indicative figures based on the Bank of Japan, *Managerial Analysis on Major Business Entities*, 2000, cited in Y. Yamaguchi *Textbook on Managerial and Financial Analysis*, Nippon Jitsugyou Shuppan, 2003, pp.212-217

[Table 6-2-6] Accounting Ratios (2006 - 2010)

Ratio	Formula	2006	2007	2008	2009	2010	Benchmark	Evaluation
Return on Assets (ROA)	Net Income/ Total Assets	0.3%	-0.6%	-1.4%	2.8%	3.9%	1.8% 1/	A
Return on Sales	Net Income/ Sales	0.4%	-1.2%	-1.9%	3.3%	4.3%	3.3% 2/	A+
Total Asset Turnover	Revenue/ Average Total Assets	n.a	55.7%	70.6%	83.5%	91.4%	0.57	A
Owners' Equity Ratio	Total Equity/ Total Assets	58.3%	56.5%	62.1%	67.4%	70.8%	0.215	A+
Current Ratio	Current Assets/ Current Liabilities	266.4%	268.0%	232.6%	286.4%	262.0%	1.008	A+
Fixed Assets to Equity + Long-term Liability	Fixed Asset/ (Equity + Long Term Liability)	48.0%	43.1%	57.3%	60.4%	59.4%	1.0023	A
Sales to Account Receivable	Account (note) Receivable/ Sales	3.8%	4.1%	3.4%	4.7%	3.4%	0.25	A+
Debt Service Coverage Ratio (DSCR)	Debt (Interest Bearing)/ Net Benefit	91.5%	0.0%	0.0%	0.0%	0.0%	25.0%	A+

1/ Return (Current profit)/ Total Assets as Proxy
2/ Return (Current Profit)/ Sales as Proxy

(Source: PT. KAI Audited Annual Reports 2006 - 2010)

[Table 6-2-7] Summary Cash-flow Statement (2006 - 2010)

(Unit: million Rp.)

	2006	2007	2008	2009	2010
Cash Fow from operating activity					
Net Income (loss)	14,207	(40,506)	(83,487)	154,800	216,336
Added (less) - non cash charges component	-	-	-	-	-
Fixed assets depreciation	16,200	370,941	247,962	221,337	198,159
Deffered tax assets	60	(40,152)	(235,146)	51,526	20,533
Defered tax	(11,100)	(42,308)			
Pension loan - all	1,156,181	195,318	-	814,263	(79,500)
Employment benefit	-	468,333	487,012	(910,147)	(2,024)
Pension loan - swakelola	20,162	106,998	(73,909)	62,970	(64,078)
Receivable rightoff reserve	110,700	863	890	58,298	6,680
Cash & Equivalent before changes in working capital	1,306,410	1,019,488	343,323	453,047	296,107
Changes in working capital					
Decrease (increase) of current assets					
Receivable - related party	(11,700)	(19,858)		(45,346)	13,194
receivable - third [arty	(13,500)	15,819	(12,298)		
other receivable	(115,100)	214	1,702	(89,834)	34,864
inventory	5,600	(64,964)	(90,448)	(70,338)	(56,303)
Accured Income	(149,800)	10,077	7,471	5,139	(3,366)
advance	(2,900)	12,717	(52,592)	31,921	(7,097)
prepaid tax	(2,000)	(8,778)	10,752	(92,033)	(10,651)
others current assets	(64,400)	(14,052)	1,016	149,494	(25,718)
Decrease (increase) of current assets					
Trade payable	2,100	40,119	101,659	(55,764)	12,603
Bank Loan payment due	(13,000)				
Deffered charges	70,700	(104,361)	39,814	82,788	(255,425)
Tax payable	68,600	(13,086)	72,667	(255,040)	30,429
Advance	39,000	58,932	15,638	(31,114)	12,775
Others payable	(3,200)	(816)	88,433	(93,130)	7,293
Net Cash flow from (for) operating activity	**1,116,810**	**931,450**	**527,138**	**(10,209)**	**48,707**
Cash flow from investing activity					
Assets release (additional)					
Shorterm investment	-	(50,000)	(14,928)	61,728	3,200
Fixed assets	(89,800)	(508,440)	(503,176)	(434,947)	(193,991)
Deposit	85,400	(197,284)	165,794	-	(163,299)
Construction in progress	42,700	(4,625)	(10,140)	57,889	(393,153)
Slow moving equipment and spareparts	700	10,856	166	(3,834)	(6,651)
Non productive fixed assets	(2,700)	(972)	(2,150)	2,533	87
Deffered charges	6,000	(458,346)	(672)	1,565	246
Pension fund -swakelola	-	(106,998)	73,909	(62,970)	64,078
Net Cash flow from (for) investing activity	**42,300**	**(1,315,809)**	**(291,198)**	**(378,037)**	**(689,485)**
Cash flow from financing activity					
Loan to Government	(31,200)	(216,933)			
Shares - Government	100,000	100,000			
Shorterm loan	-	-	-	-	161,824
Minority Interest	40,200	2,098	1,314	1,016	(363)
Government Subsidies	22,300	359,073	17,048	-	-
Devidend payment	-	(631)	-	-	(774)
Net Cash flow from (for) financing activity	**131,300**	**243,607**	**18,362**	**1,016**	**160,686**
Increase (decrease) net cash flow	**503,190**	**(140,752)**	**254,302**	**(387,230)**	**(480,092)**
Beginning cash balance	**985,719**	**1,488,909**	**1,348,157**	**1,602,459**	**1,215,230**
Ending cash balance	**1,488,909**	**1,348,157**	**1,602,459**	**1,215,230**	**735,138**

(Source: PT. KAI Audited Annual Reports2006 - 2010)

6.2.8. Technical Assistance to Operation and Maintenance Entities

(1) Railway Infrastructure

Since SPC contract out train operation and facility maintenance work to PT. KAI, it has no field technical staff, but it has management offices in charge of transportation, facility and electricity. PT. KAI is actually doing railway operation business with organization responsible for operation and maintenance of various railway facilities and infrastructure having basic equipments, working regulations and asset management ledgers. On the other hand, judging from the field survey conducted by the study team, equipment management record, management method application and management ledger record were not confirmed to be maintained appropriately. Also, it was informed that preventive maintenance is practiced based on the manual inspection on the civil structures such as bridge on foot for the entire route and it is used for the disaster prevention measure, but the study team was not able to confirm the record in the field survey. As for the MTT maintenance, it is not implemented as planned according to the hearing because it is difficult to control the train operation to secure a time space for the maintenance work.

Subjects to be addressed with regard to the operation and maintenance of facilities and equipment at PT. KAI to be contracted out for operation and maintenance are summarized as follows in [Table 6-2-8].

[Table 6-2-8] Subjects for Operation and Maintenance of Facilities and Equipments

Track, Structure, Facilities	Electricity, Communication, Signal	Rolling-stock
● MTT cannot be mobilized although track maintenance is behind the schedule. ● Lots of breakage of sleeper. ● Although mud pumping point of track bed is conspicuous, there are no record by which causative analysis was conducted. ● Basic management ledgers do exist with blank form but the information is empty. ● Although railway maintenance plan is prepared every year, there is no record of actual implementation.	● Basic management ledgers do exist with blank form but the information is empty. ● There is no maintenance record for old equipments.	● Failure rate is high. ● Preventive maintenance is not practice but ad hoc inspection and maintenance at the time of failure. ● Suitable maintenance technology is insufficient.

(Source: Study Team)

What is particularly impressive in the hearing during the field survey by the study team was that due to the high rate of rolling-stock disorder, train operation time schedule disorder is frequent and it becomes quite difficult to secure a time space for the infrastructure and facility maintenance work. Thus, the mobilization schedule of MTT can not be planned and track without maintenance work is used in practice. In the end, it is presumed that a negative spiral is occurring starting from bad track condition to transportation capacity decrease. Implementation of this project can increase the transportation capacity and cut the negative spiral, but if the present maintenance practice is applied for the infrastructure and facility renewed in the project, the negative spiral may resume.

In order for SPC to contract out the train operation and maintenance to PT. KAI in a long run, it is proposed to request PT. KAI to improve and restore the existing operation management system which does exist but not practiced properly. Particular importance should be placed on the preventive maintenance for which experienced Japanese experts (JR personnel for example) are dispatched to establish the system and help apply to the field.

(2) Maintenance management of the rolling-stock

CC205 type locomotive is a U.S. made locomotive being manufactured by EMD in US. It will be important for SPC to receive support from EMD in order to acquire necessary maintenance management skills of locomotives. The technical assistance about establishment of maintenance management system is based on inspection and repair manual by the locomotive supplier. However, the dispatch of experts for checking the compatibility of the manual offered by the supplier and the technical standard of DGR, and the personnel training for preparing an inspection period, an inspection method, a technical standard, etc. suitable for CC205 type locomotive, the training in railway enterprise companies such as JR, Railway Bureau of the Ministry of Land Infrastructure and Transport, and various research institutions, etc. is considered that the technical assistance to SPC which led is effective.

(3) Establishment of Maintenance Management Support Organization

It becomes impossible to secure the planned traffic volume if maintenance for infrastructure and facilities specified by SPC was not given. Therefore, SPC should support to establish a system for PT. KAI to implement appropriate maintenance management as it was mentioned in the preceding clause. The followings are a proposal to materialize the concept.

An organization responsible for maintenance management plan and personnel training should be established in SPC. This organization belongs to “Operation Division” shown in [Fig. 6-2-3] (P. 6-15) and executes the tasks shown below.

- Prepare a standard for maintenance management.
- Prepare manuals for maintenance management.
- Train maintenance work leaders (Track facilities maintenance management, signal and electric power facilities maintenance management, and maintenance machinery and vehicle management)

The SPC engineers, specialist invited from Japan and engineers of PT. KAI should collaborate to make the maintenance management standard and the maintenance management manual. The maintenance management standard will be ready within 9 months after SPC was established and it will be incorporated in detailed design. The maintenance management manual that SPC specifies will be ready within 6 months.

Currently, actual maintenance work is outsourced to private companies by PT. KAI. In order for the maintenance work to be implemented exactly in accordance with the manual, it is necessary to educate Indonesian maintenance work leaders and let the leaders to train the maintenance workers of PT. KAI and outsourced companies.

The maintenance leader is proposed to be Indonesian who has enough experiences in railway facility maintenance work. The number of the leader is about 20 composed of PT. KAI retiree, newly recruit, and the kind. They will be re-educated in OJT basis under the supervision of specialists invited from Japan and engineers of PT. KAI.

After 1 year of education, the maintenance leader will be assigned to PT. KAI field work for the project section seconded by SPC and implement the maintenance work jointly with PT. KAI engineers. In this way, maintenance quality that SPC expects will be satisfied.

When the 2nd Stage is ended, the maintenance leader will have the experience of the maintenance management of about 4 years at the project actual site. As a result, it will be possible to establish an independent company which specialize railway infrastructure and facility maintenance for Indonesian railway as a whole. Maintenance quality of the project railway facility will be secured by establishing the maintenance dedicated company that enables the sustainable operation of the project and thus contribute to the development of Indonesia.

The building schedule of the maintenance management support organization is shown in [Table 6-2-9].

[Table 6-2-9] Building Schedule of Maintenance Management Organization

	1st Year	2nd Year	3rd Year	4th Year	5th Year	6th Year	7th Year	8th Year	9th Year	10th Year	11th Year	12th Year
Project Preparation												
Consultant Selection Site Investigation & D/D Bidding (Contractor Selection)												
Implementation Schedule of Work					1st Stage		2nd Stage			3rd Stage		
Maintenance Planning & Training Specification / Standard Maintenance Manual Training of maintenance leader - Track Facility - Signal System & Power System - Rolling-stock												
Maintenance leader at PTKAI as a loan employee from SPC and take charge of the repair from the 1st Stage.												
Independent as a maintenance management company												

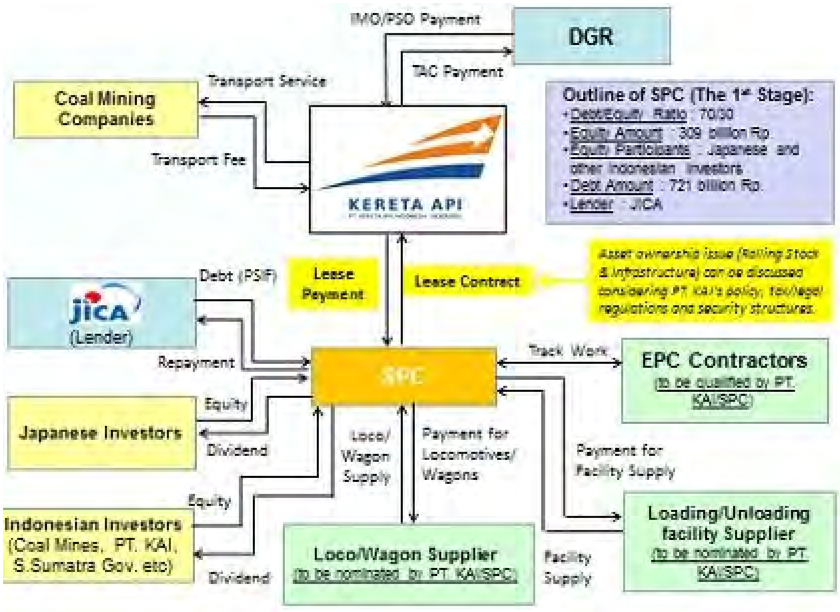
(Source: Study Team)

6.3. Organizational Structure of SPC

The scope of the work to be covered by SPC will be as follows. The proposed organization structure of SPC can be found in 6.2.4. (P. 6-15). Here, the category “Owned by SPC” defined in 3.2.2. (P. 3-35) corresponds to “Supplier for EPC contractor” in the figures below, and “Financed by SPC but not own” corresponds to “Supplier for Coal Handling Equipment” and “Supplier for Rolling-stock”.

(1) The 1st Stage

As shown in [Fig. 6-3-1] below, SPC will undertake upgrading track infrastructure and leasing of rolling-stock and loading/unloading facilities, while PT. KAI will take part in operation and maintenance of rolling-stock and track infrastructure.



(Source: Study team)

[Fig. 6-3-1] Financial Scheme for the 1st Stage

In this stage, the total project cost for rehabilitation and procurement of rolling-stock and facility will be about JY 9.88billion. Out of the amount, 70% will be financed by SPC supported by JICA Private Sector Investment Finance (PSIF=loan) and the rest will be financed by investment of private investors. The projected amount is summarized in [Table 6-3-1].

[Table 6-3-1] Rough Estimate of Cost Sharing in the 1st Stage

Stage	Total Project Costs	Infrastructure Construction by GOI	SPC
The 1st Stage	9.88 billion yen (1,086,496 million Rp.)	N/A	●Loan 6.92 billion yen (760,547 million Rp./ PSIF by JICA) ●Investment 2.96 billion yen (325,949 million Rp.)

Note: The currency conversion rate used is 110 Rp. against 1 Yen.

(Source: Study team)

In case the investment percentage by Japanese firms is assumed at maximum of 49%, the total investment amount by Japanese firms will be approximately Japanese Yen 1.5 billion, and the remaining equity will be injected by Indonesian investors. For debt financing to SPC, JICA's

PSIF will be considered.

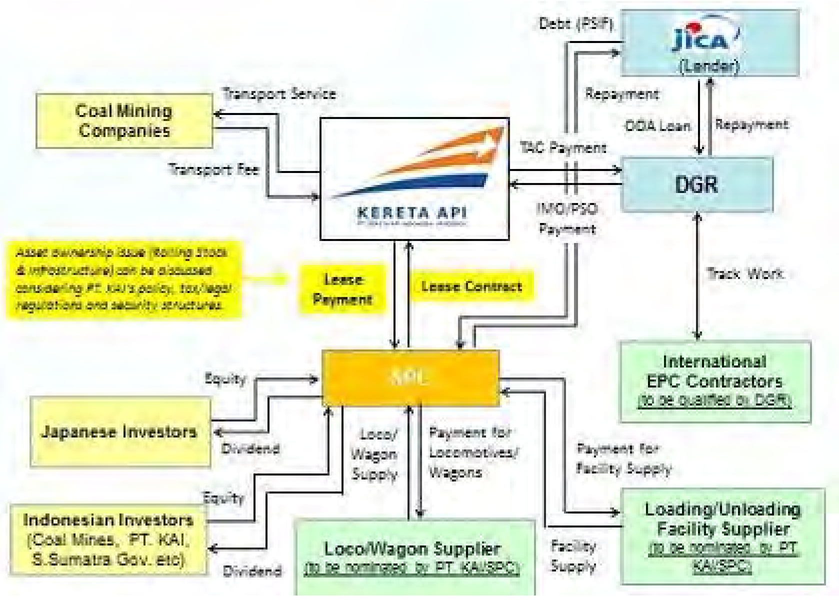
Under the scheme proposed above, considering the future asset value, rolling-stock and loading/unloading facilities will be arranged on “financing-lease contract” under which the title of asset will be transferred to PT. KAI upon final lease payment to SPC is made. On the other hand, track and infrastructure component will be on “deferred payment contract” under which the title of asset will be transferred to PT. KAI at the time of effectuation of the contract.

Sojitz co., one of the potential Japanese investors, already started to consult with Japanese and local companies to sound their interest on equity investment to the project, and is receiving positive signs from some of them including Japanese leasing company although the definite decision depends on the terms of condition such as leasing period and exit condition. However, since the definitive scope of the work, the amount and expected equity return are not defined yet, Sojitz co. intends to proceed with further discussion with the potential co-investors in accordance with the progress of discussion with PT. KAI to be able to make investment condition. However, it is judged that the South Sumatra Government will be excluded from potential co-investor considering the scheme change to “B to B business” and past discussions.

In the meantime, as a result of past discussions with PT. KAI and DGR, tendering process by PT. KAI may be observed even under the “B to B business” scheme. However, since this business model is based upon JICA’s PSIF, it can be assumed that the initiating group will be in a better position to secure the deal with PT. KAI.

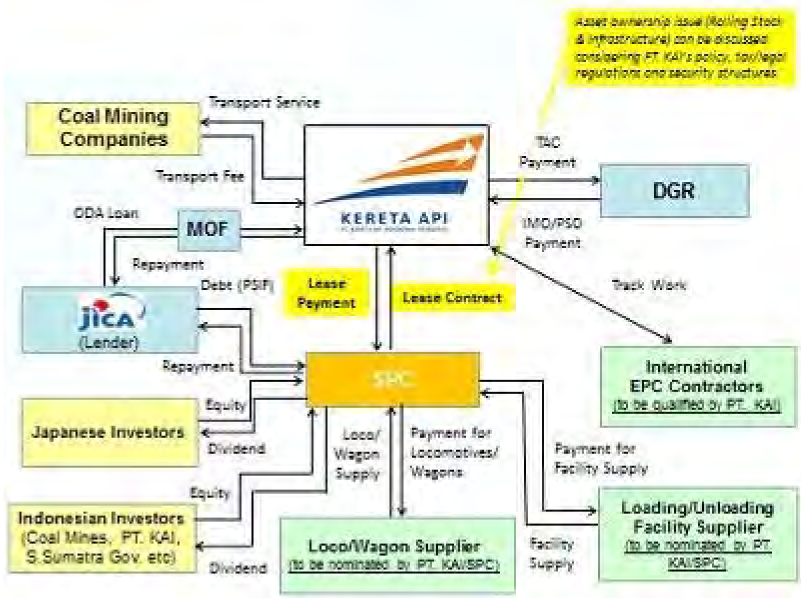
(2) The 2nd Stage and the 3rd Stage

As it can be understood in the charts below, SPC’s scope of work for the 2nd Stage and the 3rd Stage will be leasing of rolling-stock and loading/unloading facilities to PT. KAI, while PT. KAI will conduct operation and maintenance. Further, partial double-tracking and whole double-tracking works proposed in the 2nd and 3rd Stage will be conducted by either Indonesian Government or PT. KAI using Japanese ODA loan.



(Source: Study team)

[Fig. 6-3-2] Financial Scheme for the 2nd and 3rd Stages (Plan 1)



(Source: Study team)

[Fig. 6-3-3] Financial Scheme for the 2nd and 3rd Stages (Plan 2)

The total project cost and financing sources in each stage are summarized in [Table 6-3-2]. The prices indicated here are accumulated amount since the 1st stage up to the each stage calculated based on [Tabel 5-4-1] (P. 5-30), [Table 5-4-4] (P. 5-31) and [Table 5-4-7] (P. 5-32). The infrastructure construction component of the total project cost is shared by GOI and SPC, where SPC share is so calculated as to be able for the private investors to ensure their expected return from the lease fee in the first place. Then, the rest of the infrastructure cost is shared by GOI. As for SPC's financing, it is assumed that 70% of the amounts allocated for SPC is financed by PSIF and the remaining 30% is financed by investment in the same way as the 1st Stage.

[Table 6-3-2] Rough estimate of Cost Sharing in the 2nd Stage and the 3rd Stage

Stage	Total project costs	Infrastructure construction by GOI	SPC
The 2nd Stage	22.69 billion yen (2,495,681 million Rp.)	9.53 billion yen (1,048,186 million Rp.)	● Loan 9.21 billion yen (1,013,246 million Rp./ PSIF by JICA) ● Investment 3.95 billion yen (434,249 million Rp./ including Japanese companies of 49%)
The 3rd Stage	74.44 billion yen (8,188,123 million Rp.)	42.43 billion yen (4,667,330 million Rp.)	● Loan 22.41 billion yen (2,464,625 million Rp./ PSIF by JICA) ● Investment 9.60 billion yen (1,056,268 million Rp./ including Japanese companies of 49%)

Note: The currency conversion rate used is 110 Rp. against 1 Yen.

(Source: Study team)

Proposed organizational structure of SPC will be the same as the 1st Stage, however it is important to note that the structure shall be modified to the most optimum form based on the experiences acquired in the 1st Stage.

Chapter 7

Economic/ Financial/ Risk Analysis

7.1. Cost

7.1.1. Cost Estimate

The project will be implemented in 3 stages depending on the coal transportation demand. Calculation basis for the project cost in each stage can be found in Section 5.4. (P. 5-29). Cost estimate at each stage is shown in [Table 7-1-1], [Table 7-1-2] and [Table 7-1-3].

The project cost in each stage is categorized into infrastructure construction costs, rolling-stock costs, loading/unloading facility costs, consultancy service costs, land acquisition costs, and tax and others (administrative expenses, tax, prices escalation expense, and reserve fund are included) in foreign and local cost components as shown below.

[Table 7-1-1] Project Cost at the 1st Stage

(Unit: million Rp.)

	Foreign Cost	Local Cost	Total
Construction	18,262	289,965	308,227
Rolling stock	557,260	0	557,260
Loading/Unloading	14,740	0	23,100
Consultant	17,708	8,699	26,407
Land	0	0	0
Tax and others	92,320	87,543	179,863
Total	700,290	386,207	1,086,497

(Source: Study team)

[Table 7-1-2] Cumulative Project Cost up to the 2nd Stage

(Unit: million Rp.)

	Foreign Cost	Local Cost	Total
Construction	383,136	741,399	1,124,535
Rolling stock	854,920	0	854,920
Loading/Unloading	39,160	0	39,160
Consultant	38,316	22,242	60,558
Land	0	0	0
Tax and others	197,419	219,088	416,507
Total	1,512,951	982,729	2,495,680

(Source: Study team)

[Table 7-1-3] Cumulative Project Cost up to the 3rd Stage

(Unit: million Rp.)

	Foreign Cost	Local Cost	Total
Construction	1,520,063	2,756,487	4,276,550
Rolling stock	2,076,360	0	2,076,360
Loading/Unloading	183,920	0	183,920
Consultant	113,410	82,695	196,105
Land	0	52,000	52,000
Tax and others	583,357	819,831	1,403,188
Total	4,477,110	3,711,013	8,188,123

(Source: Study team)

7.1.2. Annual Fund Requirement

The project will be implemented in 3 stages depending on the coal transportation demand. Calculation basis for the project cost in each stage can be found in Section 5.4. (P. 5-29). Annual fund requirement at each stage is shown in [Table 7-1-4], [Table 7-1-5] and [Table 7-1-6].

[Table 7-1-4] Annual Fund Requirement at the 1st Stage

(Unit: million Rp.)

	1st Year	2nd Year	3rd Year	4th Year	5th Year	6th Year
Amount	0	0	54,325	162,974	434,599	434,599
(%)	0	0	5	14	40	40
	7th Year	8th Year	9th Year	10th Year	11th Year	12th Year
Amount	-	-	-	-	-	-
(%)	-	-	-	-	-	-

(Source: Study team)

[Table 7-1-5] Cumulative Annual Fund Requirement up to the 2nd Stage

(Unit: million Rp.)

	1st Year	2nd Year	3rd Year	4th Year	5th Year	6th Year
Amount	0	0	54,325	162,974	434,599	505,058
(%)	0	0	2	7	17	20
	7th Year	8th Year	9th Year	10th Year	11th Year	12th Year
Amount	634,133	704,592	-	-	-	-
(%)	25	28	-	-	-	-

Notes: The amount is the total sum up to the 2nd Stage.

(Source: Study team)

[Table 7-1-6] Cumulative Annual Fund Requirement up to the 3rd Stage

(Unit: million Rp.)

	1st Year	2nd Year	3rd Year	4th Year	5th Year	6th Year
Amount	0	0	54,325	162,974	434,599	505,058
(%)	0	0	1	2	5	6
	7th Year	8th Year	9th Year	10th Year	11th Year	12th Year
Amount	785,429	634,133	989,214	1,081,564	1,366,186	2,163,128
(%)	8	12	13	17	10	26

Notes: The amount is the total sum up to the 3rd Stage.

(Source: Study team)

7.1.3. Financial and Economic Costs of the Project

Financial costs of the Project by alternative stage (step-wise implementation by 1st, 2nd, and 3rd Stage) are summarized hereunder as the basis on which economic and financial analyses are to further be proceeded with. Note that financial cost estimates are somewhat different from the cost as elucidated in the previous section of 7.1.1. (P. 7-1) due largely to the compliance of this section with the guidelines of project analysis prepared by JICA[1], the Asian Development Bank[2], and others.

Total financial costs of the 1st Stage, the 2nd Stage, and the 3rd Stage (comprising base cost, physical and price contingencies) stand at Rp. 1,174.2 billion (JP¥ 10.65 billion), Rp. 2,887.0 billion (JP¥ 26.18 billion), and Rp. 11,157.0.billion (JP¥ 101.19 billion), in that order. Excluding

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1 *Manual of IRR estimation for Japan's Yen Loan Projects*, JBIC, September 2002

2 *Handbook on Economic Analysis of Investment Operations*, ADB 1998

price contingencies from each of these aggregate costs, the costs to estimate internal rate of return (IRR) are elucidated at Rp. 1,038.8 billion (JP¥ 9.42 billion), Rp. 2,393.1 billion (JP¥ 21.71 billion), and Rp. 7,857.6 billion (JP¥ 71.27 billion), in the same order. Annual operation costs that account for 8% of FIRR cost (base cost + physical contingency) are figured out at Rp. 83.1 billion (JP¥ 0.75 billion), Rp. 191.4 billion (JP¥ 1.74 billion), and Rp. 628.6 billion (JP¥ 5.70 billion) for respective of the 1st Stage, the 2nd Stage, and the 3rd Stage. Detailed cost estimates are given below as [Table 7-1-7], [Table 7-1-8] and [Table 7-1-9].

[Table 7-1-7] Financial Cost for the 1st Stage

(Unit: Rp. billion)

	FC	LC	Total
Construction	590.3	290.0	880.2
Land Acquisition			0.0
Administration cost		8.7	8.7
Engineering Fee	17.7	8.7	26.4
Tax and Duties		29.0	29.0
Base Cost	608.0	336.4	944.3
Physical Contingency	60.8	33.6	94.4
BC + PhyC	668.8	370.0	1,038.8
Price Contingency	34.4	101.1	135.5
Total	703.1	471.1	1,174.2

(Unit: JP¥ billion)

	FC	LC	Total
Construction	5.35	2.63	7.98
Land Acquisition			
Administration cost		0.08	0.08
Engineering Fee	0.16	0.08	0.24
Tax and Duties		0.26	0.26
Base Cost	5.51	3.05	8.57
Physical Contingency	0.55	0.31	0.86
BC + PhyC	6.07	3.36	9.42
Price Contingency	0.31	0.92	1.23
Total	6.38	4.27	10.65

(Source: Study team)

[Table 7-1-8] Financial Cost for the 2nd Stage

(Unit: Rp. billion)

	FC	LC	Total
Construction	1,277.2	741.4	2,018.6
Land Acquisition			
Administration cost		22.2	22.2
Engineering Fee	38.3	22.2	60.6
Tax and Duties		74.1	74.1
Base Cost	1,315.5	860.0	2,175.6
Physical Contingency	131.6	86.0	217.6
Base Cost + PhyC	1,447.1	946.0	2,393.1
Price Contingency	106.2	387.6	493.9
Total	1,553.3	1,333.6	2,887.0

(Unit: JP¥ billion)

	FC	LC	Total
Construction	11.58	6.72	18.31
Land Acquisition			
Administration cost		0.20	0.20
Engineering Fee	0.35	0.20	0.55
Tax and Duties		0.67	0.67
Base Cost	11.93	7.80	19.73
Physical Contingency	1.19	0.78	1.97
Base Cost + PhyC	13.13	8.58	21.71
Price Contingency	0.96	3.52	4.48
Total	14.09	12.10	26.18

(Source: Study team)

[Table 7-1-9] Financial Cost for the 3rd Stage

(Unit: Rp. billion)

	FC	LC	Total
Construction	3,780.3	2,756.5	6,536.8
Land Compensation		52.0	52.0
Administration cost		82.7	82.7
Engineering Fee	113.4	82.7	196.1
Tax and Duties		275.6	275.6
Base Cost	3,893.8	3,249.5	7,143.3
Physical Contingency	389.4	325.0	714.3
Base Cost + PhyC	4,283.1	3,574.5	7,857.6
Price Contingency	532.6	2,766.7	3,299.4
.79al	4,815.8	6,341.2	11,157.0

(Unit: JP¥ billion)

	FC	LC	Total
Construction	34.29	25.00	59.29
Land Compensation		0.47	0.47
Administration cost		0.75	0.75
Engineering Fee	1.03	0.75	1.80
Tax and Duties		2.50	2.50
Base Cost	35.32	29.47	64.79
Physical Contingency	3.53	2.95	6.48
Base Cost + PhyC	38.85	32.42	71.27
Price Contingency	4.83	25.09	29.93
Total	43.68	57.51	101.19

(Source: Study team)

Likewise, the economic costs of the 1st Stage, the 2nd Stage, and the 3rd Stage are estimated at Rp. 973.1 billion (JP¥ 8.83 billion), Rp. 2,225.1 billion (JP¥ 20.18 billion), and Rp. 7,175.8 billion (JP¥ 65.08 billion), in that order. In the estimation of Economic costs, transfer payments (taxes and duties, land acquisition compensation) and price contingency are excluded from financial cost. Further, domestic cost portion of the Project is converted to international competitive prices (border prices) by applying the Standard Conversion Factor (SCF) of 0.9 in the current analysis. Annual operation cost in economic term stands at Rp. 77.8billion (JP¥ 0.71 billion), Rp. 178.0 billion (JP¥ 1.61 billion), and Rp. 574.1 billion (JP¥ 5.21billion) for each of the 1st Stage, the 2nd Stage and the 3rd Stage. Detailed economic costs are given below in [Table 7-1-10], [Table 7-1-11] and [Table 7-1-12].

[Table 7-1-10] Economic Cost for the 1st Stage

(Unit: Rp. billion)

	FC	LC	Total
Construction	590.3	261.0	831.2
Land Acquisition			
Administration cost		7.8	7.8
Engineering Fee	17.7	7.8	25.5
Tax and Duties			
Base Cost	608.8	276.6	884.6
Physical Contingency	61.7	27.7	88.5
Base Cost + PhyC	668.8	304.3	973.1
Price Contingency			
Total	668.8	304.3	973.1

(Unit: JP¥ billion)

	FC	LC	Total
Construction	5.35	2.37	7.72
Land Acquisition			
Administration cost		0.07	0.07
Engineering Fee	0.16	0.07	0.23
Tax and Duties			
Base Cost	5.51	2.51	8.02
Physical Contingency	0.56	0.25	0.80
Base Cost + PhyC	6.15	2.76	**8.83**
Price Contingency			
Total	6.15	2.76	8.83

(Source: Study team)

[Table 7-1-11] Economic Cost for the 2nd Stage

(Unit: Rp. billion)

	FC	LC	Total
Construction	1,277.2	667.3	2,327.3
Land Acquisition			
Administration cost		20.0	20.0
Engineering Fee	38.3	20.0	58.3
Tax and Duties			
Base Cost	1,315.5	707.3	2,417.1
Physical Contingency	131.6	70.7	202.3
Base Cost + PhyC	1,447.1	778.0	2,225.1
Price Contingency			
Total	1,447.1	778.0	2,225.1

(Unit: JP¥ billion)

	FC	LC	Total
Construction	11.58	6.05	17.64
Land Acquisition			
Administration cost		0.18	0.18
Engineering Fee	0.35	0.18	0.53
Tax and Duties			
Base Cost	11.93	6.42	18.35
Physical Contingency	1.19	0.64	1.83
Base Cost + PhyC	13.13	7.06	20.18
Price Contingency			
Total	13.13	7.06	20.18

(Source: Study team)

[Table 7-1-12] Economic Cost for the 3rd Stage

(Unit: Rp. billion)

	FC	LC	Total
Construction	3,780.3	2,480.8	6,261.2
Land Acquisition			
Administration cost		74.4	74.4
Engineering Fee	113.4	74.4	187.8
Tax and Duties			0.0
Base Cost	3,893.8	2,629.7	6,523.4
Physical Contingency	389.4	263.0	652.3
Base Cost + PhyC	4,283.1	2,892.7	7,175.8
Price Contingency			
Total	4,283.1	2,892.7	7,175.8

(Unit: JP¥ billion)

	FC	LC	Total
Construction	34.29	22.50	56.79
Land Acquisition			
Administration cost		0.68	0.68
Engineering Fee	1.03	0.68	1.70
Tax and Duties			
Base Cost	35.32	23.85	59.17
Physical Contingency	3.53	2.39	5.92
Base Cost + PhyC	38.85	26.24	65.08
Price Contingency			
Total	38.85	26.24	65.08

(Source: Study team)

7.2. Benefit

7.2.1. Financial Benefit

In anticipation of the establishment of the private sector business entity to operate and maintain passenger and freight transportation services in the projected area, financial benefit of the Project is assumed to be tariff revenue emanating from the said services. Because of the newly set-up business undertaking, the incremental benefit between the “With-“and “Without-“, the Project are respectively assumed to be the target amount of 2.5MTPA (the 1st Stage), 5.0MTPA (the 2nd Stage) and 20.0MTPA (the 3rd Stage) from the current transportation services of 0.15 MTPA of coal. Passenger tariff revenue is set at Rp. 26,154 per capita[3], while freight tariff levied on the incremental supply (transportation) of coal is assumingly set at Rp. 650.1 per ton-kilometer, while taking into account the forthcoming PT. KAI freight tariff in 2012 for private coal mining companies between Sukachinta - Kertapati (179km) section coal transportation service[4].

7.2.2. Economic Benefit

In line with international trade data now in place where 70% of the coal is exported, 50% of incremental transportation of coal brought about by the Project will be exported overseas, thus leading to the estimation of economic benefit based on foreign exchange earned by coal export. Unlike financial analysis, the quantities of incremental coal transported by the Project are measured on an incremental basis, that is, differences between coal transportation currently in

[3] Source: PT. KAI, *Tarif Angkutan Barang Posisi Tahun 2010 &2011*
[4] PT. KAI Managing Director of Finance, 2 May 2012

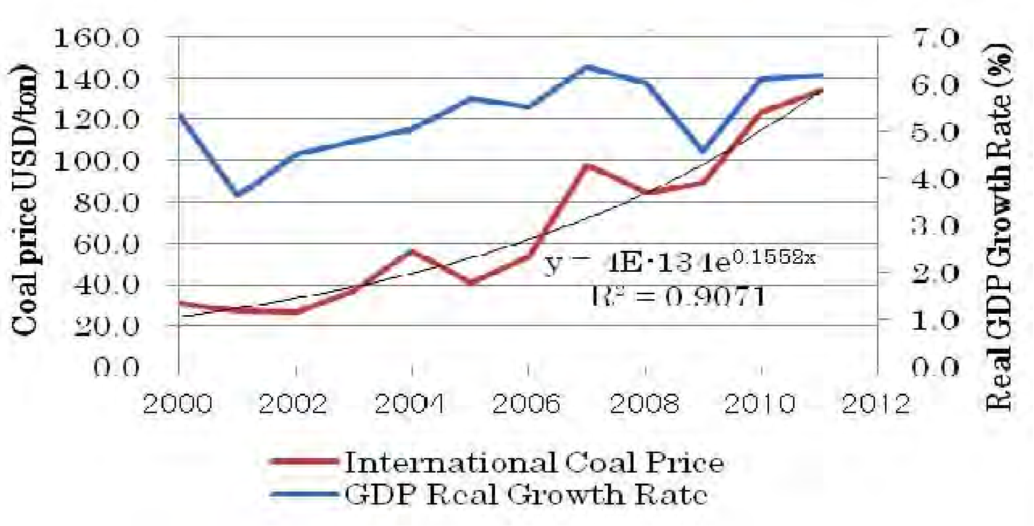
place (1.5MTPA) and those (2.5, 5.0, and 20.0MTPA) targeted additional amounts in each of the Stages.

In carrying out the analysis, export parity price of coal is estimated in lieu of international coal price, while considering a large share of economic cost of transportation from Kertapati to Tanjuang Api Api (about 80km in addition to 180km). Currently, coal transportation by barges for this 80km is in place, as such the economic cost of barge operation and maintenance cost was tried to be estimated and deducted from aggregate economic benefits. Nonetheless, due to a paucity of numerical data on the cost of barge operation and maintenance in South Sumatra[5], in tandem with a lack of the concerned economic price as applied by the World Bank and others of relevance, the economic cost of trucks to transport coal for that 80km to Tanjung Api Api was estimated as *proxy* for the concerned in the current analysis. In so doing, economic cost of transportation by truck is specifically measured in aggregate of fuel deletion and vehicle operation cost (VOC), with each of these valued at US$ 0.68 per litter[6] and US$ 0.58 per vehicle-km[7], in that order. US$ 0.03 per ton-km was applied as economic cost of fuel consumption by truck in due course[8]. As such, export parity price of coal has been estimated at US$ 119.1 per ton in the current analysis.

International price of coal is assumed to be US$ 123.2 per ton as per 2011 price, while taking a conservative view against the uprising trend of international price of coal in the past decade (average annual growth rate of 13.4% in nominal term).

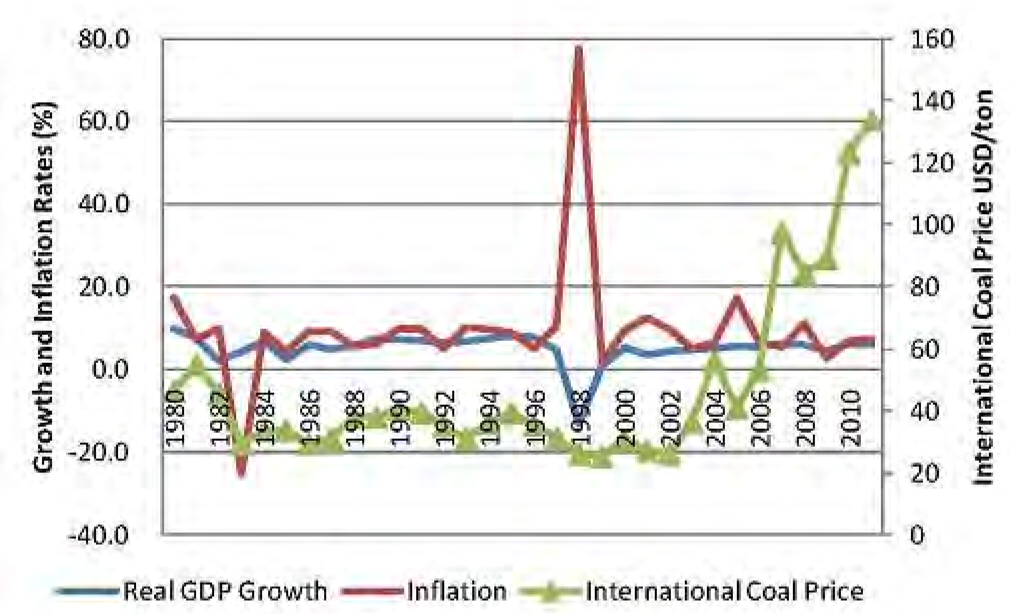
International prices of coal and macroeconomic transition since 1980 to date are respectively depicted as [Fig. 7-2-1] and [Fig. 7-2-2]. Further, inflationary pressure experienced in the developed economies affecting international demand for coal is depicted as [Fig. 7-2-3].

[5] This includes, among others, fuel, labor cost, operation and maintenance costs, depreciation, and others.
[6] Source: US Energy Information Administration, NY Harbor Ultra-low sulphur No. 2 diesel spot price, 31 January 2012
[7] Source: The World Bank, *Road Economic Decision (RED) model*, 2008
[8] Source: DFID, *A Comparison of Freight Transport Operations in Tanzania and Indonesia*, 1997



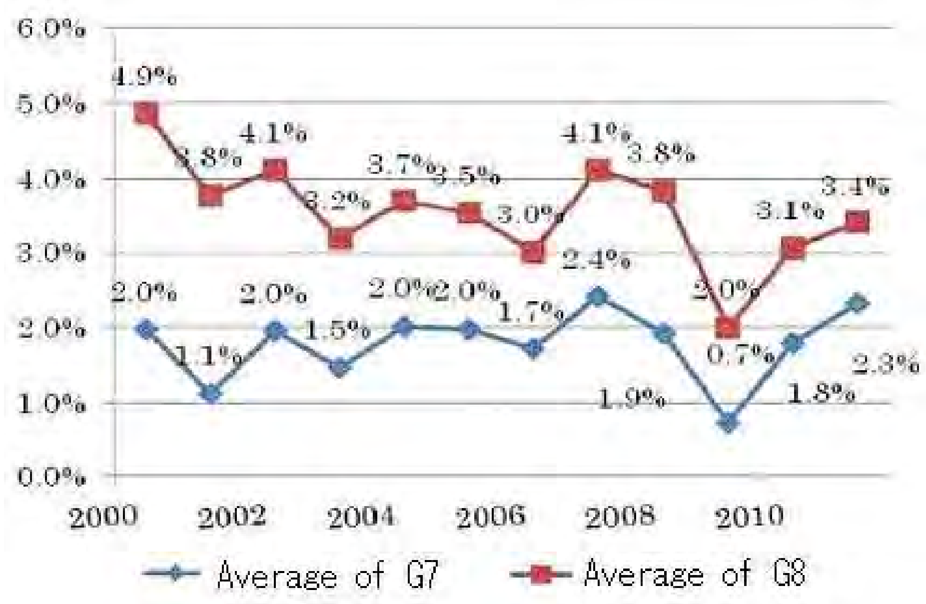
(Source: IMF World Economic Outlook, April 2011)

[Fig. 7-2-1] International Coal Price and Real GDP Growth (2000 - 2010)



(Source: IMF World Economic Outlook, April 2011)

[Fig. 7-2-2] Indonesia Macroeconomic Indicators and Coal Price (1980 - 2010)



(Source : IMF World Economic Outlook, April 2011)

[Fig. 7-2-3] Inflation Rates in Developed Economies (2000-2010)

7.3. Overall Economic and Financial Analyses of the Project

7.3.1. Analytical Framework and Model Configuration

Time-discount cash-flow analysis takes place herewith in section 7.3 to quantitatively quantify economic and financial impacts emanating from each of the 1st Stage, the 2nd Stage and the 3rd Stage, with internal rate of return (IRR[9]) as measurement index. In addition to Project FIRR analysis, the World Bank-advocated analytical methodology of *PPP-financial modeling and analysis,* is carried out in the following section of 7.4 (P. 7-17), while taking in view equity profitability and debt sustainability indices quantitatively measuring viability for investors. Net Present Value (NPV) index will also be given besides IRR to measure incremental wealth in terms of pecuniary and allocative efficiency.

At the outset of the analysis, model configuration articulating the variables and assumptive parameters used in the overall analysis of the Project is specified and summarized in [Table 7-3-1] below. Exchange quotation of the Indonesia Rupee against the Japanese Yen is set at Rp. 110.3/JP¥ as per January 2012 price.

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[9] IRR, by definition, is a discount rate that equalizes discounted net benefits (benefit-cost) over the project life, and mathematically expression as follows.

$$\text{IRR} \equiv r : \text{that makes } \sum_{t=1}^{n} \{(B - C)_t \times (1 + r)^{-t}\} = 0$$

where $(B - C)_t$ represents net benefit in the year t (t = 1, 2,…, n). The equation above is numerically solved by repeated calculation.

[Table 7-3-1] Model Configuration

No.	Variables	The 1st Stage	The 2nd Stage	The 3rd Stage
1	Project life (construction period)	24 (4)	26 (6)	30 (10)
2	Exchange rate (Rp./JP¥)	110.3	110.3	110.3
3	GDP real growth rate (%, estimate 2011)	6.2	6.2	6.2
4	Inflation rate (%, estimate 2011)	7.3	7.3	7.3
5	Economic feasibility criterion (EIRR, SDR)	12.0 %	12.0 %	12.0 %
6	Financial viability cut-off rate (FIRR-OCC)[10]	6.0 %	6.0 %	6.0 %
	Financial and economic costs			
7	Aggregate financial cost (Rp. billion)	1,174.2	2,887.0	11,157.0
8	Physical contingencies (against IRR cost)	10.0 %	10.0 %	10.0 %
9	Price contingency (FC/LC)[11]	1.6% / 7.9%	1.6% / 7.9%	1.6% / 7.9%
10	Operation and maintenance (% of IRR Cost)	8.0 %	8.0 %	8.0 %
11	IRR financial cost (Rp. billion)	1,038.2	2,393.1	7,857.6
12	Standard conversion factor (EIRR)	0.9	0.9	0.9
13	Project economic cost (Rp. billion)	973.1	2,225.1	7,175.8
14	Annual investment schedule	[Table 7-1-4] (P. 7-2)	[Table 7-1-5] (P. 7-3)	[Table 7-1-6] (P. 7-3)
	Economic and financial benefits			
15	Incremental supply of coal (MTPA) for BAU	1.5	1.5	1.5
16	Incremental supply of coal (MTPA) for FIRR	2.5	5.0	20.0
17	Freight tariff (Rp. per ton-km)	650.1	650.1	650.1
18	Revenue ratio outside of railway operation[12]	0 %	0 %	0 %
19	Coal transport revenue (Rp. billion)	279.6	559.2	1,118.5
20	Export of coal (MTPA) for EIRR analysis	1.18	2.43	9.93
21	Export Ratio of coal (%)	50	50	50
22	Incremental supply of coal (MTPA) for EIRR analysis	0.7	2.45	5.95
23	International price of coal (USD/ton)[13]	112.0	112.0	112.0
24	Unit fuel consumption (L/ton-km)	0.03	0.03	0.03
25	International price of fuel (Rp./L)	5,789	5,789	5,789
26	# of trucks employed (loading 10-ton of coal, million)	0.07	0.245	0.595
27	Economic cost of fuel deletion (Rp. billion)	19.5	19.5	19.5
28	Vehicle Operating Cost (VOC, Rp./vehicle-km)	444.3	444.3	444.3
29	Aggregate VOC (Rp. billion/year)	5.0	5.0	5.0
30	Export parity price of coal (USD/ton)	107.9	107.9	107.9

(Source: Study team)

[10] Bank of Indonesia Reference Rate, January 2012
[11] Reference: 2011 Indonesia inflation rate estimate, IMF *World Economic Outlook*, Apr. 2011,
[12] Reference: Study Proposal (Detailed version), July
[13] Reference: IMF - *Primary Commodity Prices*, 2011 (G8 countries minus Russia) in 2010 has been taken.

7.3.2. Results and Sensitivity Analysis

(1) Economic Analysis

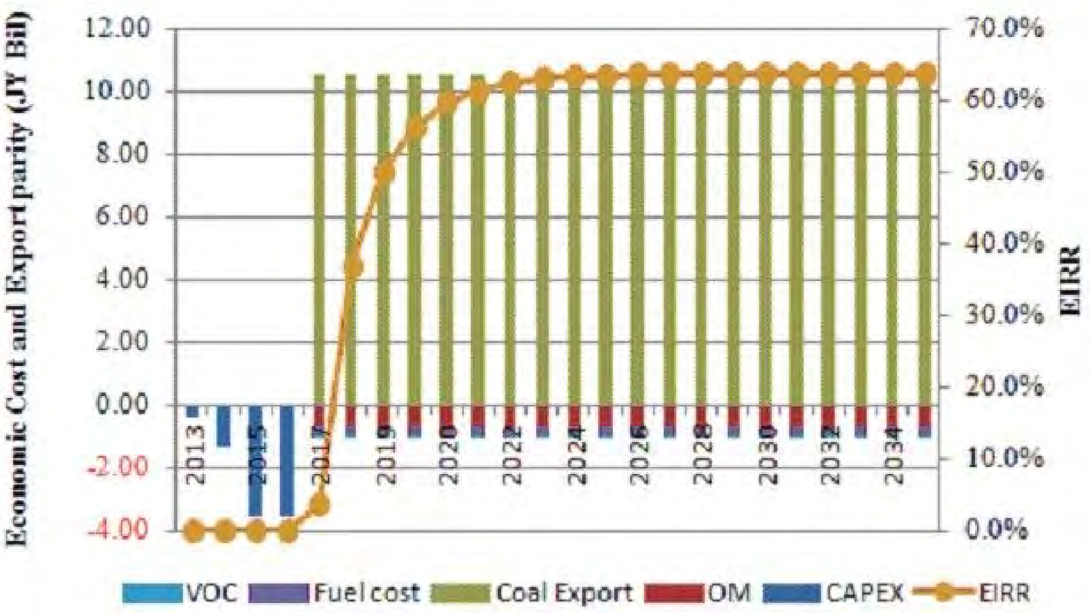
Against the assumptive variables and parameters as specified immediately above, the estimated Economic Internal Rates of Return (EIRRs) for the 1st, the 2nd and the 3rd Stages are estimated at 63.8%, 46.2%, and 38.9%, in that ascending order. Likewise ENPV by 12.0% social discount rate stand at JP¥ 38.60 billion, 60.78 billion, and 164.18 billion, in the same order (See [Table 7-3-2]).

All of the stages resulted in very high remarks on “Allocative efficiency” in the national economy with EIRRs highly exceeding the social discount rate of 12.0%, while the 1st Stage and the 2nd Stage revealing an explicit superiority over the 3rd Stage. Cost and benefit streams with depicted IRRs by stage are also given as [Fig. 7-3-1], [Fig. 7-3-2] and [Fig. 7-3-3] below.

[Table 7-3-2] EIRR and ENPV by Stage

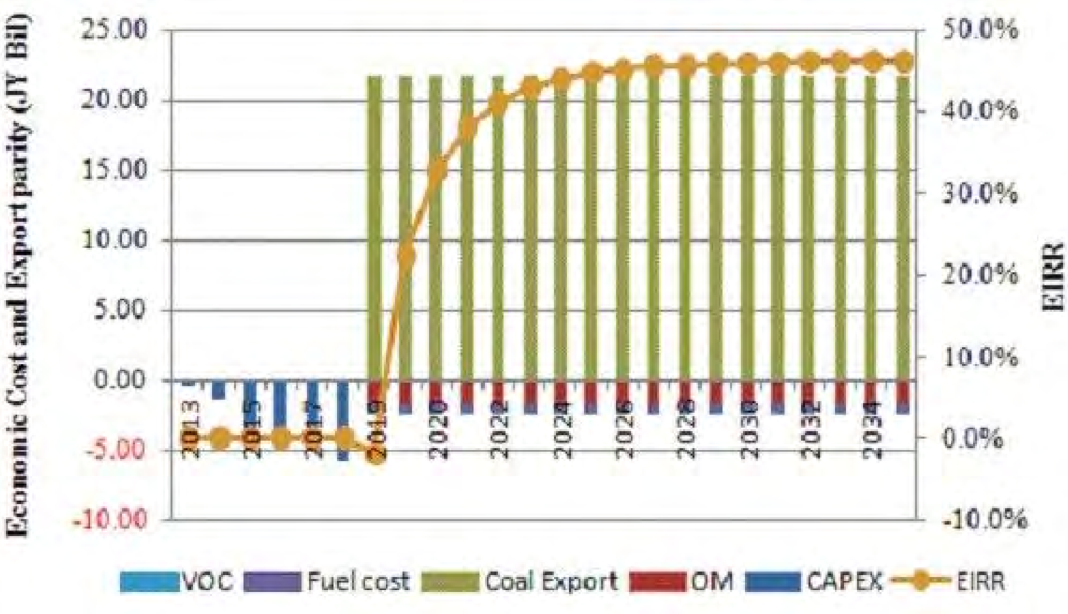
	The 1st Stage	The 2nd Stage	The 3rd Stage
EIRR (%)	63.8	46.2	38.9
ENPV (JP¥ billion)	38.60	60.78	164.18

(Source: Study team)



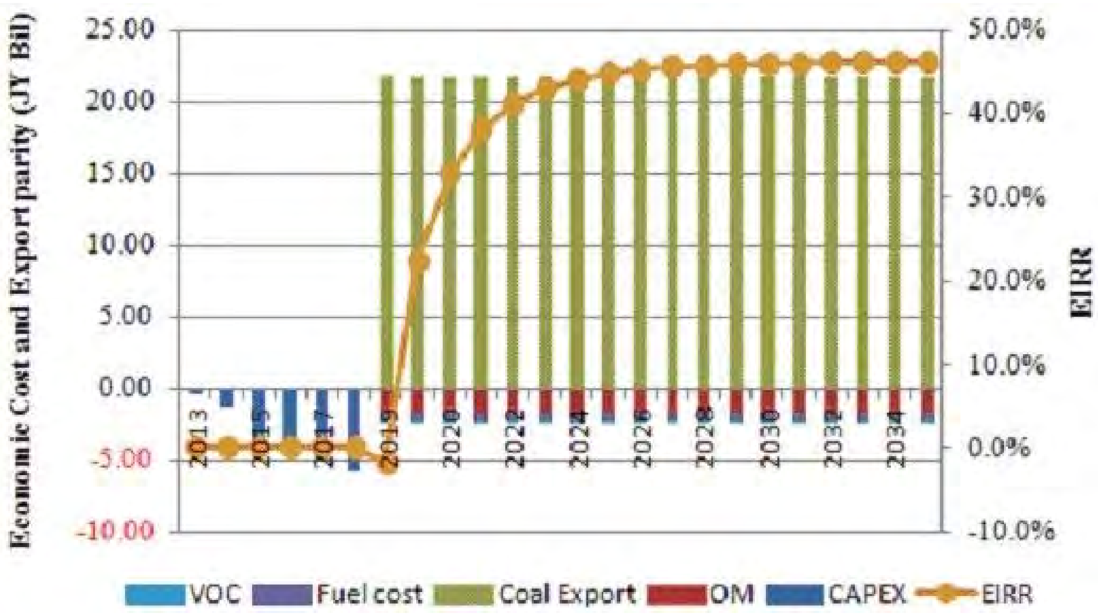
(Source: Study team)

[Fig. 7-3-1] Economic Cost and Export Parity Benefit, and EIRR for the 1st Stage



(Source: Study team)

[Fig. 7-3-2] Economic Cost and Export Parity Benefit, and EIRR for the 2nd Stage



(Source: Study team)

[Fig. 7-3-3] Economic Cost and Export Parity Benefit, and EIRR for the 3rd Stage

(2) Financial Analysis

Likewise, the estimated financial internal rate of returns (FIRRs) of the Project for the 1st, the 2nd and the 3rd Stages are estimated at 18.7%, 13.7%, and 14.6%, in that ascending order.

Likewise FNPVs by 6.0% opportunity cost of capital stand at Rp. 1,316.8 billion (JP¥ 11.94 billion), Rp. 1.627.9 billion (JP¥ 14.76 billion), and Rp. 4,891.3 billion (JP¥ 44.36 billion), in the same order (See [Table 7-3-3]).

[Table 7-3-3] FIRR and FNPV by Stage

	The 1st Stage	The 2nd Stage	The 3rd Stage
FIRR (%)	18.7	13.7	14.6
FNPV (JP¥ billion)	11.94	14.76	44.36

(Source: Study team)

Following the estimation of financial impacts, sensitivity analysis has been undertaken to numerically indicate resiliency of the concerned alternatives against risks, on a *ceteris paribus* basis. Analytical results of sensitivity, notably, ①lower benefit by 10%, ②capital cost overrun by 10%, and ③1 year delay in construction are given as [Table 7-3-4], [Table 7-3-5], and [Table 7-3-6].

As reflected in tables below, all of the stages, other than the 3rd Stage, revealed vulnerability to cost increase and benefit downsizing in compare with delay in construction, as such it would be acceptable to note that there would need rigid project administration and guidance on cost control during construction and project operation thereafter.

[Table 7-3-4] Sensitivity Analysis for the 1st Stage

	Base Case	Cost 10% Up	Benefit 10% Down	1 Years Delay
FIRR (%)	18.7	16.5	16.3	16.4

(Source: Study team)

[Table 7-3-5] Sensitivity Analysis for the 2nd Stage

	Base Case	Cost 10% Up	Benefit 10% Down	1 Years Delay
FIRR (%)	13.7	11.9	11.7	12.4

(Source: Study team)

[Table 7-3-6] Sensitivity Analysis for the 3rd Stage

	Base Case	Cost 10% Up	Benefit 10% Down	1 Years Delay
FIRR (%)	14.6	13.1	12.9	13.3

(Source: Study team)

Summary cash-flow tables of FIRR and EIRR by stage are given below in [Table 7-3-7], [Table 7-3-8] and [Table 7-3-9].

[Table 7-3-7] Summary FIRR and EIRR Cash-flow Tables for the 1st Stage

(Unit: JP¥ billion)

		Cost			Benefit			Net Benefit
		CAP EX	O&M	Total	Freigt	Passe nger	Total	
1	2013	0.47		0.47				-0.47
2	2014	1.41		1.41				-1.41
3	2015	3.77		3.77				-3.77
4	2016	3.77		3.77				-3.77
5	2017		0.75	0.75	2.79	0.02	2.81	2.05
6	2018		0.75	0.75	2.79	0.04	2.83	2.07
7	2019		0.75	0.75	2.79	0.05	2.84	2.09
8	2020		0.75	0.75	2.79	0.07	2.86	2.11
9	2021		0.75	0.75	2.79	0.09	2.88	2.12
10	2022		0.75	0.75	2.79	0.10	2.89	2.14
11	2023		0.75	0.75	2.79	0.12	2.91	2.15
12	2024		0.75	0.75	2.79	0.13	2.92	2.17
13	2025		0.75	0.75	2.79	0.15	2.94	2.19
⋮	⋮		⋮	⋮	⋮	⋮	⋮	⋮
22	2033		0.75	0.75	2.79	0.29	3.08	2.33
23	2034		0.75	0.75	2.79	0.31	3.10	2.34
24	2035		0.75	0.75	2.79	0.32	3.11	2.36
	Total	9.42	15.07	24.50	55.79	3.46	59.25	34.76

		Cost			Export Parity Price					Net Benefit
		CAP EX	O&M	Total	Coal Export	Fuel Cost	VOC	Cost of Export	Export Parity Price	
1	2013	0.44		0.44						-0.44
2	2014	1.32		1.32						-1.32
3	2015	3.53		3.53						-3.53
4	2016	3.53		3.53						-3.53
5	2017		0.71	0.71	10.53	0.31	0.08	0.38	10.14	9.44
6	2018		0.71	0.71	10.53	0.31	0.08	0.38	10.14	9.44
7	2019		0.71	0.71	10.53	0.31	0.08	0.38	10.14	9.44
8	2020		0.71	0.71	10.53	0.31	0.08	0.38	10.14	9.44
9	2021		0.71	0.71	10.53	0.31	0.08	0.38	10.14	9.44
10	2022		0.71	0.71	10.53	0.31	0.08	0.38	10.14	9.44
11	2023		0.71	0.71	10.53	0.31	0.08	0.38	10.14	9.44
12	2024		0.71	0.71	10.53	0.31	0.08	0.38	10.14	9.44
13	2025		0.71	0.71	10.53	0.31	0.08	0.38	10.14	9.44
⋮	⋮		⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮
22	2033		0.71	0.71	10.53	0.31	0.08	0.38	10.14	9.44
23	2034		0.71	0.71	10.53	0.31	0.08	0.38	10.14	9.44
24	2035		0.71	0.71	10.53	0.31	0.08	0.38	10.14	9.44
	Total	8.83	14.12	22.95	210.56	6.11	1.56	7.68	202.88	179.94

(Source: Study team)

[Table 7-3-8] Summary FIRR and EIRR Cash-flow Tables for the 2nd Stage

(Unit: JP¥ billion)

		Cost			Benefit			Net Benefit
		CAP EX	O&M	Total	Freigt	Passenger	Total	
1	2013	0.47		0.47				-0.47
2	2014	1.42		1.42				-1.42
3	2015	3.78		3.78				-3.78
4	2016	4.39		4.39				-4.39
5	2017	5.52		5.52				-5.52
6	2018	6.13		6.13				-6.13
7	2019		1.74	1.74	5.58	0.05	5.63	3.90
8	2020		1.74	1.74	5.58	0.07	5.65	3.91
9	2021		1.74	1.74	5.58	0.09	5.67	3.93
10	2022		1.74	1.74	5.58	0.10	5.68	3.94
11	2023		1.74	1.74	5.58	0.12	5.70	3.96
12	2024		1.74	1.74	5.58	0.13	5.71	3.98
13	2025		1.74	1.74	5.58	0.15	5.73	3.99
⋮	⋮		⋮	⋮	⋮	⋮	⋮	⋮
24	2035		1.74	1.74	5.58	0.29	5.87	4.13
25	2036		1.74	1.74	5.58	0.31	5.88	4.15
26	2037		1.74	1.74	5.58	0.32	5.90	4.16
	Total	21.71	31.26	31.26	100.43	3.46	103.84	50.87

		Cost			Export Parity Price					Net Benefit
		CAP EX	O&M	Total	Coal Export	Fuel Cost	VOC	Cost of Export	Export Parity Price	
1	2013	0.44		0.44						-0.44
2	2014	1.32		1.32						-1.32
3	2015	3.51		3.53						-3.51
4	2016	4.08		3.53						-4.08
5	2017	5.13		0.71						-5.13
6	2018	5.70		0.71						-5.70
7	2019		1.61	0.71	21.73	0.63	0.16	0.79	20.94	19.32
8	2020		1.61	0.71	21.73	0.63	0.16	0.79	20.94	19.32
9	2021		1.61	0.71	21.73	0.63	0.16	0.79	20.94	19.32
10	2022		1.61	0.71	21.73	0.63	0.16	0.79	20.94	19.32
11	2023		1.61	0.71	21.73	0.63	0.16	0.79	20.94	19.32
12	2024		1.61	0.71	21.73	0.63	0.16	0.79	20.94	19.32
13	2025		1.61	0.71	21.73	0.63	0.16	0.79	20.94	19.32
⋮	⋮		⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮
22	2033		1.61	0.71	21.73	0.63	0.16	0.79	20.94	19.32
23	2034		1.61	0.71	21.73	0.63	0.16	0.79	20.94	19.32
24	2035		1.61	0.71	21.73	0.63	0.16	0.79	20.94	19.32
	Total	20.18	29.06	49.24	391.10	11.36	2.91	14.26	376.84	377.60

(Source: Study team)

[Table 7-3-9] Summary FIRR and EIRR Cash-flow Tables for the 3rd Stage

(Unit: JP¥ billion)

		Cost			Benefit			Net Benefit
		CAP EX	O&M	Total	Freigt	Passenger	Total	
1	2013	0.47		0.47				-0.47
2	2014	1.42		1.42				-4.42
3	2015	3.78		3.78				-3.78
4	2016	4.40		4.40				-4.40
5	2017	5.52		5.52				-5.52
6	2018	8.61		8.61				-8.61
7	2019	9.41		9.41				-9.41
8	2020	11.89		11.89				-11.89
9	2021	6.94		6.94				-6.94
10	2022	18.83		18.83				-18.83
11	2023		5.70	5.70	22.32	0.12	22.44	16.73
12	2024		5.70	5.70	22.32	0.13	22.45	16.75
13	2025		5.70	5.70	22.32	0.15	22.47	16.77
⋮	⋮		⋮	⋮	⋮	⋮	⋮	⋮
24	2035		5.70	5.70	22.32	0.29	22.61	16.91
25	2036		5.70	5.70	22.32	0.31	22.62	16.92
26	2037		5.70	5.70	22.32	0.32	22.64	16.94
	Total	71.27	114.03	185.30	446.36	5.11	451.47	266.17

		Cost			Export Parity Price					Net Benefit
		CAP EX	O&M	Total	Coal Export	Fuel Cost	VOC	Cost of Export	Export Parity Price	
1	2013	0.43		0.43						-0.43
2	2014	1.30		0.30						-1.30
3	2015	3.45		3.45						-3.45
4	2016	4.01		4.01						-4.01
5	2017	5.04		5.04						-5.04
6	2018	7.86		7.86						-7.86
7	2019	8.60		8.60						-8.60
8	2020	10.86		10.86						-10.86
9	2021	6.33		6.33						-6.33
10	2022	17.19		17.19						-17.19
11	2023		5.21	5.21	88.93	2.58	0.66	3.24	85.69	80.48
12	2024		5.21	5.21	88.93	2.58	0.66	3.24	85.69	80.48
13	2025		5.21	5.21	88.93	2.58	0.66	3.24	85.69	80.48
⋮	⋮		⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮
22	2033		5.21	5.21	88.93	2.58	0.66	3.24	85.69	80.48
23	2034		5.21	5.21	88.93	2.58	0.66	3.24	85.69	80.48
24	2035		5.21	5.21	88.93	2.58	0.66	3.24	85.69	80.48
	Total	65.08	104.14	169.22	1,778.6	51.64	13.21	64.85	1,713.7	1,544.5

(Source: Study team)

7.4. PPP Financial Modeling and Analysis

7.4.1. Analytical Framework and Model Configuration

Special Purpose Company (SPC) is to be set up by the private sector equity investment and borrowing, and to operate rolling-stock leasing business and railway infrastructure development, with PT. KAI as a sole client. This section deals with financial analysis of SPC to measure profitability of investors and debt sustainability of SPC in the framework of *Project Finance*, while applying Equity Internal Rate of Return (Equity IRR) and Debt Service Coverage Ratio (DSCR) as indices. Sensitivity analysis will immediately follow to measure adverse impacts of local currency devaluation against hard currencies and cost increase. Further, financial advantage of lease contract with SPC over self-financing (private sector borrowing) by PT. KAI will be studied, while keeping high enough return for SPC investor. In addition, plausible share of public sector involvement (JICA's yen loan as back-finance) to SPC (sources of finance to afloat equity IRR above the cut-off line will numerically be studied.

Financial cost of each of the implementation stages is given in [Table 7-1-7] (P. 7-4), [Table 7-1-8] (P. 7-4) and [Table 7-1-9] (P. 7-5). As financing plan, 30% of equity and 70% of borrowing are presumably to emanate from the private sector and JICA private sector investment finance (PSIF). Sources of sales for SPC include ①leasing business of rolling-stocks, and ②deferred payment accrued to infrastructure investment. Model configuration with analytical variables and parameters are summarized below in［Table 7-4-1]. Meanwhile, lease rate is presumably set at 1.1% per month (annually 13.2%) while taking into view the Weighed Average Cost of Capital (WACC) of 7.75%, (= 20%×3/10 + 2.5%×7/10） plus exchange risk premium.

[Table 7-4-1] Model Configuration

	PPP Financial Analysis	The 1st Stage	The 2nd Stage	The 3rd Stage
1	Debt-Equity Ratio	70/30	70/30	70/30
2	JICA Private Sector Investment Finance (PSIF) Interest rate	2.5	2.5	2.5
3	Repayment Period (of which Grace Period)	20 (5)	20 (5)	20 (5)
4	Lease Rate (%, Locomotives/freight wagon/rolling-stock)	1.6	1.6	1.6
5	Amortization Method of JICA financing	EPP	EPP	EPP
6	PSIF Handling Charge (%)	0.3	0.3	0.3
7	Monthly infrastructure development installment payment rate (%)	1.1	1.1	1.1
8	Leasing Rate (%, month)	1.1	1.1	1.1
9	Administration cost (SPC, JP¥ billion p.a)	0.8	0.8	0.8
10	Corporate Tax (%)	25	25	25
11	Retaining to Debt Service Reserve Fund (month)	3	3	3
	PT. KAI comparative study of Lease and Borrowing	The 1st Stage	The 2nd Stage	The 3rd Stage
12	Repayment Period (year)	10	10	10
13	Interest rate (%)	10.0	10.0	10.0
14	Amortization Method	EPI	EPI	EPI
15	Down payment of Lease Contract (1st year, % of the total)	5.0	5.0	5.0
	Feasibility Indices	The 1st Stage	The 2nd Stage	The 3rd Stage
16	Foreign Exchange % Equity IRR (local currency)	15 (20)	15 (20)	15 (20)
17	Minimum Debt Service Coverage Ratio (DSCR)	1.2	1.2	1.2

Note: EPP=Equal principal payment

EPI=Equal principal and interest

(Source: Study team)

(1) Equity FIRR Cut-off Rate

Equity IRR cut-off rate is presumably set at Rupia-denominated 20% that is 5% of foreign exchange risk (devaluation) plus 15.0% hard currency-denominated return and other risk premium. This assumptive rate in Rupiah is nearly equivalent to the World Bank estimate of the cost of equity that stands at 15.4% (WB PPIAF[14], 2009).

[14] The World Bank, *Toolkit for Public-Private Partnerships in Roads and Highways*, Public-Private Infrastructure Advisory Facility PPIAF), March 2009

World Bank formula (the Capital Asset Pricing Model) for the estimation of the cost of equity
Cost of equity (C_e) = R_f + β × (GMP + CMP) Where C_f: required return on equity R_f : Risk-free return that is equivalent to the Central Bank 6-12 month obligation (BI reference rate of 6.75%) β: market risk sensitivity (0.78 for Indonesia) GMR: Global market Premium of 5.5% CRP: Country Risk Premium of 7.5% for middle-income countries inclusive of Indonesia[15]

(2) Numerical Definition of PPP-financial Modeling Indices

Numerical expression of Equity IRR and debt service coverage ratio (DSCR) are given in the following.

Calculation formula for Equity FIRR, ADSCR and LLCR
Equity FIRR: ≡ $\sum_{\mathrm{i=1}}^{\text{end of the concession}} \frac{(\text{Equity injected - dividends})}{(1+ROE)^i} = 0$ $ADSCR_n = \frac{(CAFDS)_n}{\sum_{i=1}^{3} DebtServi\boldsymbol{e},n}$

7.4.2. Results of Analysis

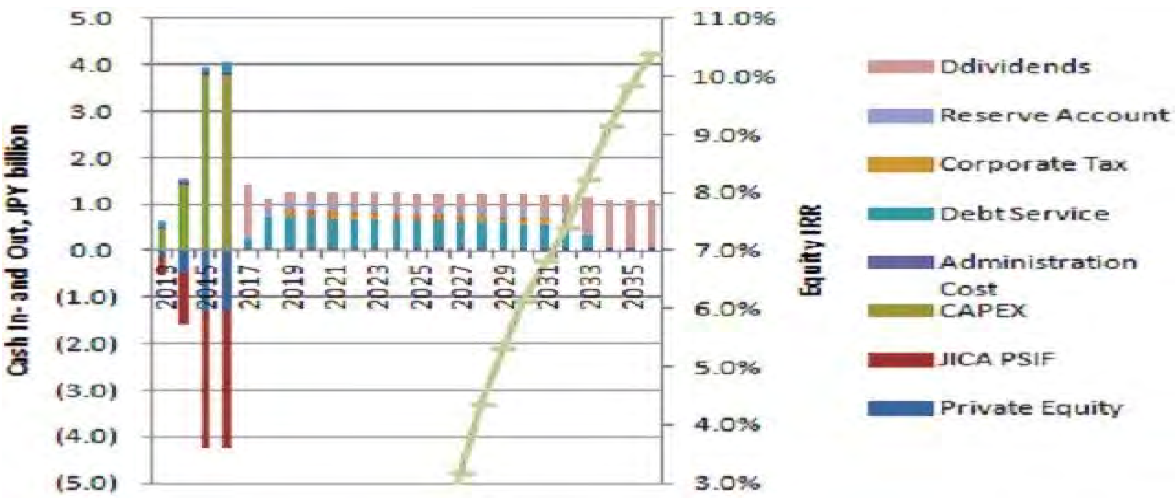
All of the implementation stages indicated high enough debt sustainability lying above cut-off rate of 1.2, whereas insufficient investor's profitability being posted with Equity IRR below the cut-off rate as it is shown in [Table 7-4-2]. Cash-flows of the 1st, the 2nd, and the 3rd are depicted and given in [Fig.7-4-1] through [Fig.7-4-3] and [Table 7-4-3].through [Table 7-4-5], in that order.

[15] WB, *Ibid.*,pp.15-17

[Table 7-4-2] Analytical Parameters and Results

Case	The 1st Stage	The 2nd Stage	The 3rd Stage
IRR Cost (JP¥ bill)[16]	9.42	21.77	70.75
Procurement/construction (year)	4	6	10
Annual sales (JP¥ bill)	1.41	3.46	13.24
Lease rate (%/month)	1.1	1.1	1.1
Benefit Generation (year)	20	20	20
Equity FIRR	10.4	10.1	6.4
Minimum DSCR (%)	1.6	1.7	1.8

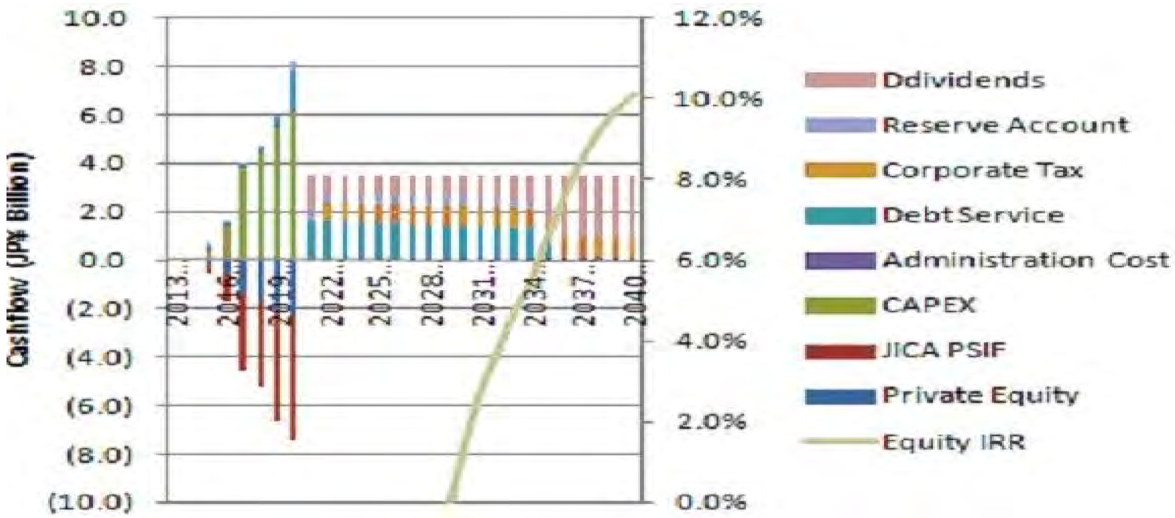
(Source: Study team)



(Source: Study team)

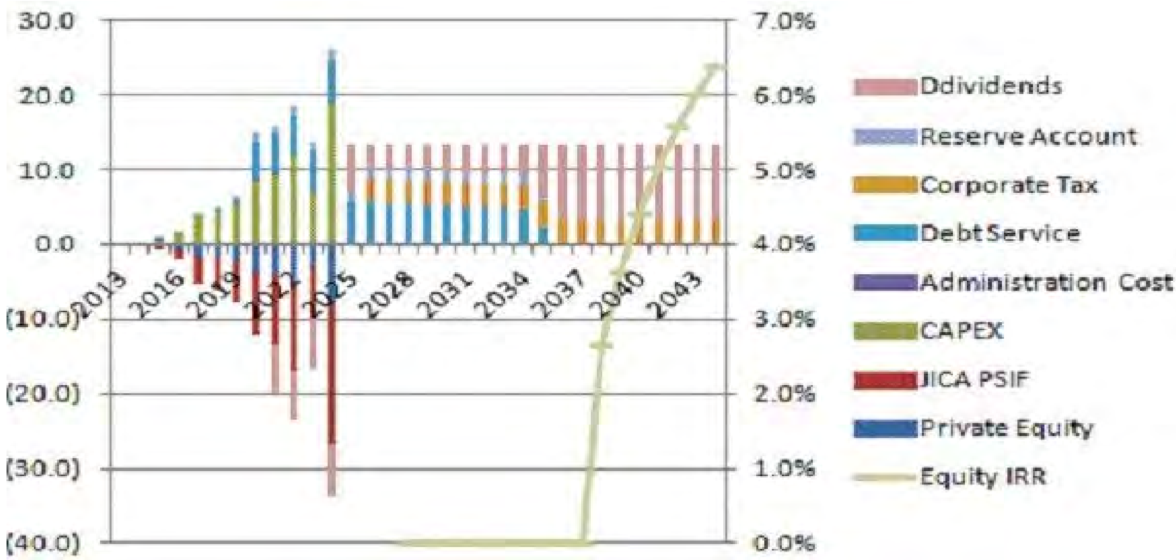
[Fig. 7-4-1] Cash Transaction and Equity FIRR for the 1st Stage

16 Costs excluding price contingency from aggregate financial cost



(Source: Study team)

[Fig. 7-4-2] Cash Transaction and Equity FIRR for the 2nd Stage



(Source: Study team)

[Fig. 7-4-3] Cash Transaction and Equity FIRR for the 3rd Stage

[Table 7-4-3] Summary Cash Flow Table for the 1st Stage

	Sales (Lease)	Sales (Infra)	Administration Cost	Interest Payment	PSIF Handling Charge	Current Profit	Corporate Tax	Earnings After Tax	Cash for Debt Service	Debt Service	DSRA Retained	Dividend
2013												
2014												
2015			0.05	0.007	0.022	-0.08		-0.08	-0.05	0.05	0.01	
2016			0.08	0.030		-0.11		-0.11	-0.08	0.03	0.01	
2017			0.08	0.093		-0.17		-0.17	-0.08	0.09	0.02	
2018			0.08	0.168		-0.24		-0.24	-0.08	0.17	0.04	
2019	0.64	0.76	0.08	0.186		1.14		1.14	1.33	0.19	0.05	1.10
2020	0.64	0.76	0.08	0.177		1.15	0.29	0.87	1.04	0.66	0.16	0.22
2021	0.64	0.76	0.08	0.165		1.17	0.29	0.87	1.04	0.65	0.16	0.23
2022	0.64	0.76	0.08	0.153		1.18	0.29	0.88	1.04	0.63	0.16	0.24
2023	0.64	0.76	0.08	0.141		1.19	0.30	0.89	1.03	0.62	0.16	0.26
2024	0.64	0.76	0.08	0.129		1.20	0.30	0.90	1.03	0.61	0.15	0.27
2025	0.64	0.76	0.08	0.117		1.21	0.30	0.91	1.03	0.60	0.15	0.28
2026	0.64	0.76	0.08	0.105		1.23	0.31	0.92	1.02	0.59	0.15	0.29
2027	0.64	0.76	0.08	0.093		1.24	0.31	0.93	1.02	0.57	0.14	0.30
2028	0.64	0.76	0.08	0.081		1.25	0.31	0.94	1.02	0.56	0.14	0.32
2029	0.64	0.76	0.08	0.069		1.26	0.32	0.95	1.02	0.55	0.14	0.33
2030	0.64	0.76	0.08	0.057		1.27	0.32	0.96	1.01	0.54	0.13	0.34
2031	0.64	0.76	0.08	0.045		1.29	0.32	0.96	1.01	0.53	0.13	0.35
2032	0.64	0.76	0.08	0.033		1.30	0.32	0.97	1.01	0.51	0.13	0.36
2033	0.64	0.76	0.08	0.021		1.31	0.33	0.98	1.00	0.50	0.13	0.38
2034	0.64	0.76	0.08	0.009		1.32	0.33	0.99	1.00	0.49	0.12	0.39
2035	0.64	0.76	0.08	0.000		1.33	0.33	1.00	1.00	0.24	0.06	0.70
2036	0.64	0.76	0.08			1.33	0.33	1.00	1.00			1.00
2037	0.64	0.76	0.08			1.33	0.33	1.00	1.00			1.00
2038	0.64	0.76	0.08			1.33	0.33	1.00	1.00			1.00

(Source: Study team)

[Table 7-4-4] Summary Cash Flow Table for the 2nd Stage

	Sales (Lease)	Sales (Infra)	Administration Cost	Interest Payment	PSIF Handling Charge	Current Profit	Corporate Tax	Earnings After Tax	Cash for Debt Service	Debt Service	DSRA Retained	Dividend
2013												
2014												
2015			0.05	0.007	0.055	-0.11		-0.11	-0.05	0.12	0.03	
2016			0.08	0.032		-0.11		-0.11	-0.08	0.03	0.01	
2017			0.08	0.100		-0.17		-0.17	-0.08	0.10	0.02	
2018			0.08	0.189		-0.26		-0.26	-0.08	0.19	0.05	
2019			0.08	0.300		-0.37		-0.37	-0.08	0.30	0.07	
2020			0.08	0.404		-0.48		-0.48	-0.08	1.59	0.40	
2021	0.93	2.52	0.08	0.406		2.97		2.97	3.38	1.59	0.40	1.40
2022	0.93	2.52	0.08	0.377		3.00	0.75	2.25	2.63	1.56	0.39	0.68
2023	0.93	2.52	0.08	0.347		3.03	0.76	2.28	2.62	1.53	0.38	0.71
2024	0.93	2.52	0.08	0.318		3.06	0.77	2.30	2.62	1.50	0.38	0.74
2025	0.93	2.52	0.08	0.288		3.09	0.77	2.32	2.61	1.47	0.37	0.77
2026	0.93	2.52	0.08	0.259		3.12	0.78	2.34	2.60	1.44	0.36	0.80
2027	0.93	2.52	0.08	0.229		3.15	0.79	2.36	2.59	1.41	0.35	0.83
2028	0.93	2.52	0.08	0.200		3.18	0.80	2.39	2.59	1.38	0.35	0.86
2029	0.93	2.52	0.08	0.170		3.21	0.80	2.41	2.58	1.35	0.34	0.89
2030	0.93	2.52	0.08	0.140		3.24	0.81	2.43	2.57	1.32	0.33	0.92
2031	0.93	2.52	0.08	0.111		3.27	0.82	2.45	2.56	1.29	0.32	0.95
2032	0.93	2.52	0.08	0.081		3.30	0.83	2.48	2.56	1.26	0.32	0.98
2033	0.93	2.52	0.08	0.052		3.33	0.83	2.50	2.55	1.23	0.31	1.01
2034	0.93	2.52	0.08	0.022		3.36	0.84	2.52	2.54	1.20	0.30	1.04
2035	0.93	2.52	0.08	0.000		3.38	0.85	2.54	2.54	0.59	0.15	1.80
2036	0.93	2.52	0.08			3.38	0.85	2.54	2.54			2.54
2037	0.93	2.52	0.08			3.38	0.85	2.54	2.54			2.54
2038	0.93	2.52	0.08			3.38	0.85	2.54	2.54			2.54
2039	0.93	2.52	0.08			3.38	0.85	2.54	2.54			2.54
2040	0.93	2.52	0.08			3.38	0.85	2.54	2.54			2.54

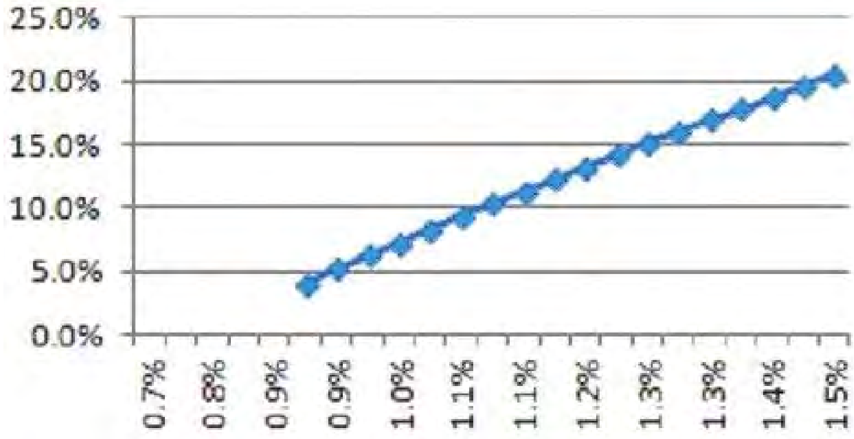
(Source: Study team)

[Table 7-4-5] Summary Cash Flow Table for the 3rd Stage

	Sales (Lease)	Sales (Infra)	Administration Cost	Interest Payment	PSIF Handling Charge	Current Profit	Corporate Tax	Earnings After Tax	Cash for Debt Service	Debt Service	DSRA Retained	Dividend
2013												
2014												
2015			0.05	0.009	0.211	-0.27		-0.27	-0.05	0.43	0.11	
2016			0.08	0.038		-0.11		-0.11	-0.08	0.04	0.01	
2017			0.08	0.116		-0.19		-0.19	-0.08	0.12	0.03	
2018			0.08	0.221		-0.30		-0.30	-0.08	0.22	0.06	
2019			0.08	0.350		-0.42		-0.42	-0.08	0.35	0.09	
2020			0.08	0.458		-0.53		-0.53	-0.08	4.99	1.25	
2021			0.08	0.572		-0.65		-0.65	-0.08	5.10	1.28	-6.45
2022			0.08	0.736		-0.81		-0.81	-0.08	5.26	1.32	-6.66
2023			0.08	0.824		-0.90		-0.90	-0.08	5.35	1.34	-6.77
2024			0.08	1.101		-1.18		-1.18	-0.08	5.63	1.41	-7.11
2025	2.35	10.88	0.08	1.104		12.06		12.06	13.16	5.63	1.41	6.12
2026	2.35	10.88	0.08	0.991		12.17	3.04	9.13	10.12	5.52	1.38	3.22
2027	2.35	10.88	0.08	0.877		12.28	3.07	9.21	10.09	5.41	1.35	3.33
2028	2.35	10.88	0.08	0.764		12.40	3.10	9.30	10.06	5.29	1.32	3.45
2029	2.35	10.88	0.08	0.651		12.51	3.13	9.38	10.03	5.18	1.29	3.56
2030	2.35	10.88	0.08	0.538		12.62	3.16	9.47	10.01	5.07	1.27	3.67
2031	2.35	10.88	0.08	0.425		12.74	3.18	9.55	9.98	4.95	1.24	3.79
2032	2.35	10.88	0.08	0.311		12.85	3.21	9.64	9.95	4.84	1.21	3.90
2033	2.35	10.88	0.08	0.198		12.96	3.24	9.72	9.92	4.73	1.18	4.01
2034	2.35	10.88	0.08	0.085		13.08	3.27	9.81	9.89	4.61	1.15	4.13
2035	2.35	10.88	0.08	0.000		13.16	3.29	9.87	9.87	2.26	0.57	7.04
2036	2.35	10.88	0.08			13.16	3.29	9.87	9.87			9.87
2037	2.35	10.88	0.08			13.16	3.29	9.87	9.87			9.87
2038	2.35	10.88	0.08			13.16	3.29	9.87	9.87			9.87
2039	2.35	10.88	0.08			13.16	3.29	9.87	9.87			9.87
2040	2.35	10.88	0.08			13.16	3.29	9.87	9.87			9.87
2041	2.35	10.88	0.08			13.16	3.29	9.87	9.87			9.87
2042	2.35	10.88	0.08			13.16	3.29	9.87	9.87			9.87
2043	2.35	10.88	0.08			13.16	3.29	9.87	9.87			9.87
2044	2.35	10.88	0.08			13.16	3.29	9.87	9.87			9.87

(Source: Study team)

Provided that the rates of lease and infrastructure deferred payment shift upward to keep financial profitability of investors above the stated cut-off rates of 15% (hard currencies) and 20% (local currency), it worked out that 1.27%/month (15.2% p.a.) and 1.45% (17.4% p.a.) of the concerned rates (lease and infrastructure development-associated revenue rates) would raise Equity IRR to the target rates of 15% and 20% arising from current 10.4%. Corresponding relationship between the revenue rate of lease and infrastructure development and Equity IRR is depicted below in [Fig. 7-4-4].

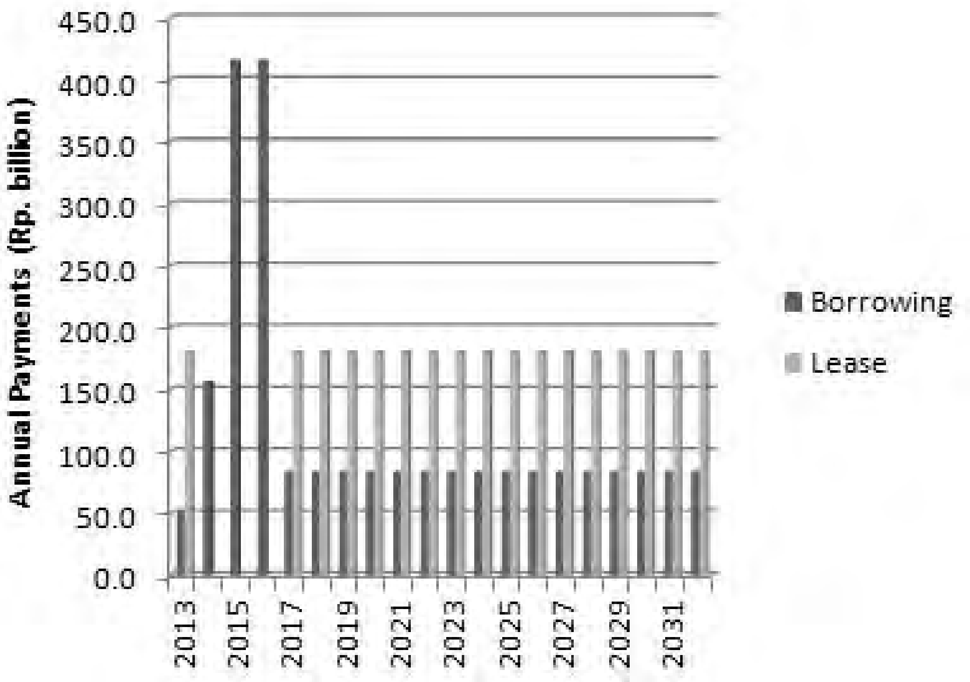


(Source: Study team)

[Fig. 7-4-4] Lease and Infrastructure Development Revenue Rate and Equity IRR for the 1st Stage

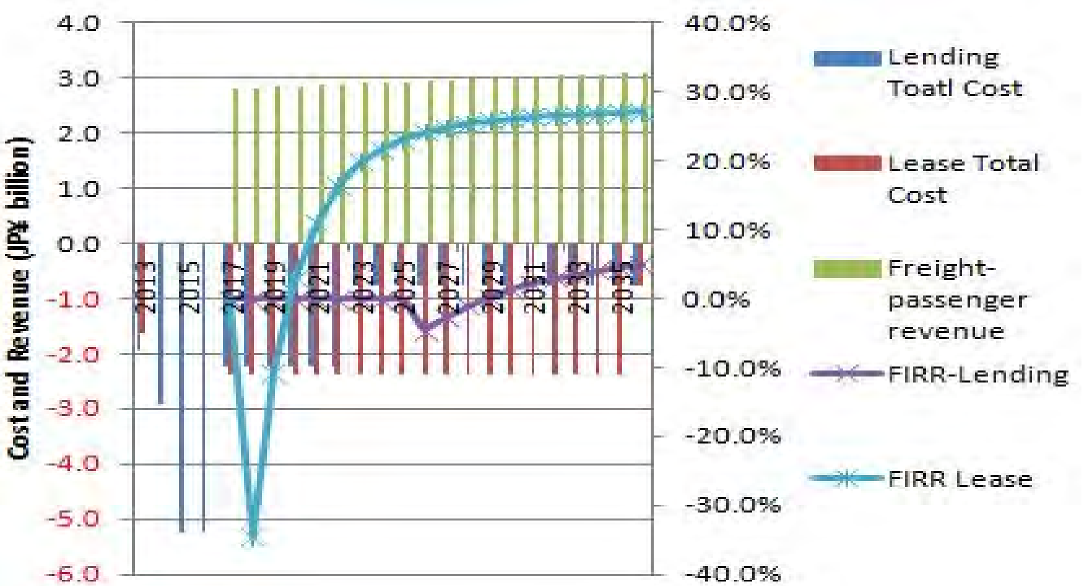
Sequentially, should the rates of lease and infrastructure development be set at 1.45% per month in order to secure investment feasibility high enough for the private sector entities, which financial tool of leasing contract with SPC and borrowing from the private sector banks would be advantageous for PT. KAI? In this light, another time-discount cash-flow analysis took place for the 1st Stage to numerically delineate superiority of leasing contract with SPC even with the said lease rate.

Against the cost of JP¥ 9.42 billion (excluding price contingency for IRR estimation purpose) the aggregate expenses for PT. KAI over the 24-year-project life period for lease and borrowing are respective of JP¥ 10.25 billion and JP¥ 11.38 billion on a 2012 year present value basis (discount rate of 10.0% as per the bank loan interest rate), 10.1% less burden by leasing contract. Likewise financial internal rate of return (FIRR) turned out to be 27.2% and 5.0% respectively indicating financial advantage of lease contract for PT. KAI. Comparative superiority of lease contract in the light of financial position is depicted by annual amortization schedules and cash-flow-associated FIRR curves in [Fig. 7-4-5] and [Fig. 7-4-6] below.



(Source: Study team)

[Fig. 7-4-5] Amortization Schedules for PT. KAI by Financing Tool for the 1st Stage



(Source: Study team)

[Fig. 7-4-6] Cash Transactions and FIRRs by Financing Tool for the 1st Stage

While Equity IRR does not reach high enough to financially viable point in the case of the profit rate of 1.1% per month, there would be some measures to raise the profitability for the private sector investors. One of these includes the case of higher lease and infrastructure deferred payment rates, and the other decreasing the amount of equity investment. As regards the 1st Stage, around 40% of downsizing of equity participation make Equity IRR high enough to 19.6%. Other private sector funds to equity would do to the prospective equity return in SPC operation. Besides, a modified equity-debt ratio would be considered in this connection. Simulation model of Equity IRR fluctuation against lower cost for SPC and foreign exchange risk (local currency devaluation) is given in [Table 7-4-6] below.

Note that devaluation of local currency against hard currencies has an inverse impact on foreign cost portion of the project and debt services. For instance, 19.6% of Equity IRR will downsized to 14.6% due to the Indonesia Rupee devaluation by 15%. Alternatively saying, foreign exchange risk would be hedged up to 15% percent of devaluation.

[Table 7-4-6] Simultaneous Two-variable Simulation Model for the 1st Stage

		Foreign Exchange Risk											
Cost variation Risk	**10.4%**	150.0%	145.0%	140.0%	135.0%	130.0%	125.0%	120.0%	115.0%	110.0%	105.0%	**100.0%**	95.0%
	45%	8.7%	10.3%	11.8%	13.4%	15.0%	16.5%	18.1%	19.6%	21.2%	22.7%	**24.2%**	25.8%
	50%	6.7%	8.2%	9.8%	11.4%	13.0%	14.6%	16.2%	17.8%	19.4%	21.0%	**22.6%**	24.2%
	55%	4.8%	6.4%	8.0%	9.6%	11.2%	12.9%	14.5%	16.2%	17.8%	19.4%	**21.0%**	22.7%
	60%	3.1%	4.7%	6.3%	7.9%	9.6%	11.2%	12.9%	14.6%	16.3%	17.9%	**19.6%**	21.2%
	65%	1.6%	3.1%	4.7%	6.4%	8.0%	9.7%	11.4%	13.1%	14.8%	16.5%	**18.2%**	19.9%
	70%	N.A.	1.7%	3.3%	4.9%	6.6%	8.3%	10.0%	11.7%	13.4%	15.2%	**16.9%**	18.6%
	75%	N.A.	N.A.	1.9%	3.6%	5.2%	6.9%	8.7%	10.4%	12.2%	13.9%	**15.7%**	17.4%
	80%	N.A.	N.A.	N.A.	2.3%	4.0%	5.7%	7.4%	9.2%	10.9%	12.7%	**14.5%**	16.3%
	85%	N.A.	N.A.	N.A.	1.1%	2.8%	4.5%	6.2%	8.0%	9.8%	11.6%	**13.4%**	15.2%
	90%	N.A.	N.A.	N.A.	N.A.	1.7%	3.4%	5.1%	6.9%	8.7%	10.5%	**12.3%**	14.2%
	95%	N.A.	N.A.	N.A.	N.A.	N.A.	2.3%	4.1%	5.9%	7.7%	9.5%	**11.3%**	13.2%
	100%	N.A.	N.A.	N.A.	N.A.	N.A.	**1.3%**	**3.1%**	**4.9%**	**6.7%**	**8.5%**	**10.4%**	**12.3%**
	105%	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	2.1%	3.9%	5.7%	7.6%	**9.5%**	11.4%
	110%	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	1.2%	3.0%	4.8%	6.7%	**8.6%**	10.5%

(Source: Study team)

Likewise the portion of public fund involvement in the cases of the 2nd and the 3rd Stages are respective of 45% and 57%, while retaining Equity IRR at 20%. Following tables of [Table 7-4-7] and [Table 7-4-8] indicate the simulation results.

[Table 7-4-7] Simultaneous Two-variable Simulation Model for the 2nd Stage

PSIF Portion (Cost variation)	**Foreign Exchange Risk**											
10.1%	150.0%	145.0%	140.0%	135.0%	130.0%	125.0%	120.0%	115.0%	110.0%	105.0%	**100.0%**	95.0%
45%	18.2%	18.8%	19.3%	19.9%	20.5%	21.1%	21.8%	22.4%	23.1%	23.8%	**24.5%**	25.3%
50%	16.5%	17.0%	17.6%	18.1%	18.7%	19.3%	20.0%	20.6%	21.3%	22.0%	**22.7%**	23.4%
55%	14.9%	15.4%	15.9%	16.5%	17.1%	17.7%	18.3%	19.0%	19.6%	20.3%	**21.0%**	21.7%
60%	13.4%	13.9%	14.4%	15.0%	15.6%	16.2%	16.8%	17.4%	18.1%	18.8%	**19.5%**	20.2%
65%	12.0%	12.5%	13.1%	13.6%	14.2%	14.8%	15.4%	16.0%	16.6%	17.3%	**18.0%**	18.7%
70%	10.7%	11.2%	11.8%	12.3%	12.9%	13.5%	14.0%	14.7%	15.3%	16.0%	**16.6%**	17.4%
75%	9.6%	10.1%	10.6%	11.1%	11.7%	12.2%	12.8%	13.4%	14.1%	14.7%	**15.4%**	16.1%
80%	8.4%	8.9%	9.5%	10.0%	10.5%	11.1%	11.7%	12.3%	12.9%	13.5%	**14.2%**	14.9%
85%	7.4%	7.9%	8.4%	8.9%	9.5%	10.0%	10.6%	11.2%	11.8%	12.4%	**13.1%**	13.8%
90%	6.5%	6.9%	7.4%	7.9%	8.5%	9.0%	9.6%	10.2%	10.8%	11.4%	**12.0%**	12.7%
95%	5.5%	6.0%	6.5%	7.0%	7.5%	8.1%	8.6%	9.2%	9.8%	10.4%	**11.1%**	11.7%
100%	**4.7%**	**5.1%**	**5.6%**	**6.1%**	**6.6%**	**7.2%**	**7.7%**	**8.3%**	**8.9%**	**9.5%**	**10.1%**	**10.8%**
105%	3.9%	4.3%	4.8%	5.3%	5.8%	6.3%	6.9%	7.4%	8.0%	8.6%	**9.2%**	9.9%

(Source: Study team)

[Table 7-4-8] Simultaneous Two-variable Simulation Model for the 3rd Stage

PSIF Portion (Cost variation)	**Foreign Exchange Risk**											
6.4%	150.0%	145.0%	140.0%	135.0%	130.0%	125.0%	120.0%	115.0%	110.0%	105.0%	100.0%	110.0%
43%	16.6%	16.9%	17.2%	17.6%	17.9%	18.3%	18.6%	19.0%	19.4%	19.8%	**20.2%**	20.6%
48%	14.6%	14.9%	15.2%	15.6%	15.9%	16.2%	16.6%	17.0%	17.3%	17.7%	**18.1%**	18.5%
53%	12.9%	13.2%	13.5%	13.8%	14.2%	14.5%	14.8%	15.2%	15.5%	15.9%	**16.3%**	16.7%
58%	11.4%	11.7%	12.0%	12.3%	12.6%	13.0%	13.3%	13.6%	14.0%	14.3%	**14.7%**	15.1%
64%	10.1%	10.4%	10.7%	11.0%	11.3%	11.6%	11.9%	12.2%	12.6%	12.9%	**13.3%**	13.6%
69%	8.9%	9.2%	9.5%	9.8%	10.1%	10.4%	10.7%	11.0%	11.3%	11.7%	**12.0%**	12.4%
74%	7.9%	8.1%	8.4%	8.7%	9.0%	9.3%	9.6%	9.9%	10.2%	10.5%	**10.9%**	11.2%
79%	6.9%	7.1%	7.4%	7.7%	8.0%	8.3%	8.5%	8.9%	9.2%	9.5%	**9.8%**	10.1%
84%	6.0%	6.2%	6.5%	6.8%	7.0%	7.3%	7.6%	7.9%	8.2%	8.5%	**8.9%**	9.2%
90%	5.2%	5.4%	5.7%	5.9%	6.2%	6.5%	6.8%	7.1%	7.4%	7.7%	**8.0%**	8.3%
95%	4.4%	4.6%	4.9%	5.2%	5.4%	5.7%	6.0%	6.3%	6.5%	6.8%	**7.2%**	7.5%
100%	**3.7%**	**3.9%**	**4.2%**	**4.4%**	**4.7%**	**5.0%**	**5.2%**	**5.5%**	**5.8%**	**6.1%**	**6.4%**	**6.7%**

(Source: Study team)

Chapter 8

Security Package

8.1. Scheme of Contracts and Guarantees

As mentioned in Chapter 2, the feasibility study of this project will be conducted in 3 stages as follows.

(1) The 1st Stage

In order to achieve the capacity expansion of 2.5MTPA, SPC will do rehabilitation of existing non-electrified line, procure locomotives, wagons and loading/ unloading facilities, and lease them to PT. KAI. However, while PT. KAI will possess rolling-stocks although SPC will still have ownership of rolling-stocks, the improved track will be transferred to Indonesian government. As for the financing, SPC will acquire ODA private sector finance (PSIF loan) for the 70% of total project costs by JICA. Also, SPC will receive investment for 30% of total project costs from investors. It is assumed that potential investors are companies such as Japanese trading houses that have knowledge on investment and infrastructure.

- Private companies in Japan and Indonesia will form a SPC.
- SPC will enter into loan agreement for 20 years, including 4 years of procurement and construction period, with PT. KAI. Through this contract, targeted transportation capacity increase is 2.5MTPA.
- Under the contracts, SPC will purchase rolling-stock and perform track upgrading work.
- SPC will lease the rolling-stocks to PT. KAI and operation & maintenance of rolling-stocks will be done by PT. KAI.
- The truck improved by SPC will be transferred to DGR.
- Normally PT. KAI pays Track Access Charge (TAC) to DGR in case its rolling-stocks are running on the right-of-way owned by DGR. However, since its rolling-stocks are running on the right-of-way rehabilitated by SPC in this case, it is assumed that TAC will be exempted by DGR.
- JICA ODA private sector finance will be explored.

As described in figure in this chapter, it is preferable that this scheme to be proceeded under the PPP scheme. In other words, this scheme needs mutual cooperation among SPC, PT. KAI and Indonesian government to enhance railway transportation capacity. In addition, it is expected that this project to be implemented under private initiative with Indonesian and Japanese governmental support to enhance economic growth in this area and Indonesia as a whole.

Japanese governmental support to this project means mainly giving a loan as JICA’s PSIF and ODA loan which have good conditions such as competitive loan conditions (low interest rates and long tenor) and this support makes this project feasible. Also, in order to apply for JICA ODA private sector finance, we have to consider the financial scheme, that is, JICA will give loans to

SPC directly or JICA will give loans to SPC via local banks.

(2) The 2nd Stage and the 3rd Stage

In order to achieve the capacity expansion of 5.0MTPA and 20.0MTPA, Indonesian government or PT. KAI will do construction work for double trucking, partially or completely. As for the financing to construct new line, Indonesian government or PT. KAI will acquire ODA loan by JICA, directly or via local bank (two step loan). On the other hand, SPC will procure locomotives, wagons and loading/unloading facilities, lease them to PT. KAI and O&M will be done by PT. KAI. Here, in case the TSL lending scheme is applied, due attention should be paid to on-lending risk such as no appropriation of national budget (APBN[1]) and slow administrative process for on-lending arrangement, in addition to procedural capability of PT. KAI on the financial arrangement.

In addition to the 1st Stage, the outline of each stage to enhance transportation capacity up to 5.0MTPA and 20.0MTPA is as follows.

- SPC established in the 1st Stage will newly enter into additional lease contract with PT. KAI.
- Under the contract, SPC will purchase additional rolling-stocks and lease them to PT. KAI.
- Operation & maintenance of rolling-stocks and track will be done by PT. KAI.
- PT. KAI or DGR will perform double-tracking work by borrowing loans from JICA or other banks. After completion of this work, the assets will be transferred to DGR.
- Normally SPC pay Track Access Charge (TAC) to DGR in case its rolling-stocks are running on the right-of-way owned by DGR. However, since its rolling-stocks are running on the right-of-way rehabilitated by SPC in this case, it is assumed that TAC will be exempted by DGR.

In order to achieve capacity expansion up to 5.0MTPA and 20.0MTPA, it is required to conduct double-tracking work partially and fully. In any case, PT. KAI or DGR will be given JICA ODA loan for developing infrastructure because the costs are too high. On the other hand, SPC will procure rolling-stocks and loading/unloading facilities and lease them to PT. KAI at the 2nd Stage and the 3rd Stage as well as at the 1st Stage. In addition, O&M will be done by PT. KAI which has enough knowledge and experience of operation in this area. Although it takes a lot of times to start this project if PT. KAI or DGR are given JICA ODA loan, this scheme can be considered as good solution to ensure medium to long-term economic growth.

The basic conditions to give JICA ODA loan to Indonesia are that loan tenor is 25years (including 7years of grace period) and interest rate is 1.4%. Meanwhile, PT. KAI is acquiring loan in Indonesian Rupiah under the condition that tenor is 10years and its interest rate is over 10%.

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1 Anggaran Pendapatan dan Belanja Negara

Therefore, utilizing JICA ODA loan is also effective for reducing PT. KAI's burden.

8.2. Proposal for Term Sheet

8.2.1. Terms and Conditions on Transportation

(1) Lease Contract between SPC and PT. KAI

The following points must be noted in preparing the term sheet.

[Table 8-2-1] Proposal for Term Sheet between SPC and PT. KAI (Part 1)

Description	Contents
Scope of Contract	● This project is a finance lease contract between SPC and PT. KAI. ● Therefore, as for rolling-stocks, they will be booked on PT. KAI's balance sheet and PT. KAI will depreciate the assets. Also, maintenance will be done by PT. KAI. However, since SPC still have ownership of rolling-stocks during the lease period, it is needed that SPC periodically supervise PT. KAI perform their maintenance work rightly. ● As for the infrastructure, once the rehabilitation work is finished, the ownership of the assets can be transferred to DGR. Meanwhile, SPC will recover the construction cost from PT. KAI and this act is regarded as that SPC will recover the cost from DGR via PT. KAI because PT. KAI normally receive IMO from DGR as a compensation for their construction or rehabilitation work. However, in this case, SPC do not have to make any contracts with DGR directly. So, for SPC, this is just a "B to B" business with PT. KAI.
Contract Period	● It is proposed that SPC and PT. KAI will have 20 year contract, because the loan tenor of JICA private sector finance and economic life of rolling-stocks are both 20 years.

(Source: Study team)

[Table 8-2-2] Proposal for Term Sheet between SPC and PT. KAI (Part 2)

Description	Contents
Fee	● Based on the lease contract on agreed scope of work between SPC and PT. KAI, SPC will receive lease fee over 20 year contract period. It is proposed to set this lease fee, in other words lease rate, on the premises that utilizing this lease is more beneficial for PT. KAI than doing same business by their own finance. Under the condition, lease rate also should be set to reach expected equity-IRR, referring to "7.4. PPP Financial Modeling and Analysis" (P. 7-17). ● In view of attracting investors, investment currency for setting up SPC is preferred to be US dollar. In this case, the JICA PSIF as well as the leasing contract with PT. KAI should be US dollar currency contract. Since the PSIF is provided in Japanese Yen, it is necessary to swap the Yen currency to US dollar done either by JICA or SPC. Currently, the coal transportation contract between coal producer and PT. KAI is in Indonesian Rupiah currency. But, it will be more convenient for the coal producer to pay the transportation fee in US dollar, because they do not have to convert the money earned by selling the coal. In this context,the currency term should be discussed among SPC, PT. KAI and coal producer before entering into leasing contract.
Train Frequency	● It is proposed that SPC and PT. KAI will agree on the frequency of train as accurate as possible in advance. Because the development of this area must be promoted and targeted transportation capacity increase must be achieved if this project is conducted by utilizing JICA private sector finance. Also, in preparation for the delay or decrease of frequency caused by PT. KAI, it's proposed that the contract include contents for penalty. ● For example, if the demand decreases, penalty charge can be calculated based on the transportation fare of the decreased amount taking account of the reason of decrease. In case of the train schedule delay, penalty charge condition depending on the reason of delay should be agreed between parties concerned.
Liability Insurance	● SPC and PT. KAI will be required to agree on the contract in preparation for accidents caused by PT. KAI.
Others	● SPC, PT. KAI and GOI have to consider how to reflect changes of Track Access Charge (TAC), Infrastructure Maintenance Obligations (IMO), Passenger Service Obligations (PSO) in somewhere. ● In order to counter the case that PT. KAI will not be able to make the lease payment, it might be necessary to secure a surety bond in a form of transportation revenue of PT. KAI from coal producer.

(Source: Study team)

(2) Contracts between SPC and Contractors and Contracts between SPC and Suppliers of Facilities

The following points must be noted in preparing the term sheet.

[Table 8-2-3] Proposal for Term Sheet between SPC and Contractors/ Suppliers

Description	Contents
Confirmation of Eligibility	● Contractors and suppliers of facilities will be selected subject to approval by PT. KAI and/or DGR.
Scope of Contract	● In order for SPC to avoid rejection after making a contract with contractors and suppliers of facilities, the contractors and suppliers have to obtain approval about specification of their products in advance from PT. KAI and/or DGR. ● In order for SPC to avoid price escalation after making a contract with contractors and suppliers of facilities, contractors will be required to consent the content of Bill of Quantity in detail or make a contract as lump-sum turnkey basis.
Payment Condition	● As for the locomotives, wagons and loading/ unloading facilities, those procurements are subject to installment payment. For example of time of payment, advanced payment, completion of final design approval, shipping, completion of inspection, completion of defect liability period, etc. ● As for the construction, milestone payment will be preferable.
Delivery Period・Construction Period	● SPC and contractors/ supplies will be required to make an agreement of penalty for the delay of construction and delivery.
Warranty Liability	● Contractors/ suppliers and SPC will be required to establish warranty conditions for construction and their products in advance. Especially, in this project, even some problems between PT. KAI and supplier may arise.
Bond	● It's preferable that SPC will receive advanced payment bond, performance bond, warranty bond from first-class banks.
Others	● Contractors/ suppliers and SPC will make agreements about termination, arbitration, governing law, etc.

(Source: Study team)

8.2.2. Guarantee from Indonesian Government

- From the view point of investors of SPC, this project is a “B to B” business based on the lease contract between SPC and PT. KAI in the field of rolling-stock and relevant facilities. Therefore, government guarantee on the payment from the government is not necessarily required. However, before making a lease contract with PT. KAI, SPC has to set reasonable lease rate and obtain security considering PT. KAI's ability to pay.

- As for the Japanese investors, various risks such as 1) acquisition and right violation, 2) war and 3) remittance risk will be explored to be hedged by NEXI for which no government guarantee by Indonesian government is necessary. Also, Japanese investors can apply for NEXI's oversea investment insurance on their investment and dividend to be received by the investors. Only when the risks above grow apparent and SPC can no longer keep its business running, the insurance will be paid to the investors. In addition to that, there is an option that Japanese investors can apply for NEXI's oversea investment insurance on the payment by PT. KAI to SPC if PT. KAI's rating is judged as grade "G". However, even by applying for this option, this insurance will be paid to the investors only if SPC can no longer keep its business running due to PT. KAI's late payment, since this insurance is not credit insurance and doesn't indemnify SPC's normal losses incurred by the case PT. KAI fall behind in their payment.

8.3. Risk Analysis

8.3.1. Sponsor Risk

Sponsor risk is a risk that project can't be implemented anymore due to sponsor, in its managerial and financial capabilities. Although it is not sponsor but SPC which implements the operation, since sponsor will be deeply engaged in operation of SPC, sponsor of the SPC is required to have enough knowledge, experiences and know-how aside from financial soundness as a matter of course.

Although, investments from private banks, infrastructure funds and leasing company regardless of Indonesian or not in addition to Japanese and Indonesian private sector including trading firms are expected to be SPC of the Project, Japanese trading firm which has been dealing with coal in South Sumatra is targeted as sponsor at this stage of the study. Besides, Indonesian local companies which have strong managerial and financial capabilities are encouraged to take part in the Project.

As such, it is projected that sponsor risk of this project is comparatively small.

8.3.2. Funding Risk

Funding risk is a risk that SPC can't raise funds as planned in terms of amount and financial condition at the planning stage.

In the 1^{st} Stage, the total project cost was reduced as much as possible and in order to make avail of JICA's PSIF. This project has diverse aspects not only financial cooperation between

Japan and Indonesia but also project financing to the profit under the lease contract with PT. KAI in the 1st Stage of the implementation. In this context, in view of that South Sumatra is rich in coal reserve in tandem with Kalimantan and environmental problems can be minimized by making use of existing railway line and unused land, the funding risk of this project is projected to be comparatively small.

In the 2nd Stage and the 3rd Stage, since the project costs for partially or double-tracking are too high for a project to be implemented by private sector investment and loan alone, it is proposed to explore the availability of JICA's ODA loan for the development of infrastructure component. Still, on the facility side such as procurement of rolling-stocks and loading/ unloading facilities is financed by private sector with the help of JICA's PSIF and/or local banks. As mentioned in the previous paragraph, since this project has an aspect of project financing to the profit under the lease contract with PT. KAI, it is projected that SPC is well attractive enough to acquire private financing, therefore, it is projected that funding risk of this project is comparatively small.

8.3.3. Completion Risk

Completion risk is a risk that supply of equipments and construction of facilities are not completed as planned.

The completion risk of the 1st Stage of the implementation is estimated to be comparatively small because the total project cost was reduced as much as possible by making full use of the existing railway between Lahat and Kertapati so that no additional land acquisition is expected.

Although, in the 2nd Stage and the 3rd Stage, the construction is expected to be big due to the implementation of partially or wholly double-tracking work and so forth, it is estimated that the completion risk can be properly managed by employing capable contractors with sufficient working record of the similar size of this project and sound fiscal position, and by having contract with supplier of facilities which secures technical qualification by PT. KAI or Indonesian government.

Since the Project is to make full use of the existing railway facilities and unused land between Lahat and Kertapati in principle, completion risk of this project is projected to be comparatively small.

8.3.4. Technical Risk

Technical risk is a risk that project may give negative social and environmental impacts by adopting inappropriate design and engineering, manufacturing, technological processes and test procedures. It is estimated that the risk can be reduced by using diesel locomotives of CC205 type manufactured by EMD which is widely in use in South Sumatra and using container type freight wagon manufactured by PT. INKA which is the sole domestic supplier and already used for the coal transportation between Lahat and Kertapati. Since the type of locomotive and the freight wagon have product guarantee system in South Sumatra, it is projected that the risk can be mitigated greatly.

As for the double-tracking work and procurement of signaling facility in the 2nd Stage and the 3rd Stage, the risk can be mitigated by contracting out the work to contractors who have track record of work in good faith with DGR or PT. KAI.

As for coal loading/ unloading facilities, the risk can be mitigated by having contract with suppliers which have good track record and established local service network for facility maintenance.

As such, it is projected that technical risk of this project is comparatively small.

8.3.5. Operational Risk

Operational risk is a risk that project operation is suspended due to unexpectedly small demand and large operation and maintenance cost. The potential customer of the Project is the coal mining company who already produces coal and has a plan to expand its production volume. As for many other coal miners, they are locating near the potential customer and transporting coal to Kertapati by truck which means that there are growing needs for railway transportation. In this study, the rail transportation tariff is set almost same as current price of the truck transportation. Considering the advantage of integrated and mass transportation system by railway, the railway is estimated to have a big advantage to the truck.

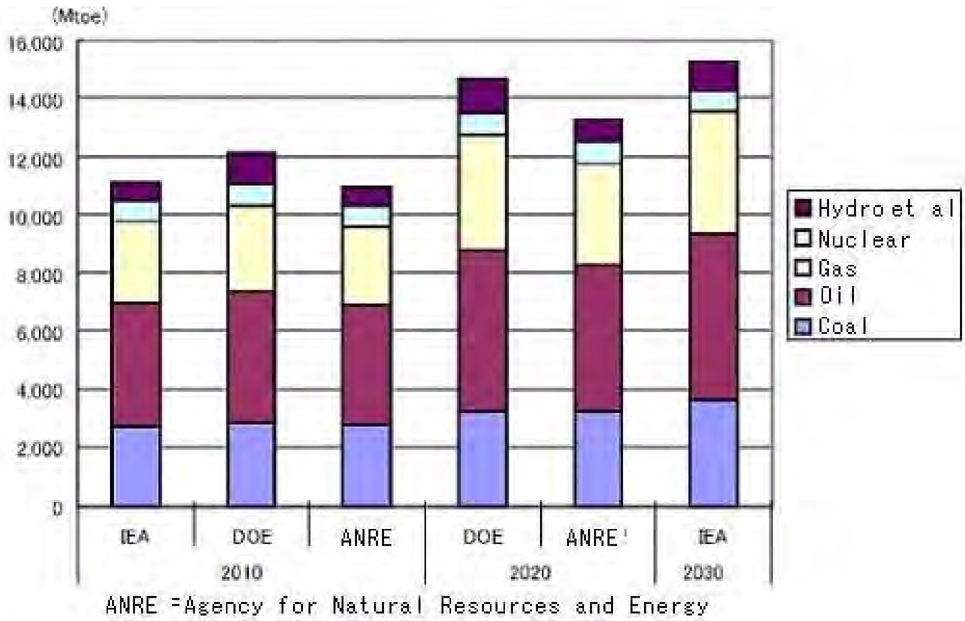
In this project, PT. KAI will operate and maintain locomotives and freight wagons. Therefore, in order for this project to contribute to promote development of South Sumatra in the end, it is proposed that SPC has a capability to supervise if PT. KAI will do maintenance work rightly. Also, SPC will recruit experienced employee to supervise the whole operation of lease transaction. As a result of this, operational risk can also be mitigated.

As such, it is projected that operational risk of this project is comparatively small.

8.3.6. Market Risk

Market risk comprises a risk arising from fluctuation of demand of product or service and a risk of price fluctuation. The risk is estimated to be low, because, as mentioned in this report, coal demand is growing with the rate overwhelming its supply due to its stable supply and price competitiveness, and the trend is projected to continue for years to come. As for the coal quality, the coal in South Sumatra is even to that of Kalimantan and has quality and price competitiveness to comply with domestic use and export to Asian countries. As for the volume of deposit, it is estimated to be 17.5 billion ton which is sufficient to recoup the investment of the Project. Furthermore, fixing the revenue which SPC receive from PT. KAI based on the lease contract can hedge the risk against price fluctuation.

The report named "World Energy Outlook", compiled by Ministry of Economy, Trade and Industry is studying primary energy supply outlook until 2030 based on the world prominent 5 reports[2] The report tells that there will be no substantial change of energy source structure until 2030 in which coal demand is expected to be large within this time scale.

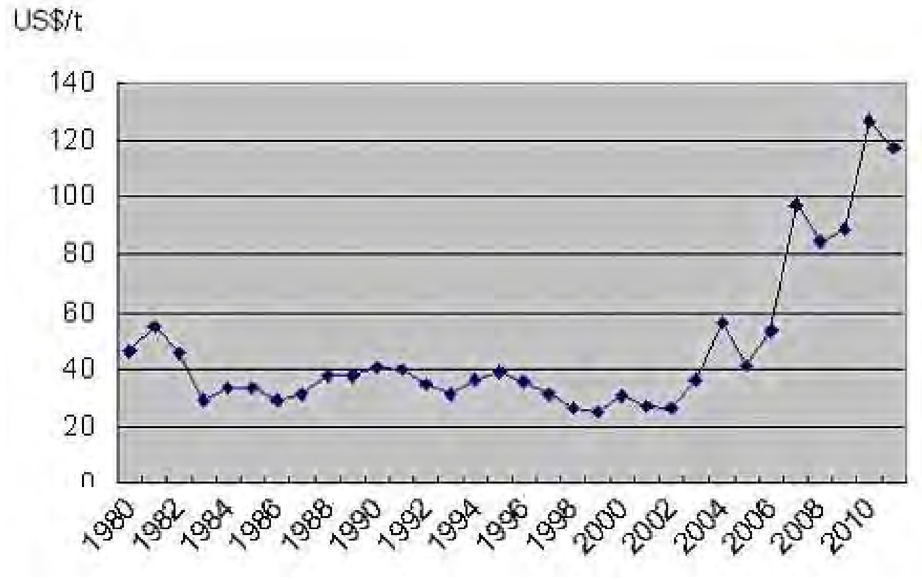


(Source: Study team)

[Fig. 8-3-1] World Energy Outlook

It can be said that it is not likely that the price of coal might go down to a level which may hamper this project's feasibility, even though the current high price level may not persist. Also, since the available coal transportation means between coal mines and shipping yard is limited to either by railway or by truck, it is estimated that coal mining companies would opt for railway than truck in the long run in view of efficiency and stability.

2 ①World Energy Outlook 2002 (IEA), ②International Energy Outlook 2003 (DOE), ③IPCC Special Report on Emissions Scenarios (IPCC), ④APEC Energy Demand and Supply Outlook 2002 (SRERC), ⑤Investigation.on measures for the supply and demand in petroleum product quality (Agency of Natural resources and Energy)



(Source: IMF Primary Commodity Prices)

[Fig. 8-3-2] Change in Coal Prices

As such, it is projected that market risk of this project is comparatively small.

8.3.7. Environmental Risk

Environmental risk is a risk that project implementation during construction and operation gives negative impact on social and natural environment. In this project, since the Project is so formulated as to make full use of the existing railway facilities between Lahat and Kertapati so that no large scale deforestation and environmental damage are anticipated, it is projected that environmental risk of this project is comparatively small.

8.3.8. Related Infrastructure and Utility Risk

Related infrastructure and utility risk is a risk that infrastructure and utility required to implement a project are not available to start construction or operation. Although, in this project, there are some facilities required to conduct rehabilitation work and double-tracking work, SPC can mitigate the risk by employing experienced contractors. In projects in which the implementation starts from land acquisition, the risk of arranging the utility will be much bigger, but in this project, the is low because this project will make full use of the existing infrastructure and utility.

In the operation stage, since the project uses diesel locomotives of CC205 type manufactured by EMD which is widely used in Sumatra and requires no electric power supply from overhead catenaries, no impact to existing electric power utility is anticipated.

As such, it is projected that related infrastructure and utility risk of this project is comparatively small.

8.3.9. Legal Risk

Legal risk is a risk that unstable legal condition in the project country and area may hamper or suspend the operation of the project. Although it is no denying that Indonesian legal system bears the potential risk, since it is an urgent task for the government to upgrade its infrastructure under the cooperation between public and private, and the PPP related legal framework is under revision having support from JICA, it is projected that the political risk which may severely damage the Project can be managed.

It is possible to reduce the political risk by tapping guarantee to be provided by agencies including PT. Penjaminan Infrastruktur Indonesia (PT. PII) which was founded with the support of World Bank.

8.3.10. Accident and Disaster Risk

Accident and disaster risk is a risk that accident and natural disaster such as earthquake and fire may stop the operation of a project. Accident risk can be reduced by establishing a system that SPC has a capability to supervise if PT. KAI will do operation and maintenance work rightly and periodically, although PT. KAI has enough experience in the work. As for the disaster risk, especially earthquake, the risk can be reduced by insurance.

8.3.11. Others

Other risk includes currency exchange risk. While the revenue of the Project is in local currency, repayment of loan and investment by SPC is by foreign currency, and in the case of the 2nd Stage and the 3rd Stage, the repayment of Yen loan by Indonesian government is in yen currency. Therefore, there is currency exchange risk on principle repayment, interest payment and dividend payment to foreign investors other than Indonesian investors participating to the SPC establishment. The risk can be dispersed among parties concerned or converted to a manageable risk by conducting quantitative and qualitative analysis, understanding the actual risk and establish risk security package.

8.3.11. Risk Mitigation Measures

The table below summarizes the mitigation measures against risks listed above/

[Table 8-3-1] Risk Mitigation Measures (Part 1)

Risk	Mitigation Measure
Sponsor risk	Explore credible investors with sufficient management and fiscal capabilities such as prominent trading firm for Japanese side and coal mining company for Indonesian side.
Funding Risk	JICA PSIF is the first priority funding resource for the 1st Stage of the implementation because the funding condition is confirmed to be generally complied in this study. However it will be reconfirmed once the contract with PT. KAI is concluded referring [Table 8-2-1] (P. 8-3) and [Table 8-2-2] (P. 8-4). As for the JICA Yen loan for the 2nd and 3rd Stages, the appropriate arrangement should be made right after the start of the project implementation.
Completion Risk	The 1st Stage implementation is considered to be less risky, because it includes light work of rehabilitation of the existing line with no land acquisition. In contrast, the 2nd and 3rd Stages include more complex works with partial double-tracking and whole double-tracking. However the risk can be mitigated by employing capable contractors in terms of financial background and working experience in the similar projects, and by employing signal and telecommunication equipment manufactures having technical assurance by PT. KAI and DGR.
Technical Risk	Type CC205 of EMD which is widely used in Sumatra is chosen for locomotive and container type car manufactured by PT. INKA of domestic company which is currently used for coal transportation between Lahat and Kertapati is chosen for freight wagon. As for double-tracking work and pertaining signaling and safety facilities, the products with technical assurance given by PT. KAI and DGR will be used for the project. As for coal loading and unloading facilities, priority will be given to such suppliers as having sufficient record in Indonesian market and forming local maintenance service network.
Operational Risk	The maintenance work for locomotive and freight car will be performed by PT. KAI with technical support provided by SPC in order to keep the maintenance quality. SPC will employ personnel with sufficient leasing business in order to manage and supervise the efficient operation of the project.

(Source: Study team)

[Table 8-3-2] Risk Mitigation Measures (Part 2)

Risk	Mitigation Measure
Market Risk	Since this project is a leasing business to PT. KAI, coal production demand fluctuation has no direct impact to the business. The revenue fluctuation of SPC can be mitigating by having fixed rate lease contract during the contract period.
Environmental Risk	It can be mitigated by making full use of existing line between Lahat and Kertapati.
Related Infrastructure and Utility Risk	It can be mitigated by employing contractors for railway infrastructure and facility upgrading who have sufficient quality assurance.
Legal Risk	In order to mitigate the risk, insurance framework such as PT. PII（PT Penjaminan Infrastruktur Indonesia）supported by the World Bank and facilities provided by other institutions will be tapped.
Accident and Disaster Risk	As for the accident, it can be mitigated by introducing periodical supervision system by SPC on working quality of PT. KAI operation and maintenance of infrastructure and rolling-stock. As for the disaster, it can be mitigated, particularly the earthquake, by having insurance contract to asset damage or loss.
Others	Other risk will be sorted out by identifying the possibility and quantifying their damages in advance, and prepare a security package in order to disperse or control them.

(Source: Study team)

Chapter 9

Project Impact Assessment

9.1. Operational and Performance Indicators

The project could achieve a modal shift from road to rail due to the expansion of the rail transportation capacity. It is expected that air quality along the road will be improved by a reduction of truck traffic. Therefore, the quantitative index of operational and performance indicators are set as follows.

Regarding each index, project participants can quantitatively evaluate a difference between a benchmark and a target with implementing the monitoring.

[Table 9-1-1] Operation and Performance Indicators

Indicators		Unit	Benchmarks (Post Construction)	Targets (Post 2nd year Operation)	Targets (Post 7th year Operation)
Operation ratio[1]		%	92	92	92
Coal transportation		MTPA	25.5	28.0	43.0
Coal production in Lahat Area		MTPA	4.7	7.2	22.2
Passenger Transportation		Thousand person-km	674,008	719,096	801,542
Freight Transportation		Million ton-km	9,381	9,829	12,519
Number of Train	Freight	train/day	79	83	105
	Passenger	train/day	16	16	20
Travel Time between Lahat and Kertapati		hour	6.17	4.5	4.5
Coal Transportation by Road		MTPA	2.2	2.2	2.2

(Source: Study team)

Regarding each index, project responsible body should confirm a status of the achievement of benchmark and target values with the following monitoring methods.

1 According to the haering to PT. KAI Palemban, maintenace operatin ratio was 97.3% based on the record of 355 working days in a year, but 5% points were reduced considering the malfunctionning risk.

[Table 9-1-2] Monitoring Methodology of Operation and Performance Indicators

Indicators	Unit	Project responsible body	Explanations	Monitoring frequency
Operation ratio	%	Railway operator	Annual operational report of railway operator	Annual
Coal Transportation	MTPA	Railway operator	Annual transport report of railway operator	Annual
Coal Production in Lahat Area	MTPA	Railway operator	Interview coal producers	Annual
Passenger Transportation	person-km	Railway operator	Annual transport report of railway operator	Annual
Freight Transportation	ton-km	Railway operator	Annual transport report of railway operator	Annual
Number of Train	train/day	Railway operator	Annual transport report of railway operator	Annual
Travel Time between Lahat and Kertapati	hour	Railway operator	Annual transport report of railway operator	Annual
Coal Transportation by Road	MTPA	Railway operator	Interview truck companies	Once before start of the project and once the target year

(Source: Study team)

In order to monitor the operational performance of the project continuously, the project responsible body should monitor the indicators following each monitoring method such as statistic or interview survey. When it becomes evident that monitoring values deviate from indicators significantly, the project responsible body should confirm the causes and reform the project to the extent possible.

Utilization of the coal resources by the Project will activate the local economies. At the same time, better accessibility to local public facilities owing to the improved railway service, and environmental improvement are also expected. Therefore, the qualitative index of operational and performance indicators will be set as follows. Regarding each index, project participants can qualitatively evaluate a difference between a benchmark and a target with implementing the beneficiary survey. Each indicator is set up based on the following framework.

[Table 9-1-3] Monitoring Framework for the Qualitative Index of Operational and Performance Indicators

Items	Explanations	Benchmarks (Post Construction)	Targets (Post 2nd year Operation)	Targets (Post 7th year Operation)
Improvement of living convenience	Travel time of passenger trains btw Lahat and Kertapati	4.75	4.75	4.75
	Number of passenger trains	6	6	7
Development of towns along the railway	Increasing income level of inhabitants along the rail with improvement of living convenience, creation of employment opportunities	18,230,598	19,510,590 (Annual real growth rate of 3.5%)	22,346,494 (Annual real growth rate of 3.5%)
Improvement of living environment	The air quality improvement by a decrease in trucks	Achievement of the environmental standard NO_2: 400μg/m^3N(hourly), 150μg/m^3N(24 hours) Noise: 70dB(commercial and service)		
Creation of employment opportunities	Employment during the construction period	340,000 persons (at the 1st Stage)	320,000 persons (at the 2nd Stage)	470,000 persons (at the 3rd Stage)

(Source: Study team)

[Table 9-1-4] Monitoring Methods for the Qualitative Index of Operational and Performance Indicators

Items	Monitoring method	Responsible body	Monitoring frequency	Monitoring target
Improvement of living convenience	Interview survey to railway passengers concerning traffic reliability	Railway operator	Target year	Cargo owners, passengers
Development of towns along the rail	Interview survey to inhabitants along the rail concerning their income level	Railway operator	Target year	Inhabitants along the rail
Improvement of living environment	Monitoring NO_x and noise for confirming the air quality improvement	Railway operator	Annual	Monitoring site
Creation of employment opportunities	Total number of employment during construction period	Railway operator	Target year	Constructors

(Source: Study team)

9.2. Evaluation and Proposal from Technical Aspect

9.2.1. Technical Aspect

Implementation of this project is proposed to be implemented with stepwise improvement approach in 3 stages starting from immediate measure depending on the increase of coal transportation demand considering economical effect.

In the 1st Stage, it is targeting to attain target transportation volume by implementing improvement and reinforcement of existing facilities supplemented by truck transportation. Major works involved in this stage are repair of track structure and reinforcement, thus no technical complexity can be foreseen. Construction period is planned to be about 4 years including design etc., and no particular problem can be foreseen as well. If any problem dared to be forecasted, since the big amount of track material for about 200km such as turnout, rail, and composite sleeper may supplied from overseas dividing in several years, procurement procedure must be properly controlled avoiding confusion and enough number of skilled maintenance clew must be secured.

The 2nd Stage must be started immediately after the completion of the 1st Stage. The major works involved are reservation of siding clear length for train evacuation and 2 signaling station construction corresponding to train extension. Construction period is planed to be 6 years including the 1st Stage work. Technical challenges are shifting of slope sections relevant to slope before and behind station where clear length is extended and relocation of crossing which crosses station before and behind in the level sections. A proper selection of method to extend the clear length with scrutinized topographic profile based on vertical section survey may and it may cause to relocate the structures other than railways such as existing road. No other technical difficulties can be foreseen.

In order to increase transportation capacity, coal loading and unloading facility at the Kertapati side must be reinforced which entails capital improvement in Kertapati station yard, coal loading and unloading facility, and barge shipping equipment. Although there is no technical difficulties in the machine components, adjustment of interest among entities concerned will be needed in respect of land reservation for the construction of new bay line etc., or capital improvement of station yard. Furthermore, although it is a precondition that full double-tracking of between Muara Enim and Prabumulih X6 section is completed, the work must be completed under this project if the progress of the double-tracking work is not as planned.

In the 3rd Stage, new line will be constructed in parallel with existing track, and clear length extension corresponding to train length extension is needed at almost all stations. Although the accumulated starting from the 1st Stage is planned to be about 10 years, there is no technical difficulties can be foreseen in the civil work and track work of general kind. The challenge at this stage is to secure land in Kertapati to reinforce coal loading and unloading facility and barge loading equipment.

Signaling and telecommunication system will be modernized in the entire stretch of additional track section as well as the existing track, which will require to develop technical solution in order to safely implement the changing work from the existing signaling and telecommunication system to the new ones while allowing normal train operation. Furthermore, the modernized signaling and telecommunication system demands bigger electric supply. In this project, since the electric power is planned to be supplied by electric power company, where the distance from transmission network of electric power company is far, additional power supply line will be needed. Moreover, since the signaling and telecommunication system will work as an integrated system, it should be avoided to procure the equipments from different suppliers with different technical culture in order to ensure safety and efficient operation and maintenance.

As it was proposed in 4.4.2. (P. 4-46), the rail replacement work which should be completed in the 1st Stage, was shifted to the 2nd Stage in order for the Project to be viable with the private sector initiative in terms of financial concern. However, it is necessary to replace the existing rail to a heavier one as early as possible for the train operation to be stable with higher speed in the long run. Therefore, the schedule for the 2nd Stage is so designed as to complete the rail replacement work at the beginning of the 2nd Stage implementation schedule. In this context, the implementation of the 2nd Stage is indispensable for the 1st Stage project to be technically viable even thought the 2nd Stage is financially inferior to the 1st Stage.

9.2.2. Conclusive Remarks and Policy Implication in Financial and Economic Aspects

In the light of the numerical deliverables of the preceding economic and financial analyses in the sections of 7.3. (P. 7-10) and 7.4. (P. 7-17), some of the conclusive remarks would be noteworthy for discussions to come. These include, among others, the followings.

- The Project EIRRs highly exceed Project FIRRs in both absolute and relative terms, profoundly implying that the concerned transportation project in the Region benefit the public and national economy of the country. Therefore, the Project will preferably be implemented under the initiating leadership and auspices of the Public sector, with external development partnership financing facilities closely in view.
- For all of the implementation stages of the 1st, 2nd, and the 3rd, debt sustainability index of minimum DSCR of SPC exceeded the cut-off rate, while revealing robustness of certain aspect of financial capacity of the prospective private sector entity. Meanwhile the analysis posted lower Equity IRR than the cut-off rate for all the stages, casting certain concern over

the profitability of the private sector investor. In this light, there may be some measures facilitating private investors to get involved with ease and some certain for profitability. One of those may include a hike of lease and infrastructure differed payment, for instance an increase by 0.35% per month will raise Equity IRR over the cut-off rate. Even so doing, financial superiority of lease contract will be retained for PT. KAI in terms of FIRR and present value-based aggregate payments when compared with own-financing by private bank borrowing.

- Alternatively, downsizing of the cost for SPC will also raise Equity IRR by introducing public fund (the Government of Indonesia supposedly supported by Japan's yen loan) to the project. Provided that public fund account for 40% of the total cost (the 1st Stage), Equity IRR will be in the neighbor of the binding profitability line. Further, it would be noteworthy for private sector investor to possibly modify equity-debt ratio from 30:70 currently in place for analysis down to 20:80.
- As reflected in the analysis of PT. KAI accounting and financial robustness in operating railway transport services, it is evident that the entity is in a position of over liquidity (Current ratio[2] 262.0%, Quick ratio[3] 193.2%) and under investment (Fixed asset to long-term capital[4] 59.4% in 2010. With this in view, PT. KAI would be a good partner as operating body of the prospective PPP-scheme transportation services in South Sumatra.

9.2.3. Environmental and Social Aspects

(1) Environmental Consideration

Concerning the environmental aspect of this Project, JICA study team prepared a draft screening report, a draft scoping report, and identifications of environmental impact elements based on JICA environmental guideline. Outline of environmental impact at each implementing stage are as follows;

At the 1st Stage, the constructions involve mainly an improvement of track, reinforcement of coal loading and unloading facility. During the construction period, environmental consideration is needed, even though no big environmental impact will be expected.

At the 2nd Stage, the constructions which involve the partial double-tracking work and reinforcement of unloading facility at Kertapati station will require environmental considerations, even though no big environmental impact will be expected. However, the branch line construction which is laid from Merapi to the main line (approximately 700 meters) will require an appropriate alignment and construction plan paying due attention to environmental considerations.

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[2] Current Asset/Current Liability
[3] (Cash+Short-term Deposits+Account Recievable+Securities)/Current Liability
[4] Fixed Assets/(Owners' Equity + Long-term Liability)

At the 3rd Stage, the construction plan involves the double-tracking work between Sukacinta and Simpang, coal loading and unloading facility at Kertapati station yard, the barge loading system. A construction site for coal loading and unloading facility is adjoining to the housing area. Therefore this work will especially require a construction plan paying due attention to environmental considerations.

In this project, in case of the double-tracking work and increasing the number of trains for passengers and freights, it is expected that negative environmental impact will not be occurred. However the construction plans at the 3rd Stage, which set up the coal loading and unloading facility at Kertapati station yard (20ha), the barge loading system and the conveyor belt for a barge transport along the Musi river, will require an environmental assessment in the construction site.

(2) Social Consideration

Concerning the social aspect, it was observed in the field survey that there are many occupants on both sides of the railway right of way (25m for in-city areas and 75m for other areas) between Lahat to Kertapati (at present, there are about 436 houses on the northern side of the line). These houses are mostly concentrating in 3 station areas of Lahat, Prabumulih and Kertapati. As about 70 houses were identified nearby Lahat station, but the Lahat-Sukacinta section is not subjected to double-tracking works, the number of houses subjected to resettlement will be about 366 units.

On the other hand, in order to construct the new coal stockyard as well as the coal unloading railway line etc. in Kertapati station in the 3rd Stage of the Project, the 20ha area annexed to this station with many inhabitants living for decades (presently about 800 households, a market and many old graves) will be subjected to resettlement.

Therefore, in terms of area for resettlement, there are substantially 2 main areas. But, in comparison to the relatively simple resettlement works along the railway line (about 366 households), the resettlement works for the 20ha area annexed to Kertapati station (presently about 800 households, a market and many old graves) will basically require high compensation costs and long time, about 3 - 5 years, for resettlement enforcement due to its complexity. The preparation for resettlement works for this part should be done before the implementation of 3rd Stage.

On social impacts, even with the completion of double-tracking project and high increase of daily traffic of coal and passengers trains, apart from the resettlement problem, no major negative social impacts are foreseeable by the installation of effective warning control system at railway crossings (for safety improvement) and adopting prevention measures to noise and air pollution. On the other hand, in comparison to bus transportation, the increase of daily trains for passengers transportation will contribute a safe, cheap and convenient transportation means for low-income people in the areas.

According to PT. KAI officials concerned, occupants presently living and having farms inside the railway right of way along the railway are mostly not illegal occupants but having some kind of previous permission from PT. KAI. Therefore, for the implementation of the Project, PT. KAI considers that it could take back these land areas by making compensation negotiations for their resettlement without having any serious social problems.

Presently, in order to implement the double-tracking works in the section between Muara Enim to Prabumulih X6, the clearance of occupants (about 200 houses) in this section was completed already within one year. Therefore, regarding the resettlement of occupants for this Project implementation, the PT. KAI proceedings for compensation negotiations, in principle, could be applied accordingly.

However, in the social surveys of this Study, local people expressed their requests on Project implementation, especially the formation of vocational trainings, as for an income recovery program for relocates. Based on the present conditions of local social capitals, the vocational trainings on agro-gardening and manufacturing of farming and workshop tools could be periodically organized in the main station premises of Muara Enim, Prabumulih and Kertapati. Besides, during the period of relocation as well as the period for relocates to attain their stable living and earning conditions in new relocation sites, the execution of a monitoring program on resettlement proceedings is considered necessary. The details of these programs will be notified in LARAP.

The Project will be implemented in 3 Stages, but similar to the 1st Stage, since partial double-tracking works will be implemented within station premises only and the construction of a short branch line of about 700m is located in the remote area of Merapi village in the 2nd Stage, it will, in principle, need no resettlement works.

But in the 3rd Stage, the project implementation, which entails whole double-tracking works from Sukacinta to Kertapati with new constructions of coal stockyard, unloading rail lines and a conveyor installation toward Musi River in areas around Kertapati station, will require a full scale of resettlement works in these areas. The preparation of LARAP (Land Acquisition & Resettlement Action Plan), therefore, will be carried out. Besides, along with the increasing number of daily train traffic and new constructions of these related installations around Kertapati station, the necessary measures for securing safety for local people as well as a proper living environment in the areas will be implemented accordingly.

For LARAP preparation, the social survey in Project area was carried out to collect the basic social data and related resettlement information. And with the formation of SPC for Project implementation, where LARAP will be duly prepared, the TOR for this preparation was made. By its application the related resettlement works will be carried out accordingly.

9.2.4. Organizational Aspect

While PT. BA is exclusively transporting coal by rail to Tarahan and Kertapati in South Sumatra State at present, most of the private coal mines are transporting coal by track except for PT. BAU which use rail to Kertapati with minimal volume due to limited railway traffic capability. On road transportation of coal by heavy duty truck has a limitation of traffic volume due to road breakage, traffic congestion and environmental concern. Night time transportation is already restricted and further decline of road transportation capacity is expected in the future, therefore the shift from on road transportation to railway transportation is in the urgent necessity.

As it was stated in 2.3. (P. 2-12), effective use of resources by developing coal mine is one of the highest priority agenda for the South Sumatra State government, and since the railway sector development is also among the very high priority, there is no serious obstacle in implementing this project.

Main purposes of the New Railway Law promulgated in 2007 are to accept participation to railway operation of not only the Central Government but also the Local Governments and private companies. A business unit to be assigned to manage this project will be, as it is stated in Chapter 5 of the Law, private enterprise which obtained management concession and governmental cooperation in accordance with Central Government guidelines. However it is also the fact that there is no actual application in the railway operation so far in terms of SPC selection procedure and environmental and social compliance. In addition, It is note worthy that there remain other uncertainties such as right of way boundary between the government and PT. KAI.

The SPC to be established in this project is planned to cooperate with PT. KAI in a "B to B business" manner under the governmental guidance based on the New Railway Law in order to expand the transportation capacity thereby make the existing railway work as a public railway. SPC will run a coal transportation business on the public owned railway facilities and infrastructure having concession from the government, and repair, upgrade and reinforce the existing facilities. And, as it has been described, the train operation and maintenance work including repair, upgrade and reinforcement of facility and infrastructure will be entrusted to PT. KAI on a contract basis, because it has sufficient experiences in the railway operation and management.

Although there is a history that the state owned Railway Company was privatized and PT. KAI was established, but this can be recognized as a special case and no private company has ever participated in the railway business in Indonesia. It implies that procedural difficulties such as government permission, cooperation contract, concession contract, and so forth will be anticipated before this project will be materialized.

9.3. Evaluation and Proposal on Project Operation

9.3.1. Possibility of Private Investment

This project is a leasing business by SPC to PT. KAI to enhance coal transportation capacity of railway from Lahat to Keretapati in South Sumatra. Private investment will be highly expected for each stage of the project although the scale and the scheme of private investment varies at each stage with the following reasons.

(1) The 1st Stage

The annual revenue which SPC can receive from the leasing business is estimated to be JP¥ 1.5billion based on the lease rate of 13.2%/year although the amount varies from year to year in accordance with terms and condition of leasing contract, while total CAPEX (Capital Expenditure) to transport the 2.5MTPA of coal is estimated to be JP¥ 9billion. As mentioned before, SPC will raise fund by acquiring JICA ODA private sector finance scheme for the 70% of the CAPEX and the rest by private investment. The JICA scheme will contribute to reduce SPC's financial burden in its interest payment. If the JICA scheme is available for the project, it is expected that investor's IRR (Internal rate of return) will go up to 20% subject to the condition that lease rate and dividend ratio to the private investors are fairly arranged. In addition, considering the fact that the coal targeted to be transported by the project is already under production, the project can be assessed as sound one, and no particular difficulty in attracting private investment is foreseeable. In fact, there are already Japanese trading house which owns coal mining right in this area is expressing interest on the project investment and Japanese leasing companies have been contacted to ask for co-investment on this project. Furthermore, Indonesian companies, such as private coal mine companies and infrastructure related companies will be candidates for co-investors for this project. As far as South Sumatra governor is concerned, as of now, it is just expected to participate in this project. Because 1) the objective of this project is to promote development of the province, so we believe this project is beneficial for the governor and 2) it is found that South Sumatra governor plan to invest other coal transportation project in this area. However, since it is important to finalize the contract framework between PT. KAI and SPC, at this stage, co-investment by South Sumatra Government will not be insisted.

(2) The 2nd Stage

Total CAPEX to transport the 5.0MTPA of coal is estimated to be JP¥ 25billion with the 1st Stage implementation cost combined. The annual revenue which SPC can receive from the leasing business newly should be set considering the case PT. KAI procure rolling-stocks and do construction work by own finance. In the same way as the 1st Stage, if the JICA scheme is available for the project, it is expected that equity IRR will go up to 20% subject to the condition that lease rate and dividend ratio to the private investors are fairly arranged. In addition, considering the fact that the coal targeted to be transported by the project is already under production, the project can be assessed as sound one, and no particular difficulty in attracting private investment is foreseeable.

(3) The 3rd Stage

Total CAPEX to transport the 20.0MTPA of coal is estimated to be JP¥ 77billion with the 1st Stage and the 2nd Stage implementation cost combined. Like the 2nd Stage, the annual revenue which SPC can receive from the leasing business newly should be set considering the case PT. KAI procure rolling-stocks and do construction work by own finance. In the same way as the 1st Stage and 2nd Stage, if the JICA scheme is available for the project, it is expected that investor's IRR will go up to 20% subject to the condition that lease rate and dividend ratio to the private investors are fairly arranged. In addition, considering the fact that the coal targeted to be transported by the project is already under production, the project can be assessed as sound one, and no particular difficulty in attracting private investment is foreseeable.

However, in order for the project to be implemented with the scenario as mentioned above, the project must be attractive enough for the private investors in the 1st Stage implementation. In this context, the following subjects must be fully discussed in advance.

[Table 9-3-1] Subject and Solution to Attract Private Investment in the 1st Stage

No.	Subject	Possible Solution
1	Business license to SPC	SPC will procure rolling-stocks, conduct rehabilitation of existing line, and then lease them to PT. KAI. In order to start this leasing business, SPC have to obtain license from the government. Therefore, it is necessary to clarify the procedure. Also, this is true to the 2nd Sage and the 3rd Stage, SPC procure rolling-stock and coal loading/ unloading facilities and lease them to PT. KAI.
2	Approval for using rolling-stocks	It is proposed to use the locomotive and container freight wagon which are already approve in its designed in Indonesia for the project. These rolling-stocks must be used during the project life. Therefore, SPC have to be given an approval by DGR for the long term use of the rolling-stocks.
3	Maintenance of rolling-stocks	Since the maintenance of the rolling-stocks owned by SPC will be done by PT. KAI, it is proposed that SPC has a capability to supervise PT. KAI perform the maintenance work rightly and periodically.
4	leasing contract with PT. KAI	This is a leasing business between SPC and PT. KAI with the objective of enhancing transportation capacity of the existing line from Lahat to Kertapati. Since the lease period is 20 years and it is very long, the way of coping with troubles occur during the period should be set in advance. Therefore, before entering into the agreement between SPC and PT. KAI, it is considered that SPC will have company which has enough resource and experience in leasing business as its sponsor and use consultants.
5	Insurance on investment	If investors to SPC are Japanese companies, they can buy insurance on investment provided by NEXI. That can help SPC hedge their risks, such as political risk and force majeure.
6	Operation cost escalation of SPC	Major component of the operation cost of SPC is labor cost and equipment cost to be procured domestically in Indonesia. Considering the inflation ration of 6.96% in Indonesia in 2010, it is needed to make a business plan incorporating the price escalation of the same level in the coming years.
7	Settlements on cost and subsidy scheme between PT. KAI and Indonesian government	At present, there is a cost and subsidy transaction scheme between the government and PT. KAI in a form of TAC (Track Access Charge), IMO (Infrastructure Maintenance and Operation) and PSO (Public Service Obligation). This project is a "B to B" business between SPC and PT. KAI, so SPC has no involvement in this transaction. Therefore, the transaction between SPC and PT. KAI should be dissociated from the transaction between government and PT. KAI.

(Source: Study team)

9.3.2. Project Scheme Proposal to Acquire Government Guarantee and Financial Support

It is proposed that JICA ODA private sector finance scheme will be applied for the project, but it entails condition such as that the project must comply with Indonesian development policy with sufficient level of project effect, the project is implement-able, the project is not feasible by the private initiative including private banking and private investment. Since this project meets the requirement mentioned above and proved to be feasible as discussed in this report, JICA ODA private sector finance scheme will be tapped from the 1st Stage of the project.

Under the condition, from the view point of investors of SPC in the 1st Stage, this project is “B to B” business between SPC and PT. KAI. Therefore, government guarantee from the Indonesian Government will not be required.

On the other hand, in the 2nd Stage and the 3rd Stage, Japanese ODA loan or two step loan by JICA is considered except for the leasing portion by SPC. In the case of applying two step loan, since the end user is proposed to be PT. KAI which has no experience of acquiring the loan from JICA, it is necessary to establish a procedure appointing Ministry of Finance of Indonesia as a conduit agency to guarantee the repayment of the loan while the Yen loan is not the case.

9.4. Estimation of Climate Change Mitigation Effect

The project could promote a modal shift from road to rail due to the expansion of the rail transportation capacity. The project can achieve not only the mitigation of both traffic congestion and air pollution but also GHG emission reduction. In order to estimate GHG emission reduction of the project, the study team will apply JICA Climate-FIT (JICA Climate Finance Impact Tool) which is established by JICA.

However, this calculation is just for reference. In order to implement the project as CDM project, the project responsible body has to apply a CDM methodology approved by UNFCCC (UN Framework Convention on Climate Change) to the project. Whether existing CDM methodology can be applied to this project or not still has not confirmed, therefore an economic analysis of this study does not include the effect of GHG emission reductions.

GHG emissions reduction due to the project is calculated as the difference between the GHG emissions without the project, which is the baseline emission, and those after the success of the modal shift to the project railway which is the project emission. Based on relevant data collected in the project, the study team will estimate GHG emission reduction with JICA Climate-FIT. Baseline emissions (BEy) and project emissions (PEy) are calculated as follows.

(1) Baseline emission

$$BE_y = TC_{dt,y} \times EF_{CO2,x} \quad , \quad TC_{dt,y} = \frac{(1-\alpha_{x,dt}) \times DD_y}{SEC_{x,dt,y}}$$

BE_y : Baseline emission: GHG emissions of non-electrified trains (t-CO_2/y)

$TC_{dt,y}$: Total annual fuel consumption of non-electrified trains (diesel trains or internal-combustion locomotives) after the project has completed (L/y)

$EF_{CO2,x}$: CO_2 emission factor of fuel category x (gr-CO_2/L)

$SEC_{x,dt,y}$: Specific fuel consumption (km/L)

DD_y : Total annual trip distance of freight trains (train km/y)

$\alpha_{x,dt}$: Mixing ratio of bio-fuel (ratio: 0 – 1)

(2) Project emission

$$PE_y = TC_{dt,y} \times EF_{CO2,x} \quad , \quad TC_{dt,y} = \frac{(1-\alpha_{x,dt}) \times DD_y}{SEC_{x,dt,y}}$$

PE_y : Project emissions: GHG emissions of freight trains (diesel train /internal-combustion locomotive) after the project has completed (t-CO_2/y)

$TC_{dt,y}$: Total annual fuel consumption of freight trains after the project has completed (L/y)

$EF_{CO2,x}$: CO_2 emission factor of fuel category x (gr-CO_2/L)

$SEC_{x,dt,y}$: Specific fuel consumption (km/L)

DD_y : Total annual trip distance of freight trains (train km/y)

$\alpha_{x,dt}$: Mixing ratio of bio-fuel (ratio: 0 – 1)

JICA Climate-FIT (JICA Climate Finance Impact Tool) applies to estimations of GHG emission reductions quantitatively with this project. Data required for estimating both baseline emissions and project emissions in the JICA Climate-FIT are shown in [Table 9-4-1] and [Table 9-4-2]. The study team collected these data in this study. In case of implementing this project, GHG emission reductions based on the data are shown in [Table 9-4-3].

[Table 9-4-1] Data Required for Estimation and Monitoring (Baseline Emission)

Items	Data type	Data contents	(Post Construction)	(Post 2nd year Operation)	(Post 7th year Operation)	Source
$P_{PJ,i,y}$	Freights by existing transport systems (t/year)	Freights of existing transport systems that would be shared in the absence of the freight train project. The total freights of existing transport systems is equal to the freight carried by freight trains	1,000,000	3,500,000	18,500,000	Study team
DD_y	Total annual trip distance driven by freight trains (Non-Electric) (km/year)	Total annual trip distance driven by freight trains after the project starts	6,969,300	7,199,400	11,638,900	Study team
$SEC_{x,dr,s}$	Specific fuel consumption of freight trains (Non-Electric) (km/L)	Specific fuel consumption of diesel car/ locomotives	0.25	0.25	0.25	PT. KAI
$N_{x,i}$	Total number of existing vehicles in fuel type x, and vehicle category i	Existing vehicle is coal transportation truck and fuel type is diesel	2,010	2,010	2,010	PT. BAU
N_i	Number of each vehicle	Coal transportation truck only	2,010	2,010	2,010	PT. BAU
OD_i	Average trip distance driven by existing vehicles in vehicle category i (km/day)	Trip distance for coal transportation truck before the project starts	180	180	180	PT. BAU: distance to Palembang
OC_i	Average occupation rate of existing vehicles in vehicle category i (ton)	Occupation rate of coal transportation truck before the project starts	10	10	10	Study team
$SEC_{x,i}$	Specific fuel consumption of existing vehicles in fuel type x, vehicle category i	Fuel consumption rate per liter of coal transportation truck (km/L)	4	4	4	Source 1
$EF_{CO2,x}$	CO_2 emission factor of fuel	CO2 emission factor of diesel per liter (gCO2/L)	2,661	2,661	2,661	IPCC value
$\alpha_{x,i}$	Mixing rate of biofuel (ratio)	Mixing ratio of biofuel in diesel	0	0	0	Assumed as zero

(Source 1: Kikkawa Tetsuji, Indian Road Transport and The Dedicated Freight Corridor Project, Nittsu Research Institute and Consulting report 2009.6)

[Table 9-4-2] Data Required for Estimation and Monitoring (Project Emission)

Items	Data type	Data contents	(Post Construction)	(Post 2nd year Operation)	(Post 7th year Operation)	Source
DD_y	Total annual trip distance driven by freight trains (Non-Electric) (km/year)	Total annual trip distance driven by freight trains after the project starts	6,969,300	7,199,400	11,638,900	Study team
$SEC_{x,dr,s}$	Specific fuel consumption of freight trains (Non-Electric) (km/L)	Specific fuel consumption of diesel car/ locomotives	0.25	0.25	0.25	PT. KAI
$EF_{CO2,x}$	CO_2 emission factor of fuel	CO_2 emission factor of diesel	2,661	2,661	2,661	IPCC value
$\alpha_{x,i}$	Mixing rate of biofuel (ratio)	Mixing ratio of biofuel in diesel	0	0	0	Assumed as zero

[Table 9-4-3] GHG Emission Reductions

(Unit: tCO_2/year)

Implementation Stage	The 1st Stage	The 2nd Stage	The 3rd Stage
Measuring timing	(Post Construction)	(Post 2nd year Operation)	(Post 7th year Operation)
Baseline emission (by Truck) (A)	11,975	41,911	221,528
Project emission (by Railway) (B)	1,954	6,837	36,140
GHG emission reduction (A-B)	10,021	35,073	185,388

(Source: Study team)

Chapter 10

Environmental and Social Impact Assessment

10.1. Environmental Considerations

10.1.1. Legal Framework of Indonesia

(1) Legal Framework

Laws related to environmental considerations of Indonesia are shown in [Table 10-1-1]. In Indonesia, the Environmental Protection and Management Act No.32 correspond to the Environment Basic Law. The old act issued in 1982 was revised in 1997. In the current act revised in 2009, the power of relevant environmental agencies and the punishment were strengthened considerably. Decrees and regulations related to each environmental element such as pollution, noise and biodiversity are ordered.

The environmental law system of South Sumatra (Sumatera Selatan) is as shown in [Table 10-1-2].

[Table 10-1-1] Environmental Laws in Indonesia

Category	Law and Regulations
Environment management	Environmental Management Act No. 23 of 1997 (EM 23/1997)
	Government Regulation No. 38/2007
	Environmental Protection and Management Act No. 32 (EPMA 32/2009)
Air	Government Regulation No. 41/1999: Air quality management and pollution control
	Decree of Ministry of Environment No. 45/1997: Air Pollutant Standard Index
Noise	Decree of Ministry of Environment No. 48/MENLH/11/1996: Noise standards
Vibration	Decree of Ministry of Environment No. 49/MENLH/11/1996: Vibration standards
Odor	Decree of Ministry of Environment No. 50/MENLH/11/1996: Odor standards
Water	Government Regulation No. 82: Water quality management and pollution control
Waste	Government regulation No. 18 of 1999: The Management of the waste of hazardous and toxic materials
	Government regulation No. 74: Hazardous waste material management
Protected area	Presidential Decree No. 32/1990: Management of protected area
Flora, Fauna, Biodiversity	Government Regulation No.7/1999: Protection of plant and animal species
	Act of Republic of Indonesia No. 5/1990: Conservation of living natural resources and their ecosystem
	Law No. 40/1990: Forestry
EIA	Decree of State Minister of Environment No. 56/1996: Criteria on significant environmental impact
	Decree of Head of BAPEDAL No. KEP299/11/1996: Guideline of social aspect in AMDAL
	Decree of Head of BAPEDAL No. KP124/12/1997: Guideline of public health aspect in AMDAL
	Governmental Regulation No. 27/1999: Environmental Impact Analysis (AMDAL)
	Presidential Decree No. 10/2000: Environmental Impact Management Agency (BAPEDAL)
	Decree of Minister of Environment No. 2/MENLH/02/2000: Guideline of AMDAL document evaluation
	Decree of Ministry of Environment No. 8/MENLH/02/2000: Public involvement and information release on the analytical process concerning AMDAL
	Decree of Ministry of Environment No. 9/MENLH/02/2000: Designing guideline of environmental impact assessment
	Decree of Ministry of Environment No. 17/2001: Type and size of business and/or activities requiring AMDAL document
	President Regulation No. 9/2005: Regarding Position, duty, Function, organization structure and workflow of the Ministry in accordance to amendment in President regulation No. 62/2005
	Regulation of the State Minister for Environmental Affairs No. 8/2006: Guidance for the preparation of environmental impact analysis
	Regulation of State Minister of Environment No. 11/2006: Type of business plan and/or activity that require analysis of environment impact

(Source: Study team)

[Table 10-1-2] Environmental Laws in South Sumatra

Category	Law and Regulations
Air and Noise	South Sumatra Governor Regulation on Air Ambient Quality Standard and Standard Noise Level No. 17/2005
Water	South Sumatra Governor Regulation on Allocation of Water and River Water Quality Standards No. 16/2005
Waste	South Sumatra Governor Regulation on Liquid Waste Quality Standard (BMLC) For Industrial Activities, Hotels, Hospitals, Domestic and Coal Mining No. 18/2005
	Muara Enim Regulation on Disposal Liquid Waste Permit No. 38/2001
	Lahat Regulation on Water and Liquid Waste Quality Standard No. 14/2005
	Lahat Regulation on Utilization Permit and Management of Liquid Waste No. 2/2006

(Source: Study team)

(2) Implementing Procedure of AMDAL

The AMDAL process in Indonesia dates back more than 20 years, and it is specifically mandated by the newly approved Environmental Protection and Management Law (Article 22) dated 8 September 2009 replacing Environmental Law No.23 of 1997. The Ministry of Environment Regulation No.8 of 2006 provides the latest guidance on the AMDAL process.

The Indonesian government imposes a "positive list" for a project and/or activity that requires AMDAL according to the type, scale and location of activity through Minister of Environment Regulation No.11. Projects not listed are obliged to prepare Environmental Management Effort or Upaya Pengelolaan Lingkungan (UKL) and Environmental Monitoring Effort or Upaya Pemantauan Lingkungan (UPL) documents in accordance with the newly approved Environmental Protection and Management Law 2009 (Article 34).

The type of activity and scale of projects that require a full AMDAL process are defined in Minister of Environment Regulation No.11 of 2006 covering the following sectors: (1) defense, (2) agriculture, (3) fishery, (4) forestry, (5) transportation, (6) satellite technology, (7) industry, (8) public work, (9) energy and mineral resources, (10) tourism, (11) nuclear development, (12) hazardous waste processing, and (13) genetic engineering. Any project located at the border or inside a protected area, no matter of type or scale, requires an AMDAL.

The AMDAL process in Indonesia is an integrated and comprehensive assessment of project impacts taking into account biological, geo-physical/chemical, socio-economic-cultural, and public health aspects. The AMDAL process aims to evaluate the environmental feasibility of a project and is the means by which the authority grants the necessary permits for the project or activity.

Implementing procedure is as follows and summarized in [Table 10-1-3]. The first step of the AMDAL process is the preparation of the Terms of Reference (KA-ANDAL) to be approved by the AMDAL Committee. The scoping process includes to be defined as follows; (Source: Minister of Environment Regulation No. 08 of 2006).

- Scope of the study,
- Type of activities of the project that may cause impact to environment,
- Environmental parameters likely to be affected by the project,
- Method of data collection and analysis,
- Potential and serious impact identification and
- Methods of impact prediction and evaluation

[Table 10-1-3] EIA Process in Indonesia

Undertaken by this Study	Implementation Agency Part	
	KA-ANDAL approval	AMDAL approval
●Project site survey └→●Screening by JICA guideline └→●Verification by JICA guideline's check list └→●Scoping proposal └→●Preliminary stake holders meeting └→●Compile draft KA-ANDAL		
	●Screening by AMDAL committee (PD11/2006) (When EIA is necessary for forward) └→●Advertize └→●Compile KA-ANDAL └→●Public discussion └→●Scoping └→●Evaluate KA-ANDAL (in 75days) └→●Amend/Approve	
<Note> ・AMDAL: Indonesian version of EIA ・KA-ANDAL: TOR for AMDAL compilation ・RKL: Environmental management plan ・RPL: Environmental monitoring plan		└→●Compile AMDAL,RKL,RPL (EMD09/2000) └→●Evaluation (in 75days) └→●Approve

(Source: Study team)

10.1.2. Present Conditions of Site

Present conditions of the Project site are summarized for every targeted section of EIA (environmental impact assessment).

(1) Natural Environment around the Project Site

① Topography and Soil Conditions

East side of South Sumatra is mainly lowland or wetland which is affected by tidal variation. On the other hand, east side is mountainous region with 900 – 2,000 meters height. Geological type of soil is river deposit or volcanic deposit. The Project site spreads in relatively flat terrain with forest or wetland. As of now, any special topography or soil condition is not observed.

Wetland Rubber trees

[Pic. 10-1-1] Typical Landscape around the Project Site

② Hydrological Regime

There are a number of big rivers which are navigable with big vessels, however it becomes unable because of recent sediment deposition.

Musi river Local river

[Pic. 10-1-2] Rivers around the Project Site

③ Flora, Fauna and Biodiversity

Flora found in Sumatera Selatan are Lauan, Merubana, Beech, Rubber, Oil palm and others.

④ Meteorology

South Sumatra belongs to tropical climate with dry season from May to October and rainy season from November to April. Observed meteorological data at “Kenten observatory in Palembang, 2010” shows as follows:

- Minimum monthly mean temperature is 26.6 degree Celsius in January.
- Maximum monthly mean temperature is 28.5 degree Celsius in May.
- Minimum monthly mean relative humidity is 84 % in October.
- Maximum monthly mean relative humidity is 88 % in February.
- Minimum monthly precipitation is 91.1 mm in July.
- Maximum monthly precipitation is 541.7 mm in March.

⑤ Landscape

As of now, any special landscape to be preserved is not found around the Project site.

⑥ Protected Area

As of now, any designated protected area is not found around the Project site.

(2) Current Situations of Pollutions

① Air pollution

Atmospheric environment is considered rather well, because exhaust gas from diesel locomotive is almost only source of air pollution and there is no significant industrial area around the Project site. Atmospheric environmental parameters are measured in the Project area, and are shown in [Table 10-1-4].

[Table 10-1-4] Air Ambient Analysis Result

No	Items	Unit	Survey Location											Threshold Value*
			1	2	3	4	5	6	7	8	9	10	11	
1	Temperature	℃	30.4	31.7	35.6	39.2	37.3	37.1	33.9	37.3	35.2	30.2	29.4	−
2	CO	ppm	5	4	3	4	5	4	4	3	4	4	4	−
		$\mu g/Nm^3$	6,170	4,930	3,700	4,930	6,170	4,930	4,930	3,700	4,930	4,930	4,930	30,000
3	Sox	$\mu g/Nm^3$	268	221	205	198	232	195	203	133	227	219	231	900
4	Nox	$\mu g/Nm^3$	233	215	212	207	176	212	153	122	176	212	153	400
5	HC	$\mu g/Nm^3$	9.3	6.5	4.4	4.8	6.5	4.8	4.4	3.8	5.5	3.8	6.4	160
6	TSP (dust)	$\mu g/Nm^3$	103.3	55.0	53.0	62.0	98.5	46.6	47.5	45.3	73.8	55.9	97.0	230

Remark		Date
Location 1	Kertapati Station	26 November 2011
Location 2	Simpang Station	26 November 2011
Location 3	Gelumbang Station	26 November 2011
Location 4	Lembak Station	26 November 2011
Location 5	Prabumulih Station	26 November 2011
Location 6	Niru Station	27 November 2011
Location 7	Gunung Megang Station	27 November 2011
Location 8	Ujan Mas Village	27 November 2011
Location 9	Muara Enim Station	27 November 2011
Location 10	Banjar - Sukacinta Village	27 November 2011
Location 11	Lahat Station	27 November 2011

Note: 1.*Threshold Value based on South Sumatra Governor Regulation No. 17/2005
2.Measurement locations are shown in [Fig. 10-1-1] (P. 10-11).

(Source: Study team)

② Water Pollution

Water qualities around the Project site are measured, and the results are shown in [Table 10-1-5]. Tributary of Musi river is flown around the site. But there is no significant indusrial area which causes water pollution. Sewage contamination around cities will be assumed.

[Table 10-1-5] Water Analysis Result

No	Items	Unit	Survey Location									Threshold Value*
			1	2	3	4	5	6	7	8	9	
1.	Temperature	℃	28.0	30.1	27.6	27.3	27.2	27.2	27.2	26.3	26.0	Dev ± 3
2.	P.H.	―	6.30	4.18*	5.27*	6.06	5.72*	6.58	6.71	7.15	6.88	6 - 9
3.	D.O.	mg/L	6.00	4.52	2.80	5.25	5.18	5.28	5.64	5.65	6.21	3
4.	Turbidity	mg/L	44	12	10	56	39	61*	39	31	51*	50
5.	Conduc tivity	mg/L	4	61	2	4	7	7	10	9	8	―
6.	C.O.D.	mg/L	7	5	8	13	7	12	9	15	6	50
7.	B.O.D.	mg/L	0.3	0.2	0.25	0.43	0.12	0.52	0.36	0.57	0.5	4
8.	T.S.S.	mg/L	152	186	194	146	214	142	160	116	148	1000

Remark		Date
Location 1	Ogan River near Kertapati Station	26 November 2011
Location 2	Branch of Keramasan River near Simpang Station	26 November 2011
Location 3	Kelekar River near Lembak Station	26 November 2011
Location 4	Niru Ruver near Niru Station	26 November 2011
Location 5	Branch of Lematang River near Gunung Megang Station	26 November 2011
Location 6	Lematang River near Ujan Mas Station	27 November 2011
Location 7	Lematang River near Muara Enim Station	27 November 2011
Location 8	Lematang River near Merapi Station	27 November 2011
Location 9	Lematang River near Lahat Station	27 November 2011

Note: 1.*Threshold Value based on South Sumatra Governor Regulation No. 16/2005
2.Measurement locations are shown in [Fig. 10-1-1] (P. 10-11).

(Source: Study team)

② Waste

It would be a big issue that a great amount of garbage and waste material is uncontrolled around the site.

[Pic. 10-1-3] Waste biside the Rails

③ Noise and Vibration

Noise and vibration are measured around the Project site, and shown in [Table 10-1-6]. Noise and vibration caused by passing trains are actually problem. Additionally, automobiles and motorbikes are also the main source in cities.

[Table 10-1-6] Noise Sampling Result

No	Location	Date	Hour	Noise	Parameter
				dBA	
1	Kertapati Station	November 26, 2011	8:00	59.6	*South Sumatra Governor Regulation Number 17 Year 2005* **) For Settlement Area, threshold 55 dBA* ***) For Industrial Area, threshold 70 dBA*
2	Simpang Station	November 26, 2011	9:30	54.5	
3	Gelumbang Station	November 26, 2011	12:15	53.6	
4	Lembak Station	November 26, 2011	13:10	31.6	
5	Prabumulih Station	November 26, 2011	15:05	56.2	
6	Niru Station	November 26, 2011	16:15	48.2	
7	Gunung Megang Station	November 26, 2011	17:30	44.5	
8	Ujan Mas - Gunung Megang	November 27, 2011	11:40	46.8	
9	Muara Enim Station	November 27, 2011	10:05	50.2	
10	Banjar - Sukacinta	November 27, 2011	9:10	60.3	
11	Lahat Station	November 27, 2011	8:05	48.1	

Note: Measurement locations are shown in [Fig. 10-1-1] (P. 10-11).

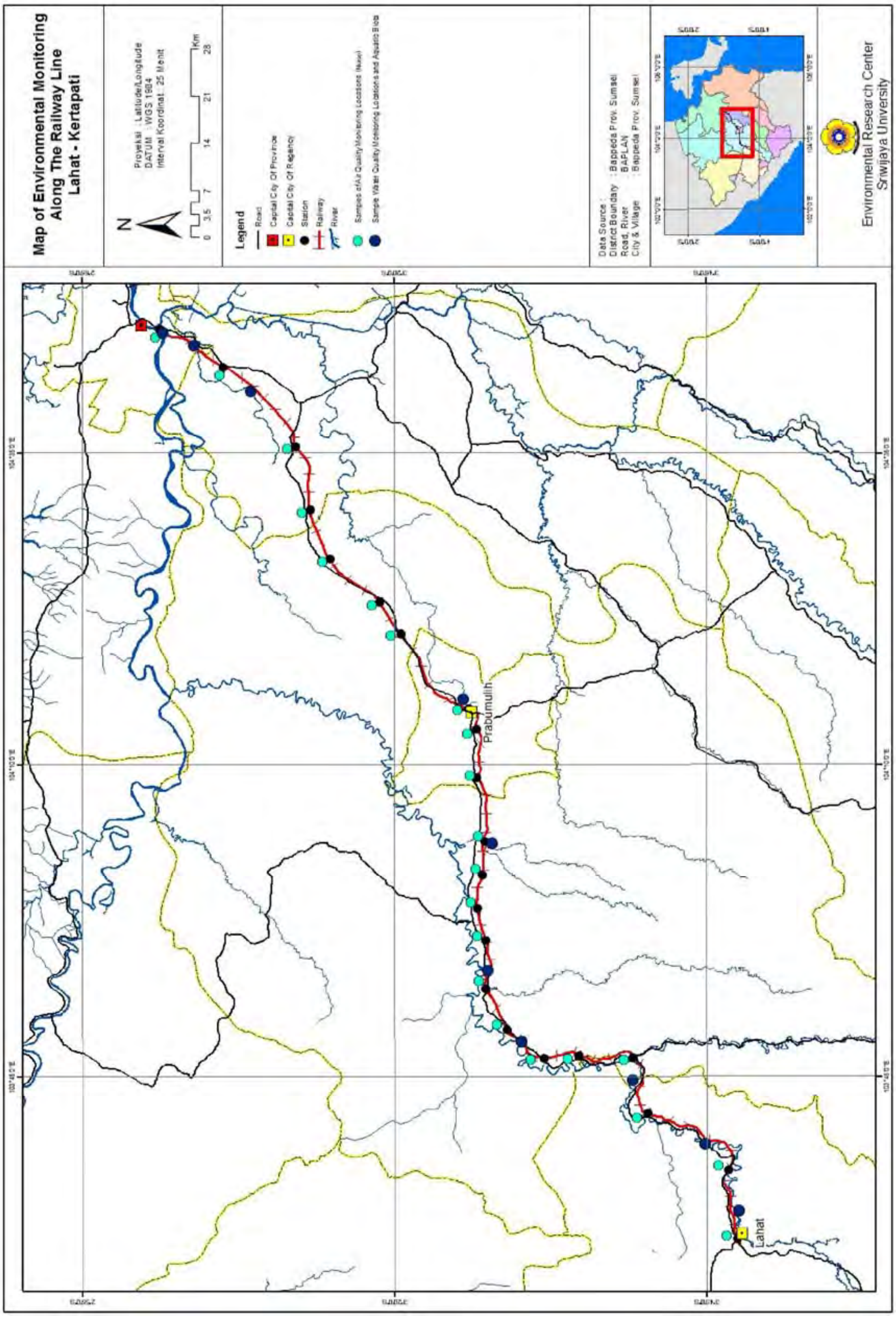
(Source: Study team)

[Pic. 10-1-4] Rail Crossing in a Town

④ Ground Subsidence

Ground subsidence is possibly occurred by civil engineering works and construction, because sedimentary soil is dominated in the site.

The locations of the measurement for ① - ④ are shown in [Fig. 10-1-1].



(Source: Study tam)

[Fig. 10-1-1] Locations for Measurements (Air, Water and Noise)

10.1.3. Positive and Negative Environmental Impacts of the Project

Environmental and social impacts by implementation of the Project are discussed using JICA's environment screening form. The screening form and check sheet are attached as [Appendix 10-1-1] and [Appendix 10-1-2]. Assumed impacts to relevant environmental items around the site are summarized in [Table 10-1-7] to [Table 10-1-10].

- Zero-Option: Without the Project
- Option 1: The 1st Stage (Single Track)
- Option 2: The 2nd Stage (Partial Double Tracking)
- Option 3: The 3rd Stage (Whole double Tracking)

[Table 10-1-7] Comparative Matrix of Alternatives for Scoping

	Likely Impact	Alternative			
		Zero Option	Alternative-1	Alternative-2	Alternative-3
Natural environment	Topography and geology features			B	B
	Soil erosion				
	Groundwater				
	Hydrological situation				
	Coastal zone				
	Flora, Fauna and Biodiversity				
	Meteorology				
	Landscape				
	Global warming				
Pollution	Air pollution		B	B	A
	Water pollution				
	Soil contamination			B	B
	Waste		B	B	B
	Noise and Vibration		B	B	A
	Ground subsidence				
	Odor				
	Bottom sediment				
	Accidents		B	B	B
Environment evaluation			B	B	A
Social	Resettlement			B	A
	Livelihood			B	A
	Cultural heritage				
	Landscape				
	Minorities/ aborigines				
	Labor condition			B	B
	Hygiene (Waste/ Dust/ Sewage)		B	B	B
	Crossing/ Traffic safety		B	B	B
Social evaluation			B	B	A

Rating:
A: Serious impact is expected.
B: Some impact is expected.
C: Extent of impact is unknown (Examination is needed. Impacts may become clear as study progresses.)
No mark: No impact is expected. IEE/EIA is not necessary.

(Source: Study team)

[Table 10-1-8] Matrix for Scoping (The 1st Stage)

	Likely Impacts	Overall Rating	Construction Phase: Extension of existing rail	Construction Phase: Related facilities (ex: station)	Construction Phase: Construction equipment operation	Operation Phase: Increase in number of train	Operation Phase: Exhaust gas, noise and vibration	Operation Phase: Coal d ust	Comments
Natural environment	Topography and geology features								
	Soil erosion								
	Groundwater								
	Hydrological situation								
	Coastal zone								
	Flora, Fauna and Biodiversity								
	Meteorology								
	Landscape								
	Global warming								
Pollution	Air pollution	B	B	B	B	B	B		Emission of air pollutant from construction equipment in construction stage and locomotives increased in operational stage will be assumed.
	Water pollution								
	Soil contamination								
	Waste	B				B			
	Noise and Vibration	B	B		B	B	B		Noise and vibration will be occurred by equipment operation in construction stage and increased number of train in operational stage.
	Ground subsidence								
	Odor								
	Bottom sediment								
	Accidents	B				B			Incidence of traffic accident is assumed to increase by increased number of train in operational stage.

Rating:

A: Serious impact is expected.

B: Some impact is expected.

C: Extent of impact is unknown (Examination is needed. Impacts may become clear as study progresses.)

No mark: No impact is expected. IEE/EIA is not necessary.

(Source: Study team)

[Table 10-1-9] Matrix for Scoping (The 2nd Stage)

	Likely Impacts	Overall Rating	Construction Phase			Operation Phase			Comments
			Extension of existing rail	Related facilities (ex: station)	Construction equipment operation	Increase in number of train	Exhaust gas, noise and vibration	Coal d ust	
Natural environment	Topography and geology features	B	B						Earthmoving for existing rail extension may cause topographical and geological impact.
	Soil erosion								
	Groundwater								
	Hydrological situation								
	Coastal zone								
	Flora, Fauna and Biodiversity								
	Meteorology								
	Landscape								
	Global warming								
Pollution	Air pollution	B	B	B	B	B	B	B	Emission of air pollutant from construction equipment in construction stage and locomotives increased in operational stage will be assumed. Dispersion of coal dust from the coal yard is assumed.
	Water pollution								
	Soil contamination	B	B						Existing rail extension may cause soil contamination by earthmoving and disposal of waste soil.
	Waste	B				B			
	Noise and Vibration	B	B		B	B	B		Noise and vibration will be occurred by equipment operation in construction stage and increased number of train in operational stage.
	Ground subsidence								
	Odor								
	Bottom sediment								
	Accidents	B				B			Incidence of traffic accident is assumed to increase by increased number of train in operational stage.

(Source: Study team)

[Table 10-1-10] Matrix for Scoping (The 3rd Stage)

	Likely Impacts	Overall Rating	Construction Phase			Operation Phase			Comments
			Extension of existing rail	Related facilities (ex: station)	Construction equipment operation	Increase in number of train	Exhaust gas, noise and vibration	Coal dust	
Natural environment	Topography and geology features	B	B						Earthmoving for existing rail extension may cause topographical and geological impact.
	Soil erosion								
	Groundwater								
	Hydrological situation								
	Coastal zone								
	Flora, Fauna and Biodiversity								
	Meteorology								
	Landscape								
	Global warming								
Pollution	Air pollution	A	B	B	B	A	A	A	Emission of air pollutant from construction equipment in construction stage and locomotives increased in operational stage will be assumed. Dispersion of coal dust from the coal yard is assumed.
	Water pollution								
	Soil contamination	B	B						Existing rail extension may cause soil contamination by earthmoving and disposal of waste soil.
	Waste	B				B			
	Noise and Vibration	A	B		B	A	A		Noise and vibration will be occurred by equipment operation in construction stage and increased number of train in operational stage.
	Ground subsidence								
	Odor								
	Bottom sediment								
	Accidents	B				B			Incidence of traffic accident is assumed to increase by increased number of train in operational stage.

(Source: Study team)

10.1.4. Preparation for Environmental Impact Assessment

In Regulation of State Minister of Environment No.11/2006, railway construction is categorized into “transport”, and the preparation and approval of AMDAL is required under the conditions listed in [Table 10-1-11]. PT. KAI presently implementing double tracking work between Mualaenim - Prabumuli X6, it is subject to AMDAL, because it is a railway construction for more than 25 kilometers. This Project, a railway improvement project between Lahat - Kertapati would be subject to AMDAL, if any condition in [Table 10-1-11] is applicable.

Through a screening based on JICA environmental guideline, this Project is classified as Category A. Therefore the implementation of EIA is a precondition for receiving Yen Loan, however AMDAL (Indonesian EIA system) has not yet been made. Accordingly, support for implementing agency to prepare AMDAL in accordance with JICA environmental guideline will be compiled in this study.

[Table 10-1-11] Railway Development Project Subject to AMDAL

No	Type of activities	Scale/Magnitude
1	Rail road	Length $\geq$ 25 km
2	Development train station	Area: $\geq$ 2 ha

(Source: Regulation of State Minister of Environment No. 11/2006)

The Project implementation plan prepared in this study consists of 3 stages as shown in [Table 10-1-12].

[Table 10-1-12] Project Implementation Plan Prepared in this Study

Project Stage	Contents
① The 1st Stage (Single Track)	●Target transport capacity = 2.5MTPA ●Traffic of train = 8 trains/day ●1 train = 1 loco + 25 freight wagon = 395m Extension of track effective length ●Running speed = 65 km/h Existing track improvement work including partial replacement of rail of existing track ●Capacity expansion of coal loading facility in Sukacinta ●Capacity expansion of coal unloading facility of PT. BAU in Kertapati
② The 2nd Stage (Partial Double Tracking)	●Target transportation capacity = 5.0MTPA ●Traffic of train = 10 trains/day ●1 train = 1 loco + 40 freight wagon = 615m Another extension of track effective length ●Complete the double tracking work between Muara Enim and X6 ●Add 2 signaling stations (The location is to be selected.) ●Construction of branch line of 700 m from Merapi to main line ●Construction of stock yard and unloading facility in the north end of Kertapati station area
③ The 3rd Stage (Whole double Tracking)	●●Target transportation capacity = 20.0MTPA ●Traffic of train = 21 trains/day ●1 train = 2 loco + 60 freight wagon = 930m Another extension of track effective length ●Whole double tracking work between Sukacinta and Kertapati ●No more work between Muara Enim and X6 ●Introduction of electric signaling system ●Development of coal stock yard in Kertapati station area of 20 ha and installation of belt conveyer system to reach Musi river

(Source: Study team)

In the current stage of implementation of the Project, drafts of screening, scoping, IEE (Initial Environmental Examination) and AMDAL can be prepared according to JICA Environmental Guideline.

Draft IEE is prepared in this study for the 1st and 2nd Stage of the project implementation, because these are not subject to AMDAL. As for the 3rd Stage of the implementation, draft of AMDAL is prepared, because the work of the stage includes a railway construction more than 25km and is subject to AMDAL.

(1) Summary of Draft IEE for the 1st Stage

The draft IEE for the 1st Stage is shown in [Appendix 10-1-3]. At the 1st Stage, the constructions involve mainly an improvement of track, reinforcement of coal loading and unloading facility. During the construction period, environmental consideration is needed, even though no big environmental impact will be expected.

(2) Summary of draft IEE for the 2nd Stage

The draft IEE for the 2nd Stage is shown in [Appendix 10-1-4]. At the 2nd Stage, the constructions which involve the partial double tracking work and reinforcement of unloading facility at Kertapati station will require environmental considerations, even though no big environmental impact will be expected. However, the branch line construction which is laid from Merapi to the main line (approximately 700m) will require an appropriate alignment and construction plan paying due attention to environmental considerations.

(3) Summary of Draft AMDAL for the 3rd Stage

The draft AMDAL for the 3rd Stage is shown in [Appendix 10-1-5].

① Construction Phase

- Air Pollution: As the number of construction machines and conveyance trucks and vehicles are limited, it seems that the impacts on the air quality are relatively small compared with the present condition. However, as the construction is mainly implemented during dry season, the countermeasures, sprinkling water, cleaning of road and so on are critical to reduce the dust and TSP. The construction plan involves coal loading and unloading facility at Kertapati station yard, the barge loading system. A construction site for coal loading and unloading facility is adjoining to the housing area. Therefore this work will especially require a construction plan paying due attention to environmental considerations.

- Noise: Noise of the construction machines and vehicles can be reduced by the regular maintenance and efficiently scheduled operation. The noise around the construction areas should be monitored so that countermeasures can be taken timely. For example, the noise impact could be reduced by a proper schedule of the operating hours of construction machines, especially near the hospitals, schools and mosques.

② Operation Phase

- Air Pollution: Although it is theoretically expected that negative environmental impact will occurred by increasing the number of trains for passenger and freight, the scale will be moderate because the absolute number of train is still small. However, the amount of air pollutant emission will be increased if maintenance for locomotives is not made properly. It is important to give periodical maintenance for the rolling-stock. A construction site for coal loading and unloading facility is adjoining to the housing area. Therefore this work will especially require a construction plan paying due attention to environmental considerations.

- Noise: Although it is theoretically expected that negative environmental impact will occurred by increasing the number of trains for passenger and freight, the scale will be moderate because the absolute number of train is still small. However, it should be noted that the noise level will be worsend if maintenances for rolling-stock and track infrastructure are not made properly.

③ Environment Management and Monitoring Plan

Effective environmental management during construction and post-construction requires the establishment of effective institutional arrangements for the implementation of the Environmental Management Plan (RKL) as well as the proper Environmental Monitoring Plan (RPL). The RKL has been prepared to deal with the following mitigation measures (see No.6 and 7 of Book 2).

[Table 10-1-13] Outline of Mitigation Measures

Environmental Impact	Construction phase	Post-Construction phase
Air Pollution	● Conduct regular watering ● Back of trucks covered with tarpaulins ● Use of equipment / machinery / construction of transportation that meets vehicle emissions standards	Perform periodic maintenance on the locomotive / train transport
Noise,Vibration	● Use of equipment / machinery / transport that meets the standards of construction noise levels ● Perform engine maintenance / construction equipment at regular intervals ● Replacing the silencer / sound suppressor on the engine / generator to reduce noise levels ● Adjusting work schedules to reduce the exposure time	● Make a noise barrier ● Using the rails and ballast material, which can reduce noise
Waste	● Create a temporary shelter (TPS) for the Hazardous Waste Collection points and temporary shelters ● Submit Hazardous Waste to a third party who has had a Hazardous waste management license ● Create and implement Standard Operating Procedures (SOP) Hazardous Waste Management ● Increasing human resource capacity through the Course/Training Hazardous Waste Management	

(Source: Study team)

There exists a railway project in South Sumatra for which AMDAL was prepared. It was conducted by PT. KAI Regional Division III South Sumatera in 2011 for a double tracking work. Summary is shown in [Table 10-1-14].

[Table 10-1-14] Summary of AMDAL Prepared for a Railway Project in South Sumatra

<table>
<tr><th>Item</th><th>Content</th></tr>
<tr><td>Name of Project</td><td>●Development Double Railway Line
●Niru station – Muara Enim station and Muara Enim station – Tanjung Enim station</td></tr>
<tr><td>Project Executive Organization</td><td>●PT Kereta Api Indonesia (Persero) / (PT. KAI) Regional Division Ⅲ Sourh Sumatera
●Address: Jenderal A. Yani street 13 Ulu No. 541 Palembang
●Telephon No.: (0711) 517736</td></tr>
<tr><td>Adress of Project Site</td><td>Rambang Dangku Sub-district, Gunung Megang Sub-District, Ujan Mas Sub-District, Muara Enim Sub-District</td></tr>
<tr><td>Project Profile</td><td>Plan to build a double track railway between Niru station - Tanjung Enim station, has a length of 60 km
<table>
<tr><th>No</th><th>Activity</th><th colspan="2">2011</th><th colspan="2">2012</th><th colspan="2">2013</th></tr>
<tr><td>1</td><td>Project Socialization</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>2</td><td>Land Supply</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>3</td><td>Construction</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>4</td><td>Operational</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
</table></td></tr>
<tr><td>Year of AMDAL</td><td>2011</td></tr>
</table>

(Source: Study team)

A meeting with local residents of the community locating around Kertapati Station was held on 27th of January, 2012 to have opnions of the people. Record of the meeting is attached as [Appendix 10-1-6]. A hearing on environmental issues is also carried out in the meeting. Typical opinions raised are summarized in the following 2.

- Environmental problem is not to be expected in particular.
- In dry season or season with small rain, coal dust disperse to the area, and residents feel hard to breathe sometime. Drinking and bathing water are polluted by dispersion of coal dust.

10.2. Social Consideration

10.2.1. Basic Legal Framework

Concerning social consideration, there are 2 basic legal aspects, land acquisition and resettlement proceedings, subjected to the implementation of this Project. However, in comparison to the few legal materials recently issued for resettlement proceeding, the legal materials related to land acquisition as notified with details in Chapter 1 have been continuously issued since 1960s. With the results from various situations of field applications, the legal materials on land acquisition had been amended time by time. Actually, a new Land Acquisition Bill is still under the process of an amendment.

(1) Land Acquisition Related Legal Framework

① The Basic Agrarian Land Law (BAL) of Act No.5 of 1960: This law constitues a fundamental regulation governing agrarian principles which legitimately justified the sovereignty of national land of Republic of Indonesia after the independence in 1945. This basic law enforced the taking back of large land plots exploited by foreigners etc. as plantations under the Dutch era for making public land under national control; meanwhile protecting the traditional land use rights of localities. This legal framework of enforcing national sovereignty on land issue and, at the same time, protecting traditional land use rights of localities has been applied as up to now, making a so-called situation of "dual system of land laws" in this country.

② Revised Railwa Law (Law No.13/1992): At the time when railway land use law was established in 1960's, the entity of railway business development had been continuously transferred from one to another in some decades for finally anchored at PT. KAI as endorsed by DGR of Ministry of Transport This was implied by Law No.13/ 1992 on Railway Monopoly for national operation and development; but lately modified by Law No.23/2007 on railway to supersede Law No.13/1992 for supporting local governments involving also in railway development. Based on this modification, the railway tracks themselves remain under state ownership but PT. KAI and even private companies can use the rail lines for passenger and freight transportation by paying a fee after getting an approval from the government. Currently, only Jawa and Sumatra islands have developed both freight and passenger trains but recently the Ministry of Transport has plans also for new railway lines in Kalimantan and Sulawesi also. Therefore, Indonesian Government has made various efforts including PPP approach for inducing foreign and private investments in railway development including SP (Special Purpose Railway) in Kalimantan and Sulawesi. The basic principle, however, is the mutual agreement .in business development among the participated parties.

③ 2 laws for land acquisition: Concerning land acquisition for development implementation for public interest, there are 2 major laws as hereunder.

1) The Land Acquisition Laws of Presidential Regulation of the Republic of Indonesia No.36/2005

The chaptering of the law is as follows.

- Chapter I covering Definition of Terms and Scope of Regulation
- Chapter II covering Functionalities and Classifications of Buildings
- Chapter III covering Requirements for A Construction on Administrative and Technical Aspects (rights over land, ownership status, construction permit, architectural requirements, environmental impacts control, landscape, infrastructural or public means, safety and health concerns, comfort and accessibility)
- Chapter IV covering Construction Implementation (technical planning, construction implementation and management, proper usage, maintenance, periodical inspection, preservation, and demolition)
- Chapter V covering Society's Role (order monitoring and preservation, offering input, opinion, & consideration, placing lawsuit and claim)
- Chapter VI covering Implications by Both Central and Regional Government
- Chapter VII covering Related Administrative Sanctions
- Chapter VIII covering Transitional Provisions

2) Presidential Regulation of the Republic of Indonesia No.65/2006 Concerning Amendment of No.36/2005

Meanwhile, in order to protect citizen losses of land properties and to make appropriate compensations for affected people in giving up their lands, buildings etc. for the implementation of public projects, the Presidential Regulation No. 65/2006 made some additions for the Presidential Regulation No. 36/2005 on Land Acquisition for Development Implementation for Public Interest, as follows:

- Compensations for Acquisition of Land, Building, etc
- Provision on Land Acquisition
- Detailed Definition of Public Needs
- Details of Institution acting as Initiator in Land Provision and its Duties
- Forms of Compensations
- Regulations on Lawsuit and Claim

For compensation matters, in principle, the owner of lost land can select from options including cash payment, substitute land or resettlement, if available. The basic principle of the present Land Acquisition Laws, therefore, is the mutual agreement on compensations and related matters from both sides. In fact, due to difficulties for making affected people consent to the designated compensations through field applications as up to now, these Land Acquisition Laws have been faced with limited applications from time to time by causing substantial conflicts between both sides in land acquisition proceedings. In order to make a solution for this hampered situation, a new Land Acquisition Bill has been recently submitted to Parliament for a resolution since August of 2011, but still waiting for an approval resolution. If this new Land Acquisition Bill is approved by the Parliament, the compulsion application for land acquisition would be orderly proceeded in order to facilitate the implementation of public projects.

(2) Resettlement Proceedings Related Legal Framework

Since the era of post-independence in Indonesia, based on the Basic Land Law, the related land laws had been constantly issued for implementation. However, on the aspect of resettlement proceedings, the legal framework was formulated as recently for facilitating the project implementation at localities. Besides, while most land laws had been made for application on national level, the legal framework for resettlement proceedings was mainly made for application at local government level. This situation could be considered due to the differences in socio-economic conditions among localities.

In order to proceed to the resettlement matter, the Government of South Sumatra Province had issued the "Statement of Governor of South Sumatra on Resettlement Compensations No.25 Year 2009" (Refer [Appendix 10-2-1]) for basically carrying out this matter. Besides, for a PT. KAI project, a "MOU (Cooperation) between PT. KAI and Judiciary High Court" (Refer [Appendix 10-2-2]) and the "Chronology for Resettlement Proceedings" (Refer [Appendix 10-2-3]) are also the basic legal materials for conducting this matter for project implementation.

Based on these legal matters and with the collaboration from local government etc, the solicitation meetings with people in affected areas will be organized. By obtaining the consent of people in affected people from these meetings, the negotiations for compensation, the payment formalities as well as the resettlement proceedings for land clearance etc. will be carried out accordingly.

Particularly, concerning the legal aspect of resettlement proceedings, as the resettlement works for this Project will be mainly carried out in the land premises controlled and managed by PT. KAI, the specific regulations of PT. KAI itself have been largely subjected to application.

According to PT. KAI officials interviewed on this matter in Kertapati, Prabumulih and Muara Enim stations, the basic proceedings have been made into 3 following steps:

- Notice to households subjected to resettlement
- Meetings with affected people for making understanding explanations
- Negotiations for compensations

These 3 steps are basically similar to the implementation of other large-scaled public projects. However, the applications are totally simplified i.e. making only simple notices to localities but without distribution of formal leaflets with detailed explanations on project works and related items, conducting some meetings for explaining the project works to local people for their understanding but no organization of formal stakeholders meetings in 3 times, for getting all-side opinions, and only simple compensation negotiations but no grievance responses or relocation assistances.

According to concerned PT. KAI officials, as the land premises for implementing this Project are under the management of PT. KAI, if no new installations to be established outside these premises, the said procedure for resettlement has been smoothly carried out as up to now. The compensation sum has been basically made, depending on the actual conditions of the house or building to be affected, but not for the land portion (as being belonged to PT. KAI).

In the section Prabunulih-Muara Enim being under works for double tracking construction, the resettlement works for about 200 affected households along the railway were completely finished last year without any serious problems. About half year was used for making notices and meetings, and another half year was for making compensation negotiations and demolition works.

According to PT. KAI officials, based on the aforementioned legal base for this matter and with the collaboration of concerned local officials etc., the resettlement implementation teams were formed accordingly. Firstly, at top level, a Resettlement Implementation Team was organized in PT. KAI Regional Headquarters, which basic formulation is shown in the following [Fig. 10-2-1].

Team Leader in charge of Resettlement Implementation

Deputy Leader

Field Implentation Chief

Legal Staff and Accounting Staff

(Source: Study team)

[Fig. 10-2-1] PT. KAI Resettlement Implementation Team

At field level, the organization of Resettlement Compensation Group is shown in the following [Fig. 10-2-2].

Chief of Field Resettlement & Compensation

|

Accounting Official & Recording Official

|

Members from Local Government・Village・Police・Army・Religion

(Source: Study team)

[Fig. 10-2-2] PT. KAI Resettlement Compensation Group

Along with the notices for land acquisition and resettlement matter by signboards or leaflets in the affected areas, this Group will organize the solicitation meetings with local people for 2 - 3 times, In these meetings, PT. KAI officials in charge will explain about the project outlines and implementation schedule as well as areas for land acquisition for project implementation, inquiries for local cooperation and compensation subjects. PT. KAI and local government officials will reply to all their inquiries for getting their basic consent for project implementation.

Regarding the details of compensation, the official price lists for compensation by subjects will be basically applied. The records of these meetings will be officially recorded. The scenes of receiving compensation as well as the receipt will be taken in photos as for evidences.

Besides, PT. KAI is planning to carry out land clearance of its land areas around Kertapati station for future construction of depots, related facilities etc. The land plot of about 90 households nearby the present coal stockyard of PT. BAU in Kertapati Station will be subjected to the first resettlement works next year with a reportedly compensation price of 400,000 – 600,000 Rp per m^2.

In the 3rd Stage of the Project, the double tracking works from Sukacinta to Kertapati and the construction of new related facilities in the areas around Kertapati station will be implemented. Despite these constructions will be carried out in the PT. KAI land areas, but with a large scaled resettlement (more than 350households along the railway and about 800 househols in the areas around Kertapati station), the preparation of LARAP, therefore, is considered necessary. Particularly, due to the aspect of in-city properties, the resettlement of households around Kertapati station will be very complicated, requiring high compensation costs and a long time of 3 - 5 years for resettlement. Resettlement proceedings, therefore, have to be started at an early stage.

10.2.2. Present Situation of Project Area

The Project Area is basically formed by 2 parts, the areas along the railway from Lahat to Kertapati and the areas around Kertapati station. Apart from some relatively dense agglomerations nearby some stations of this railway line, the areas along this railway are basically farming and plantation areas. Meanwhile, the areas around Kertapati station are the in-city areas, which were fused as grave lands in the past but being transformed as residential and business areas in nowadays.

However, these land areas are lands managed by PT. KAI. The original residents in these areas were people working or having some relations with PT. KAI for getting provisional living permits in these lands since some decades ago. Their families, however, have continued the residency by building new houses, farms etc.and even making (illegal) sale transactions, which PT. KAI could not control anymore.

The Project Area, covering the railway line between Lahat-Kertapati, is located in the central part of South Sumatra Province as for forming its backbone, This railway line is the top of this T-letter railway system in South Sumatra, starting from Lubukulinggau in the West for directing straightly to Palembang in the East with a diversion in the middle at Prabumulih for forwarding to the port of Taharan in the south The railway system, therefore, is originally developed for coal transportation; but lately for passenger transportation also, due to local demands from the convenience and safety of this transportation means.

Historically, this railway line was constructed and exploited in the Dutch era since 1864 for originally transporting coal exploited from Enim mines in the West for destinations to the ports of Palembang and Taharan for exportation. In 1942, Japan occupied Netherlands East Indies and made the unification administration of all railways in Java and Sumatra. In Sumatra, based on geographical characteristics, the three separate systems: Kita Sumatora Tetsudo (North Sumatra including Aceh), Seibu Sumatora Tetsudo (West Sumatra) and Nanbu Sumatora Tetsudo (South Sumatra) were formed for business management. After the independence in 1945, the Government of Republic of Indonesia continuously made the governance and management of these railways through various national entities, where PT. KAI is presently the last anchor from this transformation.

Sumatra Island, which has the shape of a baguette with 1,760km long and 400km wide, accounts for 25% of the total land area of this archipelago country. South Sumatra Province is bordered by Jambi Province to the north, Lampung Province to the south Bengkulu Province to the west and Bangka Islands to the east. It covers a large area of 87,017 km^2 but a population of more or less 7.25 million inhabitants (density of approx. 59 inhabitants per km^2), where more than 1.3 million inhabitants are living in Palembang, the provincial capital.

The western side of this province consists of the long mountainous wall Bukit Barisan (Parade of Mountains). This mountain range has an altitude of approximately 1,000m above sea level, where found more than 90 volcanic peaks with some high peaks such as Mount Seminung (1,964m), Mount Dempo (3,159m), Mount Pangkuk (2,125m) etc.. This western part has various large coal mines being exploited since longtime ago for supplying to domestic use as well as abroad exportation. The eastern side, however, is made of mostly marsh and swamp lands nearby the coastal areas, where laying Musi River with its attributes and some oil fields entouring Palembang. The lowland part inside this province has been partly observed with farmlands, paddy fields, plantations of rubber or palm trees as well as some gas/oil exploitation fields.

Administratively, South Sumatra Province is made from 15 regions, 217 sub-districts and 2,781 villages which detailed demographic features are shown as follows:

[Table 10-2-1] Present Situation of Administrative Units in South Sumatra Province

No	Region	Area (1,000ha)	Popul'n (million)	Density (per km^2)	Capital City	Sub-District	Village
1	OKU	277.25	0.255	96.3	Bataraja	12	138
2	OKI	1,705.83	0.230	41.5	Kayu Agung	18	297
3	Muara Enim	858.79	0.657	77.8	Muara Enim	22	305
4	Lahat	407.60	0.632	83.7	Lahat	21	359
5	Musi Rawas	1,213.45	0.546	41.7	Muara Beliti	21	258
6	Musi Banyuasin	1,447.70	0.475	36.1	Sekayu	11	209
7	Banyuasin	1,214.27	0.469	67.4	Pangkalan Balai	15	287
8	OKU Selatan	549.39	0.734	80.4	Muara Dua	19	249
9	OKU Timur	341.01	0.317	170.4	Martapura	20	286
10	Ogan Ilir	251.31	0.556	153.1	Indralaya	16	227
11	Empat Lawang	255.64	0.357	83.7	Tebing Tinggi	7	154
12	Palembang	37.40	1.340	3,847.0	Palembang	16	0
13	Prabumulih	42.16	0.130	326.8	Prabumulih	6	12
14	Pagar Alam	57.91	0.115	201.1	Pagar Alam	5	0
15	Lubuklinggau	41.98	0.175	443.2	Lubuklinggau	8	0
Total		8,701.74	7.223	About 59		217	2,781

(Source: Sumatra Selatan Dalam Angka 2010)

From this situation of administrative division and local populations, some densely regions have been found with many sub-districts and villages; meanwhile some remote regions i.e. Pagar

Alam and Lubuk Linggan have only a few sub-districts and almost no villages. This substantial disparity situation among localities could be basically caused by the inferiority of transportation means among these localities in the region.

This railway line between Lahat-Kertapati has 18 stations, namely Lahat, Sukacinta, Banjar, Muara Enim, Muara Gula, Ujan Mas, Gunung Megang, Belimbing, Niru, Penimur, K5, Prabumulih, Lembak, Karang Endah, Gelumbang, Serdang, Payakabung, Simpang and Kertapati. In fact, for passenger transportation, the passenger train generally stops at 6 stations only, which are Lahat, Banjar, Muara Enim, Prabumulih, Lembak and Kertapati., Besides, in comparison to more than 20 coal trains per day, the number of passenger trains has been limited to 4 trains per day from one direction.

Other 12 stations are basically used for temporary stops for waiting trains coming from another direction on a single track. This situation has caused sometimes long waiting times and substantial delays in departures as well as arrivals at both ends, sometimes up to some hours. In the future, if the expansion of double tracks for this line could be made, it will, therefore, definitely enhance the accessibility for local inhabitants, not only between localities but also to the capital city of Palembang as well as various tourist places in this province.

As for this purpose, PT. KAI has recently started the renovation of Kertapati Station in Palembang, the venue for SEA Games 26 in 2011, but the services for passengers have been still found in a very bad situation such as difficulties in purchasing train-tickets, non-comfortably in very crowded and old-fashioned trains for long trips. However, the situation of very crowded passengers implies the good business for this railway line.

Kertapati station in renovation

Its newly constructed platforms

Brick houses in project area

Farmlands along railway

[Pic. 10-2-1] Kertapati Station and Areas along Railway

In fact, this railway line is found passing through 3 major regions, Lahat, Muara Enim and Palembang, and about 60 villages of this province as follows:

[Table 10-2-2] Main Villages Along Railway Lahat - Kertapati

No	Section	Region	Village	Main VillageNames *
1	Lahat - Sukacinta	Lahat	12+	Agglomeration
2	Sukacinta - Banjar	Lahat	10	M. Temiang, Gunung Agung, Ilak Pandan
3	Banjar - Muara Enim	Lahat	6	Merapi, Gunung Kembang, Prabu Menang, Karang Raja, Pasarll
4	Muara Enim - M. Gula*	Muara Enim	7	Agglomeration
5	M.Gula - Ujan Mas*	Muara Enim	1	Small unit
6	Ujan Mas - Gunung Megang*	Muara Enim	3	Ujan Masa Lama, U. M. Baru, Penang Giran
7	Gunung Megang - Belimbing*	Muara Enim	7	Gunung Megano Dalam, G. M. Luar, Lubuk Mumb, Perjito, Tanjung Terang, Tanjung, Dar Kasih
8	Belimbing - Niru *	Muara Enim	4	Cinta Kasih, Belimbing, Buling, Muara Niru
9	Niru - Penimur *	Muara Enim	2	Kuripan, Gunung Raja
10	Penimur - K5 *	Prabumulih	4	Gunung Kemang, Galung, Wunosari, Pasar Prabu
11	K5 - Prabumulih *	Prabumulih	2	Prabum., Majasar
12	Prabumulih - Lembak	Prabumulih	8	Karang Raja, Gunung Ibul Bara, Cambai, Muara Sungai, Taous, Sindur, Pankul, Lembak
13	Lembak - Karang Endah	Muara Enim	3	Kemang, Kar. Endah Selatan, Karang Endah
14	Karang Endah - Gelumbang	Muara Enim	3	Sigam, Gelumbang, Bitis
15	Gelumbang - Serdang	Muara Enim	2	Gelumbang, Putak
16	Serdang - Payakabung	Ogan IÌr	1	Suak Batok
17	Payakabung - Simpang	Ogan IÌr	4	Lorok, Parit, Purnajaya, Parit
18	Simpang - Kertapati	Palembang	4	Karya Jaya, Agglomeration

* Village names were detected on Maps of Peta Jalur & Statium REL Kereta API (PT. KAI) and Provinsi Sumatera Selatan (Indo Prima Sarana)

* Shaded area between sections 4 - 11 were completed in land clearance for executing double tracking works

(Source: Study team)

The population in the Project area is mostly found from Malay and Java origins. Apart from Palembang, most people are generally living on small farms of fruits or paddy fields, and small business along the national roads or this railway, particularly in areas nearby big railway stations such as Lahat, Banjar, Muara Enim, Prabumulih and Lembak. Indigenous people could not be seen in the areas of the railway. This would be the same typical socio-economic picture for other rather developed parts in Sumatra Island.

The houses of local people are mostly made of light materials. Brick houses owned by business owners or rubber plantation owners in the region are found very few. Water from wells is generally used by local people. Only houses along national roads have electric connection. For schooling, there are some sub-districts having local buses for schooling children but most families have to use motorbikes for daily carrying their children.

One of, the main difficulties in daily life in the Project area is the transportation means for inside localities, particularly for people in vicinities to access Palembang for works and businesses. From our firsthand observations, if the railway system in the Project area could be improved for having more passenger trains on daily schedules and more branching railways in the vicinities, the regional socio-economy in this province will be largely developed.

However, along with the Project implementation, even in case of single or double tracks, the number of trains will be significantly increased. The safety problem at train crossings with roads as well as village passages across the railway and the presently manual system for controlling tracks for trains passing stations, therefore, have to be more secured basically. At present, for these critical operations the manually operated system in based on one-person control through 3 shifts per day with radio communications means.

The results of social scooping in the Project Area and proposed mitigation measures are shown in [Table 10-2-3].

[Table 10-2-3] Results of Social Scoping and Proposed Mitigation Measures

No	Subject	Description of Influence	Influence At Each Phase	Influence Level	Proposed Mitigation Measures
1	Resettlement	By starting resettlement works people in resettlement areas will be basically affected.	1st Stage: Nil 2nd Stage: Yes 3rd Stage: Yes	 B A	● Resettlement assistance ● Good preparation of relocation sites ● Proper compensation
2	Livelihood	Livehood and incomes of resettlement people will be affected.	1st Stage: Nil 2nd Stage: Yes 3rd Stage: Yes	 B A	● Income generation measures i.e. job training programs ● Proper compensation
3	Cultural Heritage	No existence of considerable cultural heritages in Project Area.	1st Stage: Nil 2nd Stage: Nil 3rd Stage: Nil		
4	Landscape	No existence of considerable social views in Project Area.	1st Stage: Nil 2nd Stage: Nil 3rd Stage: Nil		
5	Minorities Aborigines	No existence of Minorities/ Indeneous Groups in Project Area.	1st Stage: Nil 2nd Stage: Nil 3rd Stage: Nil		
6	Labor Condition	Jobs and incomes of resettlement people will be affected.	1st Stage: Nil 2nd Stage: Yes 3rd Stage: Yes	 B B	● Offering project jobs ● Job trainings for local people
7	Hygiene (Dust, Waste, Sewage)	With increase of trains, hygienic environment in stations and railway areas will be affected.	1st Stage: Yes 2nd Stage: Yes 3rd Stage: Yes	B B B	Campaigns for cleaning stations and railway areas
8	Safety at Crossings	With increase of daily trains, safety risks at crossings/passages are considered.	1st Stage: Yes 2nd Stage: Yes 3rd Stage: Yes	B B B	● Reinforcement of warning control system ● Social education

Note A: Influence at High Level
B: Influence at Minor Level
C: No clear detection of influence at present; but influences may be detected after further investigation
No mark: No influence

(Source: Study team)

Regarding Palembang, the historical provincial capital laying by the Musi River at 80km upstream, was firstly developed as an important ocean commerce port of the world over 1,300 years ago. It was once made as the capital of the Sriwijaya Empire, which scholars have called “Phoenicia of the East”. Lately it has turned up to be a famous maritime base for exporting oil, coal and lumber from Sumatra to the world. The city has the historical cultural vestiges of a Chinese Buddhist pilgrim when making a landing here on his way to India in 671 but gradually passed through various dominance conflicts. This city was finally made up as an Islamic city with the symbolic Masjid Raya Grand Mosque situated by the entrance of Ampera Bridge which was constructed by Japan as war reparations over the Musi River in 1960's. The major socio-economic and cultural features of Palembang are as follows:

[Table 10-2-4] Demographic Features of Palembang City

City Creation	14 August 1950; 11 Districts, 4 Towns, 160 Sub-districts and 2,756 Villages/ Wards
Area (Population)	374km^2 (Approx. 1.3 million inhabitants)
Races (Language)	Komering, Ogan, Pasemah and Palembang (Palembang)
Religions	Islam 95.3%, Christian 3.6%, Hindu 0.7% and Buddhist 0.4%
Traditional Items	Language: Palembang Songs: Dek Sangke, Kembanglah, Bungo Dances: Tari Gending Sriwijaya, TariTanggai, Tari Bekhusek
Produces	Lumber, Cofffee, Pepper, Coconut
Industries	Fertilizer, Cement, Plywood
Mines	Oil, Tin, Lead

(Source: Atlas Lengkap Indonesia & Dunia)

Meanwhile, the areas around Kertapati station, which were public lands in the past, but along with the development of Sumatra and railway system, had been lately made as PT. KAI controlled lands. These areas were used as common grave lands in the past but lately used as temporary living lands for PT. KAI workers and immigrants for Sumatra development works. However, the temporary residents and their families have continued to live in these areas, gradually making a city development for these areas. The 20ha area annexed to Kertapati station, which is subjected to constructions of new coal stockyard and coal loading conveyor, is presently covered by Simpang Sungki Road and still having many graves, where about 100 shops and 700 houses are found, making the busiest business area around Kertapati station.. This area has a mosque constructed in 1993 but no schools and appropriate clinics.

10.2.3. Preparations for LARAP

(1) Comparisons on Results from Preliminary Surveys

For the implementation of double tracking works for this railway in the future, the preparation of a LARAP (Land Acquisition and Resettlement Action Plan) for households etc. established in the subjected land areas is considered necessary. The preliminary field surveys inform the presence of occupants in the government owned land along the railway line between Lahat-Kertapat. No matter the occupants are legal or illegal, LARAP preparation will be necessary if the number of involuntary resettlement of the occupants is expected to be substancial. A confirmation survey by train on this line was carried out at the First JICA Study Mission and the findings are as follows:

- In the section between Muara Enim-Prabumulih X6, the land clearance for double-tracking works was totally completed in 2011. According to PT. KAI officials in Prabumulih and Muara Enim stations, about 200 households were subjected to resettlement in this section and the resettlement proceedings were smoothly carried out with only cash payment negotiations on buildings etc. because of land areas belonged to PT. KAI managed lands. According to PT. KAI officer in charge of resettlement works, the compensation amount used for this resettlement (for about 70Km with about 200 households) was around 8 billion Rp.
- As the on-going double tracking works have been carried out on the northern side, the future double tracking works of this line, in principle, will be also on the northern side, as for the subjected resettlement works. The number of resettlement units for double tracking works by section is shown in the following [Table 10-2-5].

[Table 10-2-5] Estimated Numbers of Resettlement Units for Double Tracking Works by Section

Railway Section	Units for Resettlement	Difficulty Level for Clearance
1. Kertapati - Simpang	About 5	Low
2. Simpang - Payakabung	About 1	Low
3. Payakabung - Gelumbang	About 5	Low
4. Gelumbang - Kerang Endah	About 10	Medium
5. Kerang Endah - Lembak	About 15	Medium
6. Lembak - Prabumulih	About 200	High
7. Prabumulih - K5	Clearance Completed	None
8. K5 - Penimur - Niru	Clearance Completed	None
9. Niru - Blimbing	Clearance Completed	None
10. Blimbing - Gunung Megang	Clearance Completed	None
11. Gunung Megang - Penganggiran	Clearance Completed	None
12. Peganggiran - Ujan Mas	Clearance Completed	None
13. Ujan Mas - Muara Gula	Clearance Completed	None
14. Muara Gula - Muara Enim	Clearance Completed	None
15. Muara Enim - Banjarsari	About 100	High
16. Banjarsari - Sukacinta	About 30	Medium
Total Units for Clearance (Sukacinta - Kertapati)	About 366 units	
17. Sukacinta - Lahat	About 70	No Clearance
Total Units (Kertapati - Lahat)	About 436 Unita	

(Source: Study team)

- In a project in Indonesia which requires land acquisition and/or resettlement of household, preparation of LARAP is considered necessary in case both land acquisiton and resettlement of household are required, while RAP is sufficient in case for resettlement of household alone.
- Based on preliminary survey results, the 2 sections of Lembak-Prabumulih (about 200 units) and Miuraenim-Banjarsari (about 100 units) will be the most important sections for carrying out resettlement works. However, due to not being subjected to coal transportation, the section of Sukacinta-Lahat is not subjected to double tracking works for carrying out resettlement (70 units).
- The total resettlement units along the railway from Sukacinta to Kertapati will be reduced to about 366 units. The 2 sections, Banjarsari-Miuraenim and Prabumulih-Lembak, will be the most crucial sections for resettlement works.

(2) Results from Hearing Surveys

Concerning the regulations and formalities in case of proceeding resettlement works, interviews to concerned officials of DGR in Jakarta and PT. KAI in South Sumatra (Palembang and Muara Enim), and the following information was obtained.

- According to these officials, the general proceedings for resettlement of PAP will be made in three basic steps as follows:
  1) Notices to affected localities
  2) Organization of stakeholders meetings
  3) Starting compensation negotiations
- For making notices to affected localities, with the authorization and collaboration of implementing agency, the contractor will make notices to affected localities by signboards and distribution of leaflets describing outlines of the project works and affected areas
- In collaboration with the local government, the implementing agency, will organize the stakeholders meetings (by generally three times) for explaining the project works and areas, the affected households, measures for proceeding resettlement and getting opinions from local people for discussions towards consent for this matter..
- Compensation negotiations will be made on house-by house basis. Cash compensation is the general application.
- With references to PT. KAI information and related legal materials for implementing the resettlement works of section Muara Enim - Prabumulih X6, the TOR for LARAP preparation was prepared.

(3) Analysis of Social Survey Results

In order to collect the detailed information and data for the preparation of LARAP in case of making double tracks in the future, the attached survey questionnaires for Village Social Survey (Refer [Appendix 10-2-4]) and PAP Household Census Survey (Refer [Appendix 10-2-5]) as well as the translation versions into Indonesian language were prepared. The content of surveys is based on the JICA Specifications for Environmental and Social Considerations.

The social survey was entrusted to PUSKOPKA Team, which is an affiliate consulting company under the surveillance of Humas (Public Relations Section) of PT. PESERO, Division Regional III of PT. KAI. The scope of survey consists of socio-economic surveys of 50 villages and 100 households in the areas along the railway from Sukacinta to Kertapati and the areas annexed to Kertapati station for finalizing in a report.

A Social Survey Group at Work

Field of Social Surveys

Meeting with People in Kertapati Area

PT. KAI Officers and Study Team in Meeting

[Pic. 10-2-2] Social Survey and Meeting with Local People in Kertapati Areas

The survey team of PERSERO had conducted the surveys of 60 villages and 137 households. After analysis of the survey results, the "Final Report-Survey Works on Socio-Economic Impacts And Resettlement Matter of the Project" (Refer [Appendix 10-2-6]) was compiled accordingly. According to this report, the number of surveyed villages and households by section are shown in the following [Table 10-2-6].

[Table 10-2-6] Number of Surveyed Villages and Households by Section

Section	Surveyed Vilages	Surveyed HH
1. Sukacinta - Banjar Sari	14	18
2. Banjar Sari – Muara Enim	15	20
3. Prabumulih – Lembak	12	31
4. Lembak - Karang Endah	5	5
5. Karang Endah - -Gelumbang	5	10
6. Gelumbang – Sendang	2	2
7. Sendang - PayungKudung	1	3
8, Payung Kudung - Simpang	1	3
9. Simpang – Kertapati	3	24
10. 20ha Area (A B C D Areas)	2	15
11. Area nearby Musi River	0	6
Total	60	137

(Source: Study team)

From the survey results on socio-economic impacts of this report, the additional hearing surveys to local inhabitants were carried out. The problems faced by villages as well as their requests for the Project implementation are shown in the following [Table 10-2-7].

[Table 10-2-7] Problems and Requests from Surveyed Villages

	Problems	Requests
LAHAT : Sukacinta, Merapi, Banjar Sara, Arahan, Gunung Kembang, Bira Pulan, Ulak Pardan, Muara, Telatan, Muara Mau, Tanjung Pina	● Umemployment ● Low Family Income ● Coservation of Grave (Puyang Depati Putih)	● Job Creation ● Life Improvement ● Conservation
MUARA ENIM : Muara Enim, Tungkai, Lembak, Talung Tali Sigam1, Gelumbang, Gelumbang Ling III, Karang Endah, Karang Endak Utara,	● Price Unstabikity of Rubber etc ● Market Unstability of Produces ● Thief of Agri.Produces	● Stability measures ● Thief Prevention ● Income Generation
PRABUMULIH : Pasar1, Sindur, Pankung V, Mangga Besar, Sukajadi, Karang Reja, Gurung Ibul, Cambai	● Price Unstabikity of Rubber etc、 ● Lack of Market for Produces ● Lack of Irrigation	● Market for Produces ● Construction of Irrigation ● Income Generation Program
OGAN IIR : Sei Rambutan	● Unemployment, Low Income ● Lack of Water for Domestic and Agriculture ● Lack of Social Infrastructures	● Skill Training ● FindingWater Source ● Making Social Infrastructures
KERTAPATI : Simpang, Kemang Agung, Organ Baru, Rambutan	● Lack of Drinking Water ● Isolation by Water Logging ● Safety for Crossing Railway ● Noise, Vibration, Air Pollution ● Unhigienic Living Environment	● Finding Water Source ● Water Logging ● Safety Measures ● Prevention of Noise, Vibration, Air Pollution ● Good Living Environment

(Source: Study team)

Besides, apart from the data of socio-economic and living conditions (family-structure, inhabiting years, housing conditions, occupations, revenues, living conditions etc.), the report showed also the opinions of people on the Project.implementation.

Particularly for the areas of dense populations around Kertapati station, subjected to the new constructions of coal stockyard and belt conveyor for loading coal to barges, a meeting session with local people for hearing their voices was held with the collaboration of PT. KAI officials on Jan. 27, 2012. The Minutes of Meeting with local people is shown in [Appendix 10-1-6]. The 5 following items are the most concerns:

- Sufficient Time for Relocation After Resettlement Notice
- Proper Compensation
- Nearby Places for Relocation

- Implementation of Assistance Programss for Livelihod Recovery After Relocation
- Construction of Social Infrastructures in Relocation Places

(4) Applications and Works for Each Stage of Project Implementation

As pre-conditions, the Project implementation will be carried out in each 3 Stages. In the 1st Stage, as the existing single track will be used but only the related facilities will be improved for expanding the transportation capacity, the resettlement works, therefore, will not be carried out. However, along with the increase of freight and passenger trains in the future, the following applications in three stages have been subjected to implementation plan.

① Applications and Works in the 1st Stage:

- Additional transportation capacity target from the present: 2.5MTPA
- Additional trains per day: 8 round trips per day
- Train composition: 1 Locomotive + 25 Freight wagons (container type)
- Total train length: 395m
- Expansion of effective length: From present effective length to be expanded, but not so long as for train length of 60 wagons in the future
- Average train travel speed: 65km/hr
- Expansion of coal stockyard capacity at Sukacinta
- Expansion of PT. BAU coal stockyard capacity at Kertapati station

② Applications and Works in the 2nd Stage:

- Additional transportation capacity target from the present: 5.0MTPA
- Additional trains per day: 10 round trips per day
- Train composition: 1 Locomotives + 40 Freight wagons (container type)
- Total train length: 615m
- Average train travel speed: 65km/hr
- Expansion of effective length: From present effective length to be expanded, but not so long as for train length of 60 wagons in the future
- Double tracking works for Section Muara Enim-Prabumulih X6
- Construction of 2 signaling stations
- Construction of a 700m branch line from Merapi to Sukacinta soal stockyard
- Renovation works for container yard in Kertapati station

③ Applications and Works in the 3rd Stage:

- Additional transportation capacity target from the present: 20.0MTPA
- Additional trains per day: 12 round trips per day
- Train composition: 2 Locomotives + 60 Freight wagons

- Total train length: 930m
- Average train travel speed: 65km/hr
- Introduction of electric signal system
- Construction of a belt conveyor system to barges from the 20ha land area annexted to Kertapati station based on PT. KAI construction plan

In the 3rd Stage, along with the whole double tracking works, the construction of new coal stockyard as well as belt conveyor in the areas surrounding Kertapati station for loading coal on barges will require a large scaled resettlement of inhabitants in these areas. As proceedings required for JICA study, LARAP will be prepared.

However, at the moment, as the SPC for project implementation is not formulated as yet, The organizations relating to resettlement execution could not be made for confirming the clearance limits as well as the exact number of affected households for land acquisition at each village. Stakeholders meetings, compensation costs as well as compensation payment proceedings and schedules for related programs could not be planned. This means the basic factors for LARAP preparation are not ready. Therefore, in order to make this preparation for the next step of the implementation, the T. O. R. for LARAP Preparation (Refer [Appendix 10-2-7]) was made.

Chapter 9

Project Impact Assessment

9.1. Operational and Performance Indicators

The project could achieve a modal shift from road to rail due to the expansion of the rail transportation capacity. It is expected that air quality along the road will be improved by a reduction of truck traffic. Therefore, the quantitative index of operational and performance indicators are set as follows.

Regarding each index, project participants can quantitatively evaluate a difference between a benchmark and a target with implementing the monitoring.

[Table 9-1-1] Operation and Performance Indicators

Indicators		Unit	Benchmarks (Post Construction)	Targets (Post 2nd year Operation)	Targets (Post 7th year Operation)
Operation ratio[1]		%	92	92	92
Coal transportation		MTPA	25.5	28.0	43.0
Coal production in Lahat Area		MTPA	4.7	7.2	22.2
Passenger Transportation		Thousand person-km	674,008	719,096	801,542
Freight Transportation		Million ton-km	9,381	9,829	12,519
Number of Train	Freight	train/day	79	83	105
	Passenger	train/day	16	16	20
Travel Time between Lahat and Kertapati		hour	6.17	4.5	4.5
Coal Transportation by Road		MTPA	2.2	2.2	2.2

(Source: Study team)

Regarding each index, project responsible body should confirm a status of the achievement of benchmark and target values with the following monitoring methods.

[1] According to the haering to PT. KAI Palemban, maintenace operatin ratio was 97.3% based on the record of 355 working days in a year, but 5% points were reduced considering the malfunctionning risk.

[Table 9-1-2] Monitoring Methodology of Operation and Performance Indicators

Indicators	Unit	Project responsible body	Explanations	Monitoring frequency
Operation ratio	%	Railway operator	Annual operational report of railway operator	Annual
Coal Transportation	MTPA	Railway operator	Annual transport report of railway operator	Annual
Coal Production in Lahat Area	MTPA	Railway operator	Interview coal producers	Annual
Passenger Transportation	person-km	Railway operator	Annual transport report of railway operator	Annual
Freight Transportation	ton-km	Railway operator	Annual transport report of railway operator	Annual
Number of Train	train/day	Railway operator	Annual transport report of railway operator	Annual
Travel Time between Lahat and Kertapati	hour	Railway operator	Annual transport report of railway operator	Annual
Coal Transportation by Road	MTPA	Railway operator	Interview truck companies	Once before start of the project and once the target year

(Source: Study team)

In order to monitor the operational performance of the project continuously, the project responsible body should monitor the indicators following each monitoring method such as statistic or interview survey. When it becomes evident that monitoring values deviate from indicators significantly, the project responsible body should confirm the causes and reform the project to the extent possible.

Utilization of the coal resources by the Project will activate the local economies. At the same time, better accessibility to local public facilities owing to the improved railway service, and environmental improvement are also expected. Therefore, the qualitative index of operational and performance indicators will be set as follows. Regarding each index, project participants can qualitatively evaluate a difference between a benchmark and a target with implementing the beneficiary survey. Each indicator is set up based on the following framework.

[Table 9-1-3] Monitoring Framework for the Qualitative Index of Operational and Performance Indicators

Items	Explanations	Benchmarks (Post Construction)	Targets (Post 2nd year Operation)	Targets (Post 7th year Operation)
Improvement of living convenience	Travel time of passenger trains btw Lahat and Kertapati	4.75	4.75	4.75
	Number of passenger trains	6	6	7
Development of towns along the railway	Increasing income level of inhabitants along the rail with improvement of living convenience, creation of employment opportunities	18,230,598	19,510,590 (Annual real growth rate of 3.5%)	22,346,494 (Annual real growth rate of 3.5%)
Improvement of living environment	The air quality improvement by a decrease in trucks	Achievement of the environmental standard NO_2: 400μg/m^{3}N(hourly), 150μg/m^{3}N(24 hours) Noise: 70dB(commercial and service)		
Creation of employment opportunities	Employment during the construction period	340,000 persons (at the 1st Stage)	320,000 persons (at the 2nd Stage)	470,000 persons (at the 3rd Stage)

(Source: Study team)

[Table 9-1-4] Monitoring Methods for the Qualitative Index of Operational and Performance Indicators

Items	Monitoring method	Responsible body	Monitoring frequency	Monitoring target
Improvement of living convenience	Interview survey to railway passengers concerning traffic reliability	Railway operator	Target year	Cargo owners, passengers
Development of towns along the rail	Interview survey to inhabitants along the rail concerning their income level	Railway operator	Target year	Inhabitants along the rail
Improvement of living environment	Monitoring NO_x and noise for confirming the air quality improvement	Railway operator	Annual	Monitoring site
Creation of employment opportunities	Total number of employment during construction period	Railway operator	Target year	Constructors

(Source: Study team)

9.2. Evaluation and Proposal from Technical Aspect

9.2.1. Technical Aspect

Implementation of this project is proposed to be implemented with stepwise improvement approach in 3 stages starting from immediate measure depending on the increase of coal transportation demand considering economical effect.

In the 1st Stage, it is targeting to attain target transportation volume by implementing improvement and reinforcement of existing facilities supplemented by truck transportation. Major works involved in this stage are repair of track structure and reinforcement, thus no technical complexity can be foreseen. Construction period is planned to be about 4 years including design etc., and no particular problem can be foreseen as well. If any problem dared to be forecasted, since the big amount of track material for about 200km such as turnout, rail, and composite sleeper may supplied from overseas dividing in several years, procurement procedure must be properly controlled avoiding confusion and enough number of skilled maintenance clew must be secured.

The 2nd Stage must be started immediately after the completion of the 1st Stage. The major works involved are reservation of siding clear length for train evacuation and 2 signaling station construction corresponding to train extension. Construction period is planed to be 6 years including the 1st Stage work. Technical challenges are shifting of slope sections relevant to slope before and behind station where clear length is extended and relocation of crossing which crosses station before and behind in the level sections. A proper selection of method to extend the clear length with scrutinized topographic profile based on vertical section survey may and it may cause to relocate the structures other than railways such as existing road. No other technical difficulties can be foreseen.

In order to increase transportation capacity, coal loading and unloading facility at the Kertapati side must be reinforced which entails capital improvement in Kertapati station yard, coal loading and unloading facility, and barge shipping equipment. Although there is no technical difficulties in the machine components, adjustment of interest among entities concerned will be needed in respect of land reservation for the construction of new bay line etc., or capital improvement of station yard. Furthermore, although it is a precondition that full double-tracking of between Muara Enim and Prabumulih X6 section is completed, the work must be completed under this project if the progress of the double-tracking work is not as planned.

In the 3rd Stage, new line will be constructed in parallel with existing track, and clear length extension corresponding to train length extension is needed at almost all stations. Although the accumulated starting from the 1st Stage is planned to be about 10 years, there is no technical difficulties can be foreseen in the civil work and track work of general kind. The challenge at this stage is to secure land in Kertapati to reinforce coal loading and unloading facility and barge loading equipment.

Signaling and telecommunication system will be modernized in the entire stretch of additional track section as well as the existing track, which will require to develop technical solution in order to safely implement the changing work from the existing signaling and telecommunication system to the new ones while allowing normal train operation. Furthermore, the modernized signaling and telecommunication system demands bigger electric supply. In this project, since the electric power is planned to be supplied by electric power company, where the distance from transmission network of electric power company is far, additional power supply line will be needed. Moreover, since the signaling and telecommunication system will work as an integrated system, it should be avoided to procure the equipments from different suppliers with different technical culture in order to ensure safety and efficient operation and maintenance.

As it was proposed in 4.4.2. (P. 4-46), the rail replacement work which should be completed in the 1st Stage, was shifted to the 2nd Stage in order for the Project to be viable with the private sector initiative in terms of financial concern. However, it is necessary to replace the existing rail to a heavier one as early as possible for the train operation to be stable with higher speed in the long run. Therefore, the schedule for the 2nd Stage is so designed as to complete the rail replacement work at the beginning of the 2nd Stage implementation schedule. In this context, the implementation of the 2nd Stage is indispensable for the 1st Stage project to be technically viable even thought the 2nd Stage is financially inferior to the 1st Stage.

9.2.2. Conclusive Remarks and Policy Implication in Financial and Economic Aspects

In the light of the numerical deliverables of the preceding economic and financial analyses in the sections of 7.3. (P. 7-10) and 7.4. (P. 7-17), some of the conclusive remarks would be noteworthy for discussions to come. These include, among others, the followings.

- The Project EIRRs highly exceed Project FIRRs in both absolute and relative terms, profoundly implying that the concerned transportation project in the Region benefit the public and national economy of the country. Therefore, the Project will preferably be implemented under the initiating leadership and auspices of the Public sector, with external development partnership financing facilities closely in view.
- For all of the implementation stages of the 1st, 2nd, and the 3rd, debt sustainability index of minimum DSCR of SPC exceeded the cut-off rate, while revealing robustness of certain aspect of financial capacity of the prospective private sector entity. Meanwhile the analysis posted lower Equity IRR than the cut-off rate for all the stages, casting certain concern over

the profitability of the private sector investor. In this light, there may be some measures facilitating private investors to get involved with ease and some certain for profitability. One of those may include a hike of lease and infrastructure differed payment, for instance an increase by 0.35% per month will raise Equity IRR over the cut-off rate. Even so doing, financial superiority of lease contract will be retained for PT. KAI in terms of FIRR and present value-based aggregate payments when compared with own-financing by private bank borrowing.

- Alternatively, downsizing of the cost for SPC will also raise Equity IRR by introducing public fund (the Government of Indonesia supposedly supported by Japan's yen loan) to the project. Provided that public fund account for 40% of the total cost (the 1st Stage), Equity IRR will be in the neighbor of the binding profitability line. Further, it would be noteworthy for private sector investor to possibly modify equity-debt ratio from 30:70 currently in place for analysis down to 20:80.
- As reflected in the analysis of PT. KAI accounting and financial robustness in operating railway transport services, it is evident that the entity is in a position of over liquidity (Current ratio[2] 262.0%, Quick ratio[3] 193.2%) and under investment (Fixed asset to long-term capital[4] 59.4% in 2010. With this in view, PT. KAI would be a good partner as operating body of the prospective PPP-scheme transportation services in South Sumatra.

9.2.3. Environmental and Social Aspects

(1) Environmental Consideration

Concerning the environmental aspect of this Project, JICA study team prepared a draft screening report, a draft scoping report, and identifications of environmental impact elements based on JICA environmental guideline. Outline of environmental impact at each implementing stage are as follows;

At the 1st Stage, the constructions involve mainly an improvement of track, reinforcement of coal loading and unloading facility. During the construction period, environmental consideration is needed, even though no big environmental impact will be expected.

At the 2nd Stage, the constructions which involve the partial double-tracking work and reinforcement of unloading facility at Kertapati station will require environmental considerations, even though no big environmental impact will be expected. However, the branch line construction which is laid from Merapi to the main line (approximately 700 meters) will require an appropriate alignment and construction plan paying due attention to environmental considerations.

2 Current Asset/Current Liability
3 (Cash+Short-term Deposits+Account Recievable+Securities)/Current Liability
4 Fixed Assets/(Owners' Equity + Long-term Liability)

At the 3rd Stage, the construction plan involves the double-tracking work between Sukacinta and Simpang, coal loading and unloading facility at Kertapati station yard, the barge loading system. A construction site for coal loading and unloading facility is adjoining to the housing area. Therefore this work will especially require a construction plan paying due attention to environmental considerations.

In this project, in case of the double-tracking work and increasing the number of trains for passengers and freights, it is expected that negative environmental impact will not be occurred. However the construction plans at the 3rd Stage, which set up the coal loading and unloading facility at Kertapati station yard (20ha), the barge loading system and the conveyor belt for a barge transport along the Musi river, will require an environmental assessment in the construction site.

(2) Social Consideration

Concerning the social aspect, it was observed in the field survey that there are many occupants on both sides of the railway right of way (25m for in-city areas and 75m for other areas) between Lahat to Kertapati (at present, there are about 436 houses on the northern side of the line). These houses are mostly concentrating in 3 station areas of Lahat, Prabumulih and Kertapati. As about 70 houses were identified nearby Lahat station, but the Lahat-Sukacinta section is not subjected to double-tracking works, the number of houses subjected to resettlement will be about 366 units.

On the other hand, in order to construct the new coal stockyard as well as the coal unloading railway line etc. in Kertapati station in the 3rd Stage of the Project, the 20ha area annexed to this station with many inhabitants living for decades (presently about 800 households, a market and many old graves) will be subjected to resettlement.

Therefore, in terms of area for resettlement, there are substantially 2 main areas. But, in comparison to the relatively simple resettlement works along the railway line (about 366 households), the resettlement works for the 20ha area annexed to Kertapati station (presently about 800 households, a market and many old graves) will basically require high compensation costs and long time, about 3 - 5 years, for resettlement enforcement due to its complexity. The preparation for resettlement works for this part should be done before the implementation of 3rd Stage.

On social impacts, even with the completion of double-tracking project and high increase of daily traffic of coal and passengers trains, apart from the resettlement problem, no major negative social impacts are foreseeable by the installation of effective warning control system at railway crossings (for safety improvement) and adopting prevention measures to noise and air pollution. On the other hand, in comparison to bus transportation, the increase of daily trains for passengers transportation will contribute a safe, cheap and convenient transportation means for low-income people in the areas.

According to PT. KAI officials concerned, occupants presently living and having farms inside the railway right of way along the railway are mostly not illegal occupants but having some kind of previous permission from PT. KAI. Therefore, for the implementation of the Project, PT. KAI considers that it could take back these land areas by making compensation negotiations for their resettlement without having any serious social problems.

Presently, in order to implement the double-tracking works in the section between Muara Enim to Prabumulih X6, the clearance of occupants (about 200 houses) in this section was completed already within one year. Therefore, regarding the resettlement of occupants for this Project implementation, the PT. KAI proceedings for compensation negotiations, in principle, could be applied accordingly.

However, in the social surveys of this Study, local people expressed their requests on Project implementation, especially the formation of vocational trainings, as for an income recovery program for relocates. Based on the present conditions of local social capitals, the vocational trainings on agro-gardening and manufacturing of farming and workshop tools could be periodically organized in the main station premises of Muara Enim, Prabumulih and Kertapati. Besides, during the period of relocation as well as the period for relocates to attain their stable living and earning conditions in new relocation sites, the execution of a monitoring program on resettlement proceedings is considered necessary. The details of these programs will be notified in LARAP.

The Project will be implemented in 3 Stages, but similar to the 1st Stage, since partial double-tracking works will be implemented within station premises only and the construction of a short branch line of about 700m is located in the remote area of Merapi village in the 2nd Stage, it will, in principle, need no resettlement works.

But in the 3rd Stage, the project implementation, which entails whole double-tracking works from Sukacinta to Kertapati with new constructions of coal stockyard, unloading rail lines and a conveyor installation toward Musi River in areas around Kertapati station, will require a full scale of resettlement works in these areas. The preparation of LARAP (Land Acquisition & Resettlement Action Plan), therefore, will be carried out. Besides, along with the increasing number of daily train traffic and new constructions of these related installations around Kertapati station, the necessary measures for securing safety for local people as well as a proper living environment in the areas will be implemented accordingly.

For LARAP preparation, the social survey in Project area was carried out to collect the basic social data and related resettlement information. And with the formation of SPC for Project implementation, where LARAP will be duly prepared, the TOR for this preparation was made. By its application the related resettlement works will be carried out accordingly.

9.2.4. Organizational Aspect

While PT. BA is exclusively transporting coal by rail to Tarahan and Kertapati in South Sumatra State at present, most of the private coal mines are transporting coal by track except for PT. BAU which use rail to Kertapati with minimal volume due to limited railway traffic capability. On road transportation of coal by heavy duty truck has a limitation of traffic volume due to road breakage, traffic congestion and environmental concern. Night time transportation is already restricted and further decline of road transportation capacity is expected in the future, therefore the shift from on road transportation to railway transportation is in the urgent necessity.

As it was stated in 2.3. (P. 2-12), effective use of resources by developing coal mine is one of the highest priority agenda for the South Sumatra State government, and since the railway sector development is also among the very high priority, there is no serious obstacle in implementing this project.

Main purposes of the New Railway Law promulgated in 2007 are to accept participation to railway operation of not only the Central Government but also the Local Governments and private companies. A business unit to be assigned to manage this project will be, as it is stated in Chapter 5 of the Law, private enterprise which obtained management concession and governmental cooperation in accordance with Central Government guidelines. However it is also the fact that there is no actual application in the railway operation so far in terms of SPC selection procedure and environmental and social compliance. In addition, It is note worthy that there remain other uncertainties such as right of way boundary between the government and PT. KAI.

The SPC to be established in this project is planned to cooperate with PT. KAI in a "B to B business" manner under the governmental guidance based on the New Railway Law in order to expand the transportation capacity thereby make the existing railway work as a public railway. SPC will run a coal transportation business on the public owned railway facilities and infrastructure having concession from the government, and repair, upgrade and reinforce the existing facilities. And, as it has been described, the train operation and maintenance work including repair, upgrade and reinforcement of facility and infrastructure will be entrusted to PT. KAI on a contract basis, because it has sufficient experiences in the railway operation and management.

Although there is a history that the state owned Railway Company was privatized and PT. KAI was established, but this can be recognized as a special case and no private company has ever participated in the railway business in Indonesia. It implies that procedural difficulties such as government permission, cooperation contract, concession contract, and so forth will be anticipated before this project will be materialized.

9.3. Evaluation and Proposal on Project Operation

9.3.1. Possibility of Private Investment

This project is a leasing business by SPC to PT. KAI to enhance coal transportation capacity of railway from Lahat to Keretapati in South Sumatra. Private investment will be highly expected for each stage of the project although the scale and the scheme of private investment varies at each stage with the following reasons.

(1) The 1st Stage

The annual revenue which SPC can receive from the leasing business is estimated to be JP¥ 1.5billion based on the lease rate of 13.2%/year although the amount varies from year to year in accordance with terms and condition of leasing contract, while total CAPEX (Capital Expenditure) to transport the 2.5MTPA of coal is estimated to be JP¥ 9billion. As mentioned before, SPC will raise fund by acquiring JICA ODA private sector finance scheme for the 70% of the CAPEX and the rest by private investment. The JICA scheme will contribute to reduce SPC's financial burden in its interest payment. If the JICA scheme is available for the project, it is expected that investor's IRR (Internal rate of return) will go up to 20% subject to the condition that lease rate and dividend ratio to the private investors are fairly arranged. In addition, considering the fact that the coal targeted to be transported by the project is already under production, the project can be assessed as sound one, and no particular difficulty in attracting private investment is foreseeable. In fact, there are already Japanese trading house which owns coal mining right in this area is expressing interest on the project investment and Japanese leasing companies have been contacted to ask for co-investment on this project. Furthermore, Indonesian companies, such as private coal mine companies and infrastructure related companies will be candidates for co-investors for this project. As far as South Sumatra governor is concerned, as of now, it is just expected to participate in this project. Because 1) the objective of this project is to promote development of the province, so we believe this project is beneficial for the governor and 2) it is found that South Sumatra governor plan to invest other coal transportation project in this area. However, since it is important to finalize the contract framework between PT. KAI and SPC, at this stage, co-investment by South Sumatra Government will not be insisted.

(2) The 2nd Stage

Total CAPEX to transport the 5.0MTPA of coal is estimated to be JP¥ 25billion with the 1st Stage implementation cost combined. The annual revenue which SPC can receive from the leasing business newly should be set considering the case PT. KAI procure rolling-stocks and do construction work by own finance. In the same way as the 1st Stage, if the JICA scheme is available for the project, it is expected that equity IRR will go up to 20% subject to the condition that lease rate and dividend ratio to the private investors are fairly arranged. In addition, considering the fact that the coal targeted to be transported by the project is already under production, the project can be assessed as sound one, and no particular difficulty in attracting private investment is foreseeable.

(3) The 3rd Stage

Total CAPEX to transport the 20.0MTPA of coal is estimated to be JP¥ 77billion with the 1st Stage and the 2nd Stage implementation cost combined. Like the 2nd Stage, the annual revenue which SPC can receive from the leasing business newly should be set considering the case PT. KAI procure rolling-stocks and do construction work by own finance. In the same way as the 1st Stage and 2nd Stage, if the JICA scheme is available for the project, it is expected that investor's IRR will go up to 20% subject to the condition that lease rate and dividend ratio to the private investors are fairly arranged. In addition, considering the fact that the coal targeted to be transported by the project is already under production, the project can be assessed as sound one, and no particular difficulty in attracting private investment is foreseeable.

However, in order for the project to be implemented with the scenario as mentioned above, the project must be attractive enough for the private investors in the 1st Stage implementation. In this context, the following subjects must be fully discussed in advance.

[Table 9-3-1] Subject and Solution to Attract Private Investment in the 1st Stage

No.	Subject	Possible Solution
1	Business license to SPC	SPC will procure rolling-stocks, conduct rehabilitation of existing line, and then lease them to PT. KAI. In order to start this leasing business, SPC have to obtain license from the government. Therefore, it is necessary to clarify the procedure. Also, this is true to the 2nd Sage and the 3rd Stage, SPC procure rolling-stock and coal loading/ unloading facilities and lease them to PT. KAI.
2	Approval for using rolling-stocks	It is proposed to use the locomotive and container freight wagon which are already approve in its designed in Indonesia for the project. These rolling-stocks must be used during the project life. Therefore, SPC have to be given an approval by DGR for the long term use of the rolling-stocks.
3	Maintenance of rolling-stocks	Since the maintenance of the rolling-stocks owned by SPC will be done by PT. KAI, it is proposed that SPC has a capability to supervise PT. KAI perform the maintenance work rightly and periodically.
4	leasing contract with PT. KAI	This is a leasing business between SPC and PT. KAI with the objective of enhancing transportation capacity of the existing line from Lahat to Kertapati. Since the lease period is 20 years and it is very long, the way of coping with troubles occur during the period should be set in advance. Therefore, before entering into the agreement between SPC and PT. KAI, it is considered that SPC will have company which has enough resource and experience in leasing business as its sponsor and use consultants.
5	Insurance on investment	If investors to SPC are Japanese companies, they can buy insurance on investment provided by NEXI. That can help SPC hedge their risks, such as political risk and force majeure.
6	Operation cost escalation of SPC	Major component of the operation cost of SPC is labor cost and equipment cost to be procured domestically in Indonesia. Considering the inflation ration of 6.96% in Indonesia in 2010, it is needed to make a business plan incorporating the price escalation of the same level in the coming years.
7	Settlements on cost and subsidy scheme between PT. KAI and Indonesian government	At present, there is a cost and subsidy transaction scheme between the government and PT. KAI in a form of TAC (Track Access Charge), IMO (Infrastructure Maintenance and Operation) and PSO (Public Service Obligation). This project is a “B to B” business between SPC and PT. KAI, so SPC has no involvement in this transaction. Therefore, the transaction between SPC and PT. KAI should be dissociated from the transaction between government and PT. KAI.

(Source: Study team)

9.3.2. Project Scheme Proposal to Acquire Government Guarantee and Financial Support

It is proposed that JICA ODA private sector finance scheme will be applied for the project, but it entails condition such as that the project must comply with Indonesian development policy with sufficient level of project effect, the project is implement-able, the project is not feasible by the private initiative including private banking and private investment. Since this project meets the requirement mentioned above and proved to be feasible as discussed in this report, JICA ODA private sector finance scheme will be tapped from the 1st Stage of the project.

Under the condition, from the view point of investors of SPC in the 1st Stage, this project is “B to B” business between SPC and PT. KAI. Therefore, government guarantee from the Indonesian Government will not be required.

On the other hand, in the 2nd Stage and the 3rd Stage, Japanese ODA loan or two step loan by JICA is considered except for the leasing portion by SPC. In the case of applying two step loan, since the end user is proposed to be PT. KAI which has no experience of acquiring the loan from JICA, it is necessary to establish a procedure appointing Ministry of Finance of Indonesia as a conduit agency to guarantee the repayment of the loan while the Yen loan is not the case.

9.4. Estimation of Climate Change Mitigation Effect

The project could promote a modal shift from road to rail due to the expansion of the rail transportation capacity. The project can achieve not only the mitigation of both traffic congestion and air pollution but also GHG emission reduction. In order to estimate GHG emission reduction of the project, the study team will apply JICA Climate-FIT (JICA Climate Finance Impact Tool) which is established by JICA.

However, this calculation is just for reference. In order to implement the project as CDM project, the project responsible body has to apply a CDM methodology approved by UNFCCC (UN Framework Convention on Climate Change) to the project. Whether existing CDM methodology can be applied to this project or not still has not confirmed, therefore an economic analysis of this study does not include the effect of GHG emission reductions.

GHG emissions reduction due to the project is calculated as the difference between the GHG emissions without the project, which is the baseline emission, and those after the success of the modal shift to the project railway which is the project emission. Based on relevant data collected in the project, the study team will estimate GHG emission reduction with JICA Climate-FIT. Baseline emissions (BEy) and project emissions (PEy) are calculated as follows.

(1) Baseline emission

$$BE_y = TC_{dt,y} \times EF_{CO2,x} \quad , \quad TC_{dt,y} = \frac{(1-\alpha_{x,dt}) \times DD_y}{SEC_{x,dt,y}}$$

BE_y : Baseline emission: GHG emissions of non-electrified trains (t-CO_2/y)

$TC_{dt,y}$: Total annual fuel consumption of non-electrified trains (diesel trains or internal-combustion locomotives) after the project has completed (L/y)

$EF_{CO2,x}$: CO_2 emission factor of fuel category x (gr-CO_2/L)

$SEC_{x,dt,y}$: Specific fuel consumption (km/L)

DD_y : Total annual trip distance of freight trains (train km/y)

$\alpha_{x,dt}$: Mixing ratio of bio-fuel (ratio: 0 – 1)

(2) Project emission

$$PE_y = TC_{dt,y} \times EF_{CO2,x} \quad , \quad TC_{dt,y} = \frac{(1-\alpha_{x,dt}) \times DD_y}{SEC_{x,dt,y}}$$

PE_y : Project emissions: GHG emissions of freight trains (diesel train /internal-combustion locomotive) after the project has completed (t-CO_2/y)

$TC_{dt,y}$: Total annual fuel consumption of freight trains after the project has completed (L/y)

$EF_{CO2,x}$: CO_2 emission factor of fuel category x (gr-CO_2/L)

$SEC_{x,dt,y}$: Specific fuel consumption (km/L)

DD_y : Total annual trip distance of freight trains (train km/y)

$\alpha_{x,dt}$: Mixing ratio of bio-fuel (ratio: 0 – 1)

JICA Climate-FIT (JICA Climate Finance Impact Tool) applies to estimations of GHG emission reductions quantitatively with this project. Data required for estimating both baseline emissions and project emissions in the JICA Climate-FIT are shown in [Table 9-4-1] and [Table 9-4-2]. The study team collected these data in this study. In case of implementing this project, GHG emission reductions based on the data are shown in [Table 9-4-3].

[Table 9-4-1] Data Required for Estimation and Monitoring (Baseline Emission)

Items	Data type	Data contents	(Post Construction)	(Post 2nd year Operation)	(Post 7th year Operation)	Source
$P_{PJ,i,y}$	Freights by existing transport systems (t/year)	Freights of existing transport systems that would be shared in the absence of the freight train project. The total freights of existing transport systems is equal to the freight carried by freight trains	1,000,000	3,500,000	18,500,000	Study team
DD_y	Total annual trip distance driven by freight trains (Non-Electric) (km/year)	Total annual trip distance driven by freight trains after the project starts	6,969,300	7,199,400	11,638,900	Study team
$SEC_{x,dr,s}$	Specific fuel consumption of freight trains (Non-Electric) (km/L)	Specific fuel consumption of diesel car/ locomotives	0.25	0.25	0.25	PT. KAI
$N_{x,i}$	Total number of existing vehicles in fuel type x, and vehicle category i	Existing vehicle is coal transportation truck and fuel type is diesel	2,010	2,010	2,010	PT. BAU
N_i	Number of each vehicle	Coal transportation truck only	2,010	2,010	2,010	PT. BAU
OD_i	Average trip distance driven by existing vehicles in vehicle category i (km/day)	Trip distance for coal transportation truck before the project starts	180	180	180	PT. BAU: distance to Palembang
OC_i	Average occupation rate of existing vehicles in vehicle category i (ton)	Occupation rate of coal transportation truck before the project starts	10	10	10	Study team
$SEC_{x,i}$	Specific fuel consumption of existing vehicles in fuel type x, vehicle category i	Fuel consumption rate per liter of coal transportation truck (km/L)	4	4	4	Source 1
$EF_{CO2,x}$	CO_2 emission factor of fuel	CO2 emission factor of diesel per liter (gCO2/L)	2,661	2,661	2,661	IPCC value
$\alpha_{x,i}$	Mixing rate of biofuel (ratio)	Mixing ratio of biofuel in diesel	0	0	0	Assumed as zero

(Source 1: Kikkawa Tetsuji, Indian Road Transport and The Dedicated Freight Corridor Project, Nittsu Research Institute and Consulting report 2009.6)

[Table 9-4-2] Data Required for Estimation and Monitoring (Project Emission)

Items	Data type	Data contents	(Post Construction)	(Post 2nd year Operation)	(Post 7th year Operation)	Source
DD_y	Total annual trip distance driven by freight trains (Non-Electric) (km/year)	Total annual trip distance driven by freight trains after the project starts	6,969,300	7,199,400	11,638,900	Study team
$SEC_{x,dr,s}$	Specific fuel consumption of freight trains (Non-Electric) (km/L)	Specific fuel consumption of diesel car/ locomotives	0.25	0.25	0.25	PT. KAI
$EF_{CO2,x}$	CO_2 emission factor of fuel	CO_2 emission factor of diesel	2,661	2,661	2,661	IPCC value
$\alpha_{x,i}$	Mixing rate of biofuel (ratio)	Mixing ratio of biofuel in diesel	0	0	0	Assumed as zero

[Table 9-4-3] GHG Emission Reductions

(Unit: tCO_2/year)

Implementation Stage	The 1st Stage	The 2nd Stage	The 3rd Stage
Measuring timing	(Post Construction)	(Post 2nd year Operation)	(Post 7th year Operation)
Baseline emission (by Truck) (A)	11,975	41,911	221,528
Project emission (by Railway) (B)	1,954	6,837	36,140
GHG emission reduction (A-B)	10,021	35,073	185,388

(Source: Study team)

Appendix

List of Appendix

[Appendix 3-2-1] PT. KAI Coal Transportation Capacity Expansion Plan in South Sumatra

(Pembangunan Prasarana Mendukung Angkutan Batubara Di Sumatera Selatan)

KERETA API

5 Nilai Utama

6. PEMBANGUNAN PRASARANA MENDUKUNG ANGKUTAN BATUBARA DI SUMATERA SELATAN

A. PRASARANA

-INVESTASI 2009

-INVESTASI 2010

-INVESTASI 2011

-INVESTASI 2012

INVESTASI 2009

NILAI PEKERJAAN : Rp. 144.312.865.229

NILAI REALISASI : Rp. 135.660.248.718

PAKET PEKERJAAN : 55 Paket

PROGRES : 100%

DAFTAR PEKERJAAN :

Posisi 2 Maret 2012

NO	JENIS INVESTASI	NILAI KONTRAK	PROGRES FISIK	KET
1.	PEMBANGUNAN STASIUN BARU			
	a. Belimbing Baru (5 Paket)	19.315.661.035	100 %	SELESAI
	b. Perjito (3 Paket)	6.966.601.249	100 %	SELESAI
	c. Giham Baru (4 Paket)	10.541.194.024	100 %	SELESAI
	d. Martapura Baru (5 Paket)	15.801.872.898	100 %	SELESAI
	e. Kotabumi Baru (4 Paket)	11.284.977.299	100 %	SELESAI
	f. Pidada Baru (4 Paket)	21.782.351.194	100 %	SELESAI
2.	PERPANJANGAN SPUR (LOONGSIDING)			
	a. Rejosari (1 Paket)	5.190.282.159	100 %	SELESAI
	b. Tanjungkarang (4 Paket)	13.139.784.802	100 %	SELESAI
3.	Pengadaan Bantalan Beton			
	Bantalan beton (3 Paket)	13.782.642.460	100 %	SELESAI
4.	BANGUNAN			
	Stasiun dan rumah sinyal (16 Paket)	4.000.662.885	100 %	SELESAI
5.	KEROKHIMAN			
	Pembebasan lahan (3 Paket)	5.210.796.320	100 %	SELESAI
6.	SINTELIS			
	Peralatan sintelis (3 Paket)	11.041.433.942	100 %	SELESAI

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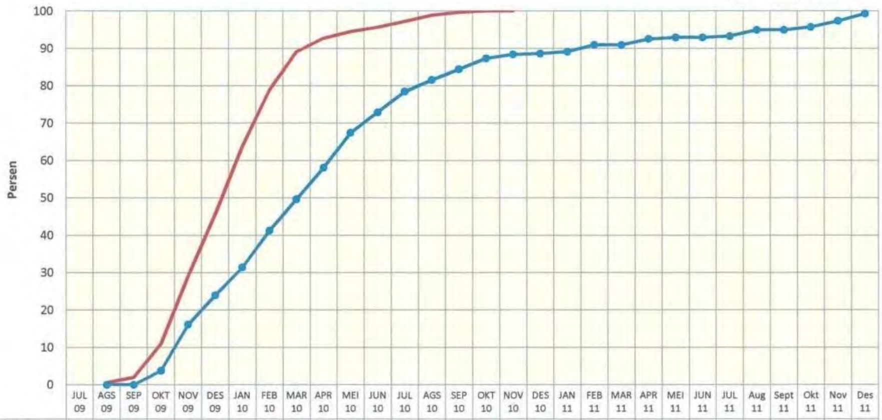
S-CURVE PELAKSANAAN INVESTASI 2009

Posisi 2 Maret 2012



	JUL 09	AGS 09	SEP 09	OKT 09	NOV 09	DES 09	JAN 10	FEB 10	MAR 10	APR 10	MEI 10	JUN 10	JUL 10	AGS 10	SEP 10
PROGRAM (KUMM)		0.58	2.03	10.8	29.0	45.5	63.7	78.7	89.1	92.7	94.4	95.6	97.2	98.8	99.6
REALISASI (KUMM)		-	-	3.76	16.1	23.9	31.3	41.1	49.6	58.0	67.4	72.9	78.4	81.5	84.3

	OKT 10	NOV 10	DES 10	JAN 11	FEB 11	MAR 11	APR 11	MEI 11	JUN 11	JUL 11	Aug 11	Sept 11	Okt 11	Nov 11	Des 11
PROGRAM (KUMM)	100.	100.													
REALISASI (KUMM)	87.3	88.3	88.6	89.1	90.9	90.9	92.5	92.8	92.89	93.26	94.9	94.9	95.69	97.3	99.3

INVESTASI 2010

NILAI PEKERJAAN : Rp. 208.144.132.008,-

NILAI REALISASI : Rp. 107.866.294.572,-

PAKET PEKERJAAN : 11 Paket

PROGRES : Selesai 3 Paket Pekerjaan (82.14%)

8 Paket sisa direncanakan selesai Februari 2012, kecuali Fly Over JPL 91 karena masih dalam tahap Design (alternatif PU)

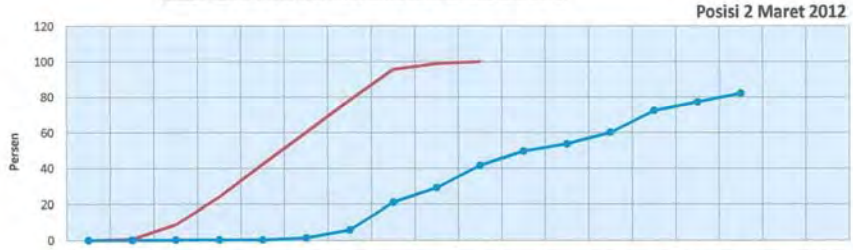
DAFTAR PAKET PEKERJAAN :

Posisi 2 Maret 2012

NO	PEKERJAAN	NILAI KONTRAK	PROGRES FIFIK	KET
1	Pembangunan jalur ganda antara Stasiun X6 - Stasiun Penimur di km 325+423 -355+100 (9.677 m'sp) lintas Prabumulih - Muaraenim	57,024,000,000	85.31 %	PELAKSANAAN
2	Pembangunan jalur ganda antara Stasiun Penimur - Stasiun Niru di km 355+100 - 343+200 (8.300 m'sp) lintas Prabumulih - Muaraenim	45,380,495,000	76.67 %	PELAKSANAAN
3	Pembangunan stasiun baru antara Stasiun Airasam- Stasiun Tanjung-rambang di km 302+550 - 304+150 (8.300 m'sp) lintas Prabumulih – Tanjungkarang	14,056,000,000	59.54 %	PELAKSANAAN
4	Pembangunan stasiun baru antara Stasiun Metur- Stasiun Pagargunung di km 285+500 - 287+150 (8.300 m'sp) lintas Prabumulih – Tanjungkarang	15,065,051,768	56.77 %	PELAKSANAAN
5	Pembangunan stasiun baru antara StasiunTigagajah- Stasiun Belatung di km 237+150 - 238+650 (8.300 m'sp) lintas Prabumulih – Tanjungkarang	16,660,800,000	82.06 %	PELAKSANAAN
6	Penataan Emplasemen Stasiun	11,009,915,869	81.99 %	PELAKSANAAN
7	***Pengadaan bantalan beton R.54 lengkap dengan alat penambat elastis sebanyak 43.750 g***	***20,662,500,000***	***100 %***	***SELESAI***
8	***Study UKL/UPL untuk mendukung proyek investasi 2010***	***972,510,000***	***100 %***	***SELESAI***
9	Jasa konsultan pengawas / supervisi	2,100,000,000	75.00 %	PELAKSANAAN
10	Penertiban dan Pembebasan Tanah	23,727,859,371	98.00 %	PELAKSANAAN
11	***AMDAL pembangunan jalur ganda NIRU-MUARAENIM dan MUARAENIM-TANJUNGENIM BARU***	***1,365,000,000***	***100 %***	***SELESAI***

S-CURVE PELAKSANAAN INVESTASI 2010

Posisi 2 Maret 2012



	Sep-10	Oct-10	Nov-10	Dec-10	Jan-11	Feb-11	Mar-11	Apr-11	May-11	Jun-11	Jul-11	Aug-11	Sep-11	Oct-11	Nov-11	Dec-11	Jan-12	Feb-12
PROGRAM (KUMM)	0	0.70	8.93	24.12	42.35	60.25	78.22	95.56	98.93	100.00								
REALISASI (KUMM)	0	0.12	0.25	0.28	0.32	1.39	5.83	21.07	29.20	41.62	49.7	53.76	60.27	72.41	77.27	82.14		

- Sesuai dengan kontrak maka waktu penyelesaian akan berkahir di bulan Februari 2012, akan tetapi dengan pencapaian progres saat ini dan beberapa kendala yang dialami saat pelaksaan kemungkinan akan mengalami keterlambatan hingga 2 bulan.
- Untuk itu konsultan supervisi sedang melakukan analisis dan perhitungan terhadap hambatan yang terjadi untuk dapat menentukan penyebab, penanggungjawab serta waktu tambahan yang diperlukan
- Beberapa hal yang sudah teridentifikasi adalah :
  - ✓ Penertiban dan pembebasan tanah
  - ✓ Jalan akses ke lokasi
  - ✓ Gangguan sosial dari warga setempat
  - ✓ Supply ballast
  - ✓ System persinyalan (PLC)
  - ✓ Kondisi tanah subsurface yg tidak memenuhi syarat
  - ✓ Perubahan / penyesuaian desain
  - ✓ Cuaca

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- Jika memang terdapat hal hal yang memang tidak dapat diprediksi awal dan dihindari maka sesuai dengan ketentuan akan segera dilaporkan ke DU

INVESTASI 2011 - (1)

NILAI PEKERJAAN : Rp. 320.736.590.000 (Ijin prinsip)
PAKET PEKERJAAN : 9 Paket
PROGRES : **Pelelangan**
Pekerjaan fisik selesai 31 Desember 2012
DAFTAR PAKET PEKERJAAN :

Posisi 2 Maret 2012

PAKET	PEKERJAAN	Jumlah peserta	Status
	Pekerjaan Konstruksi		
	Pembangunan Jalur Ganda		
1	Gunungmegang – Muaraenim (**29.700 m**) Km 364+650 – 394+350	6	Evaluasi administrasi dan teknis sudah selesai dan telah diumumkan. Pembukaan sampul harga belum dilaksanakan karena ada review proses dari management berkaitan dengan hanya satu peserta yang lulus tahap administrasi dan teknis. Saat ini masih menunggu hasil review dari management untuk kelanjutan proses dan telah diajukan surat ke Du pada tanggal 30 desember 2011 melalui surat no 428/TPP-ABB/XII/DR.III SS-2011

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INVESTASI 2011 - (2)

Posisi 2 Maret 2012

PAKET	PEKERJAAN	JUMLAH PESERTA	STATUS
	Pembangunan Stasiun Baru		
1	Antara Labuanratu – Rejosari (2.000 m)Km 21+200 – 23+200	5	Evaluasi sudah dilakukan dan dikembalikan ke Sumsel untuk dinegosiasi ulang.
2	Antara Rejosari – Tegineneng (2.100 m) Km 32+700 – 34+800	8	
3	Antara Gilas – Sepancar (1.975 m) – Km 211+025 – 213+000	7	
4	Antara Peninjauwan – Metur (1.850 m)- km 271+150 – 273+000	6	
	Pekerjaan Pengadaan dan Fabrikasi		
5	Pengadaan Bantalan Beton (62.708 btg)	5	Evaluasi dan negosiasi sudah selesai dan dalam proses penetapan pemenang (D4)
6	Pengadaan dan Fabrikasi Jembatan Baja	9	
	Pekerjaan Konsultansi		
7	Konsultan supervisi	8	Evaluasi telah selesai dan dalm proses negosiasi (D6)
8	UKL/UPL untuk 4 Stasiun Baru	10	Evaluasi telah selesai dan dalam proses untuk penetapan pemenang (Kadivre III)

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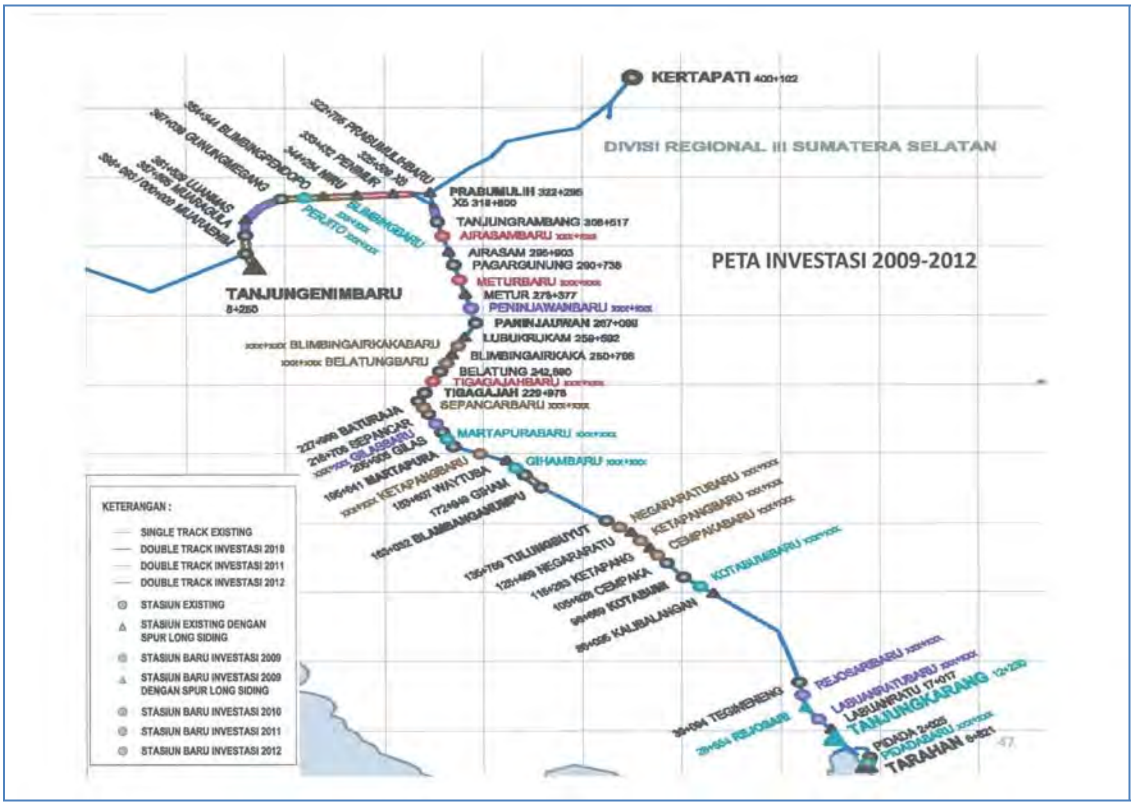
INVESTASI 2012

NILAI PEKERJAAN : Rp. 407,081,649,000,-
PAKET PEKERJAAN : 12 Paket
PROGRES : Persiapan Tender
KETERANGAN : Lelang awal direncanakan mulai Februari 2012 dan Pekerjaan fisik selesai Semester 1 2013

Posisi 2 Maret 2012

DAFTAR PAKET PEKERJAAN :

NO	PEKERJAAN	BIAYA	PROGRES FISIK	KET
1	PEMBANGUNAN JALUR GANDA KM 394+350 S.D KM 1+115 ANTARA MUARA ENIM - TANJUNG ENIM	21,781,889,000	0 %	PEYIAPAN DOKUMEN LELANG
2	PEMBANGUNAN JALUR GANDA KM 308+320 S.D KM 311+360 ANTARA TANJUNG RAMBANG - X5	18,490,835,000	0 %	
3	PEMBANGUNAN JALUR GANDA KM 311+360 S.D KM 320+100 ANTARA TANJUNG RAMBANG - X5	60,225,229,000	0 %	
4	PEMBANGUNAN JALUR GANDA KM 1+115 S.D KM 6+350 ANTARA MUARA ENIM-TANJUNG ENIM BARU	38,114,486,000	0 %	
5	PEMBANGUNAN JALUR GANDA KM 1+115 S.D KM 6+350 ANTARA MUARA ENIM-TANJUNG ENIM BARU	86,200,634,000	0 %	
6	PEMBANGUNAN JALUR GANDA KM 344+200 S.D KM 352+479 ANTARA NIRU-BLIMBING PENDOPO	48,382,669,000	0 %	
7	PEMBANGUNAN JALUR GANDA KM 352+479 S.D KM 359+140 ANTARA BLIMBING-PERJITO	37,842,517,000	0 %	
8	PEMBANGUNAN JALUR GANDAKM 359+140 S.D KM 364+634 ANTARA PERJITO-GUNUNG MEGANG	36,469,560,000	0 %	
9	PEMBANGUNAN STASIUN BELATUNG BARU KM 245+500 S.D KM 248+500	12,454,960,000	0 %	
10	PEMBANGUNAN STASIUN BLIMBING AIR KAKA KM 252+966 S.D KM 254+500	12,322,198,000	0 %	
11	PEMBANGUNAN STASIUN MARTAPURA KM 199+000 S.D KM 202+100	17,767,868,000	0 %	
12	PEMBANGUNAN STASIUN SEPANCAR KM 221+200 S.D KM 224+300	17,028,804,000	0 %	


KERTAPATI 400+102
DIVISI REGIONAL III SUMATERA SELATAN
PETA INVESTASI 2009-2012
PRABUMULIH 322+295
X5 318+800
TANJUNGRAMBANG 308+517
AIRASAMBARU
AIRASAM 295+903
PAGARGUNUNG 290+738
METURBARU
METUR 279+377
PENINJAWANBARU
PANINJAUWAN 267+090
LUBUKRUKAM 259+592
BLIMBINGAIRKAKA 250+768
BLIMBINGAIRKAKABARU
BELATUNGBARU
BELATUNG 242,880
TIGAGAJAHBARU
TIGAGAJAH 229+978
SEPANCARBARU
MARTAPURABARU
GIHAMBARU
TANJUNGENIMBARU
8+250
NEGARARATUBARU
KETAPANGBARU
CEMPAKABARU
KOTABUMIBARU
REJOSARIBARU
LABUANRATUBARU
LABUANRATU 17+017
TANJUNGKARANG 12+230
PIDADA 2+025
PIDADABARU
TARAHAN 8+821
KETERANGAN :
SINGLE TRACK EXISTING
DOUBLE TRACK INVESTASI 2010
DOUBLE TRACK INVESTASI 2011
DOUBLE TRACK INVESTASI 2012
STASIUN EXISTING
STASIUN EXISTING DENGAN SPUR LONG SIDING
STASIUN BARU INVESTASI 2009
STASIUN BARU INVESTASI 2009 DENGAN SPUR LONG SIDING
STASIUN BARU INVESTASI 2010
STASIUN BARU INVESTASI 2011
STASIUN BARU INVESTASI 2012
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KERETA API

Nilai Utama

6. PEMBANGUNAN PRASARANA MENDUKUNG ANGKUTAN BATUBARA DI SUMATERA SELATAN

B. SARANA
-LOKOMOTIF
-GERBONG
-FASILITAS

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INVESTASI SARANA UNTUK SUMATERA SELATAN

Posisi 2 Maret 2012

NO	PROGRAM	REALISASI		KETERANGAN
		DALAM PROSES	SELESAI	
	LOKOMOTIF			
1.	Pengadaan Lokomotif 6 unit CC 205		Selesai	
2.	MO 5 Lok CC 202 menjadi Lok CC 205 untuk Sumsel	Tunggu Analisi investas, Spektek, RAB		Proses Investigasi oleh Tim dari EM , EP, TR
3.	Pengadaan Lokomotif 44 unit CC 205	Tunggu Kedatangan Barang tahap I dan II		Ktr No. 128/'11 LC 1-12-2011 Thp I Nop '12 10 Lok Thp II Des '12 10 Lok Thp III Jan '13 10 Lok Thp IV Feb '13 14 Lok
	GERBONG			
1.	Pengadaan 170 Gerbong KKBW 50 ton INKA (luncur 2010)		Selesai	
2.	Pengadaan 1200 Gerbong KKBW CHINA	Thp I 180 sdh BAST Thp II 334 sdh BAST Thp III 56 pengujian tgl 6 Maret '12		Ktr No. 22/'11 21-4-'11 LC 8-6-'11 Add I 23-6-'11 dan Add II 7-12-'11 Thp I Nop '11 180 Grb Thp II Des '11 310 Grb Thp III Mart '12 80 Grb Thp IV Des '12 400 Grb Thp V Des '13 230 Grb

49

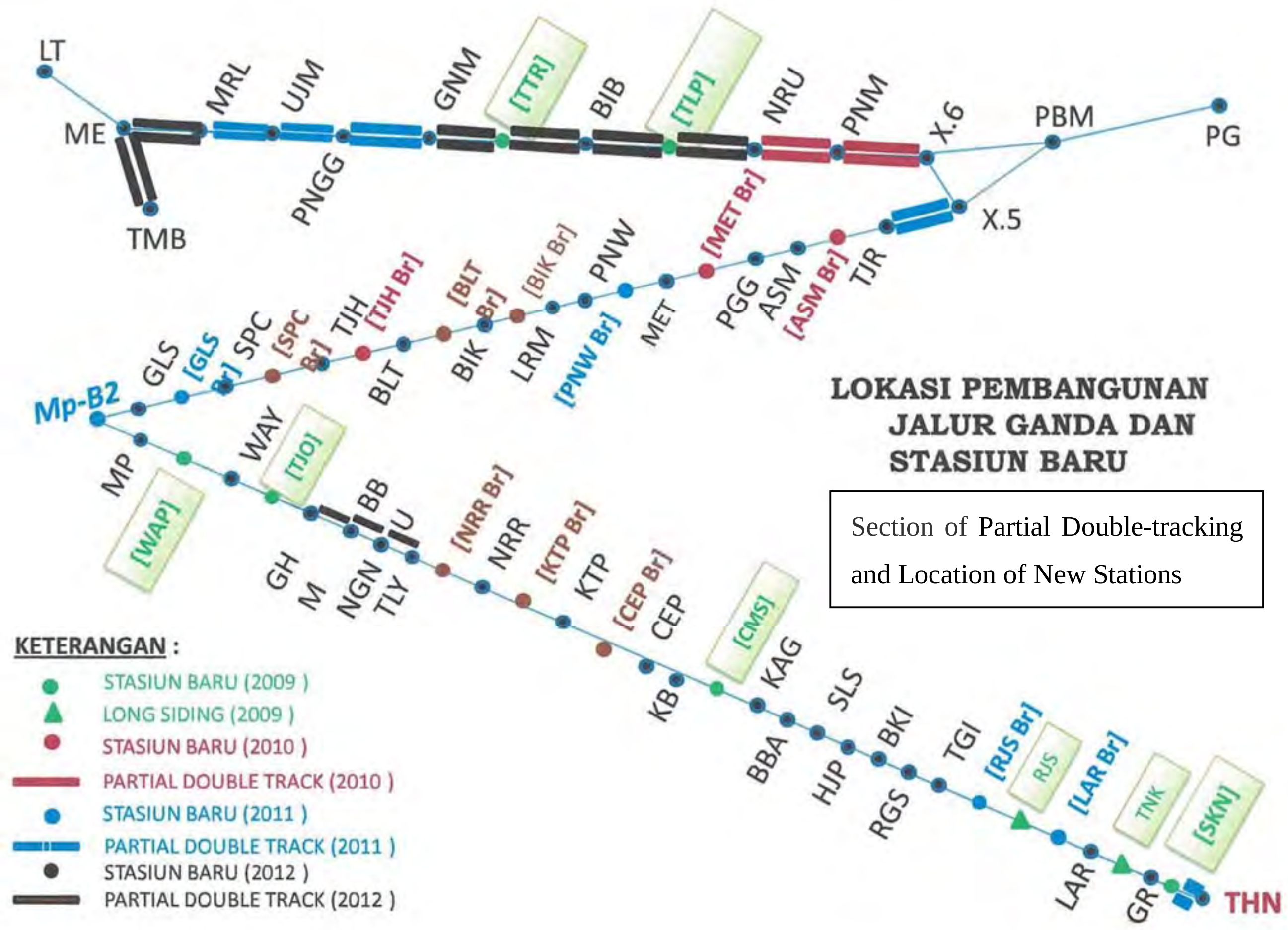
INVESTASI SARANA UNTUK SUMATERA SELATAN

Posisi 2 Maret 2012

NO	PROGRAM	REALISASI		KETERANGAN
		DALAM PROSES	SELESAI	
	FASILITAS			
1.	Pengadaan 1 unit MTT untuk Sumsel	Tunggu Kedatangan barang		Ktr No. 222/'12 tgl 30-1-2012 (Perkiraan kedatangan Mei 2013)
2.	Pengadaan Alat Timbang	Proses Panpel		Proses digabung dengan Pengadaan untuk di Jawa
3.	Pengadaan keselamatan gerbong (Boufer) untuk KKBW Sumsel	Proses Lelang		
4.	Pengadaan Crane kap. 100 ton	Tunggu Spektek		Selesai Ass resiko, RAB kirim D6 13/2/'12
5.	Pengadaan dan Pemasangan mesin universal untuk TM dan MG	Tunggu Ass. resiko		Selesai Analisa Investasi, Spektek, RAB kirim D6 13/2/'12
6.	Pemasangan Mesin kompressor pada los Kerja Lok	Tunggu Analisis Investasi		Selesai Ass. Resiko, Spektek, RAB kirim D6 13/2/'12
7.	Pengadaan Forklip 5 ton	Tunggu Analisis Investasi		Selesai Ass. Resiko, RAB kirim D6 13/2/'12
8.	Pengadaan MTT	Proses Panpel		
9.	Pengadaan dan pemasangan mesin Vertikal Turrent Lathe u By. Lt	Tunggu Analisis Investasi, RAB		Selesai Assesmen resiko, Spektek

50

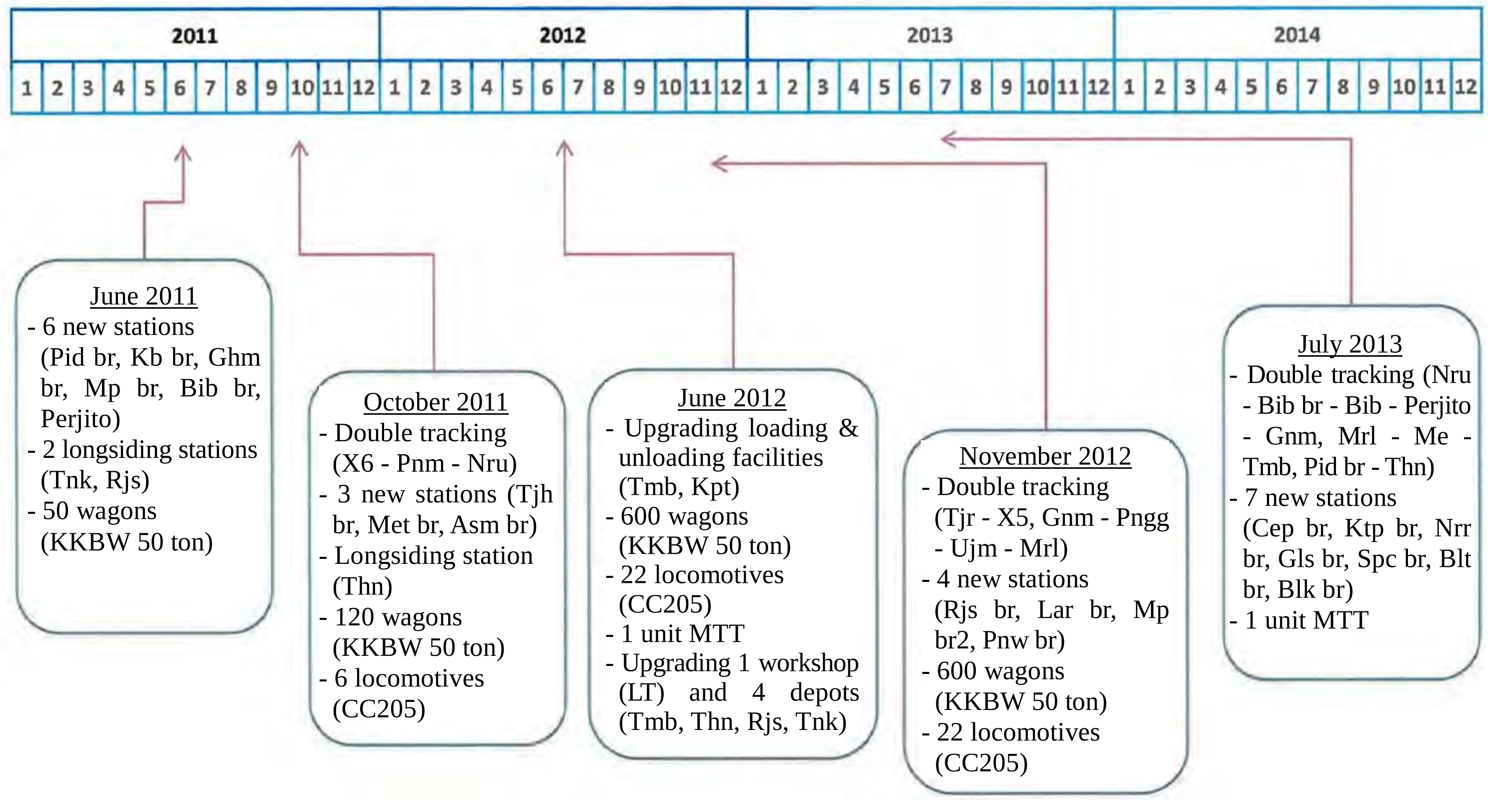
[Appendix 3-2-2] Location Map of Partial Double-tracking and New Stations



(Source: PT. KAI)

[Appendix 3-2-3] Implementation Schedule of Coal Transportation Capacity Expansion Plan

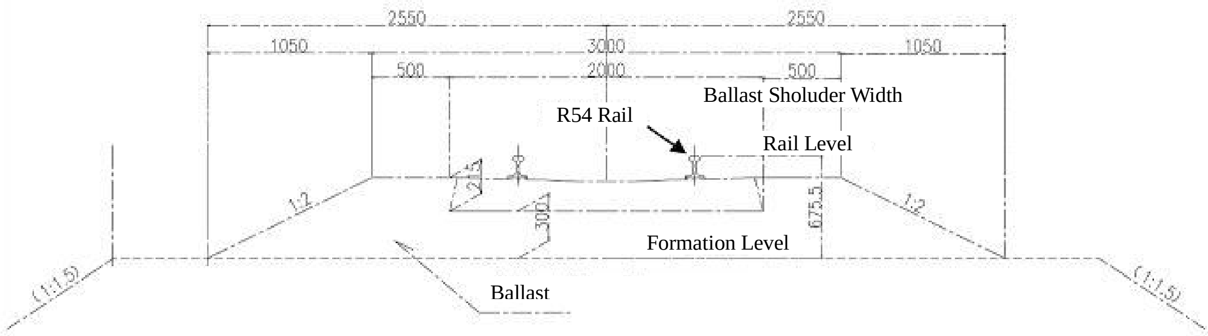
<u>Completion Schedule of Investment for Coal Transportation Capacity Expansion Plan</u>



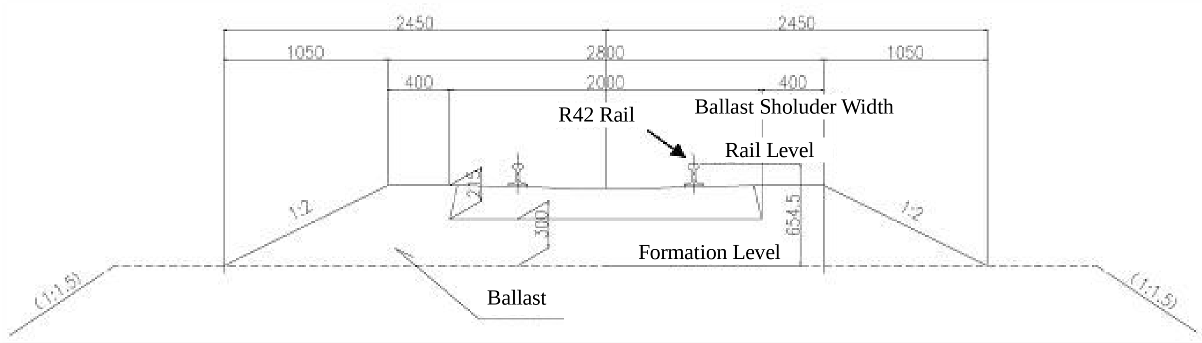
(Source: PT. KAI)

[Appendix 4-1-1] Track Structure

■Between Lahat – Prabumulih (R54 Rail, Ballast Sholuder Width = 50cm, Gauge = 1,067mm)



■Prabumulih – Kertapati (R42 Rail, Ballast Sholuder Width = 40cm, Gauge = 1,067mm)



(Source: Study team)

[Appendix 4-1-2] Track Material Inventory Table (2011)

DATA ASET JALAN REL
SUBDIVRE III.1 KERTAPATI
TAHUN 2011

Bentuk : A - 2

No.	LINTAS/ KORIDOR	Passing Tonnage (tt ton/th)	Kelas Jalan PD.10	PANJANG LINTAS (kmsp)	KEC. MAX (Vmax)	REL R.25 km	R.33 km	R.41/42 km	R.50 km	R.54 km	Th. diPasang	Pengelasan titik	Dwang Rel Km	Baut sambung	BANTALAN Kayu btg	Beton btg	Besi btg	Wesel btg	Jemb. btg	Pen. Elastis (set) Pandrol	Ftype	DE	KA Clip	Pen. Rigid set	BALAS m3	WESEL unit	TEROWONGAN m1
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21				22	23	24	25
1	Kpt - Pbm	16.08	2	77.397	70	-	-	77.397	-	-	1963	9,156	-	144	23,117	130,383	50	2,677	419	521,532	-	-	-	92,648	86,565	72	-
2	Pos X - IDL	4.100	2	4.100	70	-	-	4.100	-	-	2008	-	-	-	-	6,833	-	129	-	27,332	-	-	-	-	14,760	3	-
3	Pbm - Tjr	3.82	4	3.795	70	-	-	-	-	3.795	1970	200	-	528	-	6,367	300	506	25	10,513	-	4,667	-	-	13,282	11	-
4	Pbm - X6	10.72	2	3.205	70	-	-	-	-	3.205	1970	144	-	144	315	5,342	-	138	-	21,368	-	-	-	-	11,235	3	-
5	X5 - X6	33.10	1	3.020	70	-	-	-	-	3.020		116	-	48	-	5,034	-	46	-	20,136	-	-	-	-	10,570	1	-
6	X6 - Nru	43.81	1	18.754	70	-	-	-	-	18.754	1970	2,036	-	240	-	31,257	-	230	93	125,028	-	-	-	-	65,639	5	-
7	Nru - Me	40.20	1	51.839	70	-	-	-	-	51.839	1970	9,322	-	1,200	-	86,398	1,149	1,150	216	345,592	-	-	-	-	133,231	25	-
8	Me - Tmb	33.82	1	9.600	50	-	-	-	-	9.600	1983	422	-	912	-	16,000	500	874		64,000	-	-	-	-	33,600	19	-
9	Me - Lt	2.94	4	38.066	60	-	-	-	-	38.066	2007	3,241	-	3,581	40	61,411	3,191	690	404	245,644	-	-	-	-	127,224	62	-
10	Lt - Tl	2.17	5	66.581	50	-	-	52.955	-	13.626	2007	5,892	-	1,874	-	84,334	2,405	2,746	1,212	351,134	-	121,234	-	1,536	107,968	9	793
11	Tl - Llg	2.17	5	49.228	50	-	-	49.228	-	-	2007	4,928	-	1,946	-	81,170	4,950	480	964	332,113	-	-	-	8,110	91,364	14	-
	Jumlah	192.93		325.585		-	-	183.580	-	141.905		35,457	-	10,817	23,472	514,529	12,545	9,866	3,333	2,064,392	-	125,901	-	102,294	695,438	224	793

Section* Passing Tonnage Track Category Length Maximum Speed Rail Year of Rail Installation Rail Welding Fish Bolt Wooden PC Steel Turnout Bridge Sleeper Pandrol Rail Fastening System Ballast Turnout

*Legend of Abbreviated Name of Stations (Kpt: Kertapati, Pbm: Prabumulih, Nru: Niru, Me: Muaraenim, Lt: Lahat)

(Source: PT. KAI)

[Appendix 4-1-3] Track Structure Regulation by Line Class

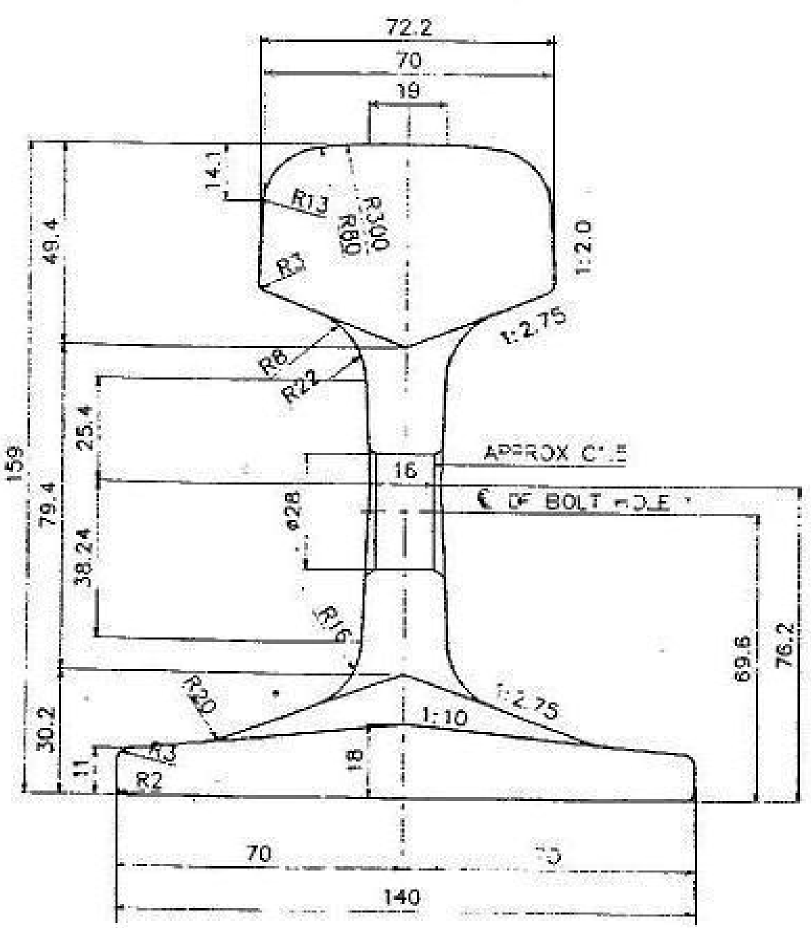
Table 2 (Clause 29)

Track Classification	Annual passing tonnage (t/year)	Maximum Train speed V max (km/h)	Wheel axle P max (ton)	Rail Type	Type of sleeper / Sleeper spacing (mm)	Type of fastener	Upper ballast thickness (cm)	Ballast shoulder width (cm)
1st	$> 20.10^6$	120	18	R.60 / R.54	Concrete / 600	EG	30	50
2nd	$10.\ 10^6 - 20.\ 10^6$	110	18	R.54 / R.50	Concrete/wooden / 600	EG	30	50
3rd	$5\cdot 10^6 - 10.\ 10^6$	100	18	R.54/ R.50/ R.42	Concrete/wood/steel / 600	EG	30	40
4th	$2{,}5.\ 10^6 - 5.\ 10^6$	90	18	R.54/ R.50/ R/42	Concrete/wood/steel / 600	EG/ET	25	40
4ths	$< 2{,}5.\ 10^6$	80	18	R.42	Wood/steel / 600	ET	25	35

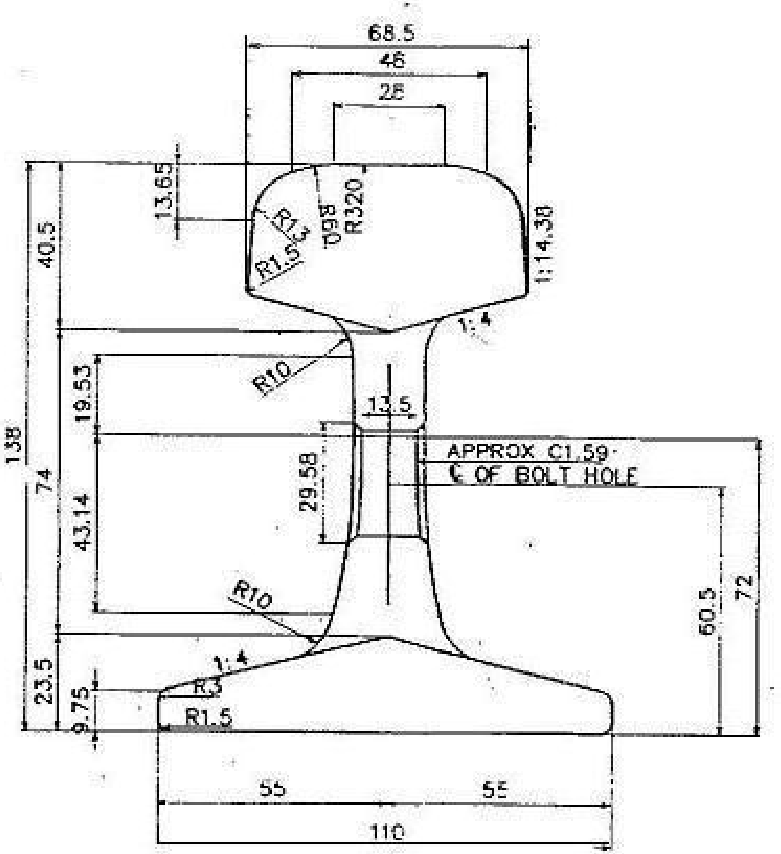
Note: ET: Single elastic EG: Double elastic

(Source: Indonesian Railway Technical Standard on Track Design, Imstallation and Maintenance)

[Appendix 4-1-4] Rail Cross Section



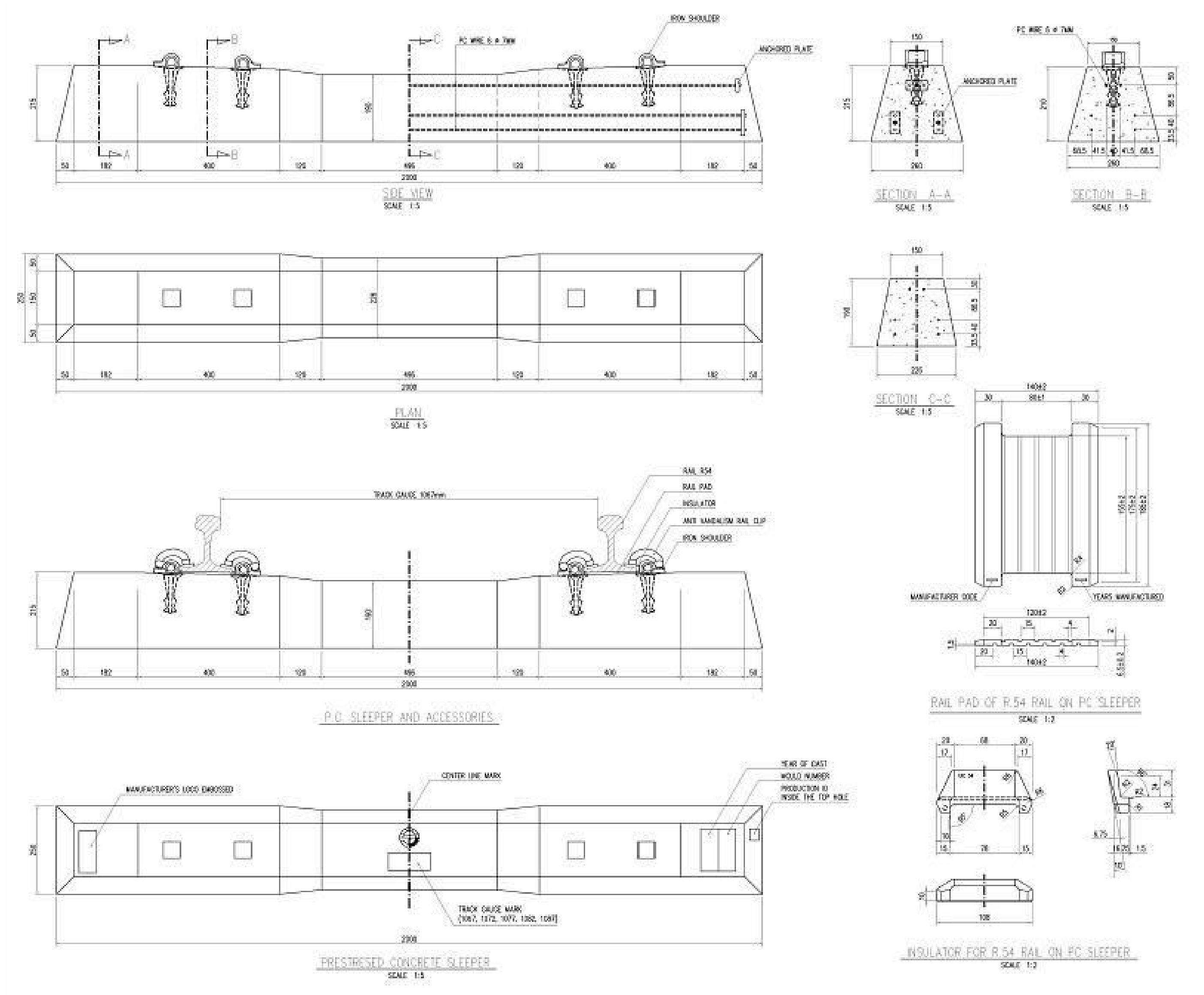
R54(UIC54)



R42

(Source: Study team)

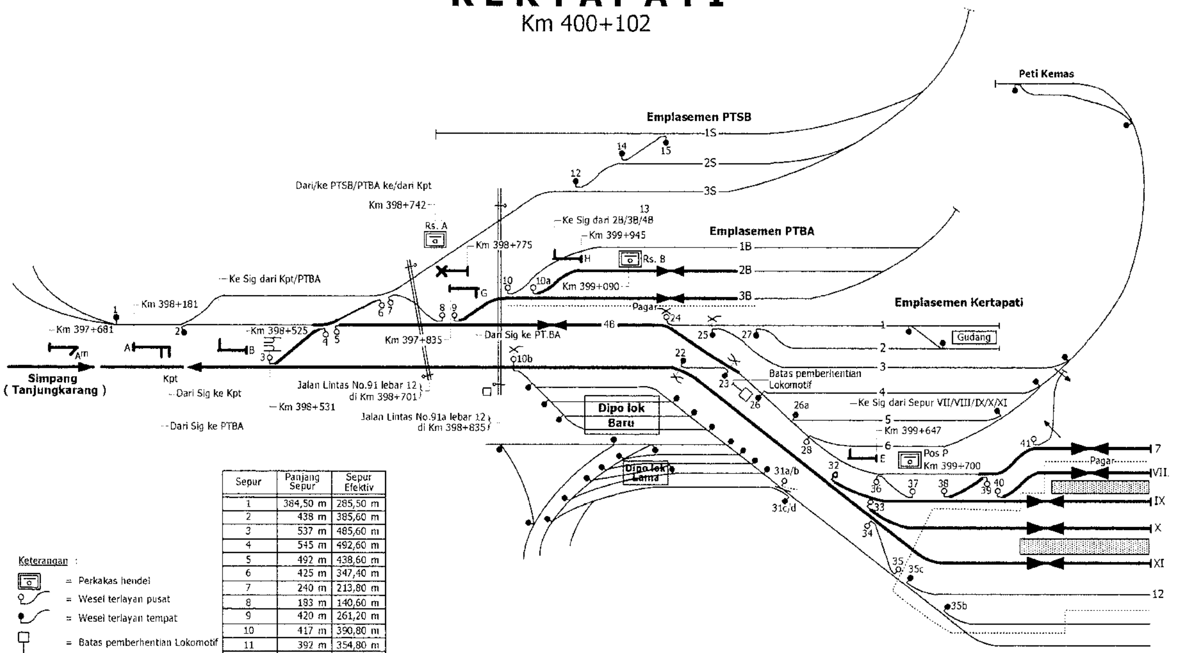
[Appendix 4-1-5] PC Sleeper



(Source: Study team)

KERTAPATI

Km 400+102



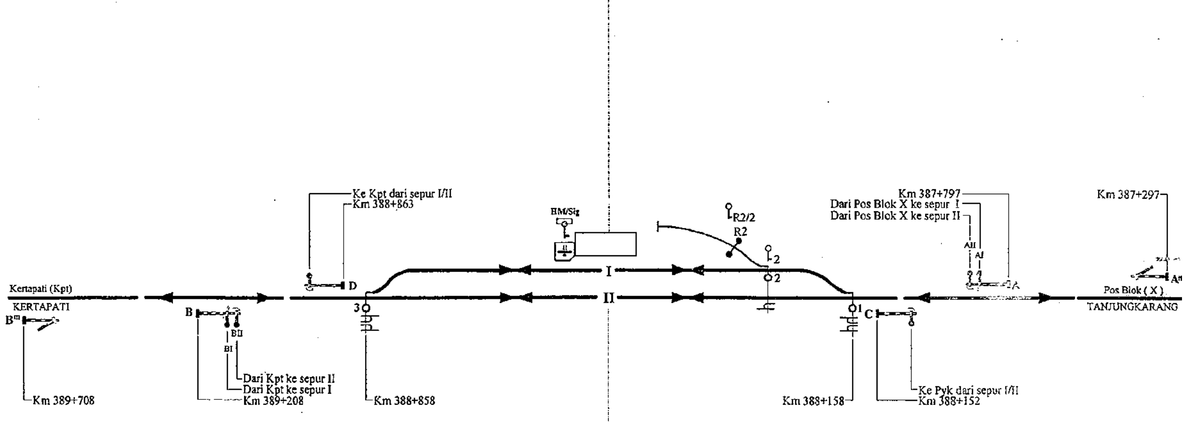
Sepur	Panjang Sepur	Sepur Efektiv
1	384,50 m	285,50 m
2	438 m	385,60 m
3	537 m	485,60 m
4	545 m	492,60 m
5	492 m	438,60 m
6	425 m	347,40 m
7	240 m	213,80 m
8	183 m	140,60 m
9	420 m	261,20 m
10	417 m	390,80 m
11	392 m	354,80 m
12	290 m	250,30 m
13	198 m	158,30 m
14	169 m	128,30 m
15	169 m	142,80 m

Keterangan :

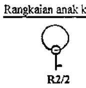
- = Perkakas hendel
- = Wesel terlayan pusat
- = Wesel terlayan tempat
- = Batas pemberhentian Lokomotif
- = Sekat dua ganda
- = Kancing tunggal
- = Kancing tunggal tiga kedudukan

SIMPANG

KM 388+500



Rangkaian anak kunci



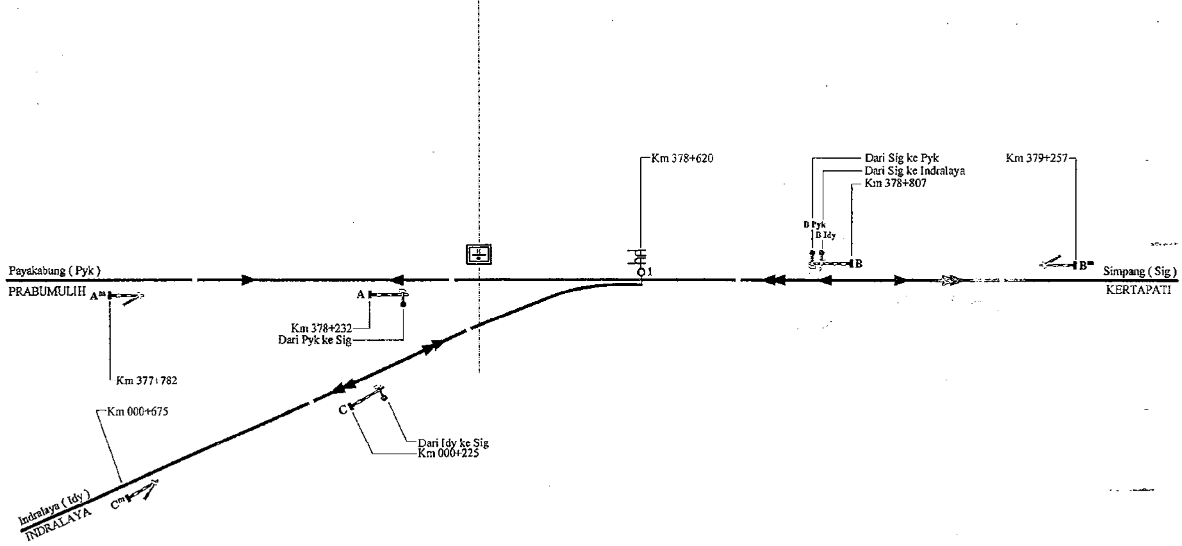
KETERANGAN

- = Perkakas hendel
- = Sekat ganda
- = Kancing
- = Perintang
- = Kunci perkakas handel
- = Kunci jamin
- = Kedudukan biasa bagi Wesel terlayan pusat

Sepur	Panjang sepur	Sepur efektiv
I	513	434
II	513	434
Simpan	68	48

POS BLOK (X)

KM 378+400 (Pnj - Kpt)
KM 000+000 (Pnj - Idy)

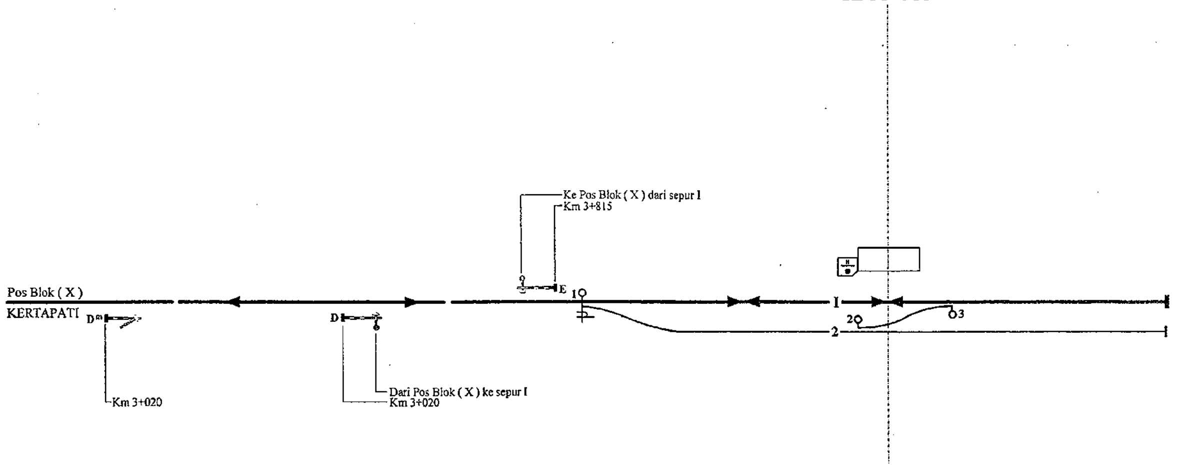


KETERANGAN

= Perkakas hendel
= Sekat
= Kedudukan biasa bagi Wesel terlayan pusat

INDRALAYA

KM 3+935

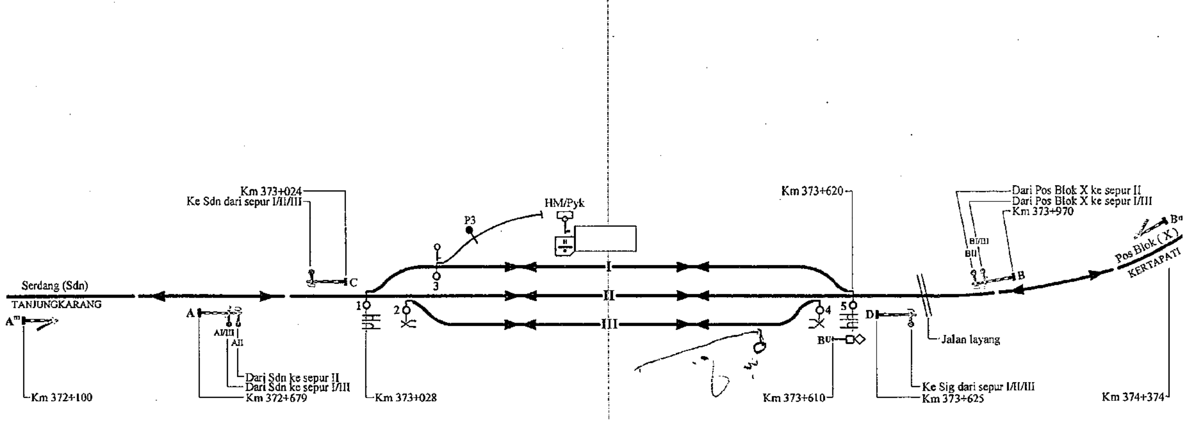


KETERANGAN

= Perkakas hendel
= Sekat
= Kedudukan biasa bagi Wesel terlayan pusat

PAYAKABUNG

KM 373+335



Rangkain anak kunci

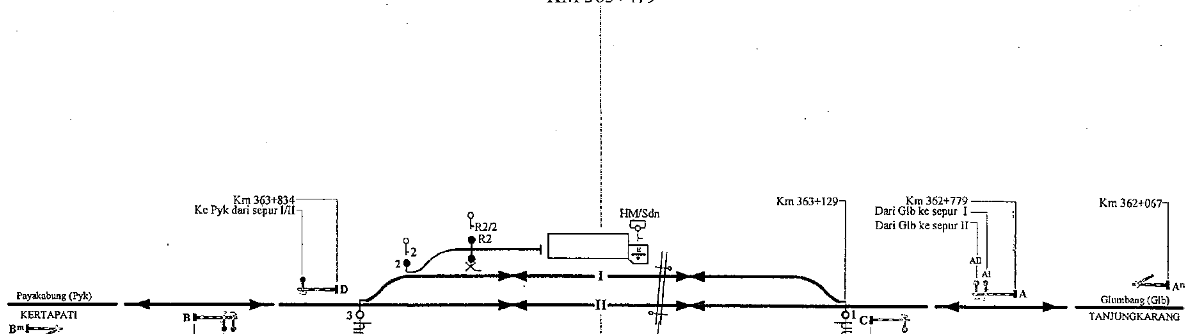
KETERANGAN

- = Perkakas handel
- = Sekat ganda
- = Pelalau
- = Kunci jamin
- = Kancing.
- = Kedudukan biasa bagi wesel terlayan pusat
- = Kedudukan biasa bagi wesel terlayan tempat

Sepur	Panjang sepur	Sepur efektiv
I	538	494
II	500	440
III	500	440
Simpan	107	84

SERDANG

KM 363+479



Rangkain anak kunci

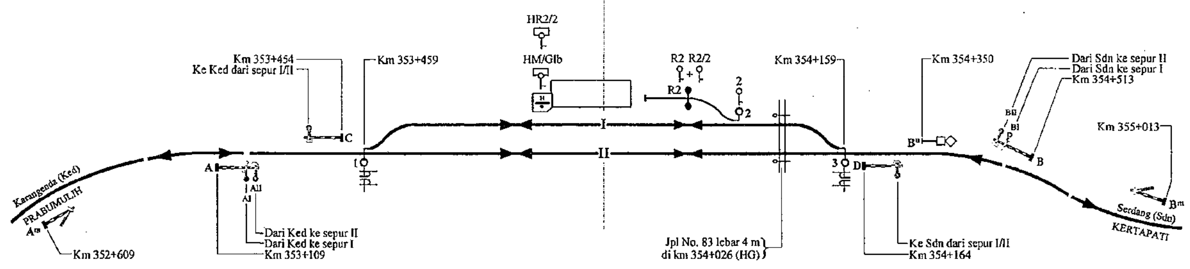
KETERANGAN

- = Perkakas hendel
- = Sekat ganda
- = Kancing.
- = Perintang
- = Kunci jamin
- = Kedudukan biasa bagi wesel terlayan pusat
- = Kedudukan biasa bagi wesel terlayan tempat

Sepur	Panjang sepur	Sepur efektiv
I	700	580
II	700	580
Simpan	100	76

GLUMBANG

KM 353+822



Rangkain anak kunci

HR2/2 R2 R2/2 2

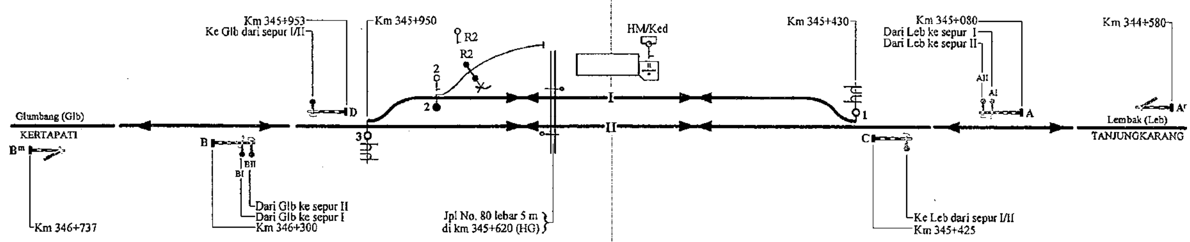
KETERANGAN

- = Perkakas hendel
- = Sekat ganda
- = Perintang
- = Kunci jamin
- = Kedudukan biasa bagi wesel terlayan pusat

Sepur	Panjang sepur	Sepur efektiv
I	700	580
II	700	580
Simpan	105	86

KARANGENDA

KM.345+594



KETERANGAN

- = Perkakas handel
- = Sekat ganda
- = Kancing.
- = Perintang
- = Kunci jamin
- = Kedudukan biasa bagi wesel terlayan pusat
- = Kedudukan biasa bagi wesel terlayan tempat

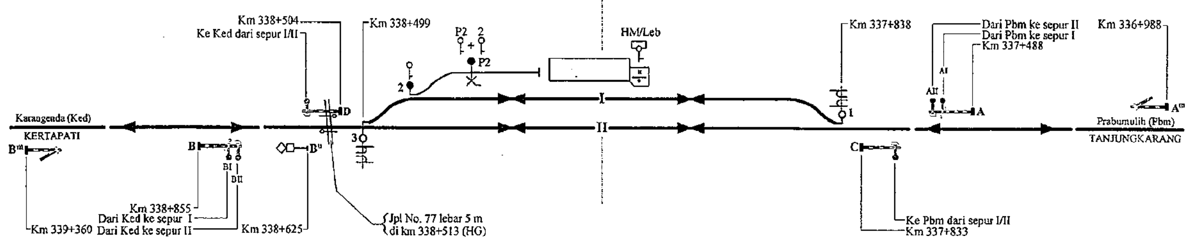
Rangkain anak kunci

2 R2/2

Sepur	Panjang sepur	Sepur efektiv
I	520	461
II	520	461
Simpan	60	40

LEMBAK

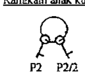
KM 338+188



KETERANGAN

- = Perkakas handel
- = Sekat ganda
- = Kancing.
- = Pelalau
- = Kunci jamin
- = Kedudukan biasa bagi wesel terlayan pusat
- = Kedudukan biasa bagi wesel terlayan tempat

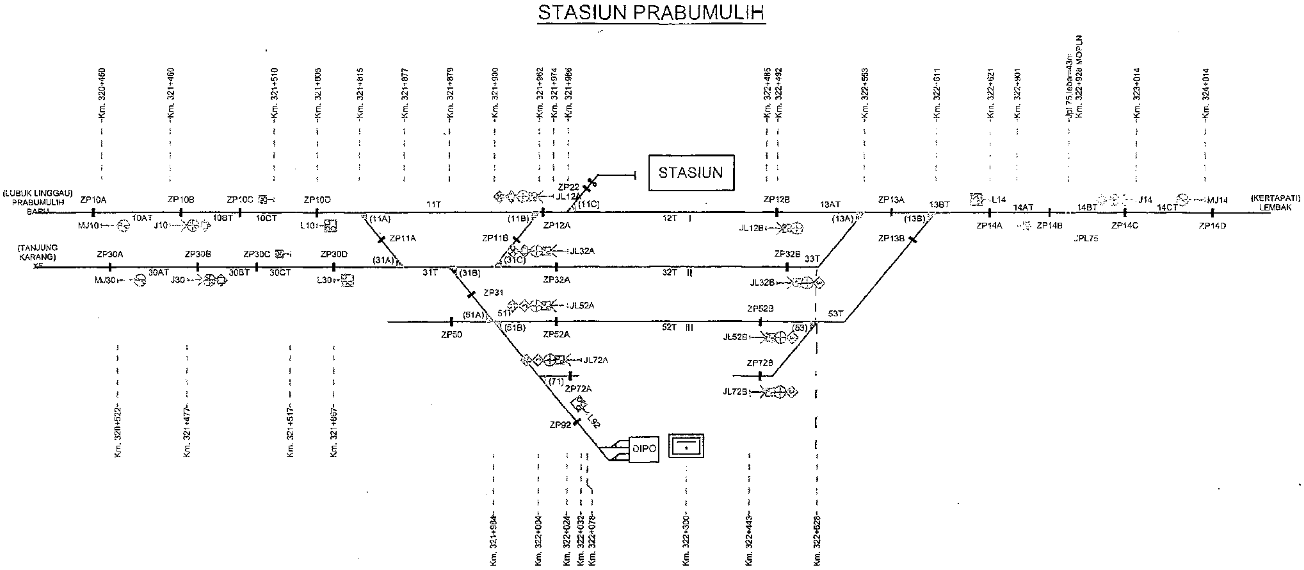
Ranekain anak kunci



Sepur	Panjang sepur	Sepur efektiv
I	661	603
II	661	603
Simpan	116	87

LAYOUT PERSINYALAN ELEKTRIK

STASIUN PRABUMULIH

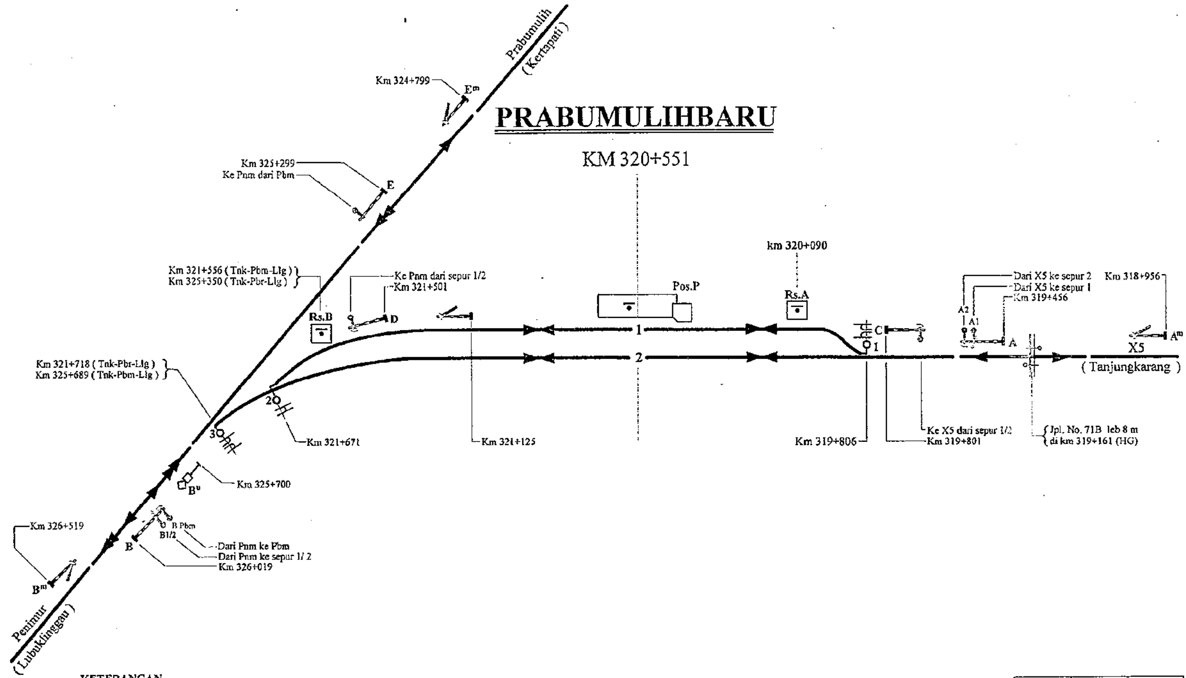


LEGENDA :

- Sinyal muka 2 aspek
- Sinyal masuk 3 aspek + emergency + variable speed indicator
- Sinyal berangkat 2 aspek + emergency + fix speed indicator + Sinyal Langsir 1 aspek + Arah
- Sinyal berangkat 2 aspek + emergency + fix speed indicator + Sinyal Langsir 1 aspek
- Sinyal berangkat 2 aspek + emergency + Variable speed indicator + Sinyal Langsir 1 aspek + Arah
- Sinyal berangkat 2 aspek + emergency + sinyal langsir 1 aspek
- Batas Langsir
- Sinyal Langsir
- Meja pelayanan/PPKA
- Wesel terlayan pusat
- Wesel terlayan tempat
- Wesel terlayan setempat dilengkapi deteksi posisi
- Wheel Detector
- Perintang

PRABUMULIHBARU

KM 320+551



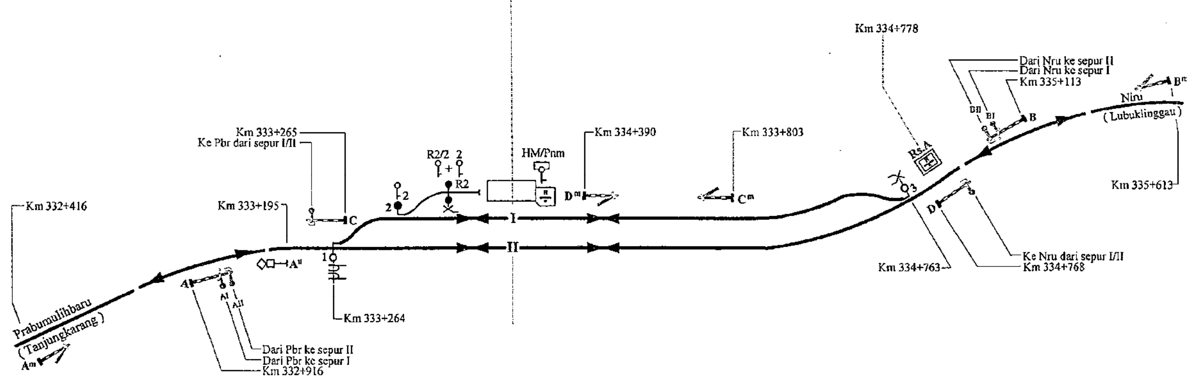
KETERANGAN

- = Perkakas handel
- = Sekat ganda
- = Kedudukan biasa bagi wesel terlayan pusat

Sepur	Panjang sepur	Sepur efektiv
I	1860	1693
II	1860	1693

PENIMUR

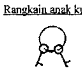
KM 333+422



KETERANGAN

- = Perkakas hendel
- = Sekat ganda
- = Kancing.
- = Perintang
- = Kunci jamin
- = Kedudukan biasa bagi wesel terlayan pusat
- = Kedudukan biasa bagi wesel terlayan tempat

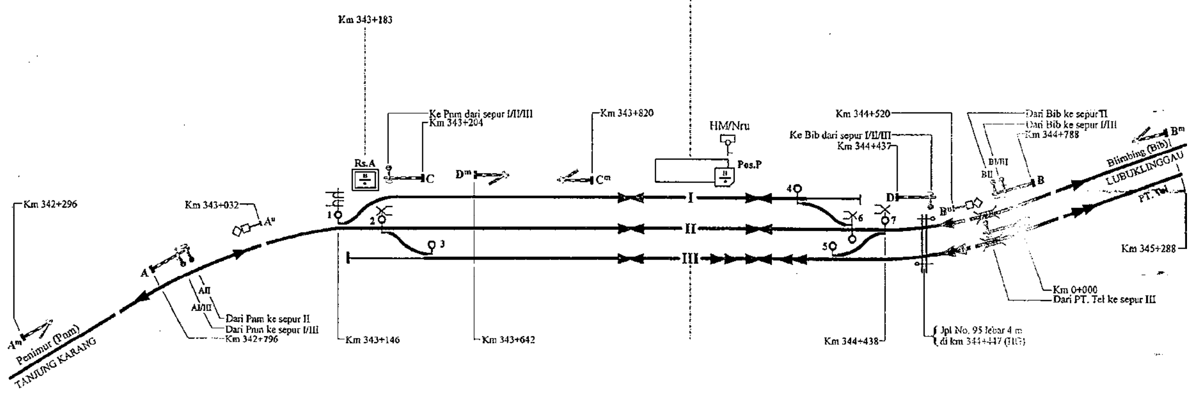
Rangkaian anak kunci



Sepur	Panjang sepur	Sepur efektiv
I	1429	1332
II	1430	1359
Simpan	147	107

NIRU

KM 344+254



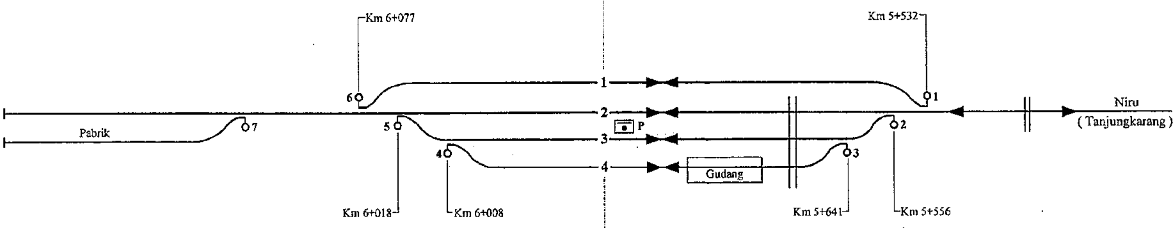
KETERANGAN

= Perkakas hendel
= Sekat ganda
= Kancing
= Pintu perlintasan HG
= Kedudukan biasa bagi wesel terlayan pusat

Sepur	Panjang sepur	Sepur efektiv
I	1140	1069
II	1142	1070
III	1098	1026
Badug I	166	96
Badug III	166	150

PT. TANJUNGENIM LESTARI

KM 5+792

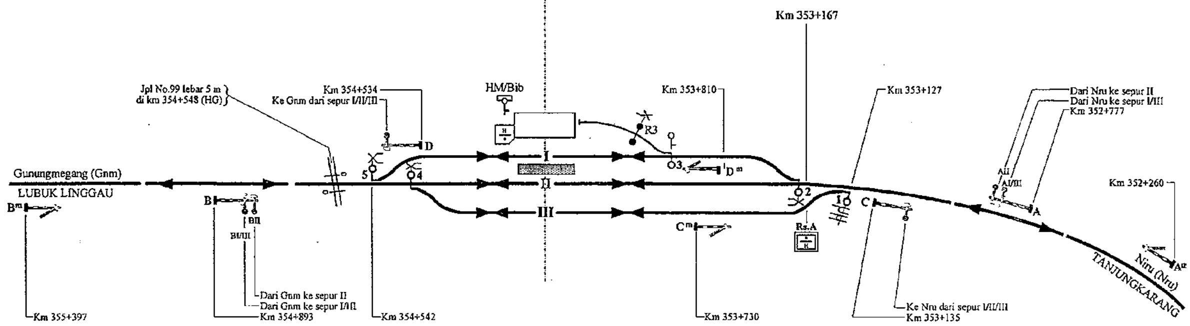


KETERANGAN

= Perkakas handel
= Kedudukan biasa bagi wesel terlayan pusat

BLIMBING

KM 354+344



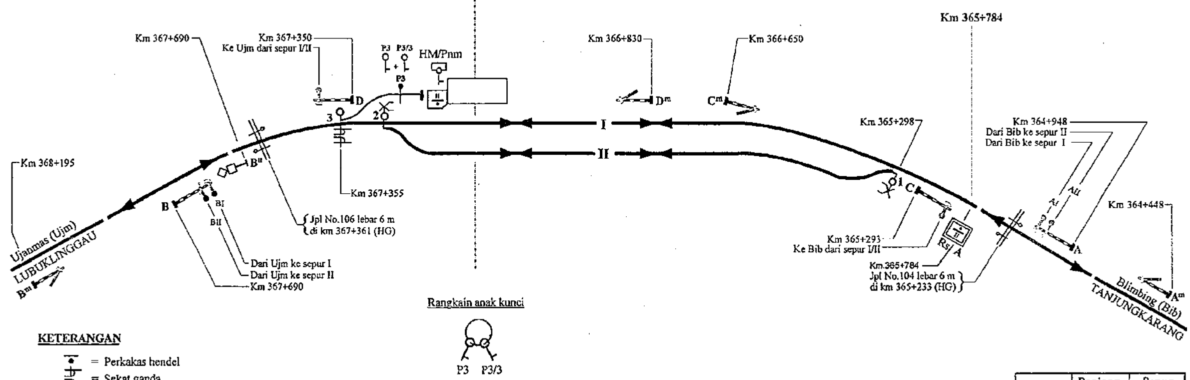
KETERANGAN

- = Perkakas hendel
- = Sekat ganda
- = Kancing.
- = Pintu perlintasan HG
- = Perintang
- = Kunci jamin
- = Kedudukan biasa bagi wesel terlayan pusat

Sepur	Panjang sepur	Sepur efektiv
I	1342	1282
II	1844	1784
III	1345	1285
Simpan	295	225

GUNUNGMEGANG

KM 367+039



Rangkain anak kunci

P3 P3/3

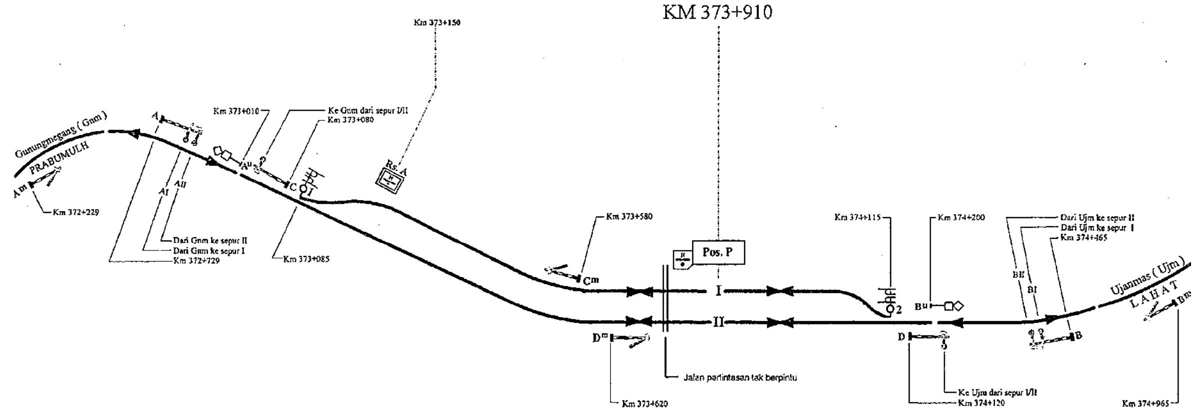
KETERANGAN

- = Perkakas hendel
- = Sekat ganda
- = Kancing.
- = Kunci jamin
- = Pelalau
- = Pintu perlintasan HG
- = Kedudukan biasa bagi wesel terlayan pusat

Sepur	Panjang sepur	Sepur efektiv
I	1557	1443
II	1557	1443
Simpan	153	83

PENANGGIRAN

KM 373+910



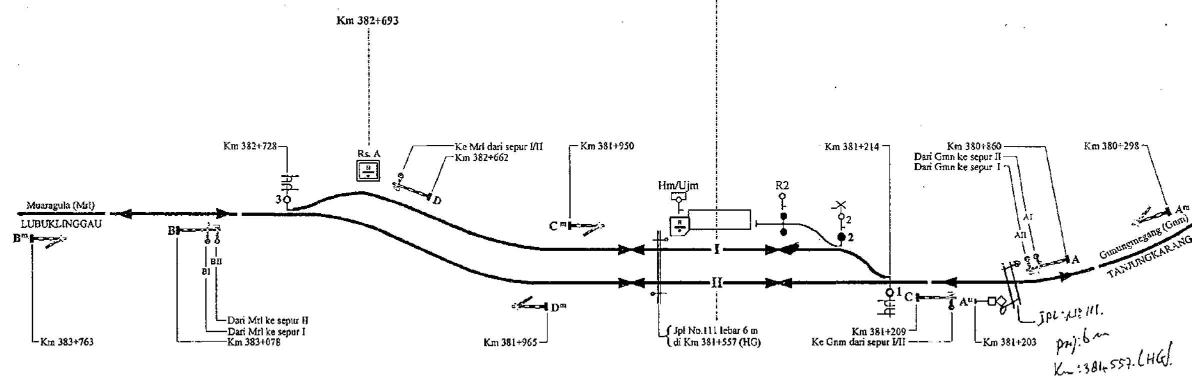
KETERANGAN

- = Perkakas hendel
- = Sekat
- = Kedudukan biasa bagi Wesel terlayan pusat

Sepur	Panjang sepur	Sepur efektiv
I	000	000
II	000	000

UJANMAS

KM 381+529



KETERANGAN

- = Perkakas handel
- = Sekat ganda
- = Kancing.
- = Kunci jamin
- = Perintang
- = Pintu perlintasan HG
- = Kedudukan biasa bagi wesel terlayan pusat
- = Kedudukan biasa bagi wesel terlayan tempat

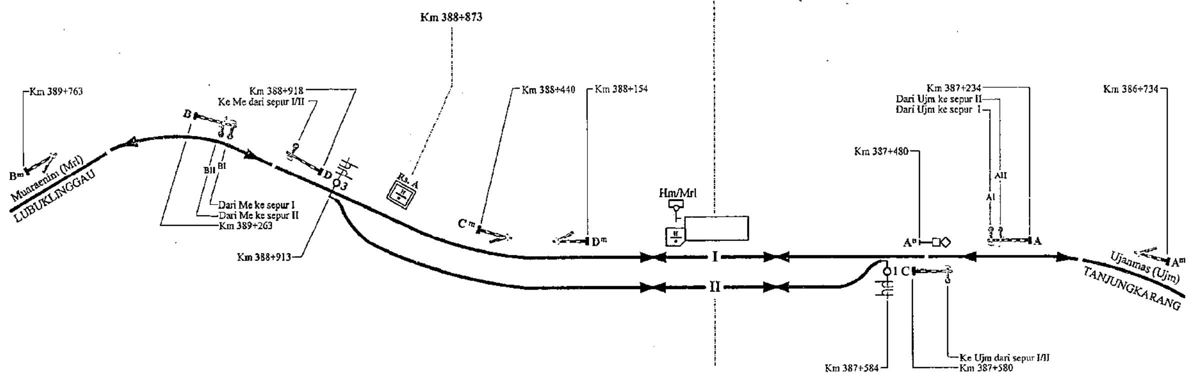
Rangkain anak kunci

2 R2/2

Sepur	Panjang sepur	Sepur efektiv
I	1453	1380
II	1454	1382
Badug	155	85

MUARAGULA

KM 387+890



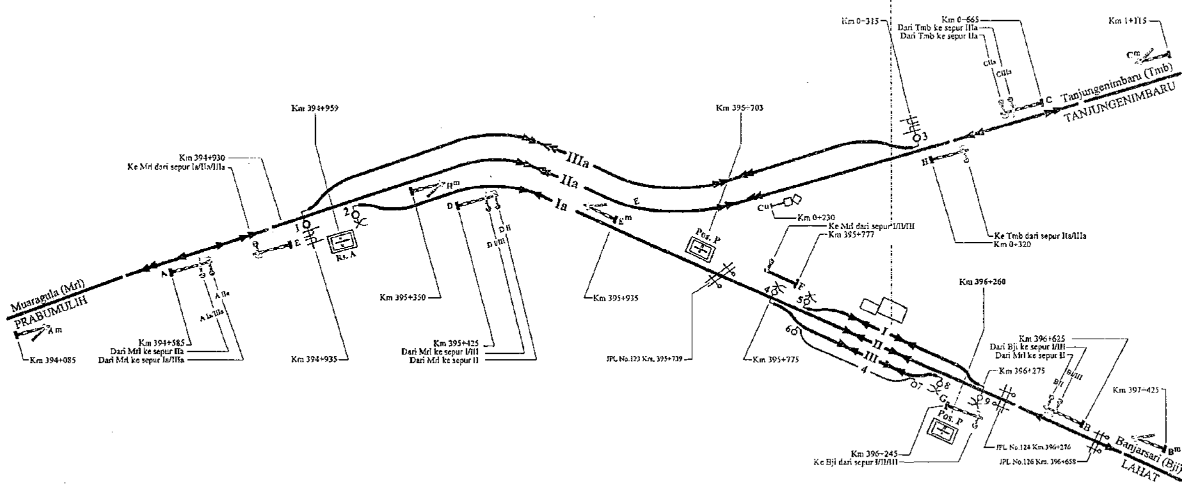
KETERANGAN

- = Perkakas handel
- = Sekat ganda
- = Kunci perkakas handel
- = Kedudukan biasa bagi wesel terlayan pusat

Sepur	Panjang sepur	Sepur efektiv
I	1269	1197
II	1268	1198
Baduk	104	34

MUARAENIM

KM 396+096



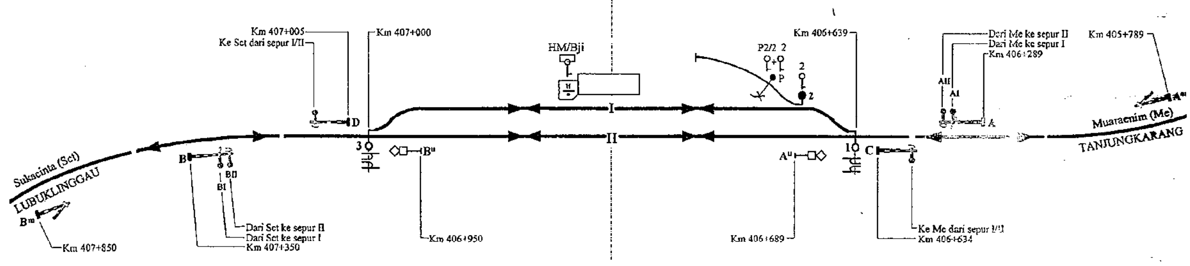
KETERANGAN

- = Perkakas handel
- = Sekat ganda
- = Kancing
- = Pintu listrik solar cell terlayan pusat
- = Kedudukan biasa bagi wesel terlayan pusat

BANJARSARI

KM 406+881 X

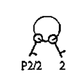
KM. 406 + 851 ✓



KETERANGAN

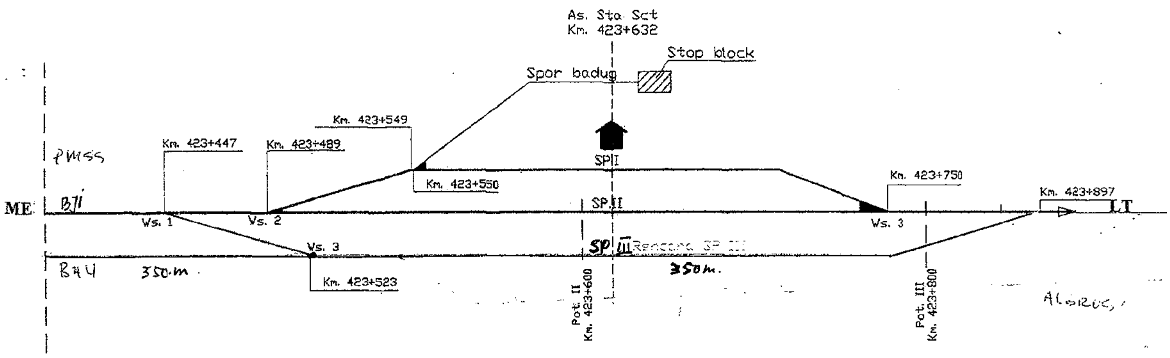
- = Perkakas handel
- = Sekat ganda
- = Kancing.
- = Pelalau
- = Kunci perkakas handel
- = Kunci jamin
- = Kedudukan biasa bagi wesel terlayan pusat
- = Kedudukan biasa bagi wesel terlayan tempat

Rangkaian anak kunci



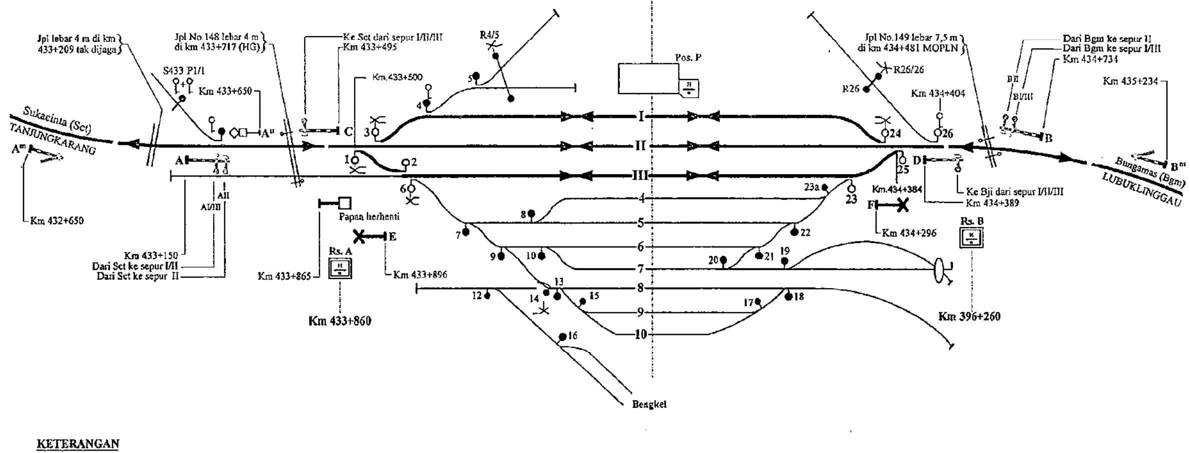
Sepur	Panjang sepur	Sepur efektiv
I	297	225
II	335	263
Simpan	161	91

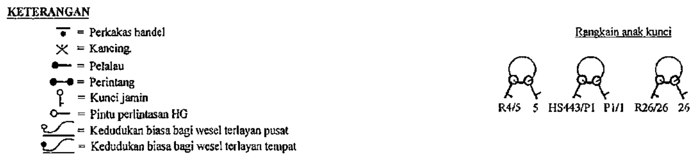
SKET EMPLASEMEN SCT



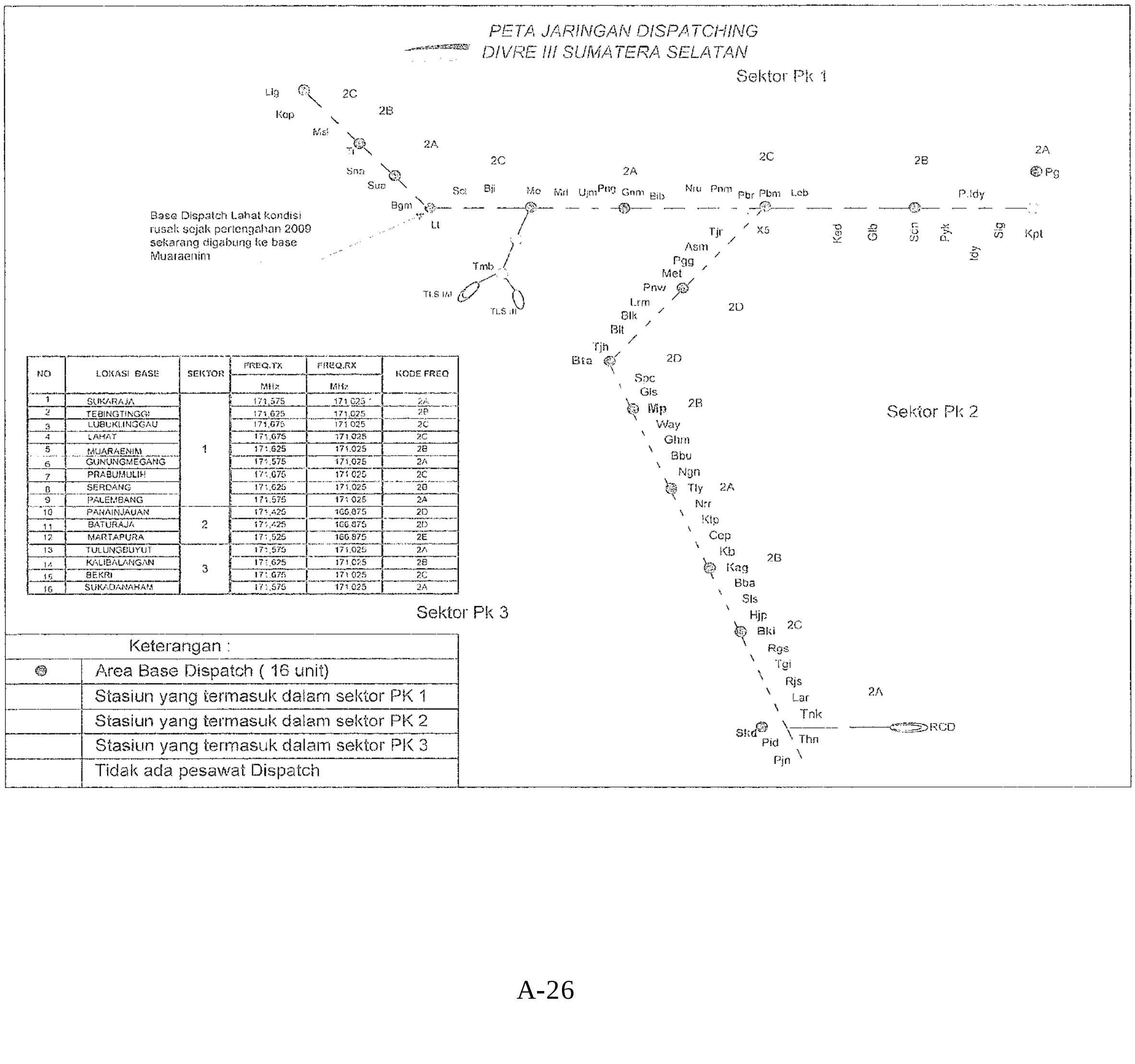
LAHAT

KM 434+159



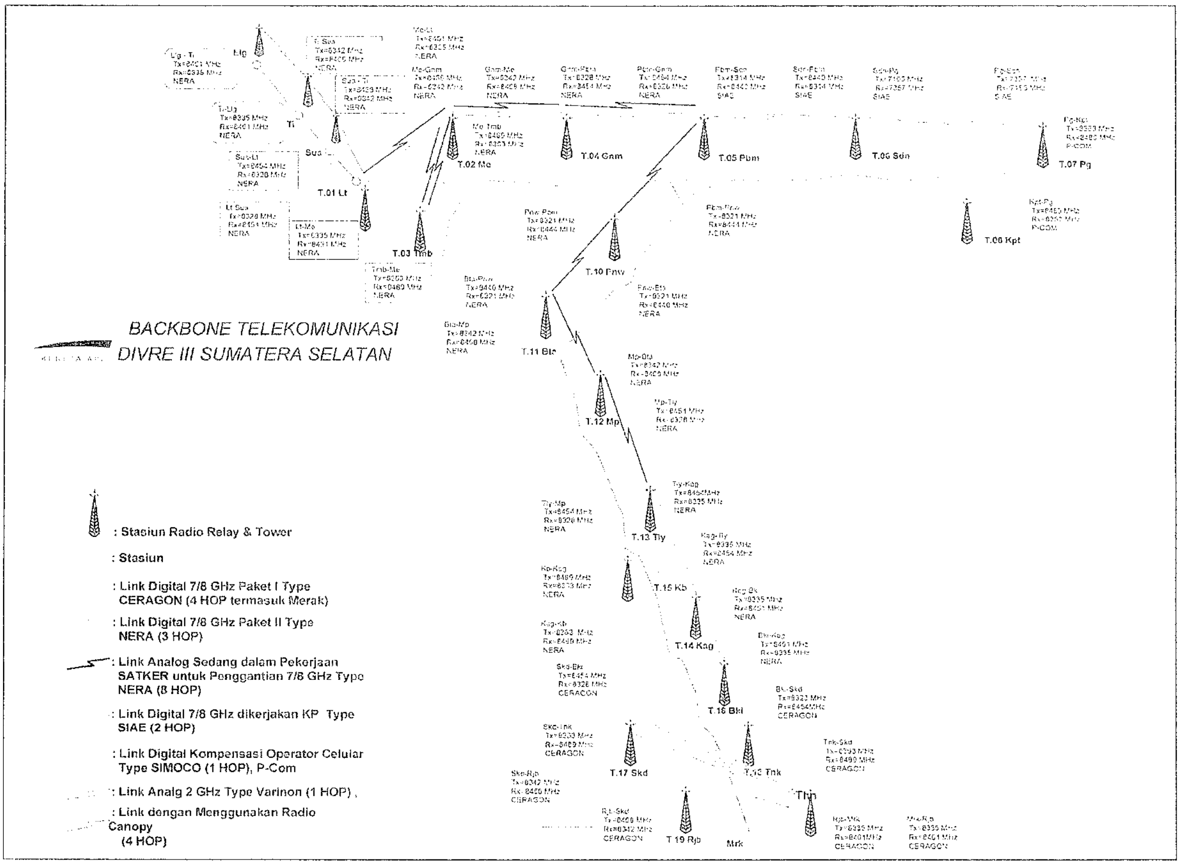


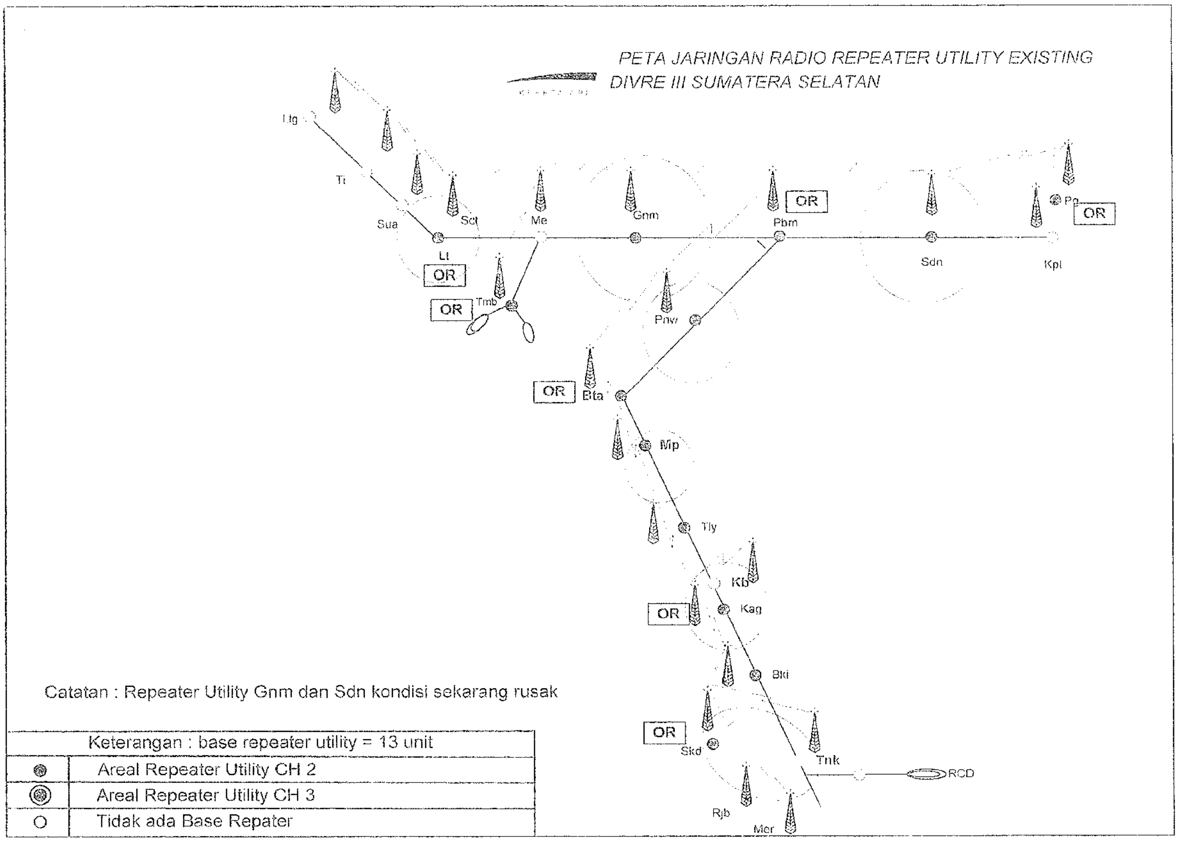
Sepur	Panjang sepur	Sepur efektiv
I	402	432
II	462	402
III	330	270
Simpan I	220	150
Simpan II	167	97



NO	LOKASI BASE	SEKTOR	FREQ.TX MHz	FREQ.RX MHz	KODE FREQ
1	SUKARAJA	1	171,575	171,025	2A
2	TEBINGTINGGI		171,625	171,025	2B
3	LUBUKLINGGAU		171,675	171,025	2C
4	LAHAT		171,675	171,025	2C
5	MUARAENIM		171,625	171,025	2B
6	GUNUNGMEGANG		171,575	171,025	2A
7	PRABUMULIH		171,675	171,025	2C
8	SERDANG		171,625	171,025	2B
9	PALEMBANG		171,575	171,025	2A
10	PANAINJAUAN	2	171,425	166,875	2D
11	BATURAJA		171,425	166,875	2D
12	MARTAPURA		171,525	166,875	2E
13	TULUNGBUYUT	3	171,575	171,025	2A
14	KALIBALANGAN		171,625	171,025	2B
15	BEKRI		171,675	171,025	2C
16	SUKADANAHAM		171,575	171,025	2A

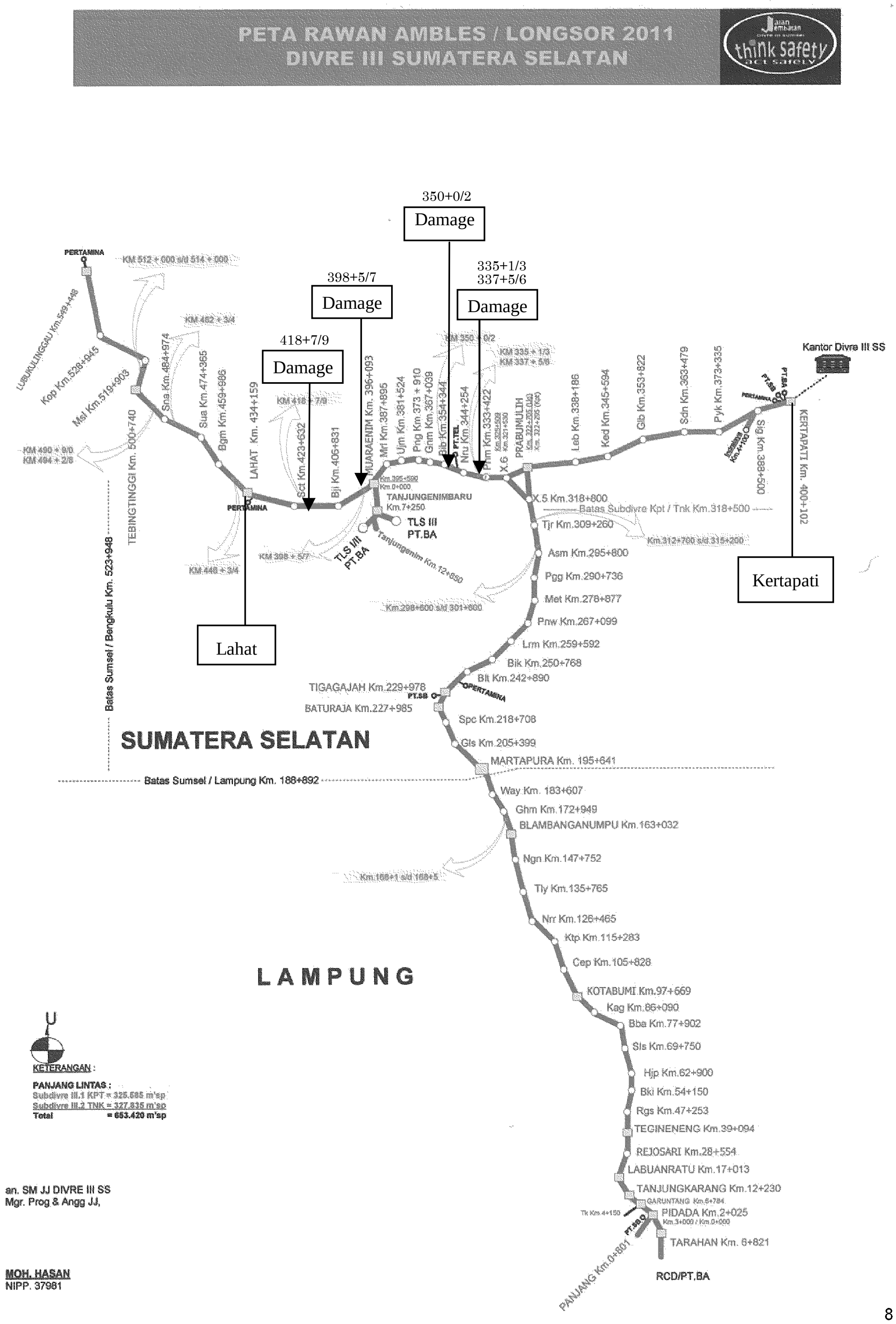
Keterangan :	
●	Area Base Dispatch (16 unit)
	Stasiun yang termasuk dalam sektor PK 1
	Stasiun yang termasuk dalam sektor PK 2
	Stasiun yang termasuk dalam sektor PK 3
	Tidak ada pesawat Dispatch





(Source: PT. KAI)

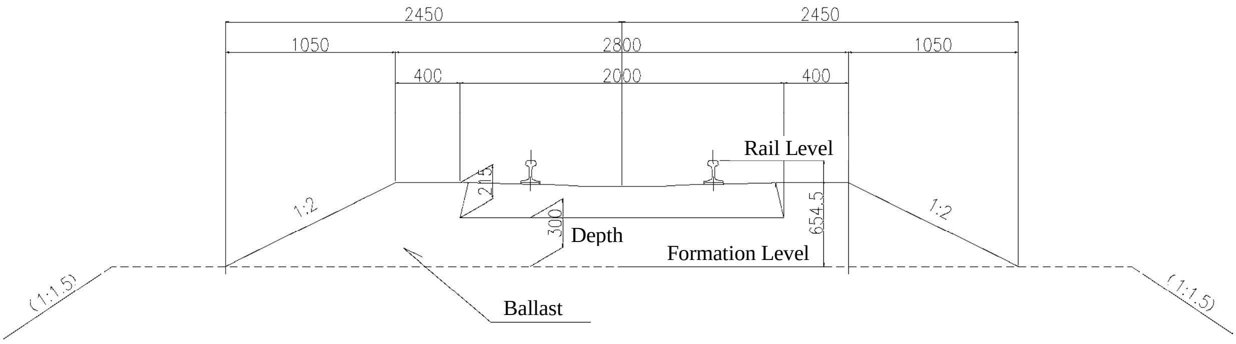
[Appendix 4-4-1] Track Bed Damage Map (2011)



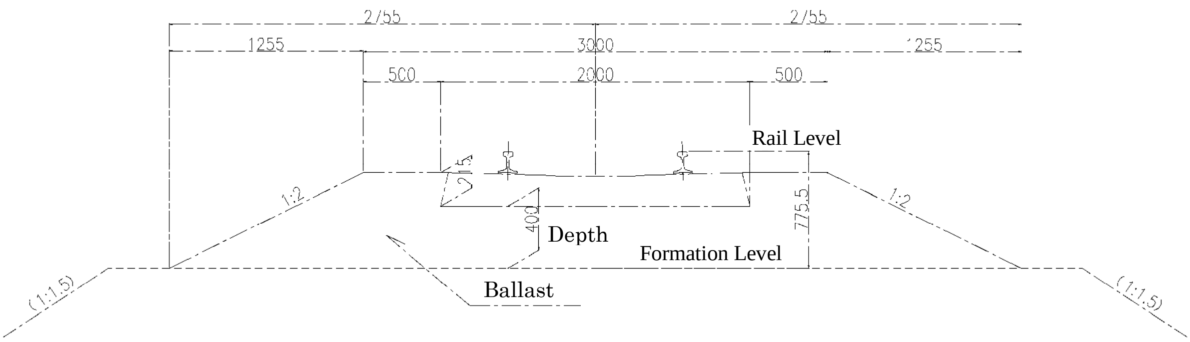
(Source : PT. KAI)

[Appendix 4-4-2] Countermeasure for Mud Pumping

Present (Depth = 30cm)



Improved (Depth = 35 - 40cm)



(Source: Study team)

[Appendix 4-4-3] Durability of Synthetic Sleeper

The synthetic sleeper is shaped out of some boards of the composite material which consists of long glass fiber and hard firing urethane. The weight and the ease of handling of a synthetic sleeper are almost the same as that of a wooden sleeper. The synthetic sleeper is a durable and long-life track material under the environment which is easy to corrode or the high load. However, since the price is expensive, the synthetic sleeper is mainly used for the bridge section, the turnout section, etc. in which it is difficult to exchange the sleepers.

Table-1 Basic Physical Properties of the Synthetic Sleeper

Item			Unit	Synthetic	Wood (Beech)	Test Method
Specific Gravity			–	0.67～0.82	0.65～0.84	JIS Z 2102
Material Strength	Bending Strengtrh		kgf/mm²	14.2	8.0	JIS Z 2113
	Young's Modulus		kgf/mm²	8.1×10³	7.1×10³	JIS Z 2113
	ngitudinal mpressive Strength		kgf/mm²	5.8	4.0	JIS Z 2111
	earing Strength		kgf/mm²	1.0	1.2	JIS Z 2114
	Longitudinal Shearing Strength		kgf/mm²	Destruction of the Base Metal	–	JIS K 6852
	Hardness		kgf/mm²	2.8	1.7	JIS Z 2117
	Impact Bending Strength	20℃	J/cm²	41	20	JIS Z 2116
		－20℃	J/cm²	41	8	
Absorbed Moisture		24 hours	mg/cm²	3.3	137 (Material) 50 (Grouting Material of Creosote)	JIS Z 2104
		110 days	mg/cm²	13.0	590 (Material) 280 (Grounting Material of Creosote)	
Electrical Properties	oltage of lternating urrent reakdown	DRY	kV	≥ 25	3	JIS C 2110
		WET	kV	13	≤ 3	
	sulation esistance	DRY	Ω	1.6×10¹³	6.6×10⁷	JIS K 6911
		WET	Ω	1.4×10⁸	5.9×10⁴	
Pull-out Strength	og Spike		tf	2.7	2.5	Type of Railway Technical Research Institute
	crew Spike		tf	6.5	4.3	
	Dog Spike (Side Pressure)		tf	1.9	1.5	

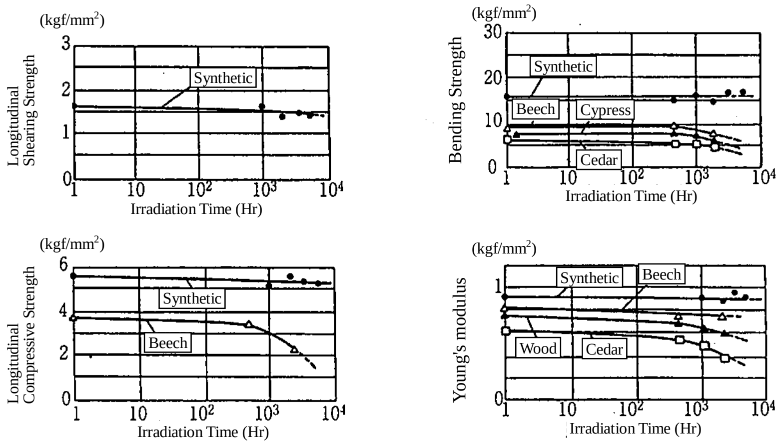


Figure-1 Test Result of a weather proofing

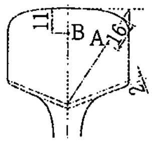
(Source: The Japan Railway Civil Engineering Association)

[Appendix 4-4-4] Head Hardened Rail

The head hardened rail was developed as the anti-wear rail in the sharp curve section. The head hardened rail which performed the forced-air-cooling using a slack and quick hardening (slack quenching) processing in-line [using the possession heat of the rail immediately after rolling] is put in practical use and standardized.

Table-1 Hardness of the Cross-sectional Hardening Bed

	Vickers Hardness (HV)	
	A	B
HH340	≥311	≥311
HH370	≥311	≥311



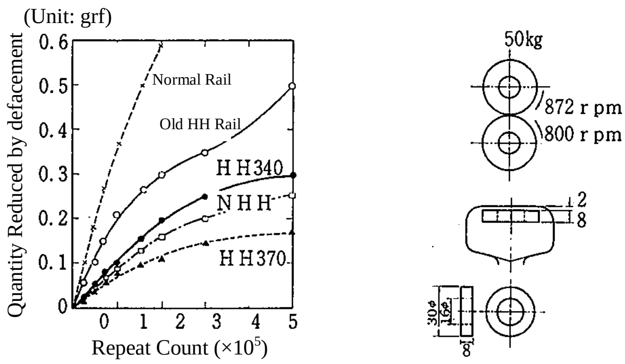


Figure-1 Polishing-test result

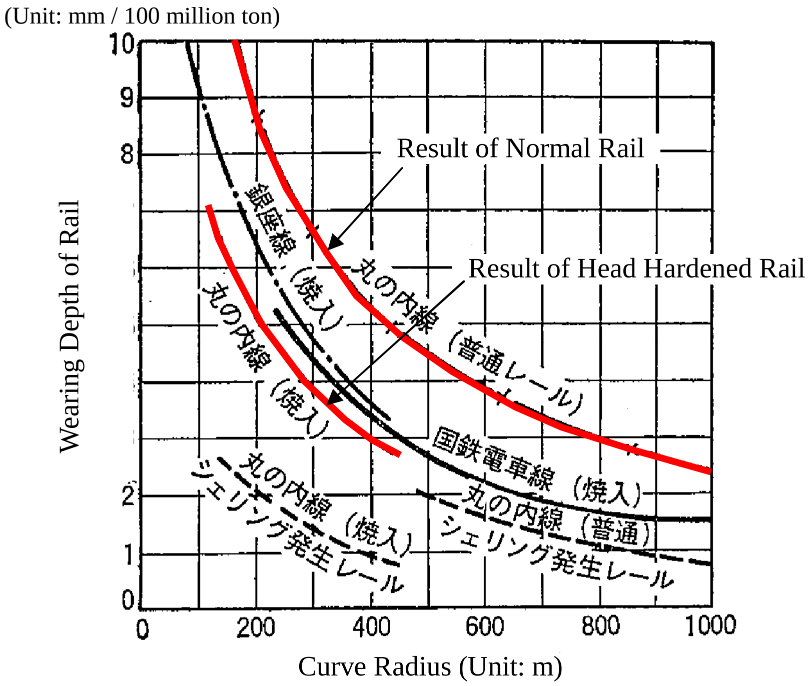


Figure-2 Relationship between Curve Radius and Wearing Depth of Rail

(Source: The Japan Railway Civil Engineering Association)

[Appendix 4-5-1] Curvature Table between Lahat and Kertapati

№	Curve Radius (m)	Location		Transition Curve Length (m)	Curve Length (m)
		Biginning	Biginning		
Lahat （434km159）					
1	500	433km533.17	433km702.03	13.61	168.86
2	440	433km051.00	433km203.00	99.14	152.00
3	490	430km928.40	431km246.67	90	318.27
4	490	429km470.80	430km271.80	90	801.00
5	1000	428km624.16	428km710.16	60	86.00
6	595	427km181.72	427km629.92	74	448.20
7	950	426km191.04	426km533.74	63.15	342.70
8	800	424km878.28	425km559.28	75	681.00
Sukacinta （423km632）					
9	540	422km936.49	423km052.81	81	116.32
10	970	420km015.80	421km928.80	62	1,913.00
11	500	418km759.10	419km267.60	87.46	508.50
12	500	418km332.95	418km612.30	73	279.35
13	470	418km100.45	418km256.45	80	156.00
14	455	417km386.20	417km652.06	92	265.86
15	500	416km999.10	417km294.70	87.48	295.60
16	715	416km553.60	416km634.60	44	81.00
17	500	416km 74.10	416km480.60	84	406.50
18	500	414km046.85	414km170.85	81	124.00
19	540	413km501.62	413km767.62	104	266.00
20	595	412km313.96	412km728.95	101	415.00
21	580	411km421.45	412km003.95	104	582.50
22	390	409km250.35	409km478.35	65	228.00
23	400	408km529.45	408km993.45	64	464.00
24	500	407km975.95	408km471.95	51.61	496.00
25	571	407km079,36	407km300.56	76.5	221.10
Banjarsari (406km851)					
26	500	406km444.60	406km571.00	87.48	126.40
27	600	404km619.60	405km389.60	100	770.00
28	460	403km953.53	404km089.03	56	135.50
29	504	402km887.40	402km973.38	60	85.98

№	Curve Radius (m)	Location		Transition Curve Length (m)	Curve Length (m)
		Biginning	Biginning		
30	485	401km809.75	402km196.75	90	387.00
31	426	401km199.39	401km277.35	60	77.96
32	500	400km397.15	400km914.15	87.48	517.00
33	670	399km838.20	400km212.00	90	373.80
34	440	399km522.70	399km701.85	99.41	149.15
35	800	399km366.33	399km447.13	75	80.80
36	520	399km042.00	399km149.75	33.5	107.75
37	400	398km916.75	399kmo42.00	51.75	125.25
38	400	398km523.00	398km865.00	51.75	342.00
39	400	397km901.40	398km144.80	62	243.00
40	264	379km389.64	397km520.14	99.41	130.50
41	440	396km015.00	396km605.55	60.5	590.55
Muaraenim (396km093)					
42	422	395km500.00	395km561.22	52.52	61.22
43	526	395km418.00	395km500.72	-	82.72
44	458	395km273.00	395km470.00	53	197.00
45	944	394km583.00	394km627.00	13.61	44.00
46	480	394km121.00	394km526.00	13.61	405.00
47	549	391km686.00	392km047.00	13.61	361.00
48	574	390km829.00	391km279.00	21.56	450.00
49	581	389km293.00	389km983.00	21.56	690.00
50	980	388km228.00	388km523.00	21.50	295.00
51	746	388km120.00	388km220.00	60	100.00
52	625	388km004.00	388km074.00	60	70.00
Muaragula (387km895)					
53	1000	386km914.00	387km558.00	97.2	644.00
54	467	386km207.00	386km422.00	74	215.00
55	385	385km614.00	385km877.00	-	263.00
56	394	385km516.00	385km641.00	70	125.00
57	472	385km087.00	385km352.00	96	265.00
58	909	383km730.00	383km944.00	63.15	214.00
59	544	382km103.00	382km635.00	50	532.00
60	431	381km809.00	382km010.00	36	201.00

№	Curve Radius (m)	Location		Transition Curve Length (m)	Curve Length (m)
		Biginning	Biginning		
Ujanmas (381km259)					
61	1000	380km744.00	381km019.00	60	275.00
62	746	380km109.00	380km321.00	73	212.00
63	819	379km444.00	379km890.00	60	446.00
64	481	378km093.00	378km824.00	64.8	731.00
65	394	377km393.00	377km947.00	64	554.00
66	796	376km939.00	377km247.00	-	308.00
67	794	-	-	102	-
68	561	376km368.00	376km626.00	76	258.00
69	1041	375km753.00	375km870.00	60	117.00
70	735	374km575.00	375km117.00	76.92	542.00
Penanggiran (373km600)					
71	1283	373km273.00	373km820.00	44	547.00
72	926	372km437.00	372km965.00	60	528.00
73	847	372km214.00	372km328.00	66.67	114.00
74	496	371km715.00	371km833.00	99.41	118.00
75	471	371km215.00	371km552.00	87.48	337.00
76	443	370km715.00	370km888.00	99.41	173.00
77	892	370km401.00	370km498.00	78	97.00
78	472	369km952.00	370km031.00	-	79.00
79	910	369km407.00	369km664.00	63.15	257.00
80	463	369km137.00	369km235.00	64	98.00
81	450	368km785.00	369km091.00	52	306.00
82	806	368km047.00	368km296.00	52	249.00
83	388	367km809.00	367km988.00	64	179.00
84	406	367km517.00	367km694.00	68.41	177.00
85	324	367km354.00	367km384.00	-	30.00
86	725	367km271.00	367km304.00	-	33.00
Gunungmegang (367km039)					
87	316	366km791.00	366km847.00	42.19	56.00
88	360	366km575.00	366km728.00	70	153.00
89	794	366km278.00	366km364.00	-	86.00
90	600	365km782.00	366km012.00	-	230.00

№	Curve Radius (m)	Location		Transition Curve Length (m)	Curve Length (m)
		Biginning	Biginning		
91	555	364km468.00	364km643.00	-	175.00
92	234	364km040.00	364km211.00	-	171.00
93	625	363km143.00	363km964.00	92.31	821.00
94	961	362km534.00	362km632.00	63.156	98.00
95	944	361km575.00	361km800.00	60	225.00
96	561	361km103.00	361km398.00	104	295.00
97	943	359km959.00	360km269.00	62.5	310.00
98	943	356km280.00	356km428.00	64	148.00
Belimbing (354km344)					
99	909	353km567.00	353km832.00	60	265.00
100	833	351km916.00	352km028.00	66	112.00
101	735	351km202.00	351km472.00	76	270.00
102	667	350km490.00	350km725.00	84	235.00
103	1086	350km198.00	350km358.00	102	160.00
104	602	-	-	102	-
105	667	348km927.00	349km307.00	76.95	380.00
106	793	348km662.00	348km827.00	75	165.00
107	1087	347km881.00	347km991.00	63.15	110.00
108	877	347km643.00	347km758.00	75	115.00
109	1063	347km297.00	347km382.00	46.15	85.00
110	943	346km108.00	346km315.00	62	207.00
111	1064	344km799.00	345km422.00	52	623.00
112	581	344km471.00	344km576.00	60	105.00
Niru (344km254)					
113	862	343km912.00	343km997.00	50	85.00
114	595	343km588.00	343km891.00	100.8	303.00
115	490	342km855.00	343km085.00	92	230.00
116	427	342km546.00	342km763.00	93	217.00
117	901	340km018.00	340km181.00	71.5	163.00
118	961	338km880.00	339km274.00	60	394.00
119	757	337km781.00	337km993.00	84	212.00
120	575	336km913.00	337km334.00	108	421.00
121	730	336km304.00	336km531.00	85.71	227.00

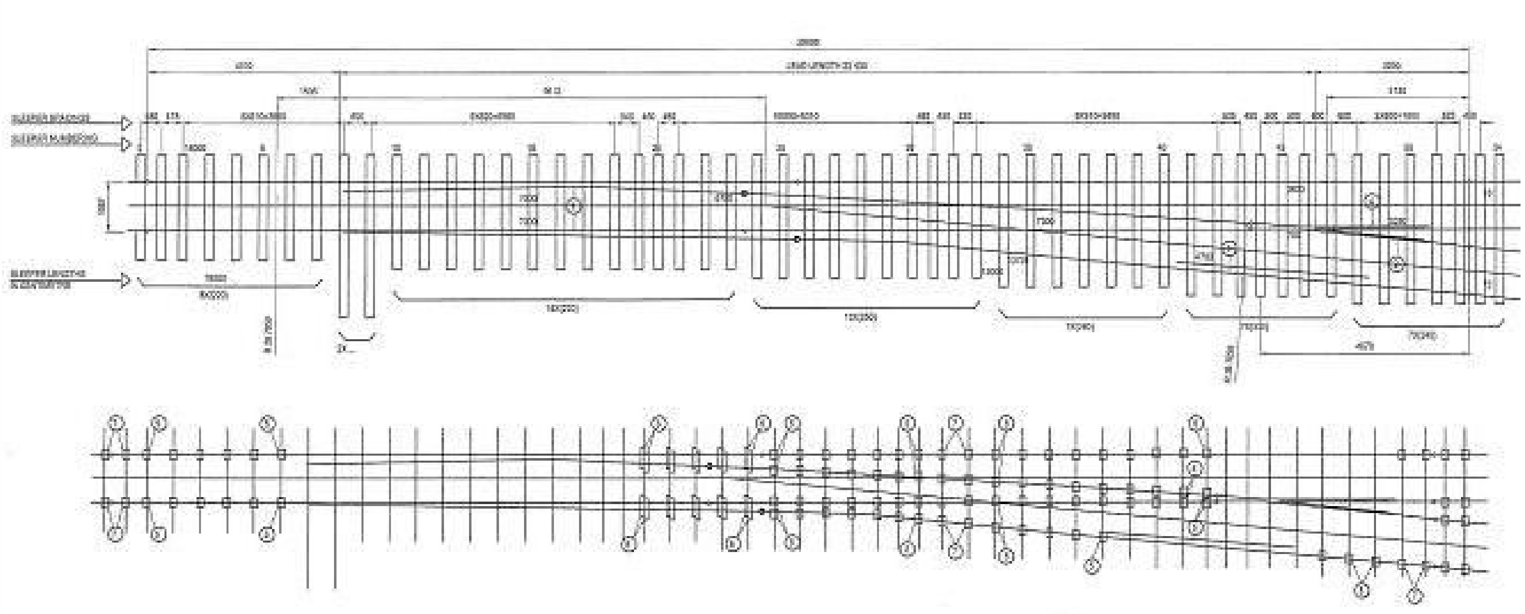
№	Curve Radius (m)	Location		Transition Curve Length (m)	Curve Length (m)
		Biginning	Biginning		
122	450	335km201.oo	335km836.00	92	635.00
123	488	333km717.00	334km487.00	87.48	770.00
Penimur (333km422)					
124	463	332km543.00	333km224.00	87.48	681.00
125	556	332km061.00	332km423.00	74	362.00
126	877	331km093.00	331km302.00	66	209.00
127	568	330km172.00	330km561.00	182	389.00
128	562	329km564.00	329km892.00	72.9	328.00
129	576	328km958.00	329km319.00	72.22	361.00
130	546	328km594.00	328km786.00	108	192.00
131	575	327km753.00	328km145.00	102	392.00
132	820	326km770.00	327km578.68	75	808.68
Prabumulih X6 (325km512)					
Prabumulih (322km295)					
133	481	321km172.00	321km444.00	120	272.00
134	1000	324km565.77	324km808.55	60	243.08
135	1000	325km247.00	325km713.00	60	466.00
136	1000	325km964.95	326km575.33	60	610.38
137	1000	326km718.98	327km037.79	60	318.81
138	1000	327km618.54	328km293.25	60	674.71
139	1000	328km653.05	329km044.45	60	391.40
140	1000	329km979.33	330km057.00	60	11.67
141	1000	333km654.16	334km037.55	60	383.39
Lembak (338km188)					
142	1000	339km785.04	339km883.07	60	98.03
143	1000	343km926.58	344km245.06	60	318.50
144	600	345km245.50	345km316.00	100	70.50
145	2000	345km430.50	345km476.00	30	45.5
Karangendah (345km594)					
146	1000	349km184.04	349km230.58	-	46.54
147	1000	351km009.26	351km317.42	60	308.16
Glumbang (353km822)					
148	1000	354km192.55	354km467.73	60	275.18
149	1000	359km244.01	359km431.35	60	187.34
150	1000	361km995.10	362km148.21	60	151.11

№	Curve Radius (m)	Location		Transition Curve Length (m)	Curve Length (m)
		Biginning	Biginning		
Serdangt (363km479)					
151	1000	365km792.53	365km950.05	60	157.55
152	1000	367km579.06	367km760.57	60	181.51
153	1032.5	368km529.79	369km123.22	60	593.43
154	5000	371km382.27	371km852.27	-	470.00
155	1002	371km901.52	372km616.35	60.8	714.83
Payakabung (373km335)					
156	2000	373km534.85	373km564.85	30	30.00
157	600	373km657.85	373km746.85	75	89.00
158	1064	373km746.85	374km202.50	19.11	455.65
159	1000	377km373.28	377km472.26	60	98.98
160	1000	377km105.74	384km378.27	60	272.53
Simpang (388km500)					
161	1000	391km135.57	391km324.45	60	188.88
162	1000	395km198.89	395km322.12	60	123.23
163	1000	397km415.80	397km878.39	60	462.59
164	1000	399km017.12	399km101.00	12.93	83.88
165	1000	399km127.17	399km184.60	12.93	57.43
166	500	399km291.98	399km445.05	25.87	153.07

(Source: Study team)

[Appendix 4-5-2] Turnout (R54 No.12)

SIMPLE TURNOUT R-54 (1:12)



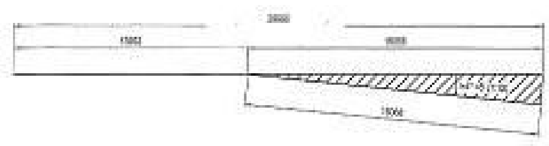
MATERIAL LIST

NO	DESCRIPTION		DIMENSION	QTY	REMARKS
1	SWITCH		7000	1	
2	MANGANESE FROG		[illegible]	1	
3	CHECK RAIL		4750	1	R54 RAIL
4	CHECK RAIL		3950	1	R54 RAIL
5	TIE PLATE	A	[illegible]	69	
6	TIE PLATE	B	[illegible]	29	
7	TIE PLATE	C	[illegible]	14	
8	TIE PLATE	D	[illegible]	14	
	FISH PLATE			36	
	INSULATED JOINT			2	
	FISH BOLT NUT			84	
	SCREW SPIKE			736	
	STOCK RAIL		18000	2	
	LEAD RAIL		12724	1	R54 RAIL
	LEAD RAIL		7500	1	R54 RAIL
	LEAD RAIL		6750	1	R54 RAIL
	MAIN RAIL		12000	2	R54 RAIL

NO	DESCRIPTION	DIMENSION	QTY	REMARKS
[illegible]	SLEEPER	[illegible]	1	CONCRETE MATERIAL
[illegible]	SLEEPER	[illegible]	1	CONCRETE MATERIAL
[illegible]	SLEEPER	[illegible]	1	CONCRETE MATERIAL
[illegible]	SLEEPER	[illegible]	1	CONCRETE MATERIAL
[illegible]	SLEEPER	[illegible]	[illegible]	CONCRETE MATERIAL
[illegible]	SLEEPER	[illegible]	[illegible]	CONCRETE MATERIAL
[illegible]	SLEEPER	[illegible]	5	CONCRETE MATERIAL

NOTE: LEFT HAND DRAWING OMITTED
SYMMETRICAL WITH RIGHT HAND TURNOUT

LEGEND:
ORDINARY JOINT
INSULATED RAIL JOINT



SKELETON

(Source: Study team)