Feasibility Study for Promotion of International Infrastructure Projects in FY2011

Study on the High Speed Railway Project (Jakarta-Bandung Section), Republic of Indonesia

FINAL REPORT

【Summary】

November 2012

Prepared for:

The Ministry of Economy, Trade and Industry

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(1) Background and Necessity of the Project

The Republic of Indonesia (hereinafter called as "Indonesia") has a total population of approximately 240 million as of 2011, which is the fourth largest in the world. The economy in Indonesia has been steadily growing and the current economic growth rate is more than 6 %, and even in 2009 when Indonesia was affected by Lehman Shock, the growth rate exceeded 4.6 %.

In Java Island where the population is more than 100 million, the transportation infrastructure has not been developed sufficiently to cope with such a large scale of population. The railway service, in particular, is less competitive in terms of the required time than passenger cars, so that more than 80 % of passengers rely on the passenger cars as transportation means. Therefore, since the traffic congestion has been serious due to the increasing number of cars mainly in the urban areas, the necessity of inter-city connection by railway has been identified.

According to the national development plan called "Masterplan for Acceleration and Expansion of Indonesia Economic Development (MP3EI)", the development of the high-speed railway between both Jakarta-Bandung and Jakarta-Surabaya is recognized as one of the corridor transportation infrastructures to support economic development. Moreover, the National Railway Master Plan (NRMP) also highlights the development of Jakarta-Surabaya high-speed railway. In addition, the high-speed railway between Jakarta and Bandung is nominated as Priority Project in Master Plan for JABODETABEK Metropolitan Priority Area (MPA) which is jointly conducted by both Indonesian and Japanese governments.

In 2008, the feasibility for introducing the high-speed railway between Jakarta and Surabaya for about 700 km was examined, but the project cost was estimated as JPY 2.1 trillion which was not practical for the Indonesian government. Thus, the study for the high-speed railway in the section between Jakarta and Bandung was carried out by the Ministry of Land, Infrastructure, Transport and Tourism (MLIT) in Japan. In accordance with the result of this study, the Indonesian government requested the Japanese government to conduct more practical study including the examination of the prior development route (Jakarta-Bandung section), the possibility of future extension (Bandung-Cirebon), and the project scheme. Therefore, in the Study, the proper route is examined for the high-speed railway between Jakarta and Cirebon as a priority section in the Jakarta-Surabaya high-speed railway plan by comparing two routes (Bandung Route and Coastal Route). In addition to those two routes, the section between Jakarta-Bandung-Gedebage in the Bandung Route is analyzed. Therefore, concerning those three alternative routes, the appropriate route is selected by the technical, economic, financial and project scheme analysis on the selected one route.

Moreover, as positive impacts to Japan, various railway related companies with superior technologies of rolling stocks, signals and communications, etc. are expected to expand their business opportunities into foreign market by exporting the Japanese Shinkansen.

(2) Basic Policies for Decision of Project Components

For the implementation of the Study on the High Speed Railway Project (Jakarta-Bandung Section) in Indonesia (hereinafter called as the "Study"), the basic policy of the Study is formulated as described below in accordance with the intension of the National Development Planning Agency (BAPPENAS) and the Directorate General of Railway (DGR) of the Ministry of Transportation (MOT) which formulated the National Railway Master Plan (NRMP) and in consideration of the consistency with related development plans and the results of the site surveys.

1) Appropriateness as Frist Phase of Jakarta-Surabaya High-Speed Railway

The appropriateness for the implementation of the high-speed railway in the section between Jakarta and Bandung is examined as the first phase of Jakarta-Surabaya high-speed railway which is stipulated in the NRMP from the technical, demand and financial viewpoints. Moreover, the project scheme for the implementation is analyzed for the promotion of Japanese ODA Loan.

2) Applicability of the Japanese Shinkansen System to Indonesia

In the Study, to apply the Japanese Shinkansen System to Indonesia, the technical, economic and financial applicability is examined.

Regarding the technical applicability, the route selection is conducted based on the consultation with the related organizations and site survey, and the comparative analysis is implemented on the routes. Furthermore, based on the survey on the users' preference, the demand forecasting is conducted to identify the conversion from the conventional transportation means to the high-speed railway and operation plan is formulated to secure the optimal transportation capacity. In addition, the technical specifications of the high-speed railway are examined based on the technical standards of Japanese Shinkansen, and the review of structures and analysis of environmental impact are performed.

Moreover, for the realization of the Project based on the examinations mentioned above, the required costs for the construction and operation and maintenance are estimated, and the schedule for the project implementation is examined. Furthermore, the project scheme of the high-speed railways in Indonesia is analyzed in consideration of the related legal systems in Indonesia, and the feasibility of the Project is evaluated from financial and economic viewpoints.

3) Legislation for introduction of high-speed railways in Indonesia

To realize the Project in Indonesia, it is necessary to confirm the legal system regarding the high-speed railway as well as environmental impact assessment and land acquisition, and to identify the issues for the project implementation.

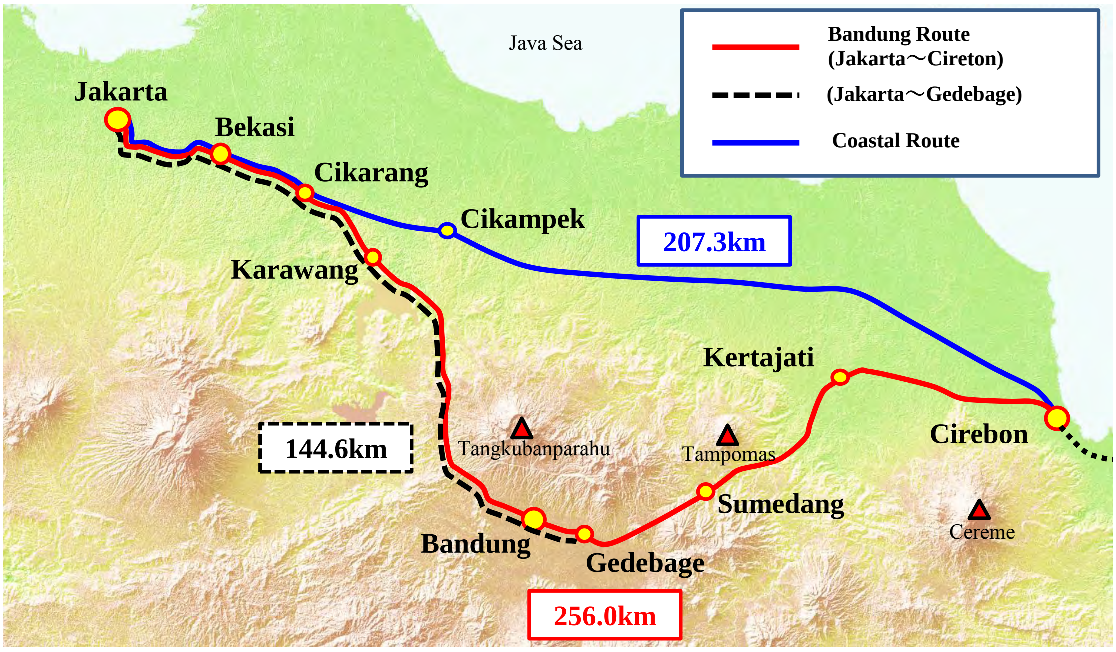
Concerning the environmental and social considerations, the policy, items and schedule of the environmental impact assessment in Indonesia are examined. Moreover, since the land acquisition is inevitable for the project implementation, some issues are recognized such as cost for the land acquisition and volume of involuntary resettlement. The project scheme is analyzed in consideration of the related laws in Indonesia and role allocation between the public and private sectors.

(3) Summary of the Project

1) Target Routes of the Study

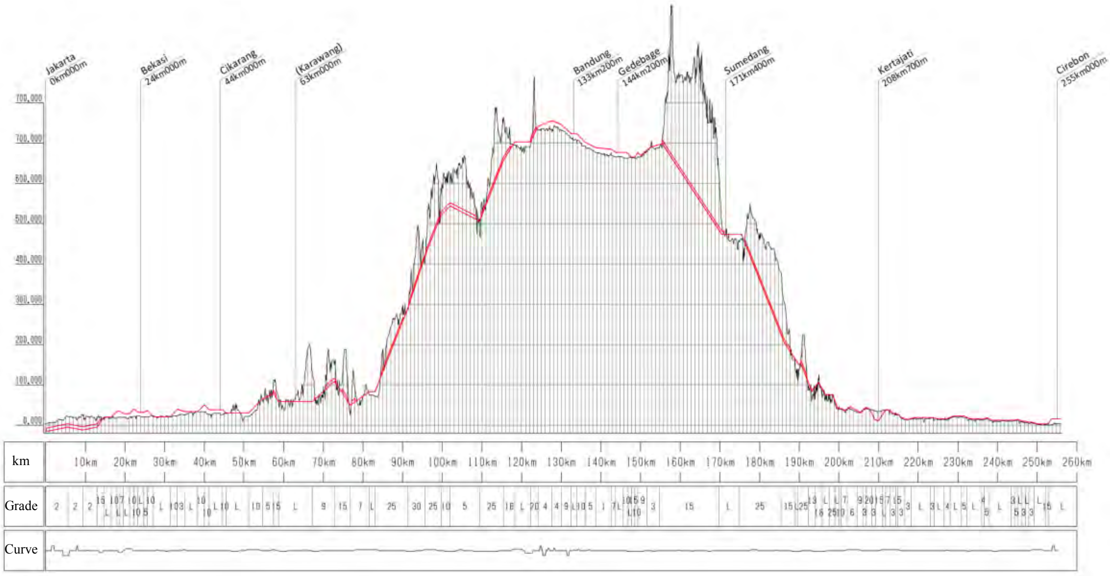
In the previous study conducted by the MLIT in Japan, the high-speed railway in the section between Jakarta and Bandung was examined. On the other hand, the route of Jakarta-Surabaya high-speed railway in the NRMP runs along the coastal line. Therefore, in the Study, the route from Jakarta to Cirebon via Bandung is set and both routes are comparatively examined as shown in Figure 1. On the Bandung Route, the difference of the elevation is approximately 700 m between Jakarta and Bandung with steep gradient. The vertical profiles of the Bandung and Coastal Routes are shown in Figure 2 and Figure 3 respectively.

Figure 1 Comparison between Bandung Route and Coastal Route (between Jakarta and Cirebon)



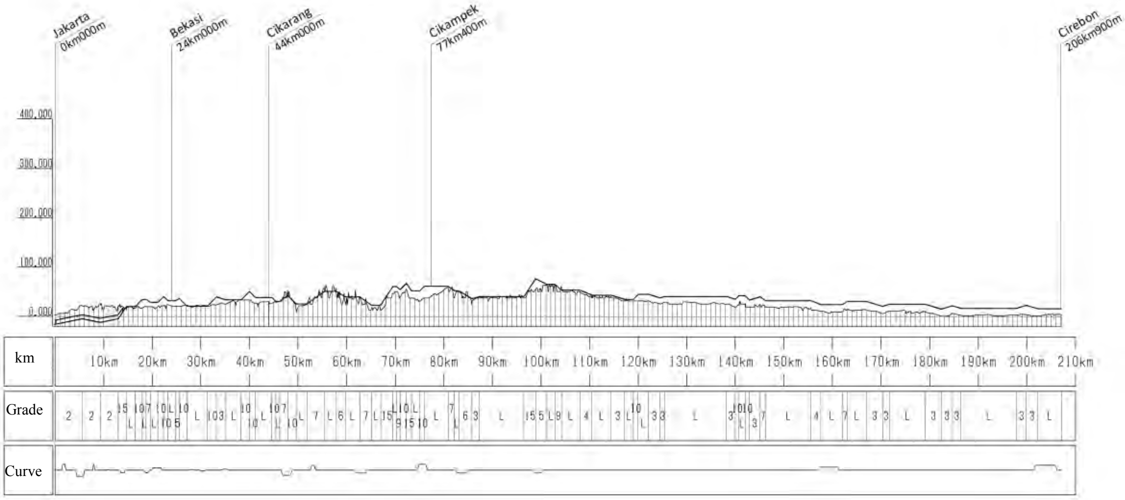
Source: prepared by Study Team

Figure 2 Elevation profile of the Bandung Route (between Jakarta and Cirebon)



Source: prepared by Study Team

Figure 3 Elevation profile of the Coastal Route (between Jakarta and Cirebon)



Source: prepared by Study Team

2) Selection of Routes and Stations

In the Study, the proper route is examined for the high-speed railway between Jakarta and Cirebon as a priority section in the Jakarta-Surabaya high-speed railway plan. For the comparison of the routes, three alternatives are considered: Bandung Route (Jakarta-Bandung-Cirebon), Coastal Route (Jakarta-Cirebon) and Jakarta-Bandung-Gedebage in the Bandung Route as the first phase of the construction.

Table 1 Outline of Alternative Routes

Route	Section	Outline
Bandung Route	Jakarta-Bandung-Cirebon	● Route connecting to the third largest city of Bandung and to Karawang and Kertajati where construction of the international airports is planned. This is also the route where the high demand is expected. ● Total length is 256.0km.
	Jakarta-Bandung-Gedebage	● Route connecting to Gedebage via Bandung as first phase of Bandung Route ● Total length is 144.6 km.
Coastal Route	Jakarta-Cirebon	● Route connecting Jakarta and Cirebon with almost the shortest distance ● Total length is 207.3 km.

Source: prepared by Study Team

For the route selection, it is considered to connect stations with the shortest distance. The continuous straight and horizontal sections are needed as long as possible not to prevent the high speed operation. Even when inevitable due to geological reasons, the steepest slope shall be 30‰. In order to avoid excessive loading to the cars, the steep slope sections shall not be continuous.

Considering the land acquisition, the areas for existing toll roads and conventional railways will be utilized as long as available. Interference with the urban area, factories, commercial facilities, grave, mosque, and other public facilities shall be avoided as much as possible. In particular, in the center of DKI Jakarta, the route will be taken under the ground because it has been developed. In principle, access to the planned airport will be an underground structure. The structure may be on the ground if the opening schedule and development location of airport are not fixed. Moreover, the route crosses the principal roads, toll roads and conventional railways as flyover with the specified clearance.

Since the stations for the high-speed railway are assumed mainly for use as passenger stations, the location of the station shall be convenient for the passengers to reach and with easy access to other transport means. However, it may be more rational to establish a new station in the suburb and to develop its surrounding area because the land acquisition is difficult in the urban area and the railway route will be restricted. Moreover, unless otherwise specific reason, the distance between each station of the high-speed railway will be planned with 20 km or more to avoid lowering of the schedule speed.

Regarding the structure, to avoid excessively long bridge, the route will cross a large river at a right angle as much as possible. In addition, the maximum length of a tunnel will be less than 20 km, and the vertical alignment of tunnel section shall be determined in consideration of the excavation direction and drainage system.

The route shall avoid the disaster hazard areas, such as landslide and fault as much as possible. Moreover, the route needs to avoid passing near the area where adverse impacts on the natural environment, animal protection, etc., are predicted.

3) Comparison of Alternative Routes

Table 2 shows the result of comparative analysis of alternative routes in terms of the route length, topographic characteristics, linkage with other transport means and disaster risks. While the Bandung Route has the steep slope and requires the relatively long tunnel, the Coastal Route runs through the alluvial plain of soft ground. Therefore, the structures shall have the sufficient earthquake resistance. On the other hand, Japan has the experiences of design and construction to cope with those similar issues, so that there will be no technical problems for both routes.

Table 2 Comparison of Alternative Routes for High-Speed Railway

Item	Bandung Route		Coastal Route
	Jakarta-Cirebon	Jakarta-Gedebage	
Length	256.0 km	144.6 km	207.3 km
Topographic Characteristics	Steep slope of maximum 30‰ used to overcome the elevation of 700 m		Not much undulation because the route mainly runs through the plain
Linkage with other Traffic Means	Connect with conventional lines in principal cities and satisfactory accessibility to the planned international airport		Connected to the conventional line in Jakarta, Cikampek, Cirebon
Disaster Risk	Relatively resistive against disaster because of high ratio of tunnel sections less affected by meteorological conditions		As the route passes through the flood-prone plain of soft ground, the route is readily affected by earthquake and weather.

Source: prepared by Study Team

4) Technical Specifications for the High-Speed Railway

The Japanese Shinkansen System will be introduced for Jakarta-Bandung-Cirebon with the following characteristics. The technical specifications of the high-speed railway are summarized in Table 3.

<Characteristics of the System>

- The Shinkansen had no fatal accident during about 50-year operation since 1964. The average delay time per train is less than 1 minute with high safety and reliability.
- Since the designated track is required, it has advantage in the prevention of accident and the increase of transportation capacity compared to the conventional railway.
- Regarding the slope, operation on continuous steep slope of 30‰ has been made at the operation speed of 210 km/h in Japan. Therefore, it is applicable in the steep slope section between Cikampek and Bandung.
- The earthquake detection technology is a unique system of Shinkansen, so that it is valuable in Indonesia which many earthquakes has been occurred.

Table 3 Technical Specification of High-Speed Railway

Parameter		Data
Track Gauge		1,435 mm
Power Supply System		AC25kV/50Hz
Maximum Operating Speed		300 km/h
Number of Car per Car-Train (MT ratio)		12 cars (9M3T)
Passenger Capacity (for reference: estimate)		12-car train with 960 passengers
		Mono-class: 5-row seats All reversible reclining seats
Maximum Axle Load (with capacity passengers)		14 t or less
Car Principal Dimensions	Length (head/tail car)	26,500 mm
	(intermediate car)	25,000 mm
	Maximum Width	about 3,350 mm
	Maximum Height	3,700 mm
	Wheel Base	17,500 mm
Body Structure		Aluminum double-skin body structure (airtight body structure)
Bogie	Design	Bolsterless type
	Wheel Diameter	$\Phi = 860$ mm
	Wheelbase	2,500 mm
Main Circuit	Control System	VVVF inverter control system
		Three-level PWM control with IGBT's
	Main Motor	Induction motor: 300kW/unit or more
	Pantograph	2/car-train
		Single-arm low noise type
Brake System		Electric commanding air brake with regenerative brake
Traction and Braking Command Circuit		Digital transmission control and back-up commanding line
Protection System		Single-step continuous (pattern) control by ATC

Source: prepared by Study Team

5) Demand Forecasting

Based on the number of users of conventional transportation means, the number of users to be converted to the high-speed railway is estimated by using the binary logit model. With interview survey, the acceptability and willingness to pay for the high-speed railway is surveyed and the conversion ratio from existing railway, long-distance bus and passenger car is quantitatively examined. As a result, the appropriate fare between Jakarta and Bandung is calculated as Rp. 200,000. The fares for Bandung Route and Coastal Route are shown in Table 4 and Table 5 respectively.

Table 4 Fare (Bandung Route)

Station	Jakarta	Bekasi	Cikarang	Karawang	Bandung	Gedebage	Sumedang	Kertajati	Cirebon
Jakarta	-	40,000	70,000	90,000	200,000	220,000	260,000	310,000	380,000
Bekasi	40,000	-	30,000	60,000	160,000	180,000	220,000	280,000	350,000
Cikarang	70,000	30,000	-	30,000	130,000	150,000	190,000	250,000	320,000
Karawang	90,000	60,000	30,000	-	110,000	120,000	160,000	220,000	290,000
Bandung	200,000	160,000	130,000	110,000	-	20,000	60,000	110,000	180,000
Gedebage	220,000	180,000	150,000	120,000	20,000	-	40,000	100,000	170,000
Sumedang	260,000	220,000	190,000	160,000	60,000	40,000	-	60,000	130,000
Kertajati	310,000	280,000	250,000	220,000	110,000	100,000	60,000	-	70,000
Cirebon	380,000	350,000	320,000	290,000	180,000	170,000	130,000	70,000	-

Source: prepared by Study Team (Unit: Rp.)

Table 5 Fare (Coastal Route)

Station	Jakarta	Bekasi	Cikarang	Cikampek	Cirebon
Jakarta	-	40,000	70,000	110,000	300,000
Bekasi	40,000	-	30,000	70,000	270,000
Cikarang	70,000	30,000	-	40,000	240,000
Cikampek	110,000	70,000	40,000	-	190,000
Cirebon	300,000	270,000	240,000	190,000	-

Source: prepared by Study Team (Unit: Rp.)

Table 6 Comparison of Traveling Time

Transportation Mode		Jakarta-Bandung	Jakarta-Cirebon
Conventional Railway		3 hours	3 hours
Passenger Car		2 hours	5 hours
Long-distance Bus		2 hours	6 hours
High-Speed Railway	Bandung Route	37 minutes	70 minutes
	Coastal Route	118 minutes (Change to existing railway at Cikampek)	49 minutes

Source: prepared by Study Team

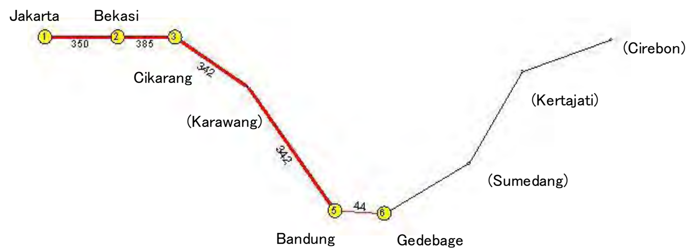
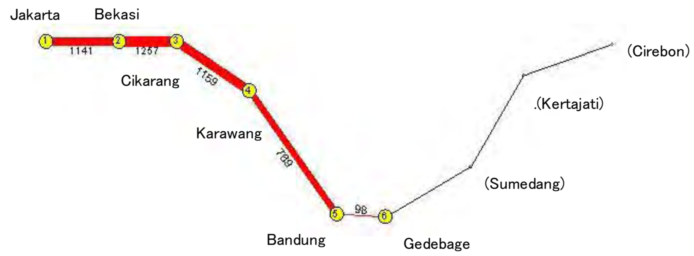
According to the result of the demand forecasting, it is identified that the number of users for the Bandung Route is estimated as 57,000 persons/day in 2020 and 171,000 persons/day in 2050. For the Coastal Route, this will be 17,000 persons for 2020 and 40,000 persons for 2050. It is clear that the demand of the Bandung Route is three or four times larger than that of the Coastal Route.

Table 7 Result of Demand Forecasting

	Bandung Route		Coastal Route
	Jakarta-Cirebon	Jakarta-Gedebage	Jakarta-Cirebon
2020	57,000	39,000	17,000
2050	171,000	127,000	40,000

Source: prepared by Study Team (Unit: person/day)

Table 8 Result of Demand Forecasting

<table>
<tr><th colspan="2"></th><th>2020</th><th>2050</th></tr>
<tr><td rowspan="2">Bandung Route</td><td>Jakarta-Cirebon</td><td>
</td><td>
</td></tr>
<tr><td>Jakarta-Gedebage</td><td>
</td><td>
</td></tr>
<tr><td>Coastal Route</td><td>Jakarta-Cirebon</td><td>
</td><td>
</td></tr>
</table>

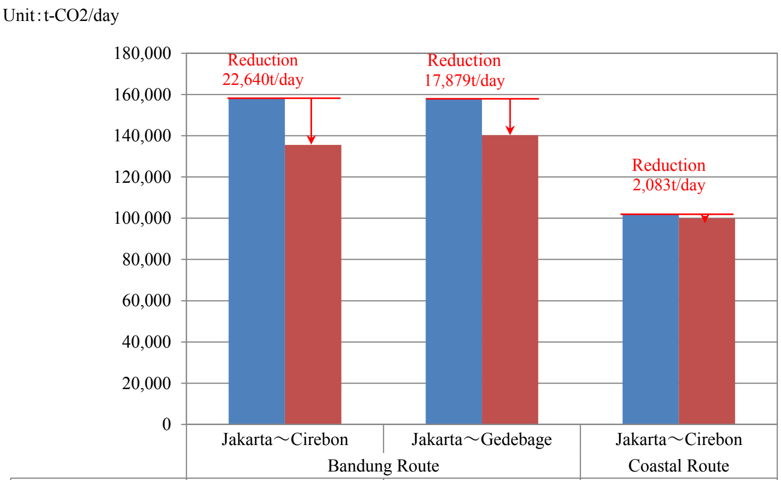
Unit: 100 persons/both-way

Source: prepared by Study Team

6) Environmental and Social Consideration

The Japanese Shinkansen System is designed to enhance the environmental performance such as energy efficiency with light weight, low noise and so on. Moreover, due to the conversion from the conventional railways and passenger cars to the high-speed railway, the traffic congestion will be mitigated resulting in the reduction of CO_2 emission. In comparing the CO_2 reduction in the construction of the Jakarta-Cirebon section, the reduction for the Bandung Route will be more than 10 times higher than that for the Coastal Route.

Figure 4 CO_2 Reduction Effect by Implementation of High-Speed Railway



	Jakarta～Cirebon (Bandung Route)	Jakarta～Gedebage (Bandung Route)	Jakarta～Cirebon (Coastal Route)
Without Project Case	158,207	158,207	101,993
With Project Case	135,566	140,328	99,960

Source: prepared by Study Team

On the other hand, the adverse impacts by the project implementation are indicated as the alternation of the topography in the regulated forests (reserved forest and production forest) by the new structures, the soil runoff and landslide. Therefore, it is necessary to take countermeasures against those issues. Moreover, the involuntary resettlement due to the land acquisition will occur along the routes, so that the land acquisition will be implemented with reasonable and equitable compensation in accordance with the Law No. 2 of 2012 on Land Acquisition for Development for Public Interest, which clearly stipulates the administrative procedures and authorities of the government.

In the environmental and social consideration aspects, the government of Indonesia will be required to conduct the following matters for the project implementation: consensus building among stakeholders, implementation of Environmental Impact Assessment (AMDAL), preparation and approval of Land Acquisition and Resettlement Action Plan (LARAP), implementation of land acquisition and compensation, and establishment of monitoring structure during construction and operation.

Table 9 Land Acquisition and Resettlement

	Bandung Route		Coastal Route
	Jakarta-Cirebon	Jakarta-Gedebage	Jakarta-Cirebon
Land Acquisition (ha)	430	222	360
Resettlement (household)	2,000～3,000	1,200～1,800	1,500～2,000

Source: prepared by Study Team

7) Total Project Cost

The construction costs for rolling stock, land acquisition as well as other required costs for the project implementation costs in Jakarta-Cirebon section are estimated as JPY 726.4 billion for the Bandung Route and JPY 584.2 billion for the Coastal Route. Since the length of tunnel sections is long compared to the total length in the section of Jakarta-Bandung-Gedebage in the Bandung Route, the cost per km is relatively high. The total project costs for all the routes are summarized in Table 10.

Table 10 Total Project Costs

Item	Bandung Route		Coastal Route
	Jakarta-Bandung -Cirebon	Jakarta-Bandung -Gedebage	Jakarta-Cirebon
Civil Engineering (Subgrade Course)	19,401	7,547	12,730
(Bridge)	118,717	90,537	197,216
(Tunnel)	174,955	110,286	54,234
Track Construction Cost	28,211	16,393	26,976
Station Construction Cost	17,200	11,100	11,100
Various Building Cost	4,174	3,340	3,372
Depot Machinery Cost	26,690	23,240	23,150
Power Line Cost	28,070	19,509	23,159
Communication Line Cost	10,101	6,545	8,187
Safety Equipment Cost	24,117	15,760	18,659
System Construction Cost	6,990	6,453	6,698
Train Track Cost	25,716	15,643	19,495
Substation Cost	54,342	38,879	40,863
Rolling Stock Cost	48,000	33,600	28,800
Total Construction Cost	586,684	398,832	474,639
Consulting Service Cost	29,334	19,942	23,732
Tax	61,602	41,877	49,837
Overhead Cost	2,933	1,994	2,373
Land Acquisition Cost	18,883	14,627	11,283
Contingency	26,934	18,262	22,292
Total Project Cost	726,370	495,534	584,156
Project Cost per km	2,837	3,427	2,818

Source: prepared by Study Team (Unit: JPY million)

8) Preliminary Economic and Financial Analysis

With estimation of the economic benefits (reduction of vehicle operating cost and travel time cost) by the project implementation, the Economic Internal Rate of Return (EIRR) is estimated as 13.6 % for the Bandung Route and a negative EIRR for the Coastal Route. These figures proved that the Bandung Route has an advantage over the Coastal Route and that the construction of the high-speed railway on the Bandung Route will be beneficial for the national economy. If the 1st stage construction on the Bandung Route is terminated in Gedebage where there is considerable demand for the railway, EIRR will increase further.

Meanwhile, it is considered difficult for the private sector to construct the high-speed railway even for the Bandung Route by itself because of the low Financial Internal Rate of Return (FIRR). If the government provides 50 % of the initial investment which excludes the cost for rolling stock and station (11 % of total project cost) burdened by the private sector, FIRR will be around 8.5 % for both BOT and Concession Schemes. However, FIRR is improved into approximately 15 % for DBL Scheme. The above-mentioned findings have proven that the construction of the high-speed railway on the Bandung Route is economically and financially feasible with certain financial support from the government.

In accordance with the above examinations, the stage construction between Jakarta and Gedebage is the most preferable due to the high economic and financial feasibility and high demand. The results of economic and financial analysis are summarized in Table 11.

Table 11 Results of Economic and Financial Analysis

Index		Bandung Route		Coastal Route
		Jakarta-Bandung-Cirebon	Jakarta- Bandung-Gedebage	Jakarta-Cirebon
B/C		1.30	1.91	0.11
EIRR		13.6 %	16.2 %	Negative
ENPV (JPY million)		127,295	260,079	Negative
FIRR	BOT (AF 50%*)	8.5 %	8.6 %	4.9 %
	Concession (Gov-S 50%*)	8.4 %	8.6 %	2.3%
	DBL (LC 1.4 %)	15.5 %	15.8 %	Negative

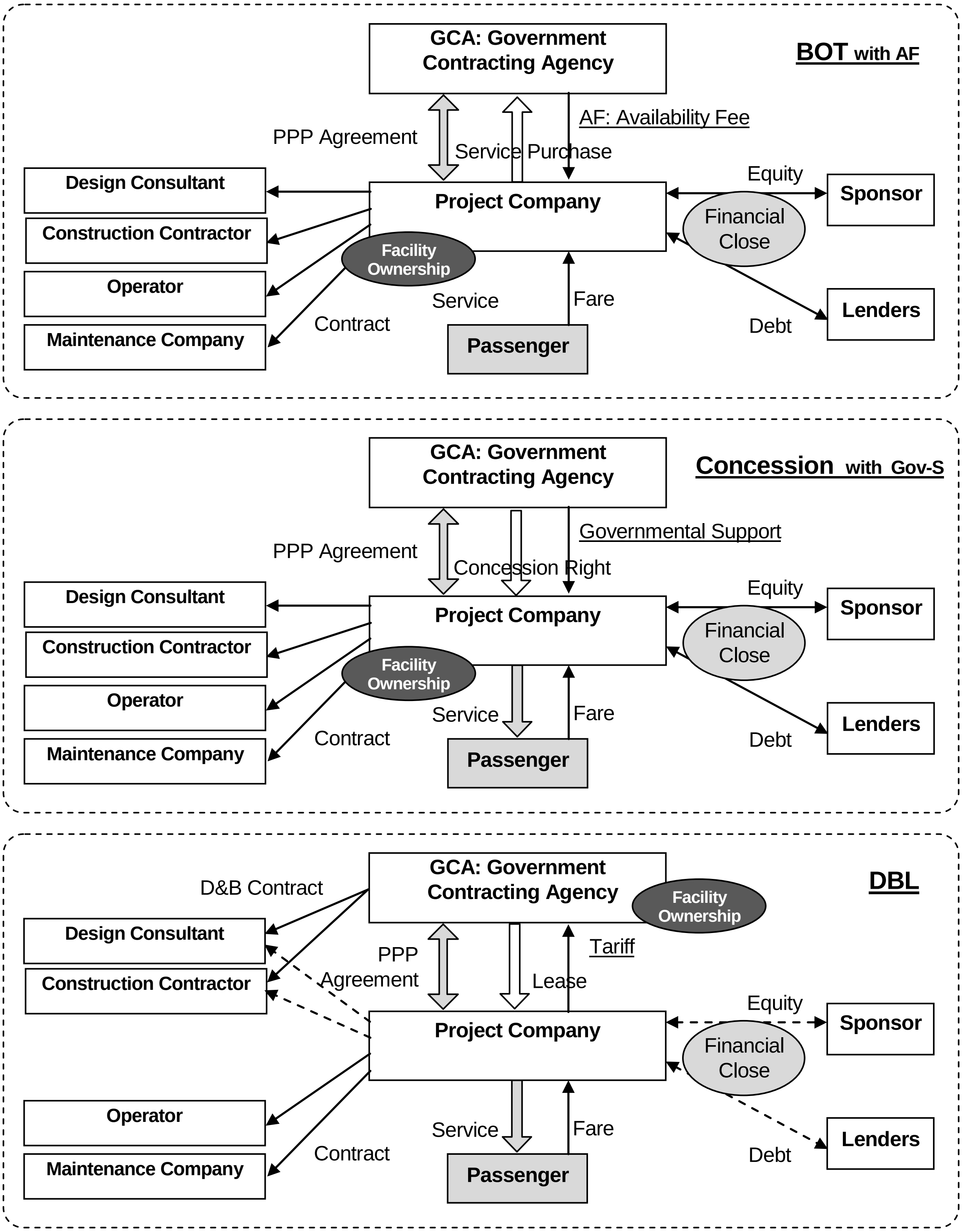
BOT: Build-Operate-Transfer, AF: Availability Fee, Gov-S: Government Support,
DBL: Design-Build-Lease, LC: Lease Cost
* Initial cost excluding rolling stock and station (11 % of total project cost) burdened by the private sector
Source: prepared by Study Team

9) Project Scheme and Prospects for Funding for the Project

In the section between Jakarta-Bandung-Gedebage of the Bandung Route which shows the high economic and financial feasibility, in accordance with the guidelines on PPP and the latest development of PPP in Indonesia, the following 3 project schemes are analyzed for the high-speed railway: 1) BOT (Build-Operate-Transfer) Scheme (with Availability Fees), 2) Concession Scheme (with government support) and 3) DBL (Design-Build-Lease) Scheme. While all the schemes will require financial contribution from the government in one way or another, all of those schemes have potential to be financially feasible. Among those three schemes, the DBL Scheme is considered as a method in which profitability of a private project company is ensured as the financial burden is small throughout the period of project implementation and know-how of the private sector can be utilized to the maximum.

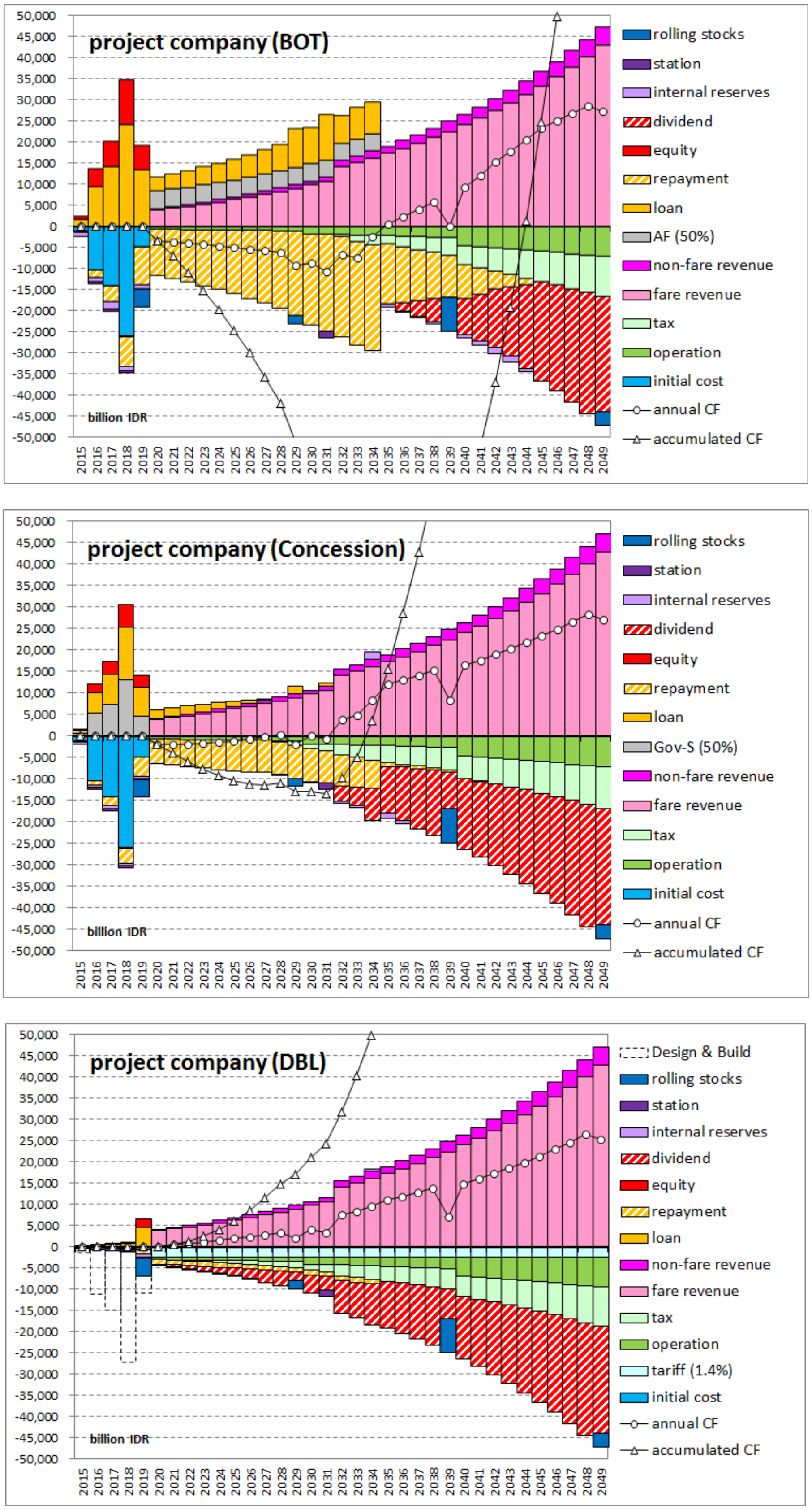
The project scheme, cash flow and comparison of each scheme are shown in Figure 5, Figure 6 and Table 12 respectively.

Figure 5 Analyzed PPP Schemes in the Study (Three Schemes)



Source: prepared by Study Team

Figure 6 Cash Flow (Three Schemes)



Source: prepared by Study Team

Table 12 Comparison of Three Financial Schemes

<table>
<tr><th colspan="2">Item \ Scheme</th><th>BOT Scheme
(with Availability Fee)</th><th>Concession Scheme
(with Gov-S)</th><th colspan="2">DBL Scheme</th></tr>
<tr><td>Description</td><td>-</td><td>- BOT: Build-Operate-Transfer.
- Private sector: design, construction, operation and maintenance, and financing, then transfer the facilities to the public sector after the end of the project period.
- Revenue: fare revenue and Availability Fee paid from public sector for service delivery.</td><td>- Private sector: with concession right, perform design and construction, operation and maintenance, and financing for facilities.
- Private sector is financially independent in principle, but public subsidies will be provided as part of the initial investment to enhance financial stability.</td><td colspan="2">- DBL: Design-Build-Lease.
- Private sector: design, construction, operation and maintenance.
- Public sector: purchase constructed facilities by and lease them to, and collect lease fee from private sector.
- Business efficiency is improved through the project company undertaking design and construction management.</td></tr>
<tr><td rowspan="4">Risk Allocation</td><td>Initial Cost Overrun</td><td>Private</td><td>Private</td><td colspan="2">Public</td></tr>
<tr><td>O&M Cost Overrun</td><td>Private</td><td>Private</td><td colspan="2">Private</td></tr>
<tr><td>Demand Changing</td><td>Shared
- Guarantee for unpredictable demand decrease is necessary.
- Option: fare revenue flows through public sector.</td><td>Shared
- Guarantee for unpredictable demand decrease is necessary.</td><td colspan="2">Shared
- Guarantee for unpredictable demand decrease is necessary.</td></tr>
<tr><td>Financing</td><td>Private</td><td>Private / Public
* depend on amount of Government Support</td><td colspan="2">Facilities for Lease: Public
Others: Private</td></tr>
<tr><td rowspan="5">CF Analysis</td><td>FIRR</td><td>8.6 % (AF 50 %*)</td><td>8.6 % (Gov-S 50 %*)</td><td>(LC 1.4 %)
15.8 %</td><td>(LC 0.2 %)
18.6 %</td></tr>
<tr><td>LLCR</td><td>1.1</td><td>1.5</td><td>4.6</td><td>4.9</td></tr>
<tr><td>DSCR min.</td><td>1.0</td><td>1.0</td><td>1.1</td><td>1.4</td></tr>
<tr><td>Equity-IRR</td><td>8.7 %</td><td>14.2 %</td><td>34.0 %</td><td>37.4 %</td></tr>
<tr><td>Year to be Profitable</td><td>Annual: 2035 (16th year)
Accumulated: 2044 (25th year)</td><td>Annual: 2032 (13th year)
Accumulated: 2034 (15th year)</td><td colspan="2">Annual: 2020 (1st year)
Accumulated: 2020 (1st year)</td></tr>
<tr><td rowspan="2">Advantage / Disadvantage</td><td>Financial</td><td>(-) It is not favorable if the financing costs in the private sector are high.
(+) Availability fee can mitigate the shortage of funds at the beginning stage of project.</td><td>(+) The effect to lower the cost of funds is high with public funds.
(-) It may require additional measures to cover the shortage of funds at initial stage of operation.</td><td colspan="2">(+) It can take advantage of low interest financing by the public (there is no use of private funds).
(+) It is possible to set the tariff in accordance with the profitability.</td></tr>
<tr><td>Operational</td><td>(+) It can be expected that payment mechanism and project monitoring maintain and improve the level of service.</td><td>(+) By granting concession right, an incentive for private sector will be clear to carry out the project voluntarily.</td><td colspan="2">(-) The degree of utilization of private technology is likely since the property owner is public.
(+) It can be affordable and fare for user can be reduced.</td></tr>
</table>

* 50 % of project costs excluding rolling stocks and stations (as 11% of Total Project Cost) which the project company is responsible for.

Source: prepared by Study Team

(4) Implementation Schedule

As the first phase of the Jakarta-Surabaya high-speed railway, it is considered that the section between Jakarta-Bandung-Gedebage has high feasibility. Moreover, the construction period will be for 5 years including the operation test for 1 year. Therefore, the implementation schedule for the Project is shown in Table 13.

Table 13 Project Implementation Schedule (Jakarta-Bandung-Gedebage)

Items	2013	2014	2015	2016	2017	2018	2019	2020
1. Feasibility Study (Basic Design, Final Business Case, Tender Document, AMDAL)	▬	▬						
2. Preparation of Presidential Decrees	▬							
3. Establishment of BUMN	★							
4. Exchange Note & Loan Agreement		★						
5. Selection of Project Company			▬					
6. Land Acquisition			▬	▬				
7. Detailed Design			▬	▬	▬			
8. Civil Works & Procurement				▬	▬	▬	▬	
9. Training in Operation						▬	▬	
10. Start of Service								▼

Source: prepared by Study Team

(5) Technical Advantages of Japanese Company

Japanese Shinkansen is the first high-speed railway in the world, which started operation in 1964. Due to the shortage of the transportation capacity by conventional railways, it was constructed with designated tracks as the high standard. The conventional railways in Japan employ a narrow gauge of 1,067 mm, but the Shinkansen employs the standard gauge of 1,435 mm. To secure safety during high-speed operation, grade crossing with other transportation means was eliminated and the possibility of collision was thoroughly removed. Also, an epochal concept and the latest technology was introduced in a total system completely different from the conventional trains, such as train method of distributed traction, unified train performance, in-train signal method, highly reliable operation management system, separation of operation with maintenance, and so on. As a result, the exceptional safety and stability are realized together: the speed beyond 200 km/h which a narrow gauge train cannot achieve, no fatal accidents of passengers for 48-year operation, and an average delay of 1 minute or less per a train. The advantage of Japanese Shinkansen System and expected effects of the application are summarized in Table 14.

Table 14 Advantages of Shinkansen System and Effects of Application on the Project

Advantages of Shinkansen System	Effects of Application on the Project
High safety and stability • No fatal accident of passengers for 48-year operation • Average delay of 1 minute or less per train • In Great East Japan Earthquake, the high-speed train safely stopped and there was no injury.	By employing the Shinkansen System to the project, it is possible to realize a high-speed railway having the same safety and stability of Japanese system. Japan's technology for earthquake detection and earthquake-proofing of railway structures will be very beneficial for Indonesia where many earthquakes happen.
Efficiency and mass transportation • Large number of passenger capacity due to wide gauged and car body • High density operation with minimum driving interval of 3 minutes	By increased capacity and high density operation, it can flexibly respond to increased demands due to economic development of Indonesia which has the 4th largest population in the world.
Low-cost infrastructure • Low axle load of rolling stock • Response to continuous rapid slope and sharp curve • Tunnel with smaller cross-section	Low axle load of rolling stock reduces load to the infrastructure, and enables saving of maintenance cost. Due to high acceleration/ deceleration performance, it is possible to respond to continuous steep slopes existing on the route of this project. The tunnel construction technology of Japan will contribute to the project where there are many tunnel sections.
Labor saving maintenance • Employment of AC motors • Inspection car, mechanized maintenance • Slab tracks	Employment of AC motor for the rolling stock, high speed inspection vehicle, and mechanization of facility maintenance, and other labor saving contribute to reduced maintenance cost. Slab tracks require high initial investment amount but the life-cycle cost will be lower including the maintenance cost. If the personnel cost of maintenance staff is low, ballasted tracks may be advantageous.
Environmental compatibility, energy saving • High speed performance and response to severe environmental standard • Low consumption of energy	High speed and response to severe environmental standards (noise, vibration, etc.) will contribute to the protection of wayside environment, and also to higher speed in cities and reduction of construction cost. Smaller operation consumption energy and CO_2 emission contribute to protection of the global environment through shifting to railway from road traffic and airplanes.
Comfort • High comfort through wide seat interval, rotating seats and air conditioning system • Technology to control vibration by active suspension	The high comfort by rotating seats and wide interval between seats will be a great selling point in competition with aircrafts. The vibration control technology by active suspension will improve comfort during running.
Technology of transfer to the existing lines • Realize by changing tracks of existing lines	Due to the necessity of changing tracks and electrification, utilization of this technology is not realistic in Indonesia.

Source: prepared by Study Team

(6) Practical Schedule and Potential Risks for Project Implementation

1) Policy Deciding Process in Indonesia

Since it is difficult for the private sector to finance the construction of the high-speed railway even in Bandung Route (Jakarta-Bandung-Gedebage) by itself, a certain type of involvement of the public sector will be needed. In particular, the following supports will be required.

a) Involvement of Public Sector in Financing the Initial Costs

Involvement of the public sector is essential in securing long-term low-interest-rate loans. The government may a) pay for the services provided by project company for a certain period of time during the project period (BOT Scheme), b) provide a financial support to project company in the initial costs (Concession Scheme), or c) finance the entire project costs and receive payback from project company in the form of lease fees after the company commences the operation (DBL Scheme). The Government of Indonesia has conducted the projects with BOT Scheme. For the use of Concession Scheme, it is necessary to coordinate and consensus building among the related government institutions in accordance with the legalization process on government subsidy. Even though the DBL Scheme is a new scheme in Indonesia, it is a scheme to encourage the participation of the private sector. Therefore, it is necessary to examine the applicability of DBL Scheme for the project implementation in line with the relevant legal frameworks in Indonesia.

b) Deregulation

Since it is possible to be difficult to cover the repayment of debt by the ticket sales revenue, the analysis on the incentive mechanism for the private sector will be required, such as tax exemption and granting of the concession for the area development along the high-speed railway route.

2) Land Acquisition

In case of the implementation of the high-speed railway in the section of Jakarta-Cirebon of the Bandung Route, the land acquisition is required for 430 ha. with the involuntary resettlement of 2,000 to 3,000 households. However, considering the total length of the route in 256 km, the impacts by the land acquisition and resettlement will be minimized since the available lands for the existing toll roads and railways are utilized. Moreover, the land acquisition and the resettlement shall be conducted with reasonable and equitable compensation.

(7) Map of Project Site in Indonesia

The map showing the study points is shown in Figure 7 below.

Figure 7 Map of Study Area

Source: prepared by Study Team based on Google Map