Republic of Indonesia
Coordination Ministry for Economic Affairs
Ministry of National Development Plan/ National Development Planning Agency
Ministry of Transportation

Feasibility Study for Jakarta-Bandung High-Speed Railway Project (As a part of Jakarta – Surabaya) Phase I

Final Report (Executive Summary)

May 2015

Japan International Cooperation Agency (JICA)
Japan International Consultants for Transportation Co., Ltd.
Yachiyo Engineering Co., Ltd.
Oriental Consultants Global Co., Ltd.
Mitsubishi Research Institute, Inc.
Nippon Koei Co., Ltd
PT. Matra Rekayasa Internasional / Universitas Gadjah Mada / PT. LAPI ITB

EI
CR(5)
15-119

TABLE OF CONTENTS

Chapter 1 Outline of Study

Project Name: Feasibility Study for Jakarta-Bandung High-Speed Railway Project (Phase-I), Stage-I & Stage-II

Country Name: Republic of Indonesia

Duration: 25th December 2013 – 20th June 2015

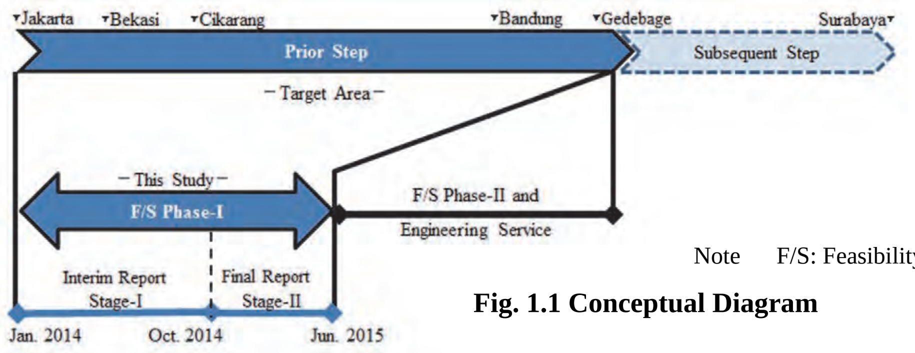
1.1 Objectives and Contents

(1) Objectives

The objective of this work is to evaluate the necessity, relevance and achievability of this project.

(2) Implementation Policy and Conceptual Diagram

This work was executed by dividing it into two stages, Stage-I and Stage-II. The conceptual diagram of Study for Java High-Speed Railway (hereinafter called as “HSR”) is shown in Fig. 1.1-1. After confirming Republic of Indonesia’s (hereinafter called as “Indonesia”) decision to proceed to Stage-II study based on the Shinkansen technology in Stage-I, Stage-II study has commenced since October 2014.



Note F/S: Feasibility

Fig. 1.1 Conceptual Diagram

(3) Phase-I Schedule

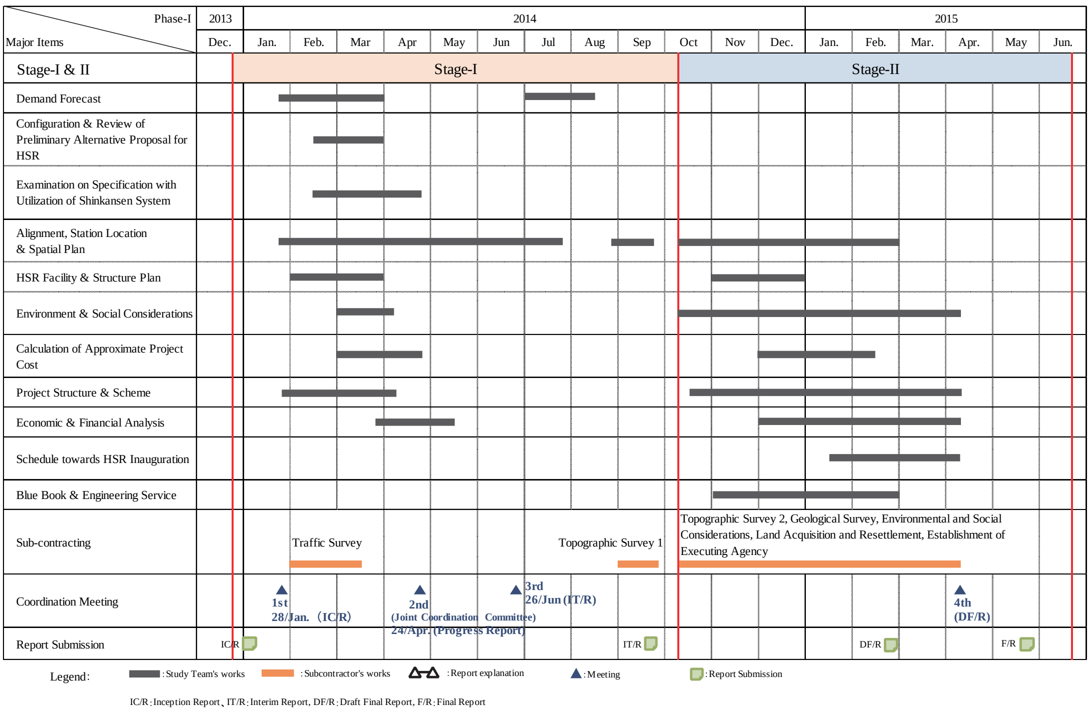
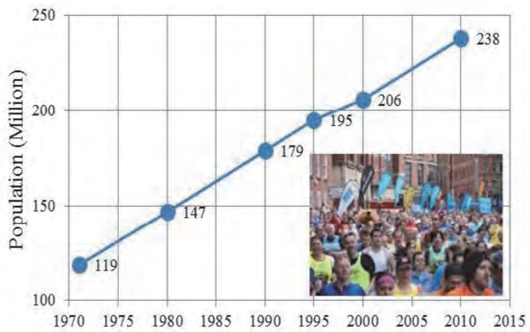


Fig. 1.2 Phase-I Schedule

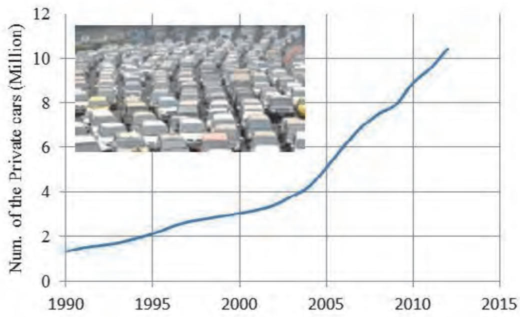
1.2 Necessity of High-Speed Railway in Indonesia

1.2.1 Current Issues

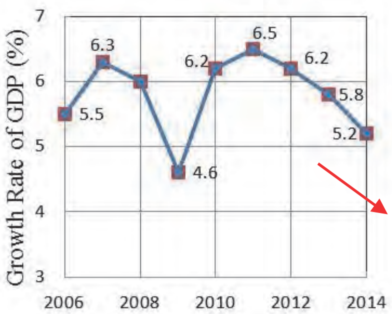
In Indonesia, population has been increasing and number of private cars has also been ever increasing. These conditions cause crucial traffic congestion. By looking at the graphs below, it can be seen that a large urban area that supports Indonesia's economy faces a serious problem of chronic traffic jams, which have considerable impact on economic activity and people's lives.



The population in 2010 is twice that of 1971.

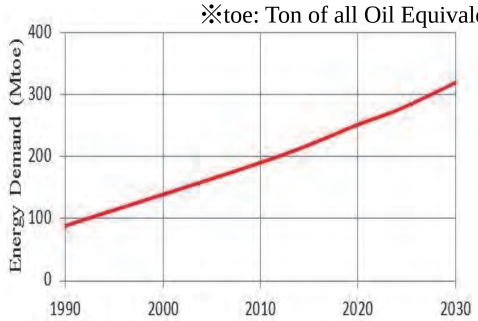


After 2005, 600,000 to 900,000 cars have continued to be added every year. (Except for 2009 due to the "Lehman Shock")



After "Lehman shock", the growth rate of GDP was in the steady 6% range, however, the rate in 2013 was 5.8% and in 2014 was 5.2%. This shows problems have begun to appear in a previously healthy economy.

※toe: Ton of all Oil Equivalent



Due to the economic growth, the growth of population, the growth in the number of cars, the delay of infrastructure development for public transportation and the chronic traffic jams, the energy demand has been increasing dramatically.

Fig. 1.3 Current issues in Indonesia

1.2.2 Effect of HSR Introduction

HSR Introduction would be one of the solutions to the above issues. HSR Introduction would enhance Modal Shift & TOD away from a car-centric social structure, would contribute a great deal to Indonesia's growth

and innovation (the saving of transport energy, the mitigation of chronic traffic jams, economic revitalization, the narrowing of regional gaps and so on) by the infrastructure development of public transportation.
The effect of HSR Introduction is as follows.

(1) Mitigation of chronic traffic jams

Figure 1.4 shows the transition of traffic volume between Jakarta and Bandung. Nowadays, it seems that the traffic volume of Jakarta – Cikampek toll load almost reaches its capacity. In 2030, the traffic volume will go over its capacity materially. As an effect of HSR inauguration, large volume conversion to HSR will be expected. And it leads mitigation of traffic jams. Figure 1.5 shows estimated increasing traveling time between Jakarta and Bandung by private cars without HSR case. Traveling time will remarkably increase.

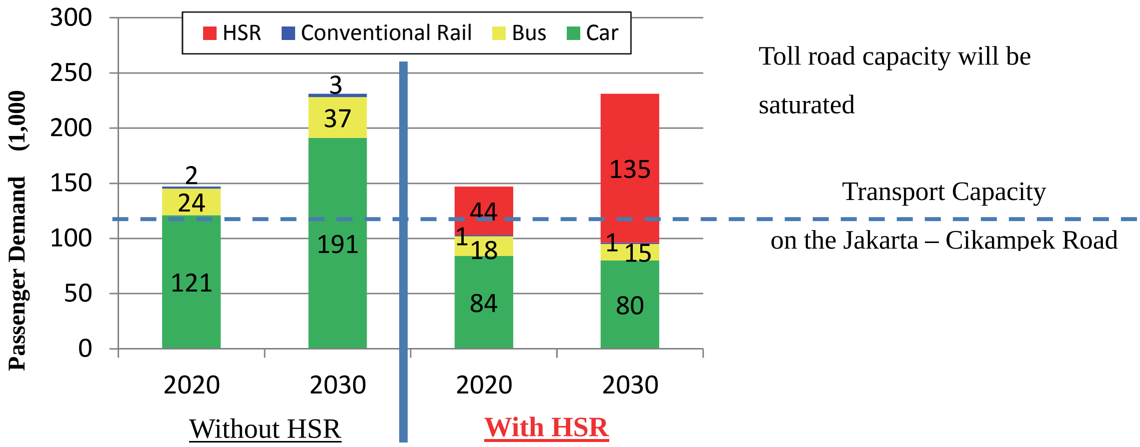


Fig. 1.4 Mitigation of Chronic Traffic Jams 2 (Growth of Passenger Demand (JKT – BDG))

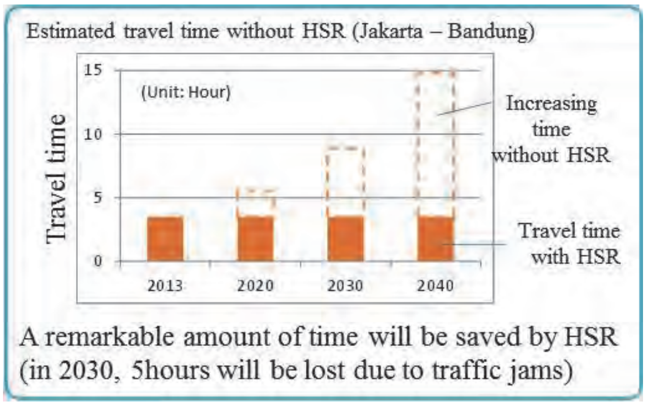


Fig. 1.5 Mitigation of Chronic Traffic Jams

(2) Saving travel time

In some cities, public transportation projects such as MRT and monorails are proceeding for the sake of mitigation of traffic jams. The TOD (Transit Oriented Development) planning in each city can get more effects by connecting each terminal by HSR. Figure 1.6 shows the effective TOD image by utilizing HSR. HSR can contribute not only to mitigation of traffic jams but also to saving travel time by cooperation with these public transportation projects.

Fig. 1.6 Modal Shift & TOD (TOD: Transit Oriented Development)

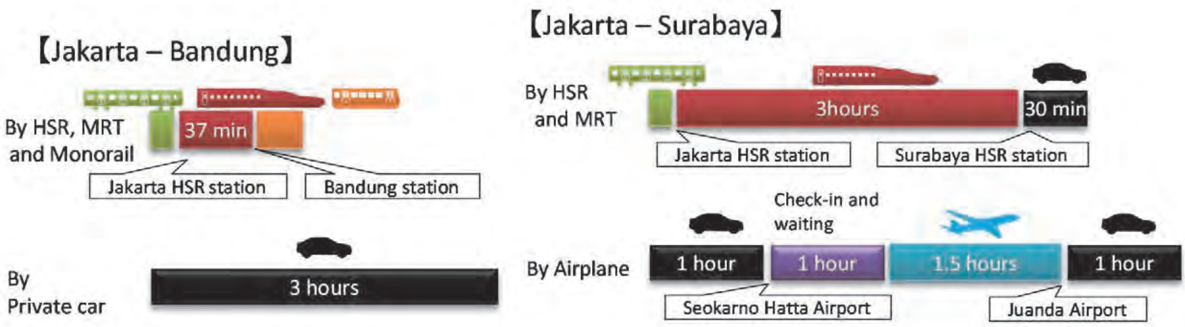


Fig. 1.7 Saving of Travel Time

(3) Energy Saving

HSR is very environmentally-friendly transportation because HSR Energy consumption per passenger is 1/5 of ca and 1/8 of airplane. It will be estimated that around 430 kl/day gasoline and 770 CO_2 emissions/day can be saved by HSR operation at inauguration.

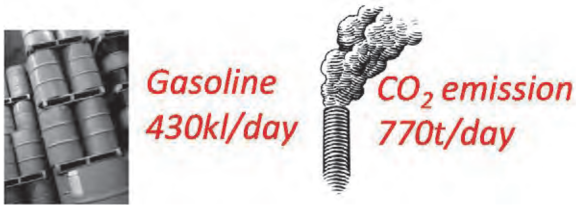
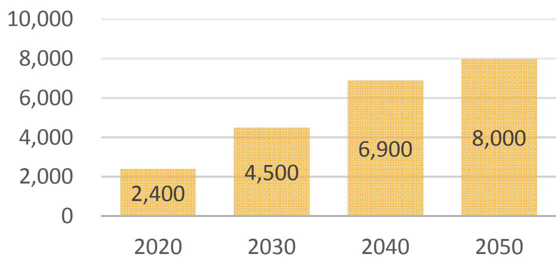


Fig. 1.8 Comparison of energy consumption **Fig. 1.9 Energy saving at inauguration**

(4) HSR Project Effect

By HSR construction, demand of relevant industry sector will be increasing. It will be 21,400 billion IDR and it is almost same as the initial investment. After the inauguration, economic effect as shown in Figure 1.10 will be expected by saving traveling time and reducing vehicle operation cost (VOC). In addition, employment creation of 35,000 workers will be expected in construction stage.



(Unit: billion IDR)

Fig. 1.10 HSR Project Effect

1.2.3 Timing of HSR Introduction

According to Figure 1.11, Indonesia's recent GDP per capita has been much more than Japan's GDP in 1964 when the Tokaido-Shinkansen was inaugurated. And also, Indonesia's recent GDP per capita has been more than China's GDP in 2007 when China's HSR was inaugurated.

This indicates that it is good timing for starting the HSR project.

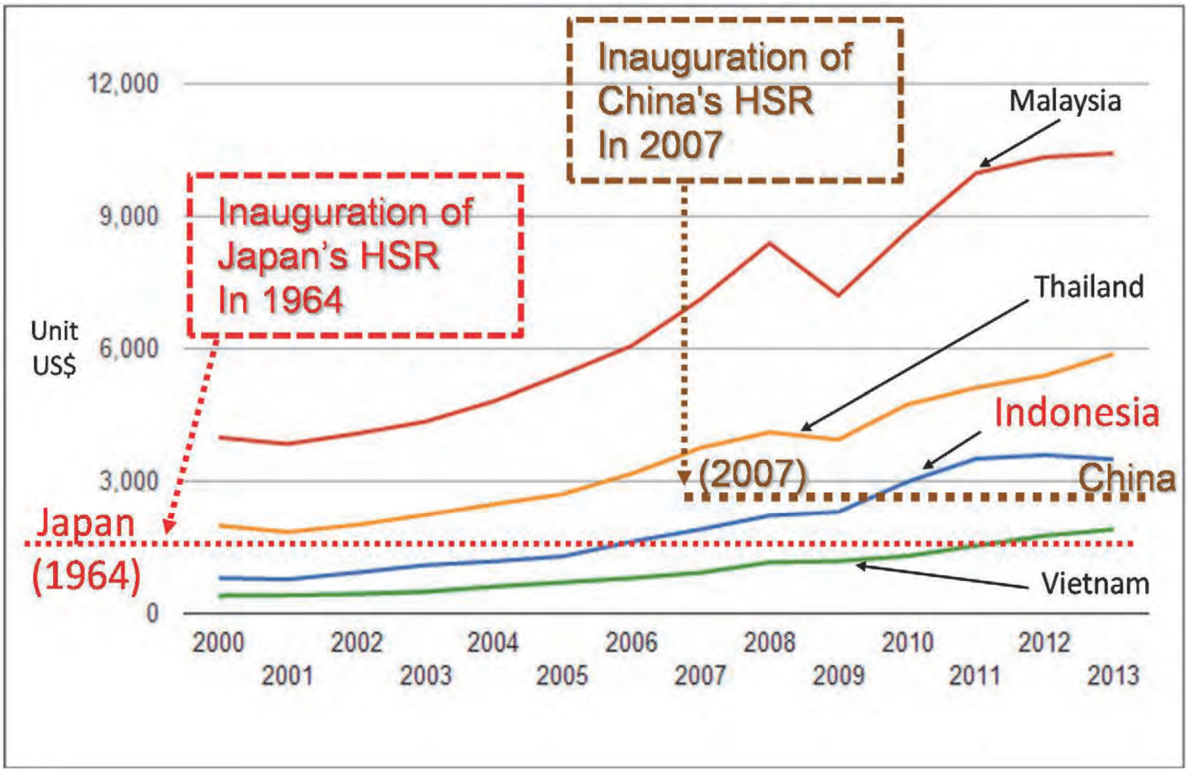


Fig. 1.11 Trend of GDP per Capita in South-East Asian Countries

Source: JICA Study Team

1.2.4 Summary of Nessecity

The above facts are summarized as follows:

Current Issues

【Growth of Population】
【Growth of Number of Cars】
【Delay of Infra. Development of Public Transportation】
【Concentration of Population in large cities】

【Chronic Traffic Jam】
【Regional Gap】

【Negative Impact to Economy】
【Time Wastage】
【Growth in Energy Consumption】
☞Negative Impact to Environments

Objectives for Solutions

【Sustainable Economic Growth for Population Growth】
☞ Reduction of Time Wastage, Economic Revitalization

【Modal Shift】
☞Away from a Car-centric Social Structure, Smooth Access for Inner-city and Inter-city

【Correction of Regional Gap】
☞ Smooth Access for Inter-city travel, Creating Jobs

【Environment Protection】
☞ Saving of Energy

Expediency & Countermeasures to achieve objectives

☞ Early Infrastructure Development, Acceleration of Modal Shift & TOD

Inner-City: Upgrading of the Existing Railway, Acceleration of Infrastructure Development for Public Transportation: MRT, Monorail, APM (Automated People Mover System) and so on

Inter-City: Acceleration of HSR Project

HSR Project that shall become a principal pillar of Modal shift & TOD, represents infrastructure development desperately needed as soon as possible.

Source: JICA Study Team

Chapter 2 Analysis of Route Alignment and Station Locations

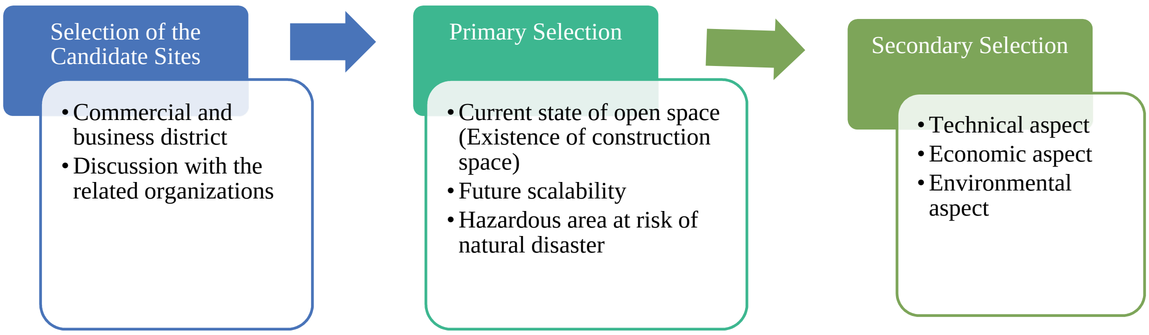
2.1 Route Alignment and Evaluation

2.1.1 Selection of the candidate HSR Jakarta Station Sites

Evaluation of the candidate HSR Jakarta station sites was conducted in accordance with the following 3 steps. First, 8 candidate sites were chosen from major commercial and business districts in Jakarta and through the discussion with related organizations. Then, in the primary selection, 6 candidate sites for the HSR station were shortlisted under the following conditions:

1. Existence of open space for construction
2. Future scalability when the number of passengers increase
3. Exclusion of hazardous areas at risk of natural disaster.

In the secondary selection, the most appropriate site in Jakarta was selected by evaluating the candidate sites from technical, economic and environmental aspects.



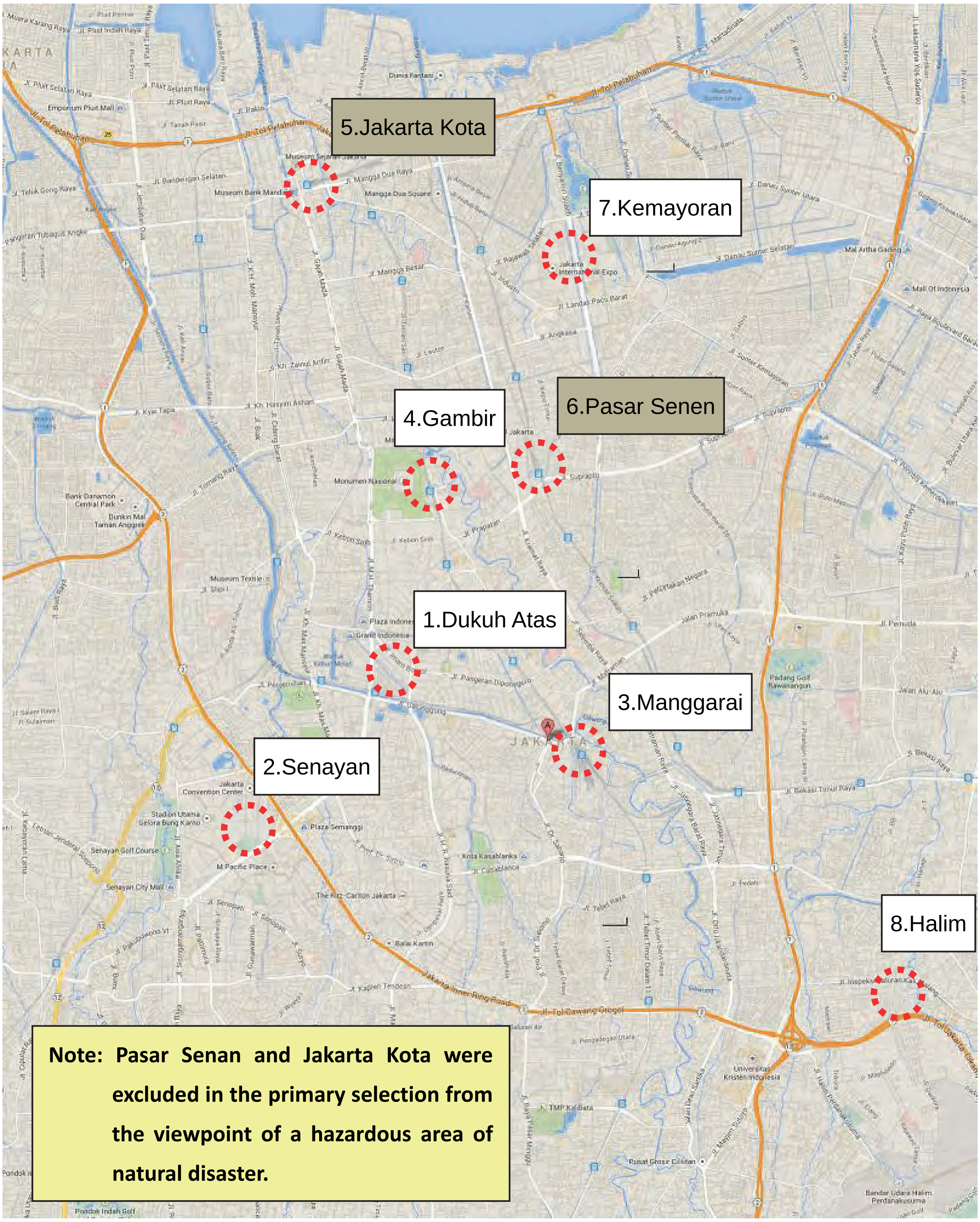
Source: JICA Study Team

Figure 2.1 Evaluation Procedure for Jakarta Station Site

(1) Selection of Candidate Sites

Since the candidate HSR Jakarta station sites can be a symbol of Jakarta, it is recommendable to develop the station at a site where it can represent a stately entrance to Jakarta. Moreover, from the viewpoint of convenience, the location is required to be adjacent to the commercial and business district where high ridership will be expected. With the above conditions and through discussions with the related organizations, the following 8 sites were selected as candidate sites for Jakarta Station. (See Figure 2.2)

1.Dukuh Atas	2.Senayan	3.Manggarai	4.Gambir
5.Jakarta Kota	6.Pasar Senen	7.Kemayoran	8.Halim



Source: JICA Study Team

Figure 2.2 Candidate Sites of Jakarta Station

(2) Primary Selection

In the primary selection, the 3 criteria shown in the previous section were evaluated in relation to each candidate site. As a result, Pasar Senen and Jakarta Kota were excluded because these sites have been designated as hazardous areas at risk of natural disaster in the Jakarta spatial plan (Jakarta 2030), and the selection was narrowed down to six sites.

(3) Secondary Selection

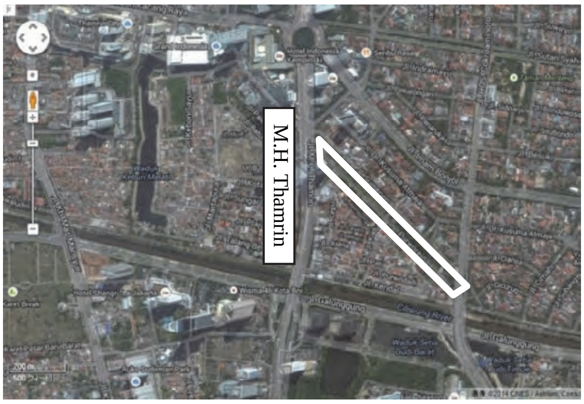
6 stations selected in the primary selection were evaluated in the secondary evaluation. To conduct the secondary evaluation, detailed evaluation items from the viewpoint of technical, economic and environmental aspects were set as follows:

Table 2.1 Evaluation Aspects

Aspect	Evaluation Item	Evaluation Criteria	Remarks
Technical	Access road	Proximity to highways Accessibility to arterial roads	
	Connection to other means of transportation	Connection to conventional lines Connection to BRT Connection to MRT Connection to Airport Link Connection to other planned lines	
Economic	Ridership	Proximity to Golden Triangle Density of “To Work” trip Conversion rate from cars	
	Construction Cost	Construction cost of civil works Area of land acquisition	
Environmental	Construction space	Area of open space	
	Possibility of expansion	Ease of development	

Source: JICA Study Team

Table 2.2 shows the overall evaluation results. Each evaluation item is classified into 3 score levels: 1.0 (Good), 0.5 (Fair) or 0.0 (Bad). Thereafter the overall evaluation is done by total score. As a result, Plan A, Dukuh Atas, is concluded as the place most suitable for the HSR Jakarta terminal station followed by Plan B, Senayan.



1. Dukuh Atas

2. Senayan

3. Manggarai

4. Gambir

5. Jakarta Kota

6. Pasar Senen

7. Kemayoran

8. Halim

Source: JICA Study Team

Figure 2.3 Construction Space

Table 2.2 Overall Evaluation of the Candidate HSR Jakarta Station Sites

	Plan A: Dukuh Atas		Plan B: Senayan		Plan C: Manggarai		Plan D: Gambir		Plan E: Kemayoran		Plan F: Halim	
Vertical Location of the Station	Underground		Underground		Underground		Underground		Underground		Underground	
Technical Aspect												
a. Accessibility												
Accessibility to Highways	Intra-Urban (Planned)	○	Intra-Urban	○	Intra-Urban (Planned)	○	No Accessibility	×	Intra-Urban (Planned)	○	Inter-City (Planned)	○
Accessibility to Arterial Roads (Road Name)	Jl. Thamrin	○	Jl. Jend Sudirman	○	No Accessibility	×	No Accessibility	×	J. Benyamin Sueb	○	No Accessibility	×
b. Connection to Other Means of Transportation												
Connection to Conventional Lines	1 line	△	No line	×	3 lines	◯	1 line	△	No line	×	No line	×
Connection to the MRT Lines	1 line	○	1 line	○	No line	×	No line	×	No line	×	No line	×
Connection to the BRT Lines (Transjakarta)	2 lines	◯	1 line	△	1 line	△	1 line	△	1 line	△	No line	×
Connection to the Planned Lines	Monorail Airport Link	◯	Monorail	△	Airport Link	△	No line	×	No line	×	Monorail Airport Link	◯
Economic Aspect												
c. Ridership												
Proximity to the Golden Triangle	Inside	◯	Inside	○	Outside	×	Outside	×	Outside	×	Outside	×
Person Trips “To Work”	>100 PT/ha	○	>100 PT/ha	○	20-60PT/ha	×	>100 PT/ha	○	20-100PT/ha	△	0-40PT/ha	×
Conversion Rate from Cars	1.000	◯	1.000	◯	0.857	△	0.877	△	0.771	×	0.711	×
d. Construction Cost and Area of Land Acquisition												
Construction Cost for Civil Works	893 million USD	△	1,042 million USD	×	853 million USD	△	945 million USD	△	1,077 million USD	×	696 million USD	◯
Area of Land Acquisition	4.8 ha	◯	11.7 ha	△	4.8 ha	◯	4.8 ha	◯	4.8 ha	◯	14.9 ha	×
Environmental Aspect												
d. Open Space (Possibility of Construction)												
Area	About 2.5 ha	△	About 21 ha	◯	About 19ha	◯	About 10 ha	○	About 8 ha	○	About 7 ha	×
Current Land Use	River, green space		Parking, plaza, driving range, baseball ground		Terminal yard for conventional line		MONAS plaza		Jakarta International EXPO (Green space)		Green space, but does not fit construction of HSR station.	
e. Possibility of Expansion												
Easiness of Development	Existence of Dukuh Atas development plan	◯	Existence of sufficient available land	◯	Existence of terminal yard relocation plan	◯	Existence of sufficient available land	◯	Existence of sufficient available land	◯	Expansion is difficult	×

Overall Evaluation (Total Score)	○10, △3, ×0	○8, △3, ×2	○5, △4, ×4	○4, △4, ×5	○5, △2, ×6	○3, △0, ×10
	11.5	9.5	7.0	6.0	6.0	3.0

Note: ○ Good (Score: 1.0) △ Fair (Score: 0.5) × Bad (Score: 0.0)

Source: JICA Study Team

2.1.2 Study of Route Alignment

(1) Setting of Route Alternatives

The draft route plans are shown in Figure 2.4. The approach to setting the route in each section is shown below.

Jakarta City – Bekasi

Underground space, expressway land and river land are utilized to minimize land acquisition. Use of the BKT Canal, the Kalimalang Canal or Jakarta - Cikampek toll road was suggested and altogether 3 proposals were studied.

Bekasi – Cikarang

It was decided to use the site of the Jakarta - Cikampek toll road to minimize land acquisition.

Cikarang – Purwakarta

One route that passes the Cikampek city area utilizing another route that accesses a new international airport planned in Karawang area and detours the existing urbanized area was studied.

Purwakarta – Padalarang

This section rises 700 m in altitude all at once. Most of the section utilizes tunnel structures and two alternatives were studied. One is a route that passes the vicinity of the existing toll road where we can judge its geological condition. Another is a shorter route with a rectilinear alignment.

Padalarang – Gedebage

This is a crowded urban area and to avoid land acquisition, existing railway lines or the sites of toll roads will be utilized. A total of 3 proposals were studied.

(2) Evaluation of the Route Alternatives

Evaluation of the Suitable Route from Jakarta to Bekasi Section

Plan A is a route to utilize underground of existing railway line and ROW of BKT Canal. Plan B is a route to utilize underground of existing railway line and ROW of Kalimalang Canal. Plan C is a route to utilize ROW of Jakarta-Cikampek toll road. Total length is the longest in Plan C, while Plan A and B are almost the same.

In Plan B, there is a toll road project and an elevated BRT project along the Kalimalang Canal. Those projects are already authorized and the HSR project has to wait for those to reach completion.

Plan C is a route recommended in the previous study. However land acquisition is greater compared with other routes. Moreover, construction cost is the highest and it necessitates a longer construction period because it has a long tunnel.

To conclude, Plan A is preferable. Land acquisition is slightly larger than Plan B, but construction cost is relatively low and there are few bottlenecks to construction.

<u>Evaluation of the Suitable Route from Bekasi to Purwakarta Section</u>

From Bekasi to Cikarang, we proposed the route to utilize ROW of Jakarta-Cikampek toll road. A route that passes the south side of the existing industrial parks was considered, but it was rejected because it was difficult to connect the existing built-up area. After Cikarang, two alternatives were examined. Plan A is a route via planned Karawang new airport and detours the existing built-up area. Plan B is a route via Cikampek Station where HSR connects with conventional railway to Surabaya.

Plan B is a route accessible to the existing built-up area, but land acquisition is slightly larger as well as construction cost is much higher in Plan B.

In Plan A, HSR can connect with a planned new airport, and its traffic demand will increase when the new airport begins its operation.

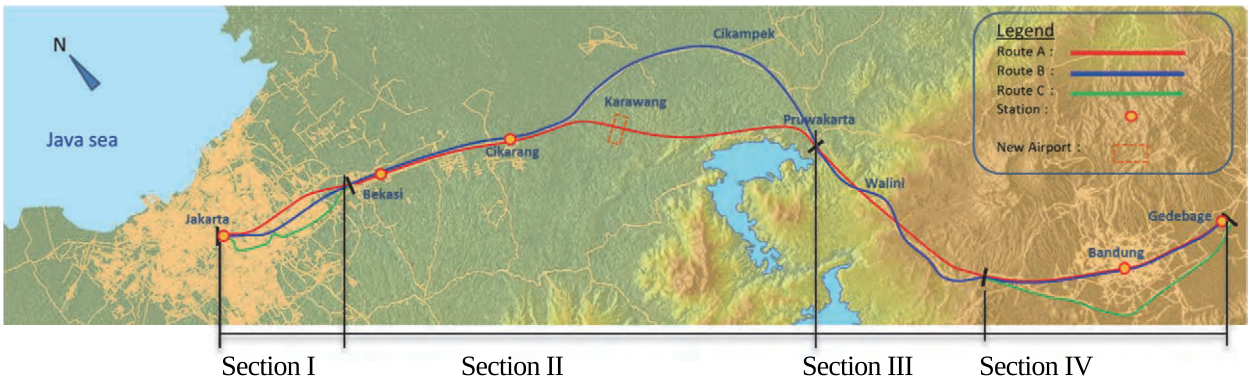
To conclude, Plan A is preferable because of low construction cost and high ridership expected from the new airport.

<u>Evaluation of the Suitable Route from Purwakarta to Padalarang Section</u>

This section mostly consists of tunnels, and the new station in Walini was requested from the West Java Province. Plan B is a route proposed in the previous study. However, in this plan, it is difficult to construct a new station in Walini. So, Plan A is preferable in that the new station might be located technically in future.

<u>Evaluation of the Suitable Route from Padalarang to Gedebage Section</u>

Plan A is a viaduct plan over the existing railway line. Plan B is a plan underground of the existing railway line. Plan C is a route to run along the toll road. Total length of Plan C is slightly longer than Plan A and B. Land acquisition is remarkably large in Plan C. Construction cost of Plan B is much higher than Plan A and C. Plan A has minimum land acquisition and construction cost. Moreover, Plan A can connect with the current Bandung station and be accessible to Bandung central area. So Plan A is recommended in this section. However, in this section the existing commuter line is planned to be elevated. So, it is necessary to consider coordination with that project.



Source: JICA Study Team

Figure 2.4 Route Options from Jakarta to Gedebage

Table 2.3 Comparison of the Candidate Routes

		I. Jakarta - Bekasi			II. Cikarang - Karawang		III.Purwakarta - Walini		IV. Bandung - Gedebage		
Outline		A North Canal	B South Canal	C Along the highway	A Via airport	B Via existing conventional lines	A Shortest	B Along the highway	A Over the existing railways	B Below the existing railways (basement)	C Along the highway
Length	Route Length	○	○	×	○	×	○	△	○	○	×
Rider-ship	Intermediate City	△	○	△	○	○	△	×	○	○	×
	Connection to Other Transport	○	○	○	○	○	△	×	○	○	×
Operation	Future Plan	○	×	○	○	△	△	×	△	△	△
	Disaster Risk	△	△	△	○	○	△	△	○	○	○
Bottleneck of Construction	Land Acquisition	△	○	×	○	×	○	○	△	○	×
	Difficulty in Construction Works	△	×	△	△	△	△	△	△	×	○
	Material Conveyance	○	○	△	△	○	△	○	○	○	○
Const. Period	Civil Works	△	○	×	○	○	×	×	○	×	○
Cost	Civil Works	○	△	×	○	×	○	×	○	×	△
General Evaluation		7.5	7.0	4.0	9.0	6.0	6.0	3.5	8.5	6.5	5.0
		A			A		A		A		

Note: ○ Good (1 point) △ Fair (0.5 point) × Bad (0 point)

Source: JICA Study Team

2.1.3 Selection of Station Locations Other Than Jakarta

<u>Bekasi</u>

Bekasi has developed into a commuter town for Jakarta and in recent years various commercial and business functions have gathered here. The existing urban area is already high in density and it is therefore proposed to locate the station in the suburbs where construction space can be secured.

<u>Cikarang</u>

This area has many large-scale industrial estates housing Japanese companies and further growth in partnership with the HSR is anticipated. A depot is planned near the station and its location is proposed in the suburbs where construction space can be secured.

<u>Bandung</u>

This is Indonesia's third largest city and public agencies as well as the head office or branch functions of various companies are concentrated here. As described in the basic policy, from the perspective of stimulating ridership, it is desirable to locate the station in the city center as the actual HSR terminal in the east.

<u>Gedebage</u>

As a candidate site for relocation of the urban functions of congested Bandung City, large-scale redevelopment is planned in this area in future. Locating the station here is strongly requested by Bandung city authorities.

<u>Others</u>

Karawang is an intermediate point on the way from Cikarang to Purwakarta. It is desirable to locate the HSR station in the international airport terminal in view of enhancing the convenience of the newly planned international airport and stimulating ridership for the HSR. Moreover, Walini district is an area where a new provincial center is planned. The section other than a tunnel structurally was selected for HSR station in future.

Station Name	Distance from Jakarta
Jakarta (underground)	0km
(Manggarai*1)	(3.5km)
Bekasi	26.1km
Cikarang	42.0km
(Karawang*2)	(59.3km)
(Walini*3)	(100.6km)
Bandung	128.5km
Gedebage	140.0km

Stations to be open in future

*1 Manggarai station will start its commercial operation after passenger volume increasing by extension to Surabaya direction.
*2 Karawang station will start its commercial operation when new airport is inaugurated in future
*3 Walini station will start its commercial operation after Walini development as a new administration center of West Java Province Gov.

Source: JICA Study Team

Figure 2.5 Station Locations

2.2 Detailed Study on Route Planning

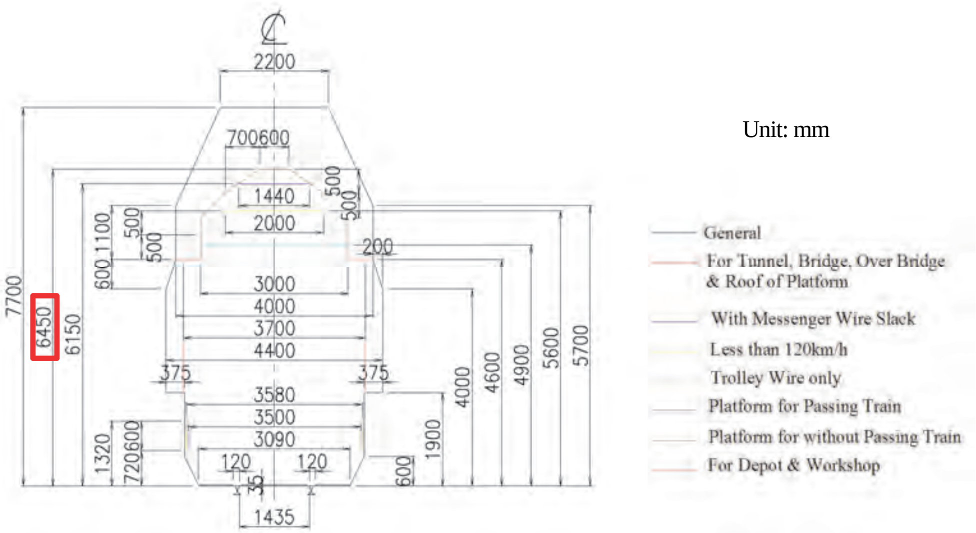
2.2.1 Route planning

On the basis of the result of the route selection in the previous section, detailed study was conducted on the route between Jakarta – Bandung/Gedebage. The study was to be done using the results of satellite photographic survey (1/10,000 scale) conducted along the planned route in this study. Table 2.4, Figure 2.6 and Figure 2.7 show the alignment conditions for HSR, construction gauge diagram of HSR and formation level width. In addition, Table 2.5 shows the results of coordination of opinions on the route plan and the response guidelines.

Table 2.4 Alignment Conditions of the High-Speed Railway

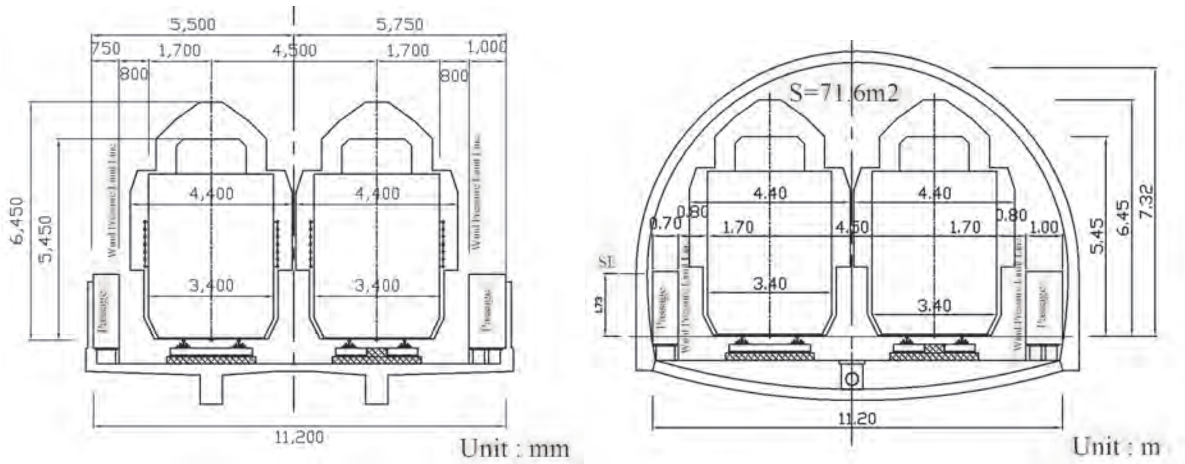
Parameters		Data
Gauge		1,435 mm
Radius of curve	Main line (high-speed section)	6,000 m or more
	Main line (other than the high-speed section)	1,000 m or more
Configuration of transition curve		Transition curve diminishing sine half-wave length
Straight line between curves	Main line	100 m
	For cases with 120 km/h or less	50 m
	For unavoidable cases	Direct connection of both transition curves (limited only to those in the opposite direction)
Length of circular curve	Main line	100 m
	For cases with 120 km/h or less	50 m
	For unavoidable cases	Direct connection of both transition curves
Maximum gradient	General	25 / 1,000
	For topographically unavoidable cases	35 / 1,000
	Area for stopping, siding, uncoupling	3 / 1,000
Vertical curve	Main line	25,000 m
	For cases with 120 km/h or less	5,000 m
Concurrence of causes	Vertical curve with the radius of 15,000 m or less must not be inserted into the transition curve.	
	No turnout should be provided in the transition curve and the vertical curve section.	
	No turnout should be provided in the grade section of 3/1000 or more.	

Source: JICA Study team (with reference to the Shinkansen Standard)



Source: "Explanation: Technical Standards concerning Railway" (Civil Engineering)

Figure 2.6 Construction Gauge Diagram of High-speed Railway



Source: JICA Study Team

Figure 2.7 Formation Level Width of Viaduct and Tunnel Sections (straight track)

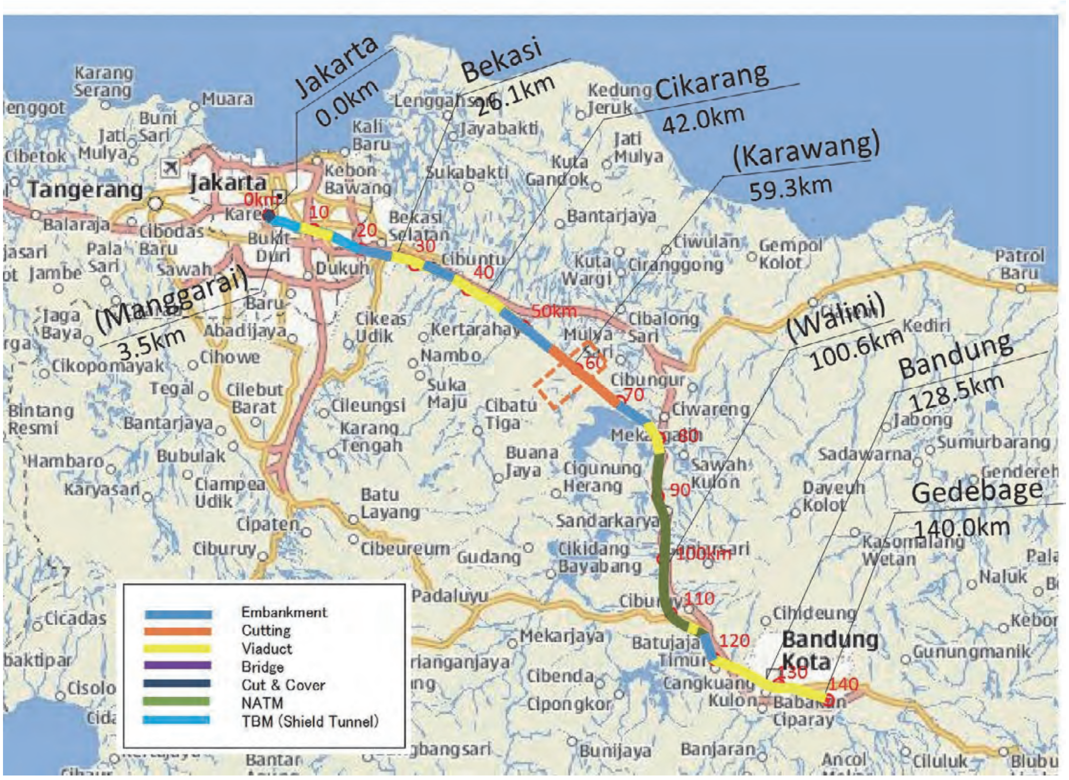
Table 2.5 Results of Coordination of Opinions on the Route Plan and the Response Guideline

Area		Opinions and requests of related authorities	Response guideline
a	Jakarta central area (Dukuh Atas)	The aboveground space is already oversaturated, so that construction of viaducts, etc. are difficult.	Use of underground space
b	BKT Canal area (Banjir Kanal Timur)	A plan exists to construct a four-lane road to the south of canal. The area above the canal quayside and the road is available.	Use of space above the four-lane road
c	Toll road area (Jakarta-Cikampek toll road)	The vacant land to the south of expressway can be used, except that the interchange addition plan and underground utilities must be taken into account.	Planning along the south side of toll road
d	Karawang industrial area	In addition to a new airport construction project, there are more than 10 development projects already approved.	Adjustment requested to the developer side
e	Mountainous area	Landslides have occurred frequently along the existing railroad lines and toll road.	Route to avoid the areas with high risks on the basis of the results of geological survey
f	Airport neighboring areas	High-speed railway structures must not present hindrance to landing and takeoff of planes.	Structure height to be limited to 45 m or less above ground
g	Bandung area (Existing railroad lines)	The project of elevating the existing railroad line in sections before and after the Bandung Station is under way.	Efforts for effective utilization of the limited right-of-way
h	Gedebage area	Projects concerning toll road, monorail system, and urban development are under way.	Adjustment to be made with the developer side concerning the location and elevation of the station

Source: JICA Study Team

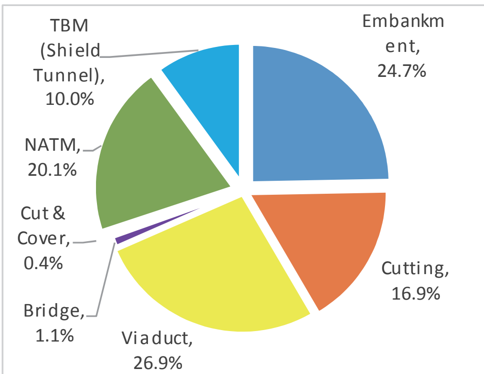
2.2.2 Outline of the Structure Design

The construction costs of civil engineering structures account for more than half of the total project cost of the high-speed railway project. In addition, there are high expectations of improvement in local labor skills and the expansion of domestic demand in Indonesia. Therefore, it is considered that materials and equipment that can be procured locally should be utilized as much as possible. In addition, proven construction methods and structure types in Indonesia should be adopted. Figure 2.8 and Figure 2.9 show the structural arrangement plan and composition ratio.



Source: JICA Study Team

Figure 2.8 Structural Arrangement Plan

Type	Length (km)	Ratio (%)	Structure Ratio
Embankment	34.6	24.7%	
Cutting	23.6	16.9%	
Viaduct	37.6	26.9%	
Bridge	1.6	1.1%	
Cut & Cover	0.5	0.4%	
NATM	28.1	20.1%	
TBM (Shield Tunnel)	14.0	10.0%	
Total	140.0	100.0%	

Source: JICA Study Team

Figure 2.9 Composition Ratio by Structural Type

Chapter 3 Demand Forecast

3.1 Preconditions for Demand Forecast

The demand forecast for HSR was conducted in the two cases: operation from Jakarta to Bandung and operation from Jakarta to Surabaya. The principal preconditions for the demand forecast are shown in Table 3.1.

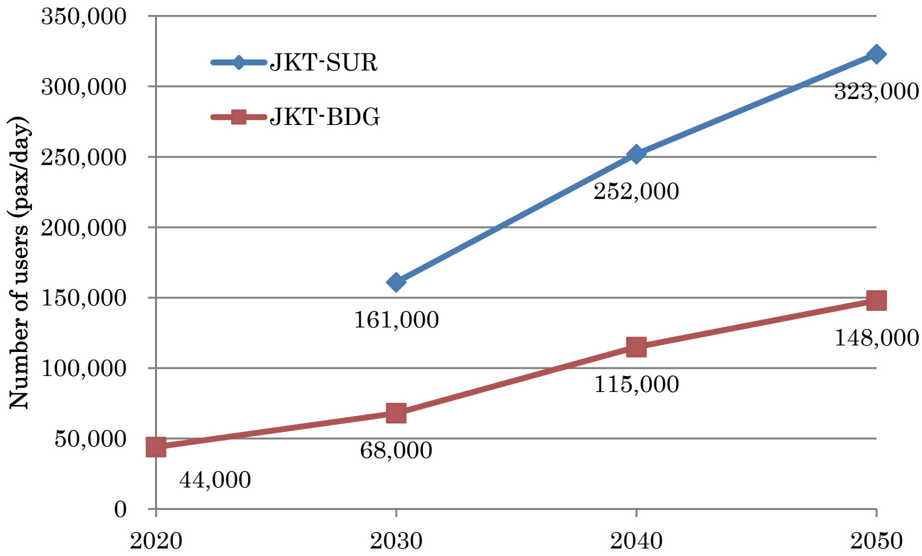
Table 3.1 Principal Preconditions for Demand Forecast

Target Year	2020 to 2050（with a 10-year interval）	
Future Traffic Demand by Transportation Mode	Estimation by regression model with GRDP	
Annual Growth Rate of GRDP in Java Island (Medium Trend Case)	2011 - 2020 5.8% 2021 - 2030 4.4% 2031 - 2040 3.3% 2041 - 2050 2.4%	
Conversion Traffic	Road	Toll road users
	Railway	Executive and business class users
Fare	Jakarta – Bandung 200,000 Rp. (about 1,800 yen) (Double price of conventional express train executive class ticket) Other fares are set by tapering rates system. • Jakarta – Surabaya 800,000 Rp. (about 7,200 yen)	
Method to make present OD	Car, Bus	By processing the results of OD interview and traffic count survey on the rest areas on the Jakarta-Cikampek toll road
	Rail, Air	By assessing the users between stations (airports) on the statistical data
Method to estimate the number of users of new Karawang Airport	By deducting the Kertajati airport demand (estimated by the Gov. of West Java Province) and maximum capacity of Soekarno-Hatta airport when the 4th terminal and 3rd runway are constructed, from Soekarno-Hatta airport future demand (estimated by JICA Study)	
Method to build the conversion models	Conversion models from existing modes to HSR are built by using the stated preference (SP) survey results which were conducted at major stations, bus terminal, airport and rest areas on the toll road	
Method to set the level of service (LOS)	LOS by mode by each OD pair was set as follows. Out-car hours=Access time + Egress time + Expected waiting time + α (for Rail/air users) + β (for air users only) α: Taxi fare [from Zone center to station (airport)] /3 /time-value β: Toll fee /3 passengers /time-value In-car hours=travel time by mode Expense= Fare by mode	

Source: JICA Study Team

3.2 Number of HSR Passengers

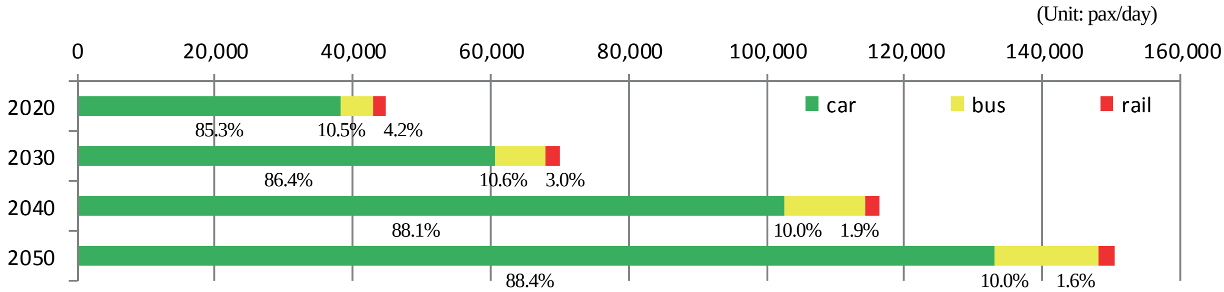
Figure 3.1 shows the estimated number of HSR passengers. The number of HSR passengers will be 44,000 pax/day by 2020, and it is predicted to increase 3.4 times, by 4.1% of the annual growth rate, to 148,000 pax/day by 2050 when the HSR is inaugurated between Jakarta and Bandung. If the HSR is extended to Surabaya, the number of HSR passengers will be 161,000 pax/day by 2030, and it is predicted to increase 2.0 times, by 3.5% of the annual growth rate to 323,000 pax/day. The reason why the growth rate between 2030 and 2040 is higher than the rate between 2020 and 2030 is that Karawang international airport is due to open in 2032.



Source: JICA Study Team

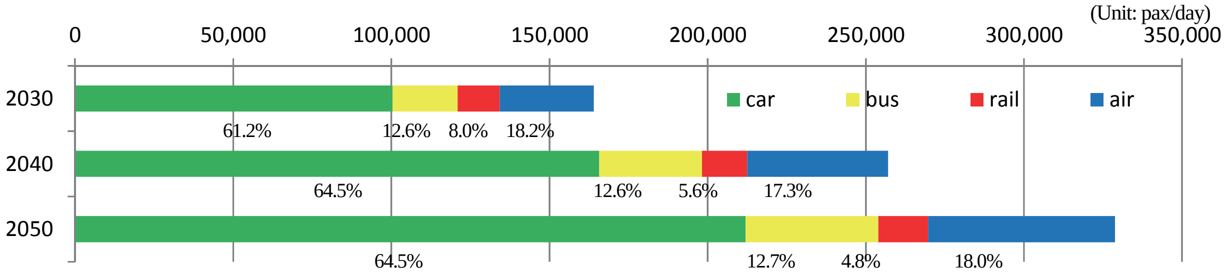
Figure 3.1 Number of HSR Passengers

Figures 3.2 and 3.3 show the estimated conversion volume from each transport mode to HSR. If the HSR is inaugurated between Jakarta and Bandung, most of the conversion volume will come from passenger cars, and the conversion rate from passenger cars will be 85 to 88%. That means that the HSR introduction will contribute to reducing the traffic volume of passenger cars. On the other hand, if the HSR is extended to Surabaya, the conversion rate from passenger cars will be 61 to 65% followed by the conversion rate of air of 17 to 18%.



Source: JICA Study Team

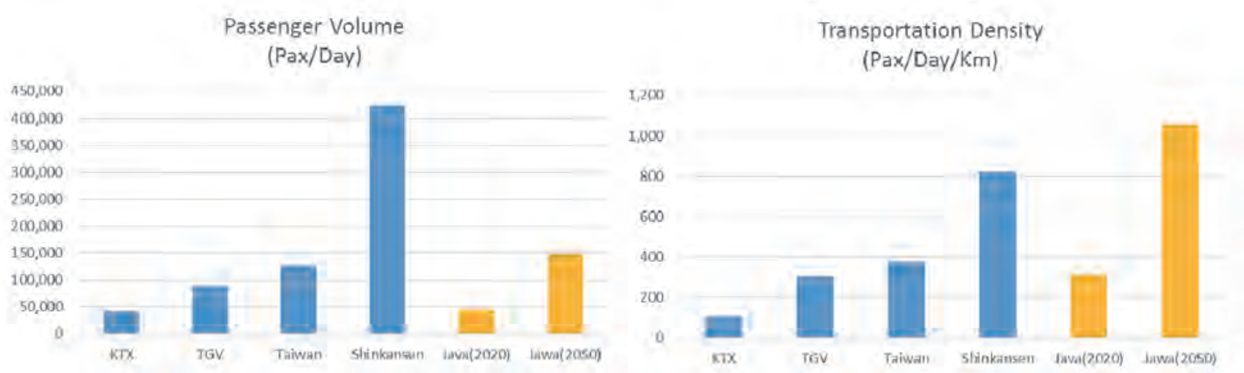
Figure 3.2 Conversion Volume from Each Transport Mode to HSR (Jakarta - Bandung)



Source: JICA Study Team

Figure 3.3 Conversion Volume from Each Transport Mode to HSR (Jakarta - Surabaya)

Figure 3.4 shows comparison of the HSR ridership in the world. It is estimated that the passenger volume of Jakarta – Bandung operation case in 2020 will be almost same as that of Korea, and its transportation density will be almost the same as TGV (France) even in the inaugural year. Moreover, the transportation density in 2050 is predicted to exceed that of Japanese Shinkansen (Tokaido).



Type	Line	Distance	Yearly Passenger Volume	Year of Statistics
KTX	Gyeongbu	412 km	15,220,000	2009
TGV	Atlantique	290 km	32,000,000	2008
Taiwan HSR		339 km	46,310,000	2013
Shinkansen	Tokaido	515 km	154,820,000	2013
Java (Study)	Jakarta – Bandung	140 km	16,060,000	2020 (Estimated)
Java (Study)	Jakarta – Bandung	140 km	54,020,000	2050 (Estimated)

Source: JICA Study Team

Figure 3.4 Demand Comparison of High-Speed Railways Worldwide

3.3 HSR Transport Volume by Section

Figure 3.5 shows the section volume in each case by each estimated year. If the HSR is inaugurated between Jakarta and Bandung, the transport volume by section will be high throughout between Jakarta and Bandung. In particular, the section volume between Bekasi and Karawang will be the highest. On the other hand, the section volume between Bandung and Gedebage will stay at 33 - 35% of the volume between Jakarta and Bandung.

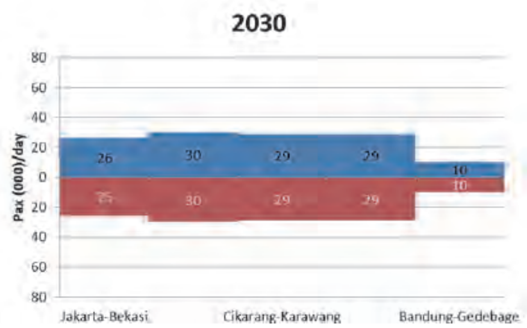
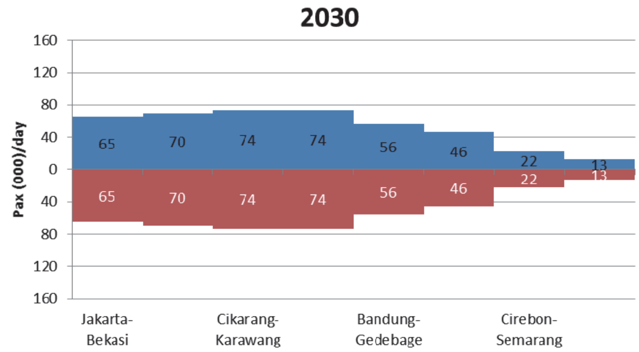
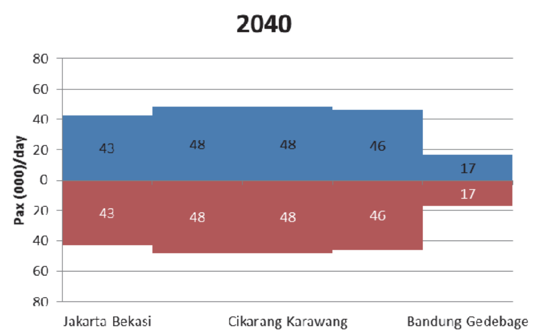
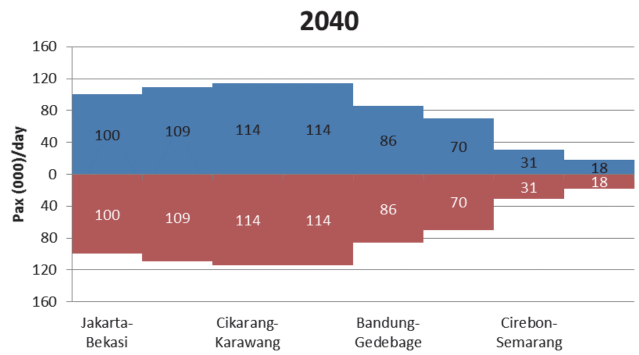
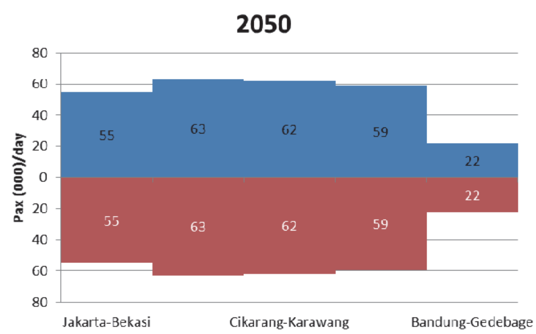
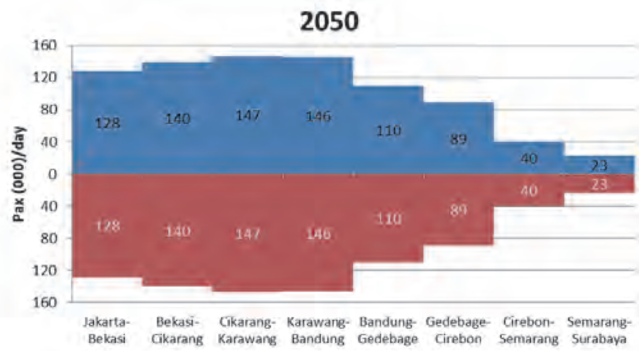
If the HSR is extended to Surabaya, the section volume between Cikarang and Bandung will be the highest. The volume will decline after passing Bandung, and 16 - 17% of the maximum section volume is estimated between Semarang and Surabaya.

3.4 Demand Sensitivity Analysis

The demand forecast is estimated based on several preconditions, and it will necessarily fluctuate when the preconditions change. According to the results of the sensitivity analysis, it is apparent for HSR demand to be mostly affected by decline in travel speed, and it means that HSR has more positive impact if the road improvement has not progressed.

Table 3.2 Results of Sensitivity Analysis

.	Fluctuation in HSR Demand
GRDP in Java Island -10%	-12 to -14%
GRDP in Java Island +10%	+14%
HSR Fare -10%	+9 to 15%
Vehicle Travel Speed -15%	+21 to 26%

<table>
<tr><th>If the HSR is inaugurated between Jakarta and Bandung</th><th>If the HSR is inaugurated between Jakarta and Surabaya</th></tr>
<tr><td>
</td><td>HSR will not inaugurated yet in 2020</td></tr>
<tr><td>
</td><td>
</td></tr>
<tr><td>
</td><td>
</td></tr>
<tr><td>
</td><td>
</td></tr>
</table>

Source: JICA Study Team

Figure 3.6 HSR Transport Volumes by Section

Chapter 4 Technical Solution on High-Speed Railway System

4.1 Technical Comparison on High Speed Railway System

After starting high-speed rail operation in Japan in 1964, in the 1980s, European countries, such as France, Italy, Germany and Spain, launched operations one after another. After 2000, East Asian countries, such as South Korea, Taiwan and China, opened high-speed rail lines, and Turkey, the Netherlands and Russia also started operation in 2009.

Table 4.1 shows the characteristics of the main high-speed trains incorporating the latest technologies.

Table 4.1 Example of High-Speed Railways around the World

Country		Japan	France	Spain	China	South Korea
Inauguration Year		1964	1981	1992	2007	2004
Vehicle performance	Class	E5	TGV-POS	S112	CRH3C	KTX- Sancheon
	Type	EMU	Locomotive	Locomotive	EMU	Locomotive
	Train Configuration [*1]	8M2T	2L8T	2L12T	4M4T	2L8T
	Maximum Operation Speed	320km/h	320km/h	300km/h	300km/h	300km/h
	Output/Capacity	13.1kW	26.0kW	22.0kW	15.8kW	24.2kW
	Weight/Capacity	0.62t	1.18t	0.89t	0.76t	1.11t
	Train Width	3350 mm	2904 mm	2960 mm	3265 mm	2970 mm
	Seat Configuration	2+3	2+2	2+2	2+3	2+2
	Seat Pitch	1040 mm	900 mm	1000 mm	920 mm [*2]	980 mm
Geography/Climate	Maximum Gradient	35‰	35‰	12.5‰	20‰	15‰
	Earthquake Frequency[*3]	29	0	0	5	0
	Earthquake Experience	Much	Little	Little	Little	Little
	Annual Rainfall	Kagoshima 2266mm	Paris 653mm	Madrid 437mm	Beijing 534mm	Seoul 1429mm
Features		Most efficient transportation network created Superior prevention of climatic disaster	Changed from locomotive type to EMU type	Supports various track gauges and non-electric operation	Rapid growth has created world's largest high-speed railway network	Only operated with locomotive type Slopes are not steep

*1 M: Motor car, T: Trailer car, L: Locomotive

*2 Seat pitch of ICE3 which is the base train for CRH3C is 920 mm.

*3 Frequency of earthquakes is the number of earthquakes with a magnitude of 7 or more that have occurred in the relevant country since 2000

[Reference] Annual Precipitation in Indonesia: 1480mm (Jakarta), 1656mm (Bandung), Number of Earthquakes: 12
Annual Precipitation in Tokyo: 1529mm

Source: JICA Study Team

In comparison with others systems, the Shinkansen system has the following features as shown in the above table.

(1) It has the smallest rate on output per capacity though it can ensure a wide seat pitch for passenger comfort.

(2) It has a very reliable performance against earthquakes, which have frequently occurred in Japan.

(3) It has a great running record in rainy areas compared with other systems.

(4) It performs well over steep sections.

Therefore, it can be said that the Shinkansen is the most suitable system for Indonesia because it is well suited to the climate and physical conditions (such as earthquakes and rain), runs with reasonable energy consumption and has a high level of passenger comfort.

4.2 Major Features of the Specifications

The specifications of the proposed high-speed railway system are examined based on worldwide standards for high-speed railway systems with consideration given to the topographic features and relevant regulations in Indonesia.

The maximum speed design is set at 350km/h. Ground facilities such as curve radius and transition curves are designed to cope with speeds up to 350km/h in the future. The maximum operation speed is set at 320km/h in consideration of technical trends and the traveling time between Jakarta and Bandung. Therefore, the maximum speed performance of the rolling stock is set at 320km/h.

The specifications for the E&M system are designed to be suitable for Indonesia in consideration of the worldwide high-speed railway systems described in the above section. Due to the topographic features and demand trends, the system configuration is similar to the Japanese Shinkansen system.

The train-set is a 12-car formation with 3.4m car body width that can accommodate a 2+3-seat arrangement, in order to correspond to mass transport between Jakarta and Bandung.

The major features of the specifications are shown in the table below.

Table 4.2 Basic Features of the Specifications of Java High-speed Rail

Item		Specification	Remarks
Operation	Design maximum speed	350km/h	
	Maximum operation speed	320km/h	300km/h at inauguration
	Traffic direction	Right-hand traffic	
Construction Standards	Gauge	1435mm	
	Maximum cant	200mm	
	Permissive cant deficiency	90mm	
	Maximum gradient	35‰	
	Distance between center of tracks	4500mm	
	Maximum axle load	16t	
Rolling Stock	Train formation	10M2T(12 cars)	
	Traction power	12000kW	
	Passenger capacity	925	
Power supply	Electrification system	AC25kV/ 50Hz	
	Overhead catenary system	Simple	
	Span distance	60m	
Signaling	Signaling system	Cab signal	
	Train protection system	DS-ATC	
Telecommunication	Communication system	Digital train radio	

Source: JICA Study Team

4.3 Track and Station Yard Planning

4.3.1 Track Planning

Compared to slab track, ballast track has lower construction costs but higher maintenance costs over the long term. Therefore, when comparing the construction cost and maintenance cost, slab track is more advantageous. Basically, the Shinkansen uses slab track, which is ballast-less, for viaducts, bridges, and tunnels. Taiwan and China, which have built and operated high-speed railways in recent years, also use mainly ballast-less tracks.

We recommend the use of synthetic sleepers for main line turnouts because they do not warp, twist, corrode, or crack. The concrete roadbed sections will use a synthetic sleeper direct-coupling structure as the turnout structure. A movable nose crossing is recommended where the passing speed exceeds 130km/h.

4.3.2 Station Yard Planning

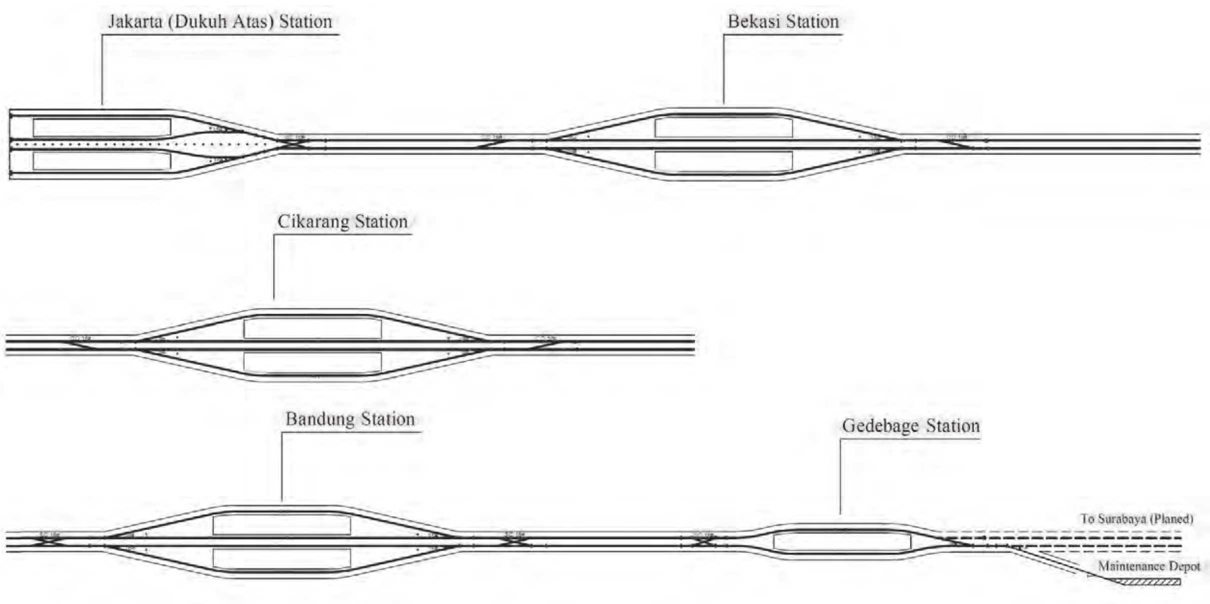
There will be five stations at inauguration: Jakarta, Bekasi, Cikarang, Bandung, and Gedebage. The high speed railway station will be planned as a ground station, except for the metropolitan area where the land acquisition is difficult and the airport where there are large ground obstacles. The platform is determined to be of a type sufficiently compatible with the future growth of users while referring to the assumed number of station users and the operation plan.

The candidates for future addition include Manggarai, the terminal of existing railroad lines of the metropolitan area, Karawang where industrial development is underway, which is also a candidate for construction of a new airport, and Walini to which the provincial capital of West Java Province is planned to be relocated.

Table 4.3 List of Station Data

Station	Distance	Station type/platform	Remarks
Jakarta	0.0 km	Underground station/two end transverse platforms and four tracks	All trains stop/shuttle
Bekasi	26.1 km	Elevated station/two island platforms and four tracks	Some trains passing on the main line/stop on the subsidiary main track
Cikarang	42.0 km	Elevated station/two island platforms and four tracks	Some trains passing on the main line/stop on the subsidiary main track
Bandung	128.5 km	Elevated station/two island platforms and four tracks	All trains stop/some trains shuttling
Gedebage	139.6 km	Elevated station/an island platform and two tracks	Some trains shuttling
(Manggarai)	3.5 km	Underground station/two island platforms and four tracks	Some trains passing on the main line/stop on the subsidiary main track
(Karawang)	59.3 km	Underground station/two island platforms and four tracks	Some trains passing on the main line/stop on the subsidiary main track
(Walini)	100.6 km	Elevated station/a pair of separate platforms serving two tracks between them	Some trains passing on the main line/stop on the main track

Source: Study Team

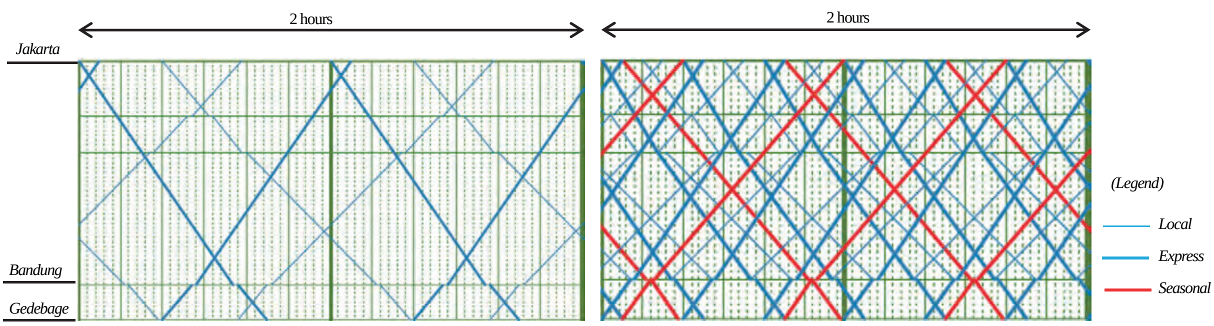


Source: Study Team

Figure 4.1 Station Yard Planning

4.4 Operation Planning

There are 3 types of trains: local, express and seasonal trains. The express train will stop at Jakarta, Bandung and Gedebage, and the trip time between Jakarta and Bandung will become 37 minutes. Train performance is equal to JR-East's series E5. The schedule for train operation is from 6 a.m. to 0 a.m. (18 hours), 70 trains per day will be operated at commercial operation launch in 2020. According to the demand forecast, maximum section volume in 2020 will be 39,000 per day. This volume is expected to become 126,000 in 2050. The number of train services will also increase along the demand forecast. In 2040, 170 trains will be operated every day. The passenger load factor is under 70%. HSR operation will start with 7 train sets, and 11 more sets are necessary by 2040.



Source: Study Team

Figure 4.2 Operation during the Peak Hours in 2020 (left) and 2050 (right)

4.5 Rolling Stock Planning

Table 4.4 shows the specifications for the proposed train and Figures 4.3 to 4.5 show the exterior and interior images of the train.

The proposed train is based on Shinkansen trains and specifically the E5 Series which is the cutting-edge Shinkansen with a maximum operation speed of 320km/h.

Figure 4.3 Exterior image

Figure 4.4 Business class

Figure 4.5 Standard class

Source: East Japan Railway Company

Table 4.4 Specifications of Proposed Rolling Stock

Item		Data
Track Gauge		1,435mm
Maximum Train Output		12,000kW
Train Configuration and Passenger capacity		12 cars (10M2T), 925 passengers
Body Structure		Aluminum double-skin body (airtight body structure)
Bogie		Bolster less type
Propulsion System	Control System	IGBT PWM Converter/Inverter
	Traction Motor	Induction motor: 300kW
Brake System		Electric command air brake with regenerative brake

Source: JICA Study Team

Table 4.5 shows the passenger capacity of each car. The proposed train is planned so that the 7th car is business class and the other cars are mono class. In addition, 2 toilets are allocated at the back of odd number cars and the 8th car as the 7th car toilets are for business class passengers only. One of the two toilets in each car is for women only and a disabled stall is provided in the 5th car.

Table 4.5 Seating Capacity

Car Number	1	2	3	4	5	6	7	8	9	10	11	12
Class※	M	M	M	M	M	M	B	M	M	M	M	M
Capacity	30	100	85	100	60	100	55	85	85	100	85	40
Toilet	○	–	○	–	○	–	○	○	○	–	○	–

*M: Mono Class, B: Business Class

Source: JICA Study Team

4.6 Depots/Workshops

4.6.1 Basic Policy for Depots/Workshops

Maintenance (cleaning, inspection, and repair) is critical for securing the safety and maintaining the stability and comfort of the high-speed rail network. The Shinkansen maintenance system in Japan will be applied to the basic policy for the workshops. Highly efficient modern rolling stock maintenance depots / workshops will operate on the basis of heavy maintenance in the workshop and light maintenance in the depot.

4.6.2 Design Conditions and Depot Layout

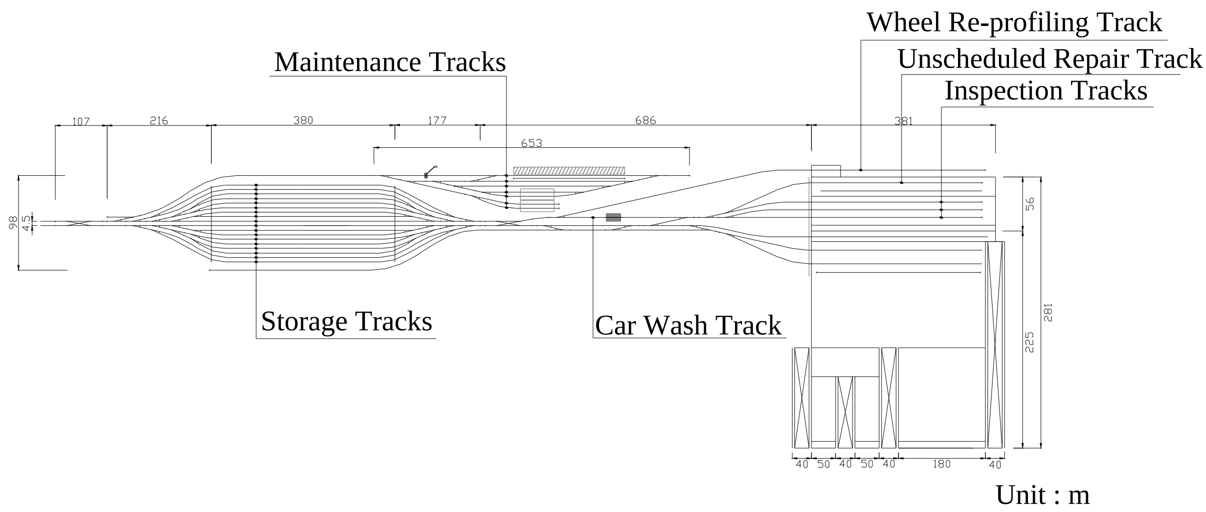
The target section is Jakarta – Gedebage. The target year is 2050. At that time, 12 cars/train×18 trains = 216 cars will be operated. Table 4.6 shows the maintenance period. The maintenance period for the new trains is based on the Japanese maintenance period, based on past experience, lessons-learnt and achievements.

Table 4.6 Maintenance Period

Category		Maintenance Points	Period
Light Maintenance	Daily Inspection	Supply and replacement of consumables, and inspection of operation and functioning of pantographs, running gears, brakes, door operating system, etc. Visual inspection mainly from the outside, according to the train usage conditions.	Less than 48 hours
	Monthly Inspection	Inspection of what is required for normal functioning of train, such as condition and functioning of pantographs, main circuit system, control system, brake system, bogies, and insulation of electric parts. Inspection of the bogies regarding the shape of the wheel tread and flaws in axles	Less than 30 days or 30,000 km
Heavy Maintenance	Bogie Inspection	Disassembly and inspection of main parts of bogies, e.g. wheel sets, wheels, driving device, brake system, main motors. Ensuring of efficiency of the inspection by using bogie replacement system.	Less than 18 months or 600,000 km
	Overhaul	Detailed inspection of the main equipment disassembled from the cars. Repair and repainting of the bodies and repair of the passenger cabin equipment.	Less than 3 years or 1,200,000 km
Other Maintenance	ATC Inspection	Inspection of the condition and characteristics of onboard ATC equipment	Less than 90 days
	Extraordinary Inspection	Ad hoc inspection whenever necessary, e.g. at the time of equipment breakdown	Whenever necessary
	Wheel Re-profiling	Keeping the wheel tread and flange in good shape using wheel re-profiling machines.	In accordance with the re-profiling schedule and whenever necessary

Source: JICA Study Team

Proposed layout of the main workshop is shown in Figure 4.6.



Source: Study Team

Figure 4.6 Yard Planning in the Workshop

4.7 Electrical Systems

4.7.1 Substations and Catenary System Planning

The feeding system will be a 2×25kV feeding system. This system allows a long distance between substations. There is little EMI. It is easy to consider the receiving points to which power is supplied. The incoming voltage of Java high speed railways is 150 kV in accordance with the results of the meeting with PLN. The locations of the substations will be so that electricity can be supplied from PLN substations in accordance with the meeting results of the meeting with PLN. The neighboring substations are able to compensate when one substation is down. Including a sub-station for workshop, 5 substations are planned.

4.7.2 Signaling System

To ensure the safety and reliability of HSR operation, DS-ATC which has been installed on the Tohoku Shinkansen operated by JR East should be introduced for signaling. The system consists of Station Programmable Route Control (Station PRC) equipment with centralized train control function and ATC interlocking combined logic controller (Saint) which have been installed on this line.

4.7.3 Telecommunication System

The train radio is used for communication between the train dispatcher in the operation control center and the train crew. The train radio is of the duplex operation, digital transmission type with Private Leaky Coaxial cable (LCX). The fiber-optic communication system with synchronous digital hierarchy (SDH) not affected by induction will be employed as the trunk transmission system because high circuit demand is expected. As for the disaster detection system, Wind observation device, Rainfall monitor and Rail temperature alarm will be introduced.

Chapter 5 Station Vicinities and Urban/Regional Development

5.1 HSR Construction and Economic Development

It was 50 years ago in 1964 that the Tokaido Shinkansen, Japan's first high-speed railway (bullet train) construction was completed for operation. Japan was just waking up to the new era of rapid economic growth. Many heavy industrial parks were developed and major changes in production took place along the Tokai coastal route (Pacific Industrial Belt) between Tokyo and Osaka, the two largest cities of the nation. The existing ordinary railway at the time in the Tokai region, the so-called Tokaido Line, was just about reaching its capacity and more passenger and freight trains needed to be operated in order to meet the heavy demand for transportation. And the Tokaido Shinkansen contributed to the success of the Tokyo Olympic Game held in that year with its transportation capacity and high-speed operation between Tokyo and Osaka. The mass transit system like the Shinkansen is very important for a big event a lot of people come from extensive area such as the massive sports event. The operating distance in the Japanese Shinkansen is increasing since its inauguration of the section between Tokyo and Shin-osaka of the Tokaido Shinkansen, and it reaches over 5 times of the distance of the opening time. Such extension of the line not only contributed to increasing the national transport capacity but also strengthened the relationship between the cities along the corridor, thus accelerating economic development in those cities. Table 5.1 shows the HSR impact to regional growth in such as population, number of company and local government receipt, and HSR impact is outstanding in the cities with HSR stations.

Table 5.1 HSR Impact to Regional Growth

	Cities with HSR Stations	National Average
Population Growth (1975-1995)	32%	12%
Company Number Growth (1975-1991)	46%	21%
Local Gov't Receipt Growth (1980-1993)	155%	110%

Source: Shinkansen's Local Impact, 2010, Christopher Hood, Oxford Univ.

This situation, when the introduction of the Tokaido Sinkansen was discussed in Japan, seems to be the same as the current situation between Jakarta and Bandung. In the east part of Jakarta there are many industrial parks along the toll road, and a mega industrial complex is formed. The traffic congestion on the Jakarta – Cikampek toll road that serves this area is ever worsening, and it causes much negative impact to the regional economic activities and the life of ordinary citizens.

The history of the Japanese Shinkansen indicates that high-speed railway development will deliver mainly two possible impacts.

(1) Traffic Capacity Increase and Modal Shift in the Region

- There is a potential to increase the transportation capacity between Jakarta and Bandung for passenger travel in the project target region while shifting the transportation trend from automobile-oriented mode to railway-oriented mode to reduce the heavy load of road traffic. It is indeed apparent today that the traffic demand on toll roads simply goes on increasing as continuous traffic jams are observed on the toll roads. The demand for travel between Jakarta and Bandung is always high, so the capacity upgrade of transportation in the region should effectively match the solution of the current problem in transportation. Thus, the introduction of HSR development will definitely contribute to such a modal shift in regional transportation.

- The area between Jakarta and Karawang has been highly developed with medium-heavy industrial parks providing high-quality production of automobiles and electrical products, and a high-speed traffic link between these areas is necessary for further economic growth and expansion of industry. Thus, the high-speed railway will contribute to the region's further industrial development and ultimately to economic growth and sustainable development of society.

(2) Connecting the Regional Centers Directly to the Capital

- As it will be connected with the capital city, Jakarta, more demand in the service industry will be sought in the Bandung region in view of high-quality employment promised by its educational environment. Moreover, Jakarta-based and Bandung-based businesses will quickly develop a regional business network for a wide range of services, which is the basis of the manufacturing industry distributed among those cities. Consequently, remote city connection to the capital city will be another benefit to local economic growth.
- On the other hand, from the tourism point of view, the currently-experienced long drives on congested toll roads and fragile weather-based dependency on air travel will be exchanged for more stable and timely rail travel when the high speed railway system is introduced for tourists traveling between the cities in the region.

5.2 Station Vicinities and Urban/Regional Development

It is apparent that the HSR has a positive impact on urban and regional development through the worldwide HSR examples, but it is necessary to take some actions in the areas where the HSR passes. The strategy to be taken by each city and regency is examined here so that the ripple effect of High Speed Railway development becomes widespread.

(1) Strategy for Urban Development Plans around the Proposed Stations

Each city or planned station site has many uniquely situated growth patterns, and it is necessary to formulate a development plan of each station vicinity based on those strategies. Figure 5-1 shows the principal strategy for development around the stations.

Basic Policy	Measures
Basic Policy 1: **Attractive development for the area around the HSR station**	• Develop open green space that integrates public space and functions around the station. • Develop mixed-use building(s) at higher floor area ratio (F.A.R.) for development as the central commercial landmark. • Promote uniformly control area developments surrounding the station.
Basic Policy 2: **Re-improvement of regional transportation system with the HSR introduction**	• Provision of connectivity HSR station and the conventional railway station. • Develop a sophisticated transportation hub at the HSR station for optimum multimodal networking in the area considering TOD. • Develop a new road network suitably for the new station's transportation integration into the city or region. • Develop a feeder service network which connects rural or remote areas in the regency.
Basic Policy 3: **Revision of the related regulations**	• Apply possible modification and/or change in Land-Use or Zoning related regulation with more flexible development program allowance (ease of height limitation and larger F.A.R. allowance). • Seek corporative development between government agencies and private developers to achieve highly integrated station area development.

Source: Study Team

Figure 5.1 Strategy for Urban Development Plans around the Proposed Stations

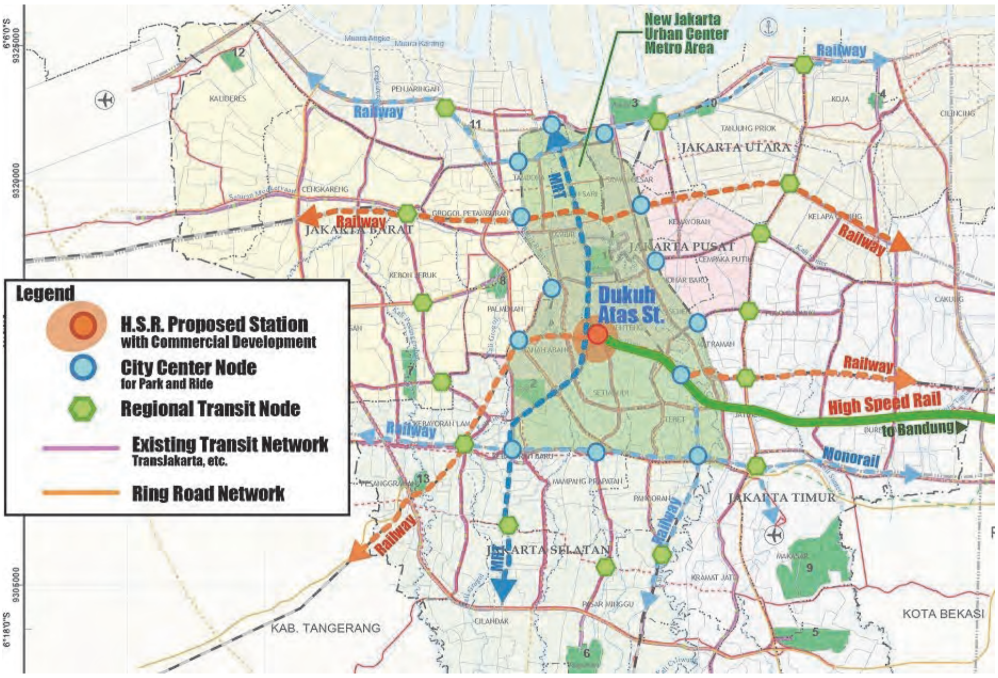
Development around HSR Station

Improvement of Regional Transportation based on the Public Transport (TOD)

Figure 5.2 Development Images

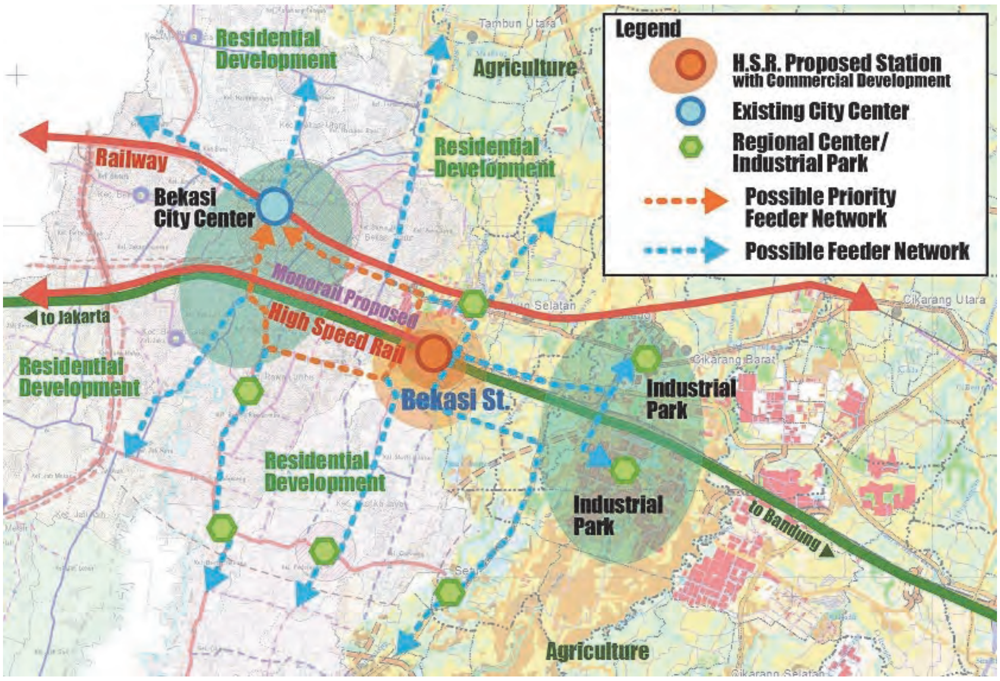
(2) Station Area Development Strategy

Based on the above-mentioned planning strategies and the characteristics of each station, stations and the areas around the stations are proposed as shown in Figures 5.3 to 5.6.

Development Strategy	A major action to be taken with regard to the HSR station development is to highly integrate the station into the previously master-planned Dukuh Atas area redevelopment.
Transportation Network	
Basic Policy of Improvement	1) Attractive development for the area around the HSR station and formation of built-up area centering on the HSR station • Reorganize the possible architectural and building arrangement of the previously made Dukuh Atas station area redevelopment plan. • Develop a multi-purpose building in the HSR station to provide a highly convenient function for users as well as to play the role of a landmark. • Provide as large a public open space in the station complex as possible to create a pleasant urban space in the area. 2) Re-improvement of regional transportation system with the HSR introduction • Provide an effective feeder network from Dukuh Atas station in order to serve the overall city area and enable people to gain the benefit of HSR transportation. • Provide more Park-and-Ride facilities for the periphery railway stations to enable private cars and bikes to park outside the city center. • Develop a multimodal transit complex at Dukuh Atas Station where major public feeder services are housed, and only pick-up and drop-off lanes for private cars and bikes are provided under city center entry regulations. 3) Revision of the related regulations • Follow the land use pattern as suggested in the previous Dukuh Atas development plan with possible adjustments, if necessary, for better integration of the HSR station into the targeted location of the area. • Current land use and zoning regulations should be changed in the future around Dukuh Atas area for more commercial oriented and dense development rather than residential use.

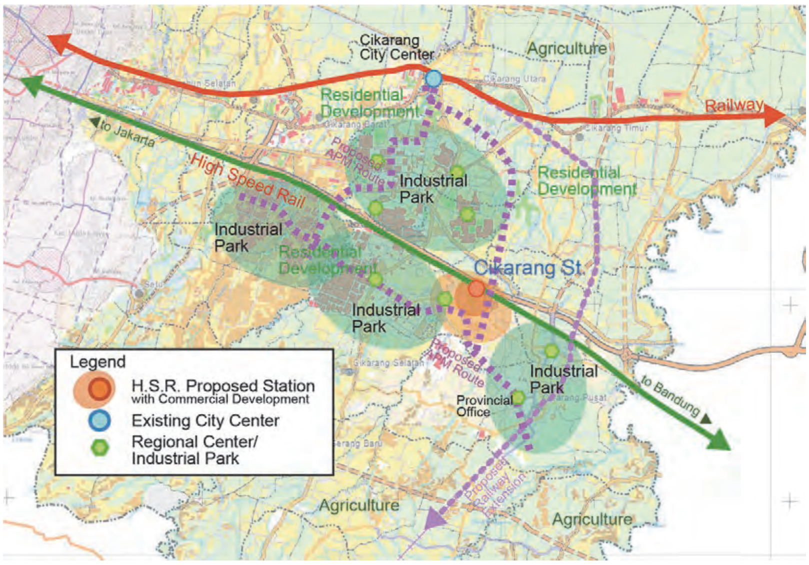
Source: Study Team

Figure 5.3 Concept of DKI Jakarta Transport Network with High-Speed Rail Development

Development Strategy	Develop the transport system connecting HSR station to the existing built-up area and industrial parks.
Transportation Network	
Basic Policy of Improvement	1) Attractive development for the area around the HSR station and formation of built-up area centering on the HSR station • Select the less problematic sites for land acquisition for the HSR station development. • Designate new urban commercial, service and residential land use zones around the HSR station area with mainly commercial use at the station. 2) Re-improvement of regional transportation system with the HSR introduction • Develop appropriate station front facilities including a TOD based multimodal transport network terminal with easy access for users. • Formulate a road and transport plan to effectively link the station site to the surrounding industrial development sites as well as residential development areas. • Develop a new road network including the upgrading of the existing roads and bridges to the existing Bekasi urban center in order to provide a convenient feeder system between areas. • Possibly extend the projected monorail line to the HSR station site in order to integrate the commuter rail system with the new HSR development. • Strengthen and upgrade the existing road network between Bekasi city residential area and the developing industrial zone in order to expand the service capacity of the industrial parks. 3) Revision of the related regulations • Cooperative development work should be made between Kota Bekasi and Bekasi Regency since the station for Kota area will be set within the jurisdiction of the Bekasi Regency.

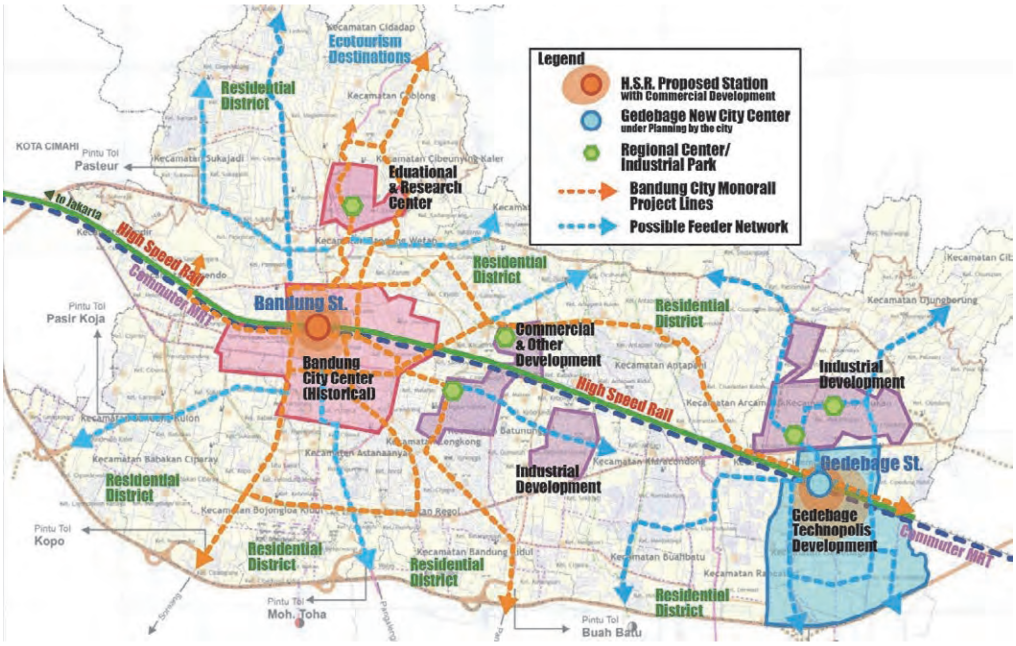
Source: Study Team

Figure 5.4 Concept of Bekasi Transport Network with High-Speed Rail Development

Development Strategy	Connect HSR station to the peripheral industrial parks and residential areas as well as plan the close coordination with APM (Automated People Mover).
Transportation Network	
Basic Policy of Improvement	1) Attractive development for the area around the HSR station and formulation of built-up area centering on the HSR station • Select less problematic sites for land acquisition for HSR station adjacent to the industrial development zones. • Develop appropriate station front facilities including a multimodal transport network terminal with easy access for users with good feeder services to the industrial parks and related residential areas. 2) Re-improvement of regional transportation system with the HSR introduction • Formulate a road and transport plan to effectively link the station site to the surrounding industrial development sites as well as residential development areas. • Develop a new road network including upgrading of the existing roads and bridges in order to provide a convenient feeder system between areas. • The proposed APM system should be well connected for better transport integration in the area so that the flow of economic and service actives will be achieved through HSR and APM developments over a larger region for more benefit. 3) Revision of the related regulations • Designate new urban commercial, service and residential land use zones around the HSR station area with mainly commercial use at the station.

Source: Study Team

Figure 5.5 Concept of Cikarang Transport Network with High-Speed Rail Development

<table>
<tr><td>Development Strategy</td><td>Reorganize the roads and traffic patterns as well as develop HSR station as a multimodal transit center to alleviate traffic congestion in the city.</td></tr>
<tr><td>Transportation Network</td><td>
</td></tr>
<tr><td>Basic Policy of Improvement</td><td>1) Attractive development for the area around the HSR station and formulation of built-up area centering on the HSR station
• Coordinate with the commuter railway and city monorail development plans, as the HSR station will be developed at the same location as where the existing railway station is located.
• Synchronize the HSR development with the ongoing Bandung TOD plan and its activities for both Bandung and Gedebage stations.
• Designate the area surrounding the station as commercial, service and public use oriented zones for development, including tourist accommodation and attractions.
2) Re-improvement of regional transportation system with the HSR introduction
• Integrate the projected city road network plan to effectively connect the railway station complex to the urban transport network.
• Provide an effective feeder and public transportation network including a commuter railway and monorail networks in the city for easy access to city functions, which include two urban centers and the development in Bandung and Gedebage.
• Develop university and institution service buses for the convenience of the institution workers and students at the railway station complex.
• Provide a citywide feeder service network from the railway station complex.
• Develop a tourist bus terminal and Angkot station for the tourist attractions connected with the railway station complex.</td></tr>
</table>

Source: Study Team

Figure 5.6 Concept of Bandung and Gedebage Transport Network with High-Speed Rail Development

Chapter 6 Environment and Social Considerations

6.1 Framework of Environmental and Social Considerations in this Study

(1) Background

The project is the first high-speed railway project in Indonesia. Considering the scale (total length) of the project and the nature of the high-speed railway, a review of the environmental and social considerations is important to avoid, minimize and mitigate the negative impacts of the project. For example, the impacts on the natural environment, noise and vibration, land acquisition, resettlement, and division of the community are typically controversial for high-speed railways, and they have to be studied carefully and appropriately. Therefore, this study is categorized as a Category A project as defined in the JICA Guidelines for Environmental and Social Considerations in 2010 (JICA Guidelines). In the case of Category A projects, JICA encourages the project proponents to consult local stakeholders about their understanding of development needs and the likely adverse impacts on the environment and society.

(2) Overall framework of environmental and social considerations for the study

The overall framework of environmental and social considerations for this Phase I study and expected Phase II and future studies are as follows:

In the Phase I study, firstly the Stage I study aims to conduct a baseline survey to select the optimal alternative through comparative analysis of transportation modes and high-speed railway alternatives. In Stage II, environmental and social considerations for the selected alternative will be are conducted.

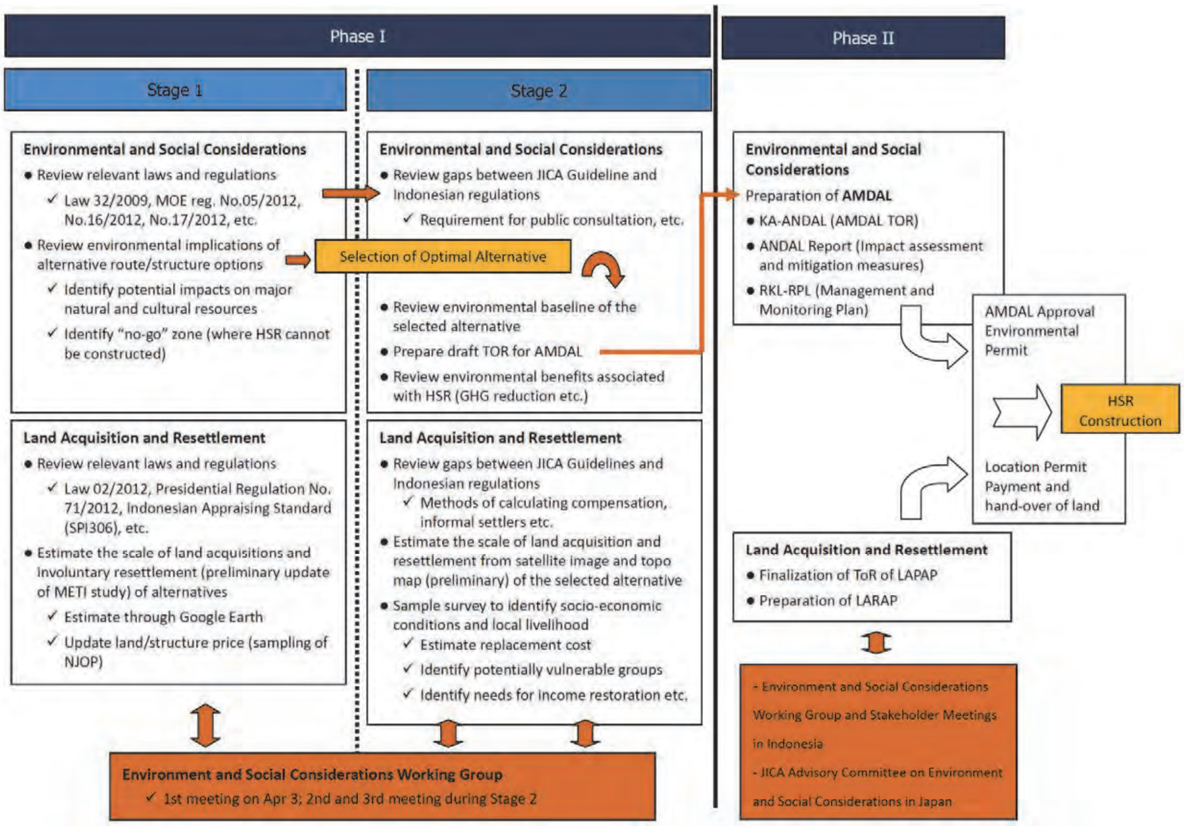


Figure 6.1 Overall Framework of Environmental and Social Considerations in the Project

(3) Environmental and Social Considerations Working Group

Considering the scale and impact of this project, the Indonesian side and the JICA Study Team jointly formed a Spatial Plan and Environmental and Social Considerations Working Group to exchange information and views related to environmental and social considerations. It is important and beneficial for the project to involve the major stakeholders including not only DGR and the Ministry of Environment, but the Ministry of Agriculture and Ministry of Environment and Forestry. The results, major participating organizations and schedule are as follows.

Table 6.1 Environmental and Social Considerations Working Group

Timing / Items	Draft contents of discussion
Organizations to be invited	● Ministry of Transport, Ministry of Environment, Ministry of Agriculture, Ministry of Forestry, Jakarta Capital City and West Java Province (Environmental Agency, Land Agency etc.)
1st WG	● Stage I, 3rd April 2014 ● Explanation and discussion of overall framework of environmental and social considerations
2nd WG	● Stage II, November 2014 to January 2015, 13 times (9 times: local governments and 4 times: central government) ● Explanation and discussion on alternatives and study on environmental and social considerations, spatial plan and further actions to be taken by the study team and local governments ● Explanation and discussion on alternatives and discussion on specific issues related to central government agencies on environmental and social considerations
3rd WG	● WG was not arranged due to tight schedule of Indonesian side, ● Explanation of the result of the study by distribution of “route book” on alignment, station and structure options decided through the discussion with stakeholders and achieved basic consensus among stakeholders ● Discussion of the plan for environmental and social considerations in Phase II was conducted in the final JCC held in April 2016.

Source: JICA Study Team

6.2 Environmental and Social Considerations

The following scope was implemented for environmental and social considerations in the study.

1) Review and analysis of key laws and regulations related to environmental and social considerations
2) Review of practices relating to environmental and social considerations in relevant projects
3) Review of alternative transport modes from the viewpoint of environmental and social considerations
4) Comparison of alternatives for HSR in terms of environmental and social considerations
5) Implementation of baseline survey for environmental and social considerations
6) Environmental and social considerations for optimal option

The following are the major achievements during Stage II of the study.

(1) Preliminary scoping based on the baseline survey for environmental and social considerations

Secondary information on natural, living and social environment was collected and the following preliminary scoping was conducted.

Table 6.2 Potential impact on environment

Category	Items	Impact		
		P	C	O
Natural environment	Climate/meteorological phenomena	D	D	D
	Topography	D	B-	D
	Soil erosion	D	B-	B-
	Hydrology	D	D	B-
	Groundwater	D	B-	B-
	Ecosystem/flora and fauna	D	B-	B-
	Protected area/forest	B-	B-	B-
	Coastal zone	D	D	D
	Landscape	D	D	B+/B-
	Natural disaster	D	B-	B-
Living environment	Air pollution	D	B-	A+/B-
	Water pollution	D	B-	B-
	Soil contamination	D	C-	B-
	Noise/vibration	D	B-	A-
	Low frequency noise/micro-pressure wave	D	D	A-
	Sunshine obstruction	D	D	B-
	Wave obstruction	D	D	B-
	Waste/hazardous waste	D	B-	B-
Social environment	Involuntary resettlement	A-	B-	D
	Land use	B-	B-	A+
	Utilization of local resources	D	B-	D
	General, Regional/City Plans	B-	D	B+
	Social institutions and local decision-making institutions	C-	C-	C-
	Social Infrastructure and Services	B-	B-	B+/B-
	Local economy and livelihood	B-	B+	A+/B-
	Unequal Distribution of Benefit and Damage	B-	B-	B-
	Local conflicts of interest	C-	C-	C-
	Water Usage, Water Rights and Communal Rights	C-	C-	C-
	Cultural and Historical Heritage	D	C-	C-
	Religious Facilities	B-	B-	B-
	Sensitive facilities (ex. hospital, school, precision machine factory)	A-	B-	B-
	Poor people	C-	B+	C-
	Ethnic Minorities/Indigenous people	D	D	D
	Gender	C-	C-	C-
	Children's rights	D	D	D
	Public health	D	B-	B-
	Occupational Health and Safety (OHS)	D	B-	B-
Others	Accident	D	B-	C+/C-
	Climate change	D	D	A+

Note: A: Significant positive/negative impact is expected.

B: Positive/negative impact is expected to some extent.

C: Extent of positive/negative impact is unknown. (A further examination is needed, and the impact could be clarified as the study progresses)

D: No impact is expected.

+: Positive impact, -: Negative impact

P: Pre-construction, C: construction, O: operation

Source: JICA Study Team

(2) Environmental and social considerations on the optimal option

The environmental and social considerations study including the field survey was conducted on the optimal option. Based on this practice, several improvements including the location of depot and the change in structure from an elevated structure to underground one were made.

6.3 Land Acquisition and Resettlement

The scale of land acquisition and the cost associated with it have been estimated based on the indicative alignment discussed in Chapter 2.2, satellite imagery, official maps of forest and supplementary field survey. 3,188 households or 13,700 people will be affected by the project[1]. The total areas to be acquired for the project are estimated to be 271.7 ha, of which 265.1 ha will be in West Java Province. The areas for main track, side road for construction and maintenance, and depot and workshop will be 198.2ha, 25.8ha, and 47.7ha respectively. The detailed estimate of land acquisition per administrate areas and land types is shown below.

Table 6.3 Estimated Scale of Land Acquisition

	Residential/ commercial (high density)	Residential/ commercial (low density)	Irrigated Paddy Field	Non-irrigated Paddy Field	Forest	Plantation and dry land	Total (ha)
DKI Jakarta	0	6.6	0	0	0	0	**6.6**
West Java	83.2	70.8	31	9.9	32.2	38	**265.1**
Total	**83.2**	**77.4**	**31**	**9.9**	**32.2**	**38**	**271.7**

Source: JICA Study Team

In addition to the above, a total of 69.1ha of underground space (11.6ha in DKI Jakarta and 57.5 in West Java) will be used for the project. Several regulations guiding the use of underground space such as Regulation of the Minister of Public Works No. 02/ PRT/ M/ 2014 and the regulation of DKI Jakarta No. 167/ 2012 have been developed, but the detailed procedures and mechanism for obtaining the right to use underground space of private land will have to be clarified in the course of the project preparation.

According to the Law No.2/ 2012, the process of land acquisition is divided into four stages, namely i) planning; ii) preparation; iii) implementation; and iv) handover. It is expected that the first stage (planning) will be completed during Phase II (15 months). Three subsequent stages will take minimum 319 working days and maximum 583 days, depending on the time needed for grievance redress. The total cost associated with the land acquisition and involuntary resettlement is estimated to be IDR 3,746.6 billion as shown below. The unit price for land and structure are based on the sampling survey during Stage II, in which the market price of land and structures were estimated based on interviews with local officials and residents. The results were then verified by local real estate agents.

Table 6.4 Estimated Cost of Land Acquisition

	Item	Cost (million IDR)
A	Land[1]	2,548,000
B	Structure	177,000
C	Underground[2]	270,000
D	Allowance to affected households[3]	150,000

[1] Based on the satellite imagery. The estimate assume that one structure is resided by one household and the average household size of 4.3 (which is based on the livelihood survey carried out in the project area).

	Item	Cost (million IDR)
E	Total Direct Cost (A to D)	3,145,000
F	Indirect Cost (5% of direct cost)	157,250
G	Irrigation and plantation[4]	300,000
H	Total	3,602,250
I	Contingency (10% of H)	360,225
J	**Grand Total**	**3,962,475 (JPY40,536 million)[5]**

Note: 1. Include cost for additional land for forest (2x) and irrigated paddy field (3X) as per requirements of Ministry of Forestry Regulation No. P16 / Menhut-II/ 2014 and Ministry of Agriculture Act No. 41/ 2009; 2. Assumes the super superficies of 30% (i.e. paying land owner 30% of the land price for using underground space); 3. Includes *solatium*, which is a sort of emotional compensation for residents, as per SPI 306; 4. Based on expert judgment; 5. IDR1 = JPY0.01023.
Source: JICA Study Team

6.4 Next Steps

Actions for Phase II are as follows

- To resolve the issue of land permits already issued
- Clarify procedures and requirement for using the underground space
- To further discuss with the Ministry of Agriculture and the Ministry of Environment and Forestry regarding the rational and need for compensating forest and agricultural area including the tunnel section of the HSR
- Preparation of AMDAL and LARAP documents in Phase II

AMDAL process will be started by preparation of KA-ANDAL (TOR) together with the public consultation. It will be followed by Baseline Survey, ANDAL Processes and Environmental Permits Processes. It will require around 12 months

As discussed above, the land acquisition process is divided into four stages: i) planning; ii) preparation; iii) implementation; and iv) handover. The LARAP document will be prepared in the planning stage (which is Phase II of this F/S), and submitted to governors of DKI Jakarta and West Java province for approval. Upon their approval, governors establish a preparation team to initiate the preparation stage. At the end of the preparation stage, the project proponent submits application for execution of land acquisition to the Head of National Land Agency (BPN). Then, BPN establishes an implementation team to lead the implementation stage in which valuation of assets by independent appraisers, negotiation and payment of compensation will be carried out. The planning stage (LARAP preparation) does not have specific time frame, but other stages are to be completed within minimum 319 days and maximum 583 days, according to the Law No. 2/ 2012.

Chapter 7 Cost Estimation

The preliminary project cost is calculated as the sum of the following items:

I. Construction and procurement cost

II. Consulting service fee

III. Land acquisition fee

IV. Administrative cost

V. Contingencies

VI. VAT

In this case, the total project cost of the high-speed railway system includes not only the construction and procurement cost (civil works, track works, facility-related cost, E&M and rolling stock) but also the consulting service fee, land acquisition and housing compensation cost, general administrative cost, reserve fund and value-added tax. Each of the required quantities is multiplied by the basic unit price to calculate the construction cost of each facility, which is then totaled to calculate the construction costs.

Table 7.1 Preliminary Project Cost

1 USD=9,701IDR=99.24JPY

Item				F/C (million USD)	L/C (billion IDR)	Total (million USD)
(1)Construction / Procurement Cost	Civil Works		140 km	916	16,253	2,591
	Disaster Prevention Equipment		1 LS	19	10	20
	Track Works		140 km	131	1,924	329
	Station Works		1 LS	78	617	141
	Depot/ Workshop		1 LS	228	1,399	372
	Electric Facility		1 LS	440	1,312	576
	System/Automatic Fare Collection		1 LS	35	0	35
	Signaling and Telecommunications Facility		1 LS	224	1,364	364
	Rolling Stock		84 train	360	0	360
	Maintenance Equipment		1 LS	22	0	22
	Preparation for Operation		1 LS	10	98	20
	Construction/Procurement Cost (sub-total)		140 km	2,463	22,977	4,831
(2) Consulting Service Cost		※	1 LS	104	1,144	221
(3) Land Acquisition Cost			272 ha	0	3,962	408
(4) Management Cost		{（2）} x 10%	1 LS	0	215	22
(5) Contingency		{(1)＋(2) - Rolling Stock Cost} x 5%	1 LS	110	1,206	235
(6) Value-added Taxes		{（1）＋（2）} x 10%	1 LS	0	4,902	505
Project Cost			140 km	2,677	34,406	6,223
Project Cost (USD)			140 km	2,677	3,547	6,223
Project Cost (%)				43.0	57.0	100.0

※: {(1)-(Rolling Stock+Maintenance Eq.+Preoperating cost)}x5%

The base month for the calculation is March 2014.

Construction cost = 4,429 million USD (31.6 million USD/km)

Source: Study Team

Chapter 8 Project Modality

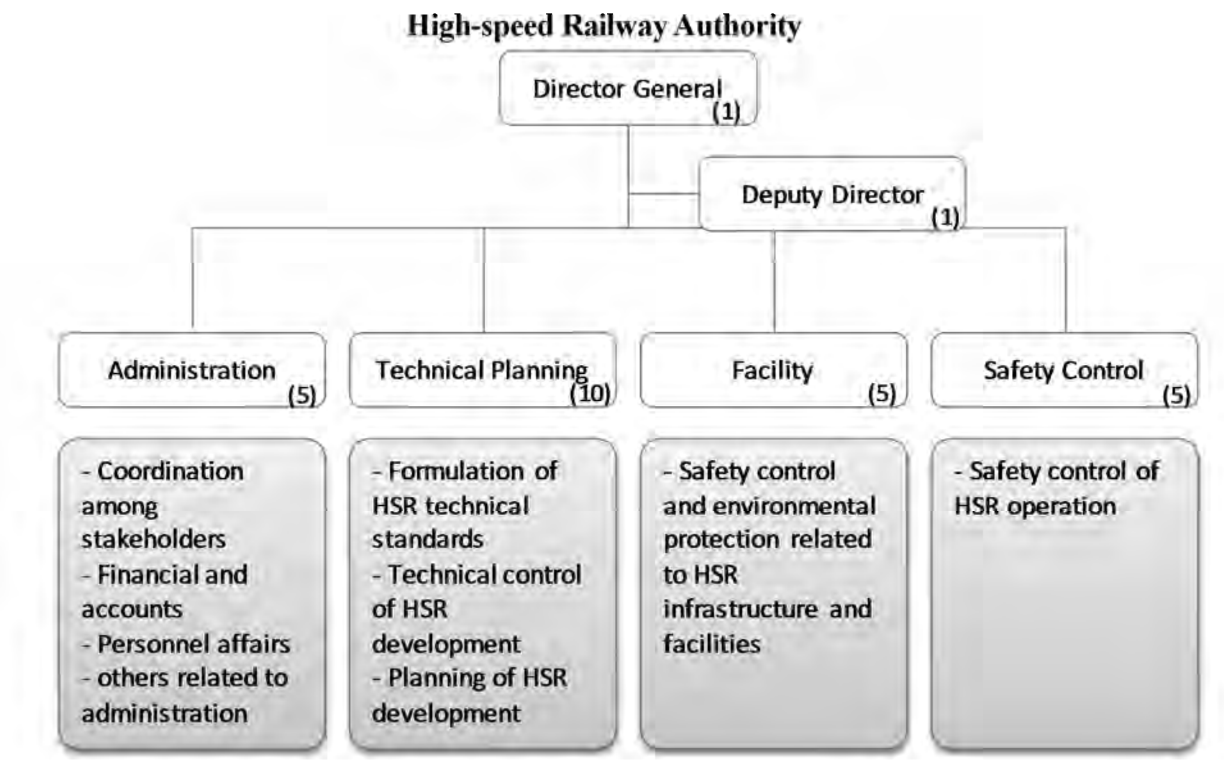
8.1 Examination of Implementation Structure and Project Modality

8.1.1 Regulatory Authority

Considering that the HSR is a new technology in the country and the paradigm, standards and safety control that are totally different from those of the business management in the conventional lines are required, establishment of a new authority that falls under the Ministry of Transportation would be the better option for the country. Figure 8.1 shows a plan of organizational structure of the authority.

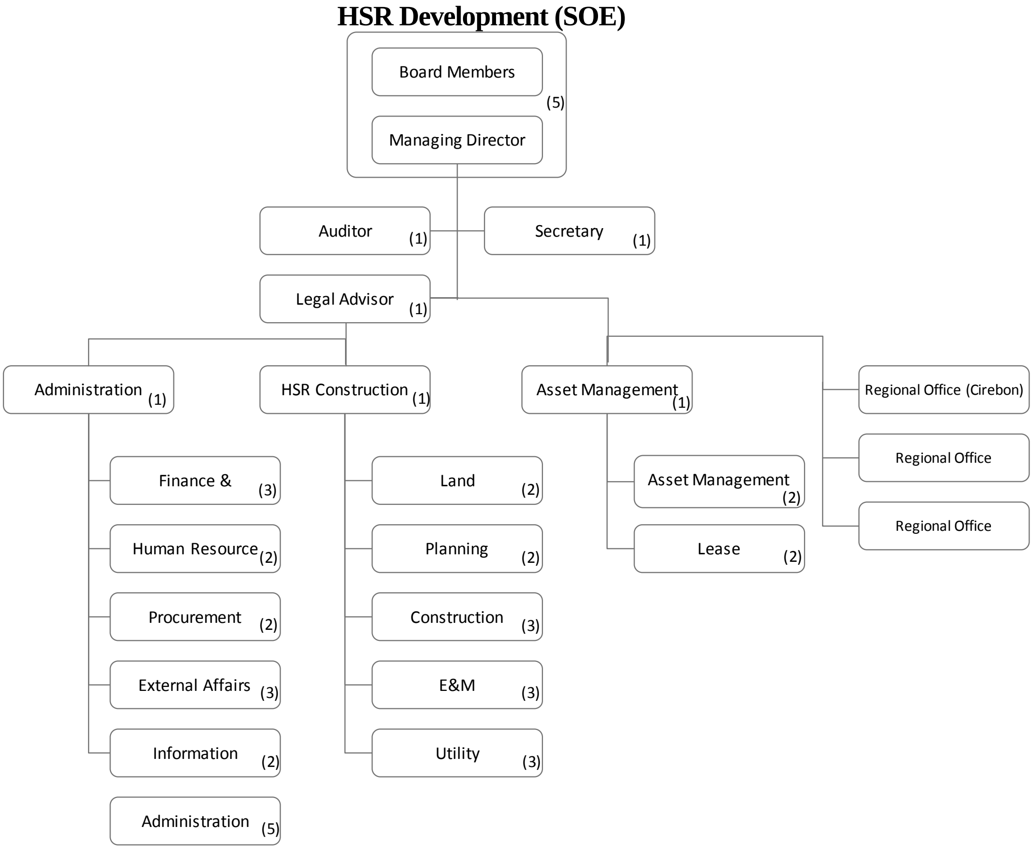
8.1.2 State-Owned Enterprise

As the existing tracks of conventional lines cannot be utilized for HSR development due to different concept and standards, new dedicated tracks must be constructed. In order to avoid impact on the HSR development from the business operation of the conventional lines, it is recommended that a state-owned company (hereinafter referred to as "SOE") that will be engaged in HSR development would be established. Figure 8.2 shows a plan of organizational structure of the SOE.



Note: Figures in brackets shows the number of personnel.
Source: prepared by the JICA Study Team

Figure 8.1 Organizational Structure of the HSR Authority



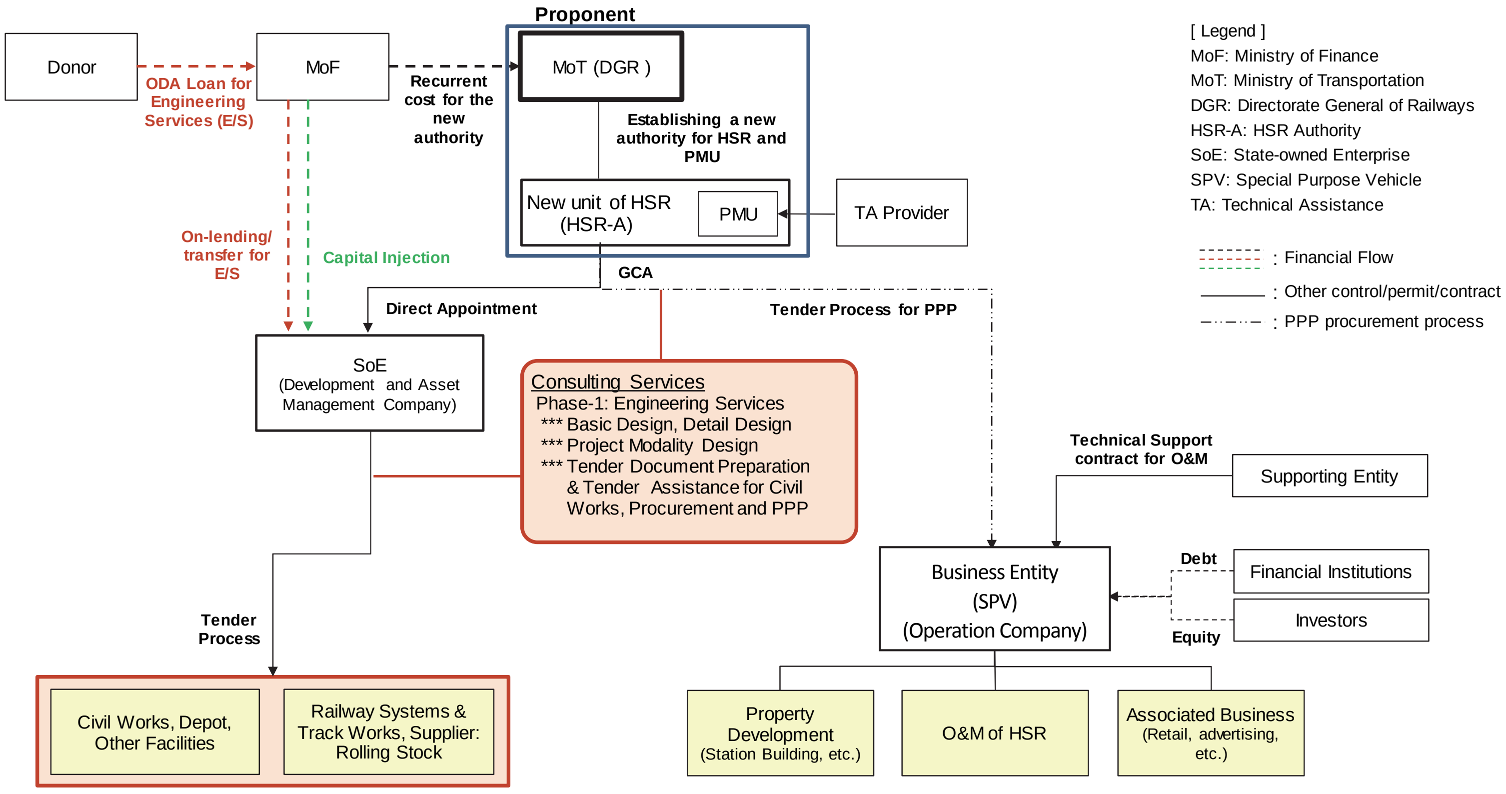
Note: Figures in brackets shows the number of personnel.
Source: prepared by the JICA Study Team

Figure 8.2 Organizational Structure of the HSR Development (SOE)

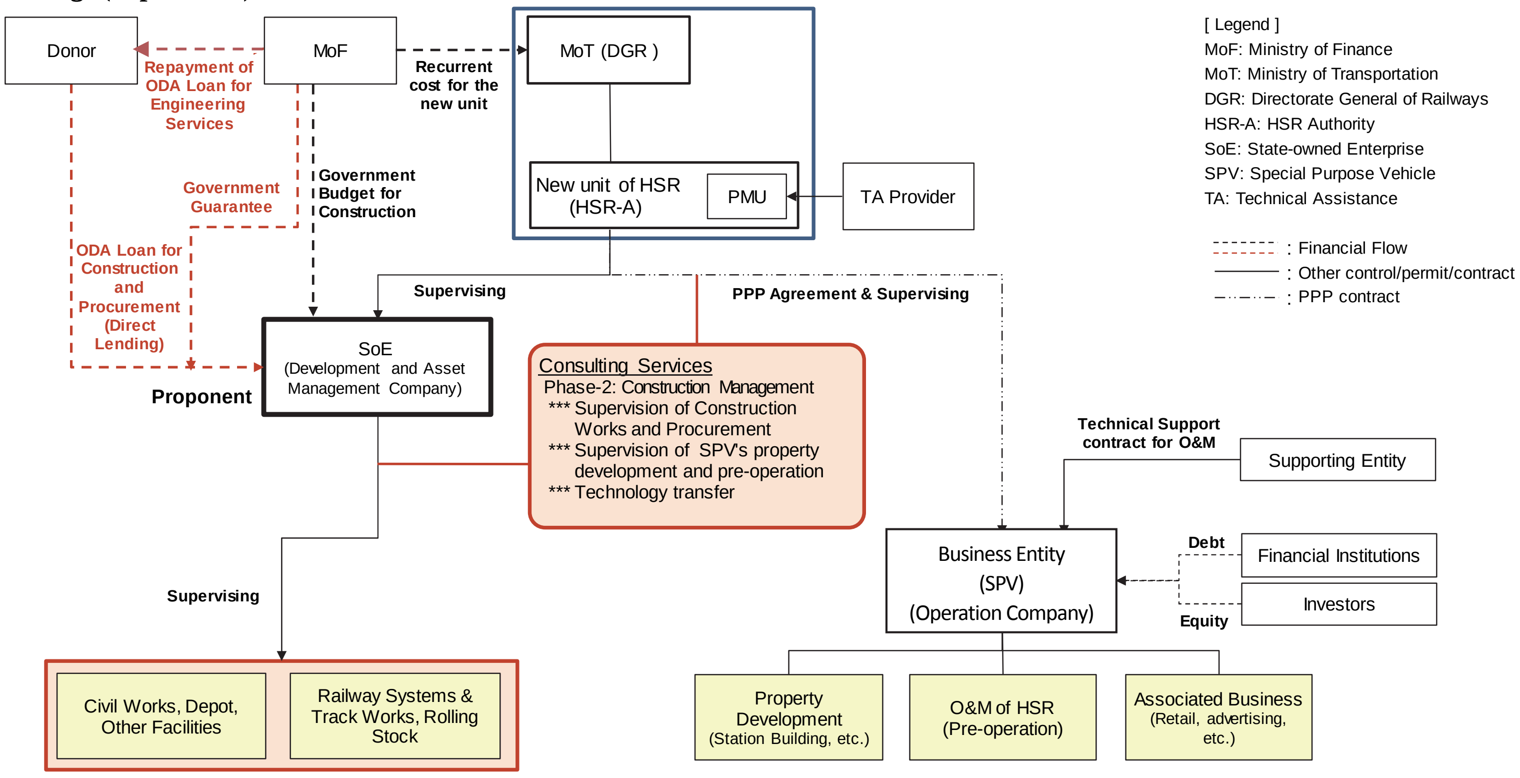
8.1.3 Project Modality

Especially the private financing is highly expected by the Indonesian side because of the financial constraint of the government. Therefore, a PPP-based model in which a business entity (SPV) will operate and maintain the HSR systems is a priority for the examination of project modality, while the SOE-based model in which the development and operation of the HSR will be done by two SOEs is examined as the alternative. Figure 8.3 and Figure 8.4 show the implementation structure for the PPP-based model and vertical separation model respectively.

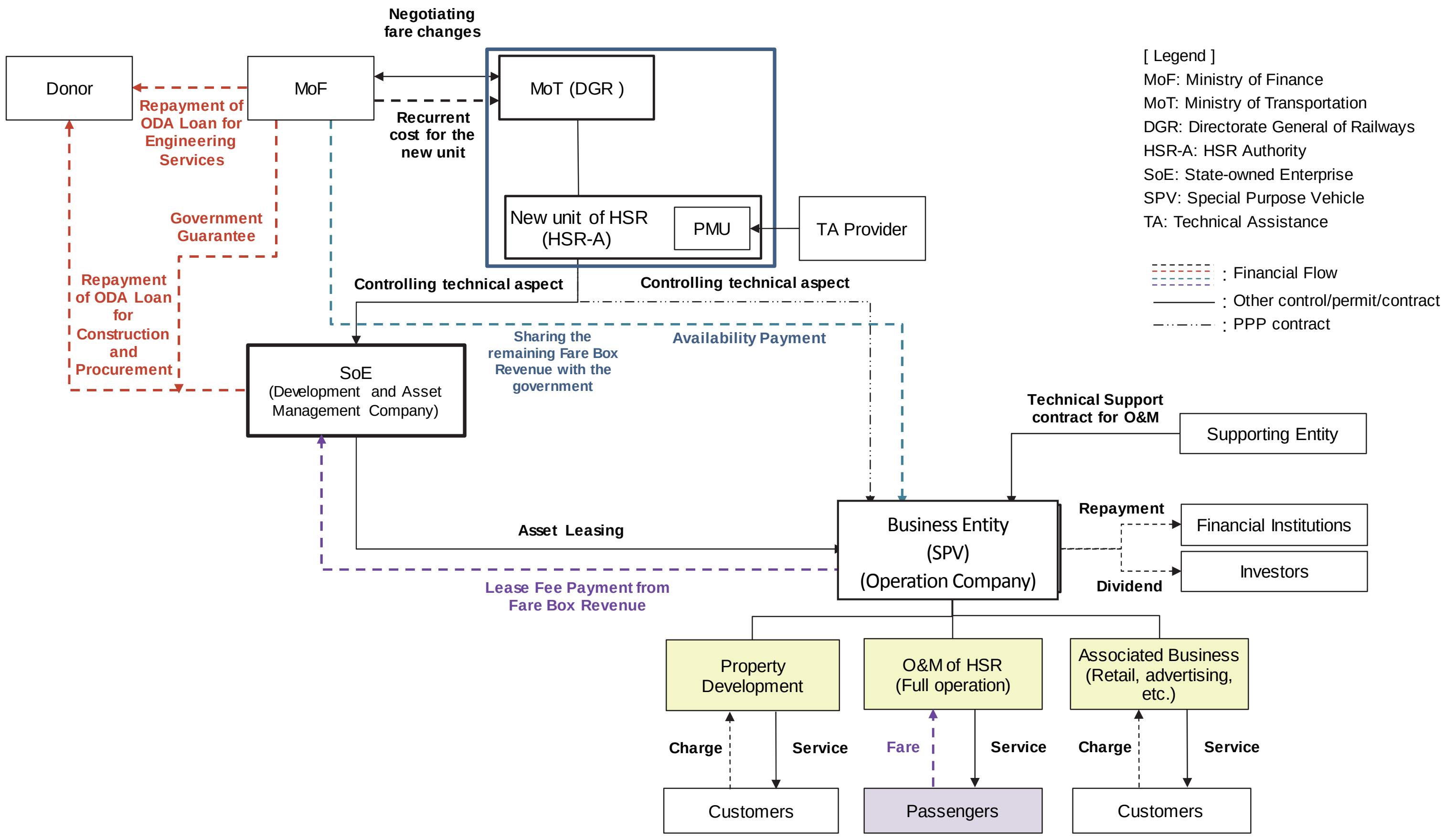
1) Preparation State (Design and Tender Documents Preparation)



2) Construction Stage (Supervision)



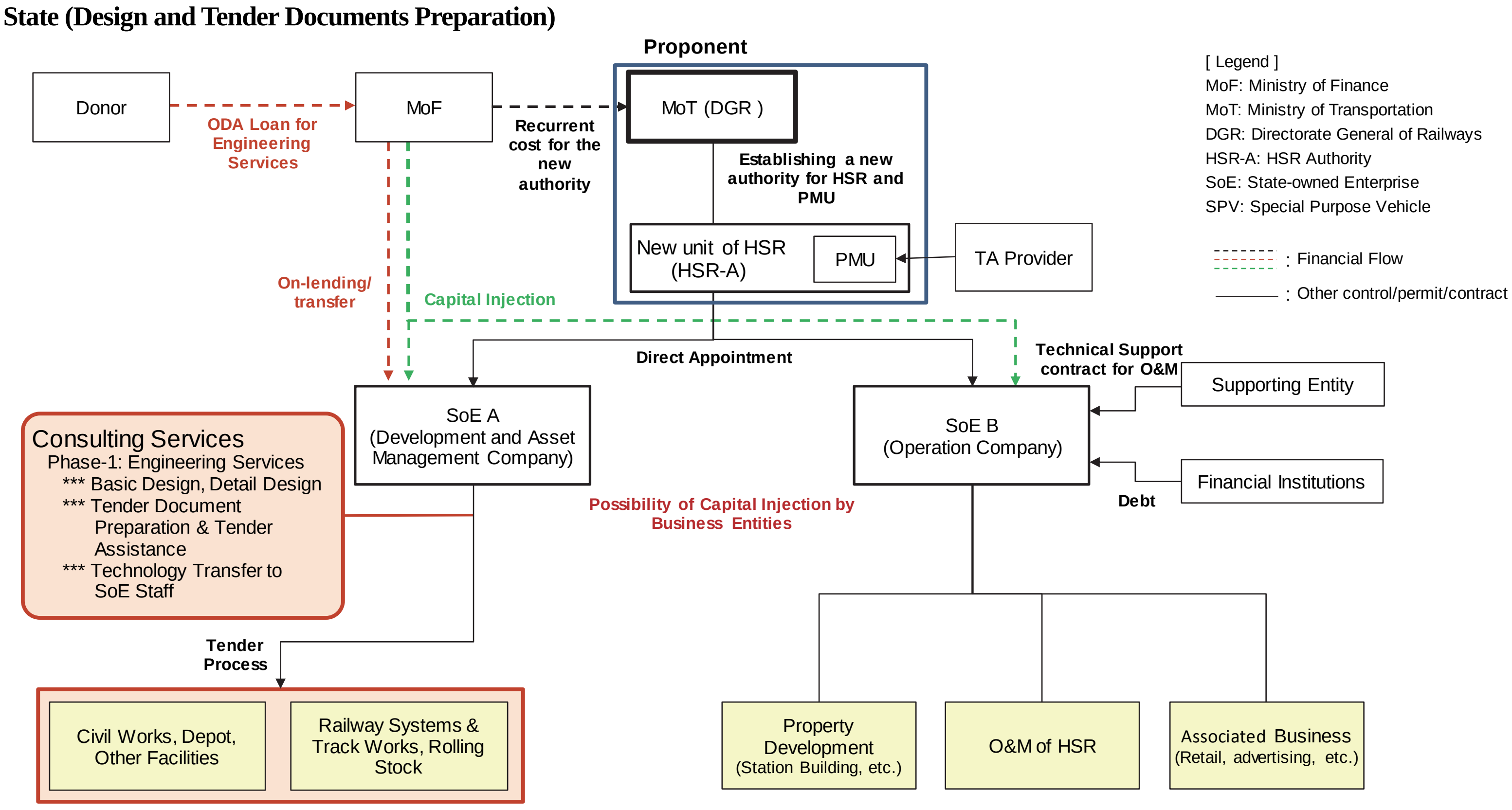
3) Operation Stage (Operation and Maintenance)



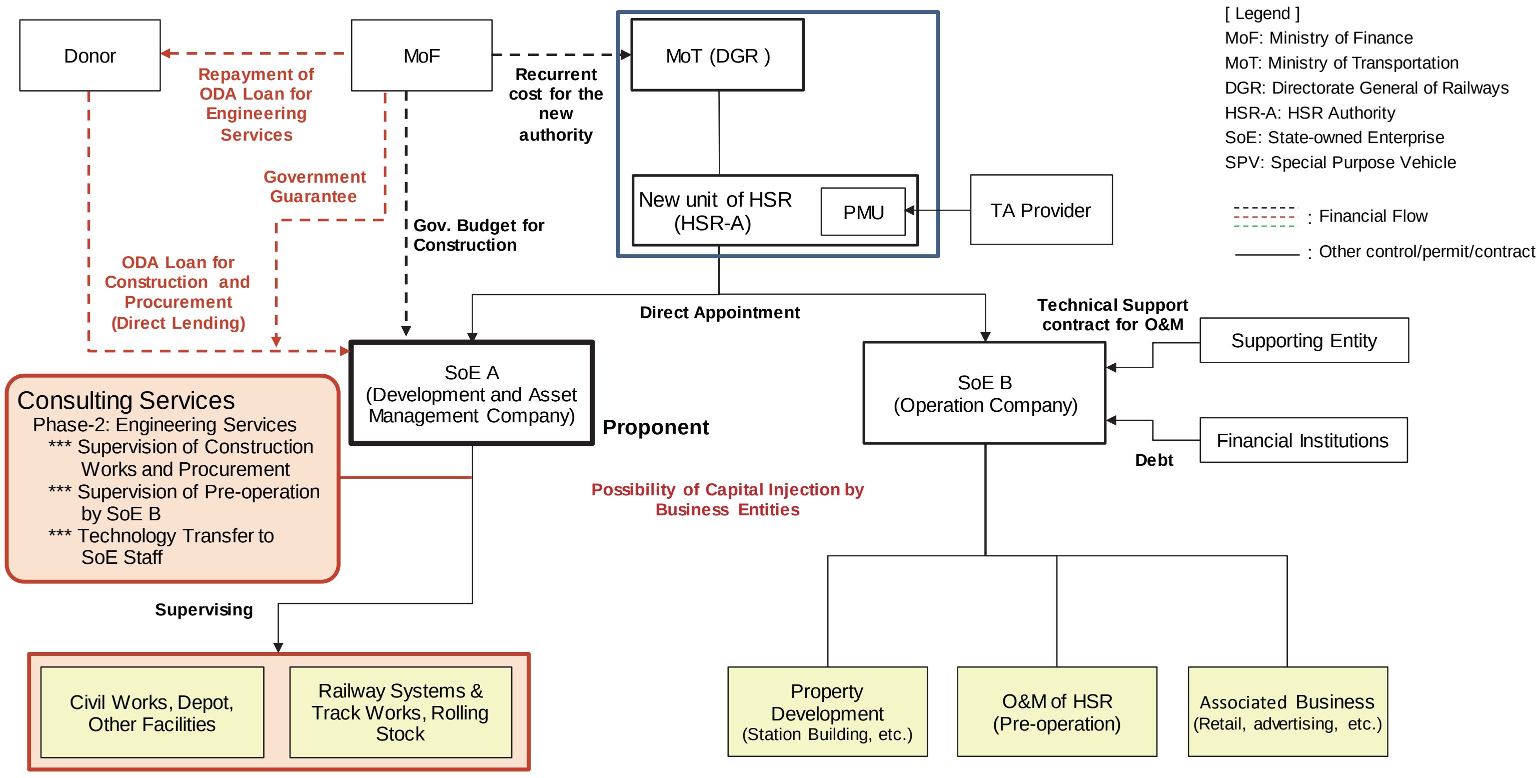
Source: JICA Study Team

Figure 8.3 Project Scheme of PPP-based Model (by Stage)

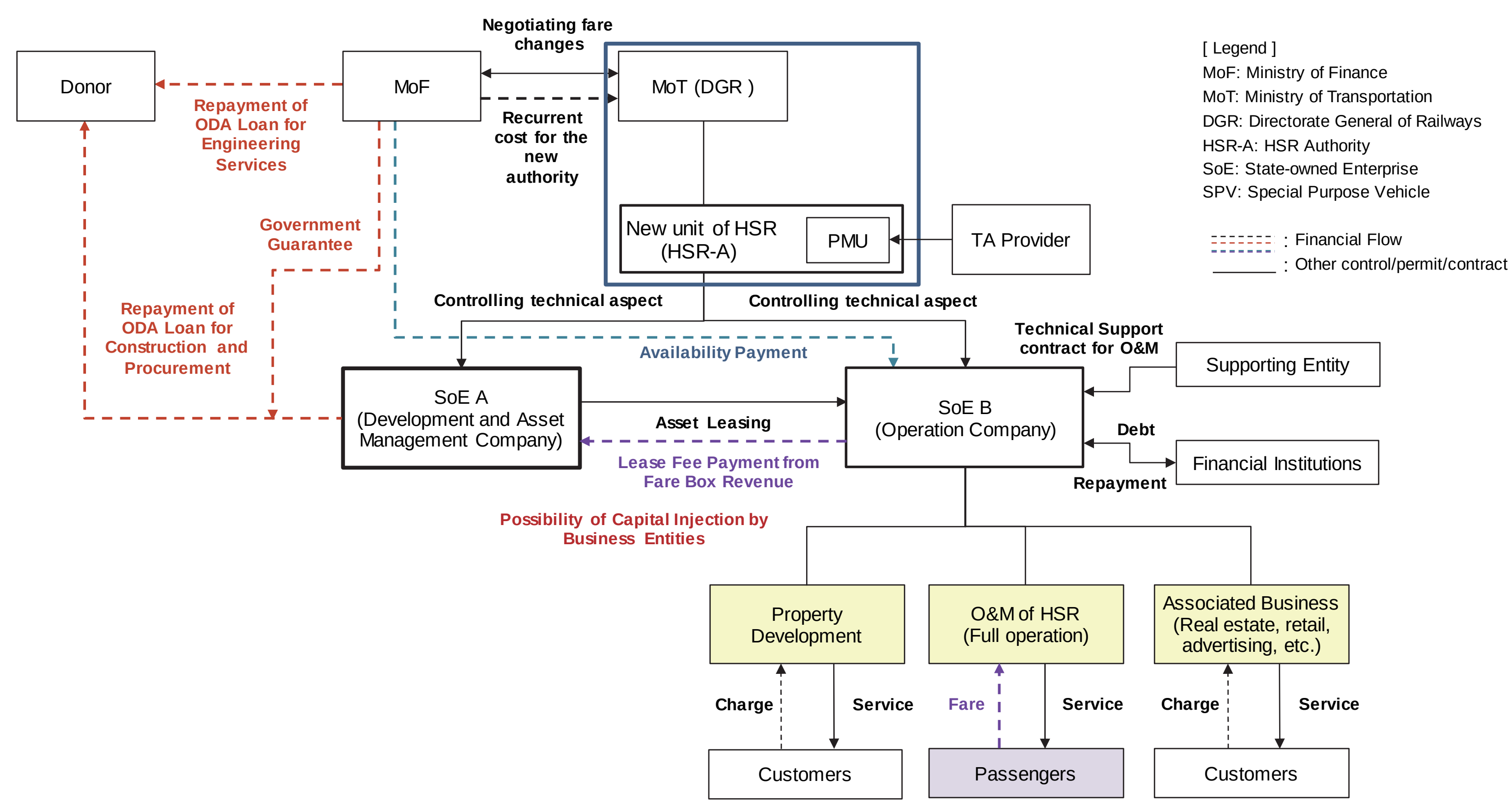
1) Preparation State (Design and Tender Documents Preparation)



2) Construction Stage (Supervision)



3) Operation Stage (Operation and Maintenance)



Source: JICA Study Team

Figure 8.4 Project Scheme of SOE-based Model (by Stage)

8.2 Examination of Financial Options

In view of the huge demand for infrastructure projects, the financial community has been creating a number of innovative financial instruments, though most of them are still under development. It is, however, worthwhile taking them into account and developing them together with both Indonesian and Japanese financial communities to better support implementation of infrastructure projects.

As for possible financing available from Japan, types of funding include: JICA ODA STEP Yen Loans, JICA ODA Untied Yen Loans, JICA PSIF (Private Sector Investment Finance) Loans, JBIC Export Loans, JBIC Overseas Investment Loans, investment by the Japan Overseas Infrastructure Investment Corporation for Transport & Urban Development (JOIN), and loans from Japanese banks through their Indonesian subsidiaries and/or branches.

As for possible financing available from Indonesia, options are finance by PT Sarana Multi Infrastruktur (PT SMI), finance by PT Indonesia Infrastructure Finance (PT IIF), Indonesia Investment Guarantee Fund (IIGF) guarantee, and loans from Indonesian major banks.

Possible, new and innovative financing sources are partial risk guarantee, real estate investment trusts (REIT) and infrastructure investment trusts (InvIT), land value capture (LVC), town planning schemes (TPS) and station development.

8.3 Cost Sharing between Key Players

There are only two models of project modality in the IIGF's guidelines: investment in all project costs by the business entity (concession model) or by the government (O&M model). However, it is necessary to consider the vertical separation model in the infrastructure project and examine the cost sharing between the key players. Table 8.1 shows some example patterns of the cost sharing between the key players for the PPP-based model. Considering the result of financial analysis, the cost sharing must be further examined.

Table 8.1 Example of Cost Sharing between the Key Players for the PPP-based Model

Unit: billiion IDR

Item		Breakdown	Pattern 1 (Base Case)			Pattern 2			Pattern 3			Pattern 4			Private Model		
			Gov	SOE	SPV	Gov	SOE	SPV	Gov	SOE	SPV	Gov	SOE	SPV	Gov	SOE	SPV
Construction/ Procurement Cost	Civil Works	Embankment		2,114			2,114			2,114			2,114				2,114
		Cutting		766			766			766			766				766
		U type Retaining Wall		167			167			167			167				167
		Viaduct (Regular Bridge)		8,178			8,178				8,178			8,178			8,178
		Bridge		419			419			419			419				419
		Tunnel (Mountain Tunneling)		5,266			5,266			5,266			5,266				5,266
		Shield Tunnel		6,402			6,402			6,402			6,402				6,402
		Cut and Cover		881			881			881			881				881
		Transverse		422			422			422			422				422
		Service Road		358			358			358			358				358
		Environmental Program		165			165			165			165				165
		Sub-Total	0	25,138	0	0	25,138	0	0	16,959	8,178	0	16,959	8,178	0	0	25,138
	Disaster Prevention Equipment			196				196		196				196			196
	Track Works			3,193				3,193		3,193			3,193				3,193
	Station Works				1,371			1,371			1,371			1,371			1,371
	Depot/ Workshop			3,611			1,269	2,342		3,611				3,611			3,611
	Electric Facility			5,584			5,584			5,584			5,584				5,584
	System/Automatic Fare Collection			339			339			339			339				339
	Signaling and Telecommunications Facility				3,535		3,535			3,535			3,535				3,535
	Rolling Stock			3,490			3,490			3,490			3,490				3,490
	Maintenance Equipment				216			216			216			216			216
	Preparation for Operation				196			196			196			196			196
(1) Construction/Procurement Cost			0	41,550	5,317	0	39,354	7,513	0	36,907	9,961	0	33,100	13,767	0	0	46,867
(2) Land Acquisition Cost			3,962			3,962			3,962			3,962			3,962		
(3) Consulting Service Cost			680	1,397	266	680	1,288	376	680	1,575	89	680	1,384	279			2,343
(4) Management Cost			68	139	27	68	129	38	68	157	9	68	138	28			234
(5) Contingency			34	2,147	279	34	2,032	394	34	1,924	502	34	1,724	702			2,461
(6) Value-added Taxes			4,921			4,921			4,921			4,921					4,921
Total Project Cost			**9,665**	**45,233**	**5,889**	**9,665**	**42,803**	**8,321**	**9,665**	**40,563**	**10,561**	**9,665**	**36,347**	**14,777**	**3,962**	**0**	**56,826**
Percentage to Total Project Cost			16%	74%	10%	16%	70%	14%	16%	67%	17%	16%	60%	24%	6%	0%	94%

Note: Private Model shows a case that the government takes responsibility for land acquisition only and the remaining portion is taken by the SPV.

Source: JICA Study Team

Chapter 9 Estimating Project Effects

9.1 Financial Analysis

Basically the analysis is based on the business scheme studied in Chapter 8. In addition analyses are conducted on each case of project cost sharing schemes described in table 8.1, necessitated by the need to evaluated different cost sharing schemes between related parties under the project structure, as written in section 8.3.

9.1.1 Preconditions

(1) Project period

The project period is set to 50 years, in consideration of factors such as facility lifetime.

(2) Exchange rate (respecified)

The exchange rates are set as below, in accordance with the tentative JICA Yen loan evaluation criteria for Indonesia in FY2013.

- USD/JPY 1 USD ＝ 99.24 JPY
- USD/IDR 1 USD ＝ 9,697.3 IDR
- IDR/JPY 1 IDR = 0.001023 JPY

(3) Cases under evaluation

In general the analysis is based on the business scheme studied in Chapter 8. In addition analyses were conducted on each case of project cost sharing schemes described in section 8.3, necessitated by the need to evaluate different cost sharing schemes between related parties under the project structure, as written in section 8.3.

(4) Value-added tax rate

A value-added tax for the project is exempted as written in Chapter 8.

(5) Tariff

It is assumed that all portion financed in foreign currency is subject to tariff, for which tariff rate of 5% is applied in view of the laws of Indonesia.

(6) Corporation tax

A corporation tax of 25% is applied in view of the laws of Indonesia.

(7) Rate of lease

Among all infrastructures acquired and leased by the state-owned enterprise, for assets financed by Yen-loan scheme, the operating company is assumed to pay the lease amount to the state-owned enterprise under the condition of lease rate of 0.1% and lease period of 40 years. That is, for the Yen loan used for infrastructure development signed by the state-owned enterprise, the repayment for both interest and principal is to be made by the operating company paying equal amount each year.

(8) Fund-raising method

The state-owned enterprise acting as the main project development body is assumed to be able to use Yen loan (STEP) to procure full funding for items that are under the subject of Yen loan mechanism. For those items outside the coverage of Yen loan mechanism, and for the government-funded portion of construction cost, it is assumed that they would be funded by equity investment from the Indonesian government's budget. Also, the main project operating body which is the private entity is set to finance the initial cost through equity capital and commercial bank loans with debt equity ratio of 85%.

(9) Short-term loan

It is assumed that when the accumulated cash flow becomes negative, the whole cumulative deficit is to be covered by short-term loan.

(10) Loan conditions

1) Yen loan

STEP conditions are applied to Yen loan: annual interest rate of 0.1% and 40 year repayment period including a 10 year grace period. Annual interest rate during construction period is assumed to be 0.3% on both construction works and consultancy services[2].

2) Commercial bank loan

Based on the Indonesian 10 year government bond yield added with risk premium under Indonesian standard, the annual interest rate of a commercial bank loan is assumed to be 14% for a 10-year loan. The interest during construction is set to be 14% on both construction works and consultancy services.

3) Short-term loan

Likewise, considering the yield rate of a 10-year Indonesian government bond and risk premiums in Indonesia, annual interest rate for a 5-year loan is assumed to be 12%.

2 Refer to JICA Yen loan evaluation criteria for other middle-income country in FY2013.

9.1.2 Estimation of FIRR

The estimation result for each case shows positive FIRR for both public project development body and private project operating body. The project is evaluated as financially feasible.

Table9.1 Financial Analysis (FIRR)

	FIRR (Private operator)	FIRR (State-owned enterprise)
Cost Sharing Case 1 (Base Case)	16.77%	0.97%
Cost Sharing Case 2	13.67%	0.97%
Cost Sharing Case 3	10.99%	0.98%
Cost Sharing Case 4	9.54%	0.97%
Reference: Private Project Case 1 (Land Acquisition Cost charged to Indonesian Government)	5.28%	0.90%
Reference: Private Project Case 1 (Land Acquisition Cost charged to SPV)	5.04%	-

9.1.3 Cash Flow Analysis

For each case nominal cash flows are estimated and analyzed. The project is found to be financially sound and investable. Resultant Equity IRR in each case exceeds 14%, a value higher than standard investment criterion in Indonesia where WACC of private companies are assumed to be between 14 to 20% based on comment by one Indonesian PPP specialist. Note that even though the DSCR can in some period run below 1.0, since in all cost sharing plans the cumulative cash flows for all project period are positive, in terms of accounting the periodic cash shortage for years of higher debt service payment can be covered by reserve account.

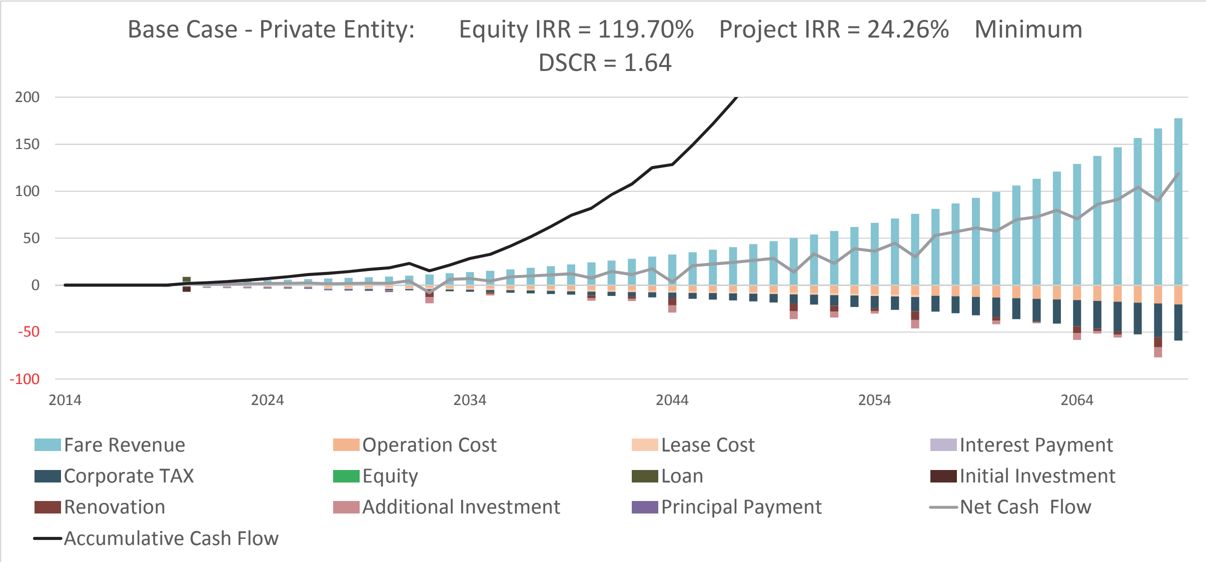
It is necessary to note, however, that the result of financial feasibility of the project in this analysis is based on following points.

・Normally investors and lenders tend to give more conservative figures to revenues and costs. In particular lenders are more risk-averse: they typically make loan decision based on the worst case scenario. Therefore some investors or lenders may not be satisfied by current equity IRR. For this project investors and lenders would be especially cautious compared with usual projects as it’s project period spans to as long as 50 years with relatively massive investment amount.

・If project costs are borne solely by private operating body the body become insolvent.(Chart 14.3-11 and Chart 14.3-11) This is due to excessive burden of financial cost which would make the project reliant upon short-term borrowings. In other words, the project implementation would face significant difficulty without alleviation of financial burden through Yen loan. Therefore, Project IRR and other indicators are not calculated.

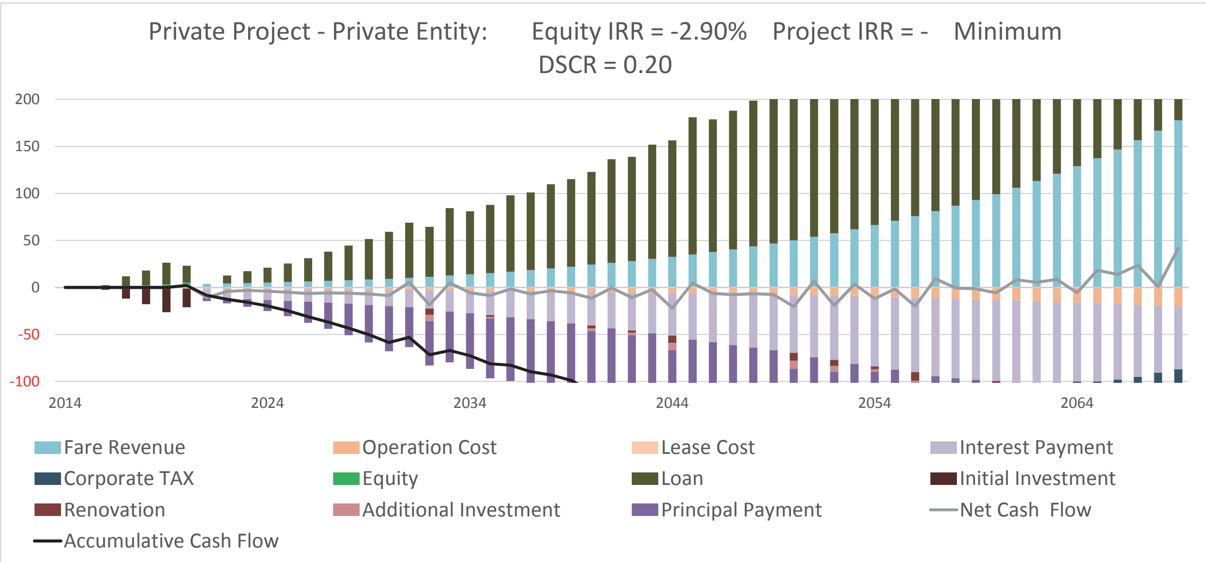
Table 9.2 Results of Cash Flow Analysis

	Results	Note:
Cost Sharing Case 1 (Base Case)	Equity IRR = 119.70% Project IRR=24.26% DSCR (minimum) = 1.64	Figures on the left are values for private operating body. For state-owned enterprise, the cash flows are always zero.
Cost Sharing Case 2	Equity IRR = 74.05% Project IRR=18.35% DSCR (minimum) = 1.20	
Cost Sharing Case 3	Equity IRR = 29.37% Project IRR=14.06% DSCR (minimum) = 0.86	
Cost Sharing Case 4	Equity IRR = 21.21% Project IRR=11.33% DSCR (minimum) = -3.36	



Source: JICA Study Team

Figure 9.1 Cash Flow of project operating private body
(Case 1 (Base Case), Cash Flow Analysis, Nominal Term, Unit: trillion IDR)



Source: JICA Study Team

Figure 9.2 Cash Flow of project operating private body
(Private Project Case 1 (Land Acquisition Cost Charged to Indonesian Government), Cash Flow Analysis, Nominal Term, Unit: trillion IDR)

9.2 Economic Analysis

The preconditions are as below.

(1) Without HSR Case
For the “Without HSR Case” which is to be utilized as a base case for comparison, the case without the HSR project whence only the current transportation system continues to be available is used in conducting the economic analysis.

(2) Social Discount Rate
Based on other similar projects and economic analysis given by ADB, the social discount rate is set to be 12%.

(3) Cost
As the cost of project we will use the economic price to which neither VAT nor internal tariff are applied.

(4) Benefit
Factors considered to be the benefits attributable to the project are: 1) supplier’s benefit of fare revenue and 2) passenger’s benefit of reduced travel time and reduced cost of travel for those switching transport modes. Below are the specific values set.

1) Supplier’s Benefit (Fare Revenue)
Based on the results of demand forecast given above the fare revenue is defined to be the sum of the number of HSR users multiplied by the fare amount for each path between zones. As the forecast is conducted only on 2020, 2030, 2040 and 2050 for the interval times between these times the fare revenue values are linearly supplemented. For substitutes in the period after 2050, the 2040 to 2050 growth rate is applied.

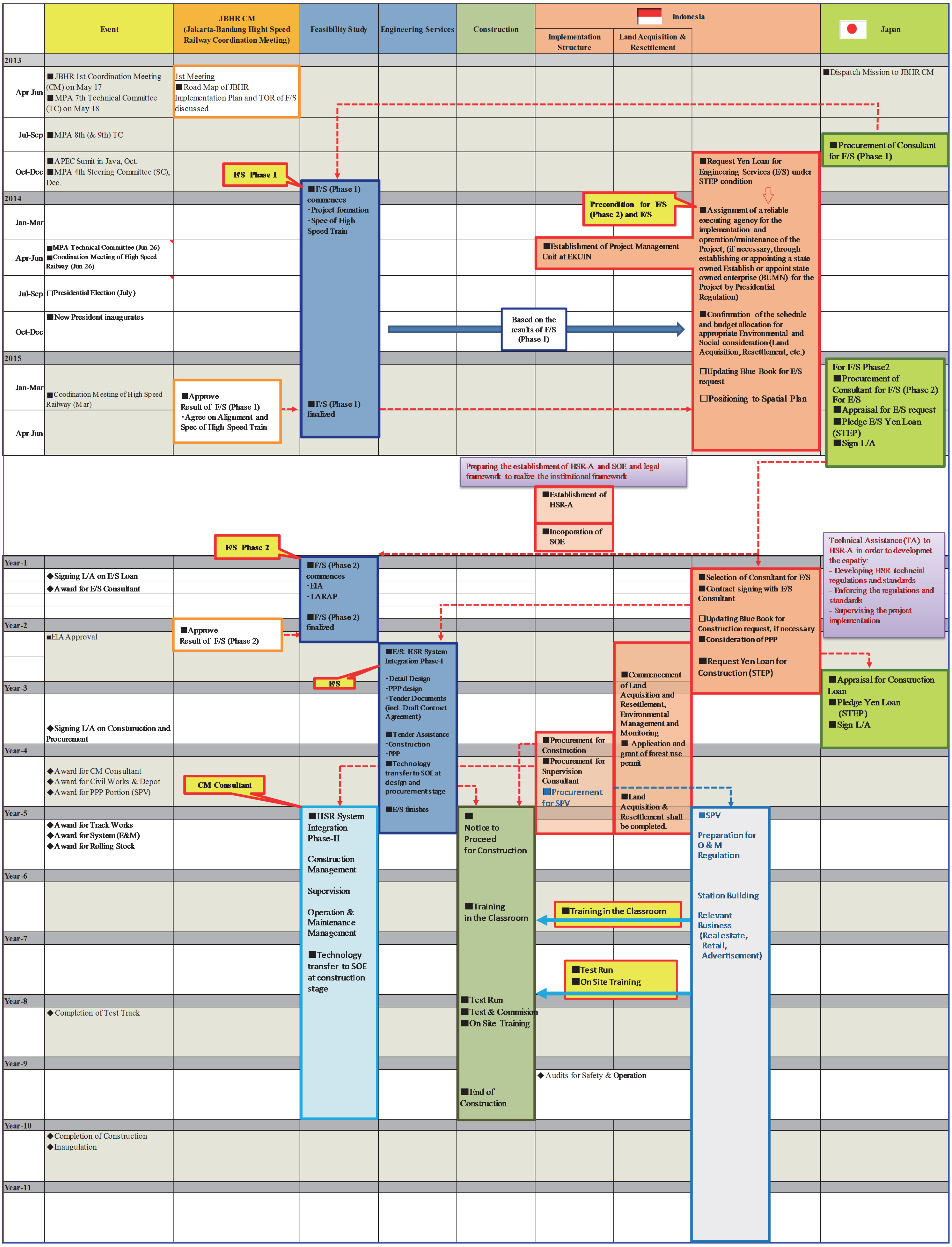
2) Benefit of Reduced Travel Time
The benefit is defined to be the difference between the travel time for HSR users and that for users in “Without HSR Case” multiplied by the value of time. The value of time is 77,001/hour (FY2014 standard) which is based upon the METI report of last year.

3) Benefit of Reduced Cost of Car Travel
For users who switch from automobiles to HSR the benefit of reduced car use cost is taken into account. As the basic unit for the calculation we used the preceding JICA report last year, in which a passenger car (carrying 3 persons) costs 3,356 IDR/vehicle-km, a small bus (carrying 5 persons) costs 1,670 IDR/vehicle-km and a large bus (carrying 15 persons) costs 2,684 IDR/vehicle-km.
The economic analysis yielded evaluation results in support of economic feasibility. The EIRR was computed as 12.50% which is larger than social discount rate of 12%.

- EIRR=12.50%
- NPV=2.08 trillion IDR (approximately 21.3 billion JPY)
- B/C=1.05

Chapter 10 Schedule towards HSR Inauguration

The Schedule towards HSR inauguration is shown in Fig. 10.1-1.



Source: Study Team

Fig. 10.1 Schedule towards HSR Inauguration

Chapter 11 Conclusion and Recommendations

11.1 History of the Studies

11.1.1 Background

Railways are currently only operated on the islands of Java and Sumatra in Indonesia. The total length of railways operated on Java is 3,425 km, and the number of passengers transported by long-distance trains per year steadily grew from 2006 to 2010 at an average annual rate of 9%, but the percentage of passengers transported by railways is still low at approximately 6%. On the other hand, approximately 85% of all passengers are transported by the highways and roads, resulting in increasingly severe traffic jams on the urban roads and intercity highways. Accordingly, the government of Indonesia is proceeding with plans for electrification and expansion of tracks (double or quadruple tracks) in order to boost the transport capacity of the railway network in Java. In order to enable railways to play an important role in the passenger transport and to make them competitive with air and road transport services, in addition to improvement of the existing railway lines, further strengthening of the transportation network based on the development of a high speed railway to link cities has been positioned as an issue for urgent review.
Java High Speed Railway Development has been positioned in the main upper-level plans concerning railways as outlined below.

(1) Masterplan of Acceleration and Expansion of Indonesia Economic Development (*Masterplan Percepatan dan Perluasan Pembangunan Ekonomi Indonesia* - MP3EI): The development of a high speed railway route in the economic corridors between Jakarta - Bandung and Jakarta - Surabaya should be conducted as an integral part of the railway plan for this corridor.

(2) National Railway Master Plan (NRMP): This plan also discusses the introduction of a high speed railway connecting Jakarta and Surabaya.

(3) Metropolitan Priority Area (MPA) Concept: The Jakarta - Bandung High Speed Railway is one of the priority projects.

Development of a high speed railway between Jakarta - Surabaya (approximately 733 km) was considered based on the above plans. In 2009 the JETRO-F/S on Java HSR (High -Speed Rail) Construction Project was done for the above stated section. In 2011 the MLIT-F/S Preliminary Study was conducted and examined the Jakarta – Bandung section for the priority phase section where many passengers would be expected, from the standpoint of the scale of investment and economic viability. Three alternative routes were examined in the section, and the route along the current highway connecting Jakarta – Purwakarta - Bandung was preferred. The METI- Pre F/S on Jakarta -Bandung HSR was undertaken in 2012. Comparing the route via Bandung to that via the northern plain between Jakarta and Cirebon, the Jakarta-Bandung section was preferred as primary priority of a part of Jakarta – Surabaya HSR project authorized in the National Railway Master Plan, in spite of some constraints such as long distance and steep gradient. In

October 2013, the government of Indonesia requested the government of Japan to conduct a feasibility study concerning the achievability of HSR.

11.1.2 The Study (Phase I, Stage I)

The MOU of TOR signed between JICA and the Indonesian Government in October 2013, divided the "Feasibility Study for Jakarta - Bandung High Speed Railway Project" into 2 phases. The objective of Phase I was to analyze the necessity, relevance & basic feasibility, while that of Phase II was to examine the technical, financial, environmental and institutional feasibility. Two preconditions that should be achieved in the period between the 2 phases were set: (1) Request of Yen Loan for E/S after the project is listed in Blue Book, (2) Assigning reliable executing agencies, etc. Phase I was further divided into 2 stages, with a precondition of "Consensus-building of necessity, relevance and specification (decision of introducing Japanese "Shinkansen" technology if possible)" between the two stages. The objective of Stage I was to get basic agreement regarding HSR system, demand forecast, route alignment and stations location, etc., while that of Stage II was to study structure plan, environment and social considerations, project modality, etc. and to consider the spatial plans of the central and the local governments.

The JICA Study Team (JST) of the titled project explained the Inception Report at the Coordination Meeting in January, 2014, at the beginning of the study and got the agreement of Indonesian Government. At the meeting in April 2014, where the interim progress was reported, the Indonesian Government requested JST to closely communicate with local governments preparing spatial plans and to support MOT (Ministry of Transportation) in preparing the Blue Book. In the final Coordination Meeting of the Stage I held in June, 2014, it was approved to proceed to Stage II study based on Shinkansen Technology.

11.1.3 The Study (Phase I, Stage II)

In the Stage II, the geological survey and the topographic study (preparation of topographic maps of 1/10,000 scale) were conducted, followed by review of the environment and social consideration, estimation of scale and cost of the land acquisition as well as improvement of accuracy of route alignment and structure plan. The project scheme was examined in cooperation with the Gadjah Mada University, resulting in the reasonable execution agencies and profitable business scheme.

11.2 Summary

11.2.1 HSR System and Japanese Shinkansen Priority

Indonesia and Japan have very similar natural conditions – experiencing earthquakes, strong rains, volcanos, etc. The topographic challenges are also similar; the HSR faces 33km slopes with 25~30‰ gradient up to the 700m high Bandung Basin. Furthermore, Java Island and Honshu Island in Japan have equivalent social conditions such as population distribution. There are some large cities on the planned alignment such as Bekasi, Bandung and Semarang that have populations of more than one million as well as Jakarta and Surabaya. And these cities form the same urban structure as that of the Tokaido and Sanyo Shinkansen area.

In addition, being environment-friendly is an important issue. Considering the factors above, the Japanese system has the priority, and this was agreed upon the Coordination Meeting held on June 26. Japanese system's advantages are summarized as follows:

- Safety: No fatalities or injuries for more the 50 years
- Punctuality: Within 1 minute of the average delay time per trip (Record from 2001 to 2008)
- Sophisticated earthquake countermeasures: The quickest earthquake detection sysytem
- Power cut off after only 16 seconds (50 sec. shorter than TGV)
- Superior energy consumption: 23% lower than that of Chinese, 41 - 44% lower than others
- Gradability: Continuous steep section with 30‰
- Compact structure design: Tunnels with small cross section and track width, resulting in low cost
- Environment: Rolling stock design for noise control

The design speed will be 350km/h, and the trains will be able to run at 320km/h, utilizing Series E5 rolling stock capability. However in the years after inauguration, the speed will be limited to 300km/h, with a 37 minute travel time between Jakarta and Bandung, waiting for (1) Company staff to achieve the highest skill, (2) Inhabitants to become accustomed to the environmental impact from the HSR running.

11.2.2 Location of the Stations and Alignment

JST selected 8 candidate places in Jakarta for the main station. Among the alternatives, Dukuh Atas underground station is qualified because it is located within the CBD (Central Business District), and it allows easy transfer to MRT-J (under construction), Pt. KCJ and BRT. In Bandung, it was proposed to construct the HSR station parallel with the existing Bandung station. Regarding the terminal of Bandung, Gedebage was selected based on the request of West Java Province, where the area development is proceeding, and an extending it to Surabaya will be considered in the future. Bekasi and Cikarang stations were planned between Jakarta and Bandung. These stations are located adjacent to the downtown, and many industrial parks are planned and under construction. As a result, there will be five stations within the 140km alignment between Jakarta and Bandung (Gedebage) at the opening stage. After the inauguration 3 other stations are planned to be added; those are Manggarai (Development Plan), Karawang (Airport) and Walini (new province capital function).

As to the route alignment, it was designed so that number of resettlement and the impacts on paddy fields and forests will be minimized. To minimize resettlement in Jakarta, mainly tunnels, and elevated track over Banjir Kanal partially are selected. In Bekasi City and Bekasi Regency, ROW of the toll road are utilized. In the mountainous area where the train goes up 700m high, NATM tunnel is adopted. In Bandung area, HSR alignment is selected in the area of the convention line, that has ROW with 20m to 25m wide and an elevated track is planned.

The location of station and route alignment in Jakarta were approved in the meeting chaired by the vice governor, and the JST sent the meeting record to the governor. The station locations in the West Java Province were basically approved in June at West Java with related municipal governments in attendance.

The HSR route and the detailed station locations were agreed upon in the meeting with the West Java Province, followed by explanation to the each government along the route and advice regarding the development policy around the HSR station.

11.2.3 Traffic Demand

After inauguration supposed in 2020, 44,000 daily passengers are predicted to use the service, with 88% of the passengers coming from car users. In 2050 the volume of passengers is estimated to reach 148,000 passengers.
HSR can connect Jakarta to Bandung with only 37 minutes, and the transport capacity per HSR track is 5 times as much as that of per highway lane. The maximum revenue can be achieved when the fare between Jakarta and Bandung is set at 200 thousand rupiah. Some argue that the route length is too short for HSR; however, at present it takes 3 hours to travel between the two city centers by highway. When there is a traffic jam, it may take 4 or 5 hours. Accordingly, HSR has enough competitiveness due to its high operation speed even in the short distance. The share of HSR at the inauguration is forecast at 18%. However, when no additional investment for the highway is adopted, the share increases. For example, the demand will increase by 20% if the travel speed on the highway decreases by 15%.

11.2.4 Environment and Social Consideration

The route alignment is designed to minimize and mitigate the environmental impact, with natural and social matters being discussed with related ministries and municipal offices.
The total land acquisition is about 270 ha, with relocating 3,188 households. The land is acquired in accordance with the Compulsory Land Acquisition Law, but it is assumed to take time for the negotiation. And it is necessary to start discussion with developers of the industrial parks, especially in Karawang area, immediately because some of them already has the permission for development. An area of about 14km is used for the underground section. But there is only a general guideline for the underground space regulation, and detail procedures or compensation cost has not been stipulated yet.

11.2.5 Cost Estimation

Total project cost is estimated at US$6,223 million, including US$4,831 million for the construction/procurement cost and US$913 million for land acquisition cost & value-added tax. The local portions account for 57%. The exchange rates are 99.2JPY per USD and 97.7IDR per JPY.

11.2.6 Business Scheme and Financial Analysis

(1) Organizational Structure

A new authority (High Speed Railway Authority) must be established under the MOT because of necessity of the authority that will be responsible for technical control of HSR development and operation. A new state-owned enterprise (SOE) must be established to implement the construction works of the HSR development as an entity that can be a borrower of external loan from donors. In order to realize the effective development and operation, the function of development and operation must be separated. The new SOE will function as developer and the operation will be implemented by other entity. PPP can be applied to the function of HSR operation, considering the financial constraints of the Government of Indonesia and the funding policy of infrastructure development. To develop the technical foundation of the new authority and SOE, technical cooperation to those organizations is strongly requested.

(2) Financing

In order to reduce the financial transaction cost, soft loan with low interest rate and ultra-long term maturity must be utilized. Direct lending from donor to the new SOE is also one of the measures that can contribute to reduction of the financial cost and making the project bankability better. If the Japan's ODA loan with STEP is applied to the HSR development, conditions are as follows:

- Concessional interest rate: 0.1 percent, and
- Ultra-long term maturity: 10 years grace period and 30 years repayment period

If the project is implemented with PPP, a business entity (SPV) will lease out the HSR infrastructure from the new SOE and pay the lease fee. The SOE will repay the loan directly to donors using the lease fee paid by the SPV.

(3) Financial Analysis for PPP-based Model

Financial Internal rate of Return (FIRR) for 4 patterns of cost sharing was computed as follows;

- FIRR of SPV: 14.93% to 8.69% (SPV cost sharing: 10% to 24%)
- FIRR of SOE: 0.97% to 0.98% (SOE cost sharing: 60% to 74%)

Those 4 patterns results show the project feasibility in terms of FIRR. However, one of the major risks of project implementation with PPP is fare revenue or ridership. The accuracy of the expected ridership is not so high because no major-shared operator exists between Jakarta and Bandung. Therefore, the state government must provide the SPV with support to ridership risk such as availability payment in order to attract business entities to participate in the project. Amendment of the regulations on PPP to provide the availability payment to SPVs is under preparation by the Ministry of Finance.

As for a comparison with the PPP-based model, if a private company bears 94% of the project cost or all the project cost excluding land acquisition, accumulated loss in 2035 will reach to IDR 90 trillion and continue to increase. Besides, it is impossible to calculate some indices to evaluate the project feasibility, such as equity IRR and project IRR. This means the project implementation with only private financing is not feasible.

11.2.7 Economic Effect

The EIRR was computed as 12.5% which is larger than social discount rate of 12%, and this means the project is feasible from the viewpoint of the Indonesian economy.

Job creation in construction stage is approx. 35,000 workers for 5 years, considering only 1st effect. Effect of construction for relevant industrial sector in construction stage is IDR 44,800 billion, which is almost double of initial cost. Effect of operation including demand increase in the relevant industrial sector and household consumption ranges IDR 2,400 billion to IDR 8,000 billion per year.

11.3 Conclusions

11.3.1 HSR of Jakarta-Surabaya is necessary from the following viewpoints:

- Resolve the over-concentration in Jakarta and induce well-balanced development of the country
- Correspond the increasing traffic demand in the future and ensure the smooth economic activities and citizen life
- Promote industries related to HSR project and create job opportunities
- Introduce relatively energy- and environment-friendly transport modes
- Formulate efficient transportation system with HSR

11.3.2 Jakarta-Bandung is recommended as the first priority section

The first priority construction section of Java HSR is recommended between Jakarta and Bandung. After that the section Bandung and Surabaya will be realized. The reasons for this stepped development are outlined below:

- To reduce the risks - funding , managing railway and ridership
- To gradually built the operation know-how and HSR technology
- To take advantage of the marketability of Jakarta – Bandung section

11.3.3 Introducing Japanese HSR is relevant

Japanese Shinkansen technology has the priority as stated in 11.2.1. Considering the similarity of natural and social conditions, the rich countermeasures based on the advanced technology, the fact that no passenger fatality has been recorded since inauguration (over 50 years) will be useful. Series E5 is to be introduced, because of its stable operation speed of 320km/h. In Java HSR at first stage E5 will run at 300km/h until the operation know-how is acquired. Besides, the light, sharp and air-tight body of E5 makes cost saving for civil structures-- tunnel, bridges and soil structures, as well as energy-saving and environmental-friendly.

In addition to above, the experience and knowledge that has been gained from JR privatization since 1987 will be utilized. Study and examination of detailed regulations in Japan for the land acquisition and land utilization will also assist in developing the Indonesian HSR.

11.4 Recommendations

11.4.1 HSR project should be started now

Long time is required to make legislation, regulation, institutional set-up etc. for HSR. HSR technology and safety regulations are important. Those are inauguration process, driver's license, official safety investigation committee, basic specification etc. And overtime rapid urbanization will make the land acquisition for suitable route difficult.

Furthermore, the Indonesian economy has reached a level suitable to construct HSR for the following reasons:

(1) GDP per capita in Indonesia is now US$3,400 (IMF in 2014)

This figure is much greater than that of the Tokaido Shinkansen inaugural year of 1964. Since then the Shinkansen has significantly contributed to increasing Japanese economic growth and balancing development nationwide.

(2) The HSR project cost ratio to national budget is comparatively smaller

In Japan of 1964, the ratio of the HSR project cost of 380 billion yen to the budget of 3,600 billion yen represented over 10%. On the other hand now in Indonesia HSR 60.4 trillion rupiah project cost compared to 2,020 trillion rupiah in the national budget makes a ratio of just 3%.

11.4.2 The HSR route must be registered in Spatial Plans

Along the proposed HSR route, many projects are under way — (1) public transportation such as LRT (AGT, APV), monorail, BRT, etc., (2) industrial parks and new roads, etc. To avoid future excessive cost and excessive negotiation time, the approval of HSR should be acted earlier and HSR should be considered in the Spatial Plan of each municipal government.

To develop better functions for the new stations, transfer facilities to buses, taxis, should be planned and be regulated under the urban design. In addition, to make the HSR right of way, land value capture policy and regulations are important including town planning schemes and relaxation of floor to space ratio rules.

11.4.3 Legislation for Project Scheme

HSR Project is a large scale linear route plan; therefore, related laws should be enacted.

(1) Legislation for PPP project Scheme

The project should be opened to access to the market by private companies. Following assistance by government will be expected.

- Improvement of PPP regulations on government support to ridership risk; to provide availability payment and fare change approval rules
- Institutionalization of the direct lending from the donors to SOE

(2) Institutional building for HSR

1) HSR-A

HSR-A will be the key-entity for this project and it should be establish as soon as possible. This authority makes basic regulations and standards of HSR - technology and safety and regulate th SOE’s development works in preparation and construction stages. And in pre-operation stage, this authority issues certification of inauguration training completion and drivers' license and found official safety investigation committee.

2) SOE

SOE also should be established as a next entity of HSR-A without missing the opportunity. Major roles of this entity are as follows.

- To develop HSR structure and facilities
- To manage the HSR assets (leasing to the SPV)
- To streamline the financial management (receiving lease fee, repayment to donor, etc.)

(3) Possible new and innovative financing tools

Following financing tool is enacted in Japan and institutionalization in quick manner is expected.

- Partial risk guarantee
- REIT (Real Estate Investment Trust)
- LVC (Land Value Capture): Town Planning Scheme and Station Area Development

11.5 For the Next Step

JICA study team had 8 Indonesian engineers and staff jointly working with Japanese experts, as well as JICA study team contracted Indonesian universities and consultants. Through the Study, the Indonesians have steady acquired the Japanese technology of HSR, Shinkansen. JICA study team expresses sincere gratitude for the cooperation of Indonesian Central/local governments as well as Japanese embassy and JICA. The spirit of Japanese cooperation on HSR is to be of the Indonesian people, by the Indonesian people and for the people. Japanese people are looking forward that by introduction of HSR system, Indonesian economy will greatly develop as Japan has passed.

JICA study team expresses sincere gratitude for the cooperation with Indonesian central/municipal governments and related organizations, as same as for JICA and Japanese governments. JICA study team expects that HSR project will be realized and devote to develop Indonesian economy in the near future.