

Socialist Republic of Vietnam
Vietnam Railways

**Preparatory Survey for
Hanoi City Urban Railway
Construction Project (Line 1)**

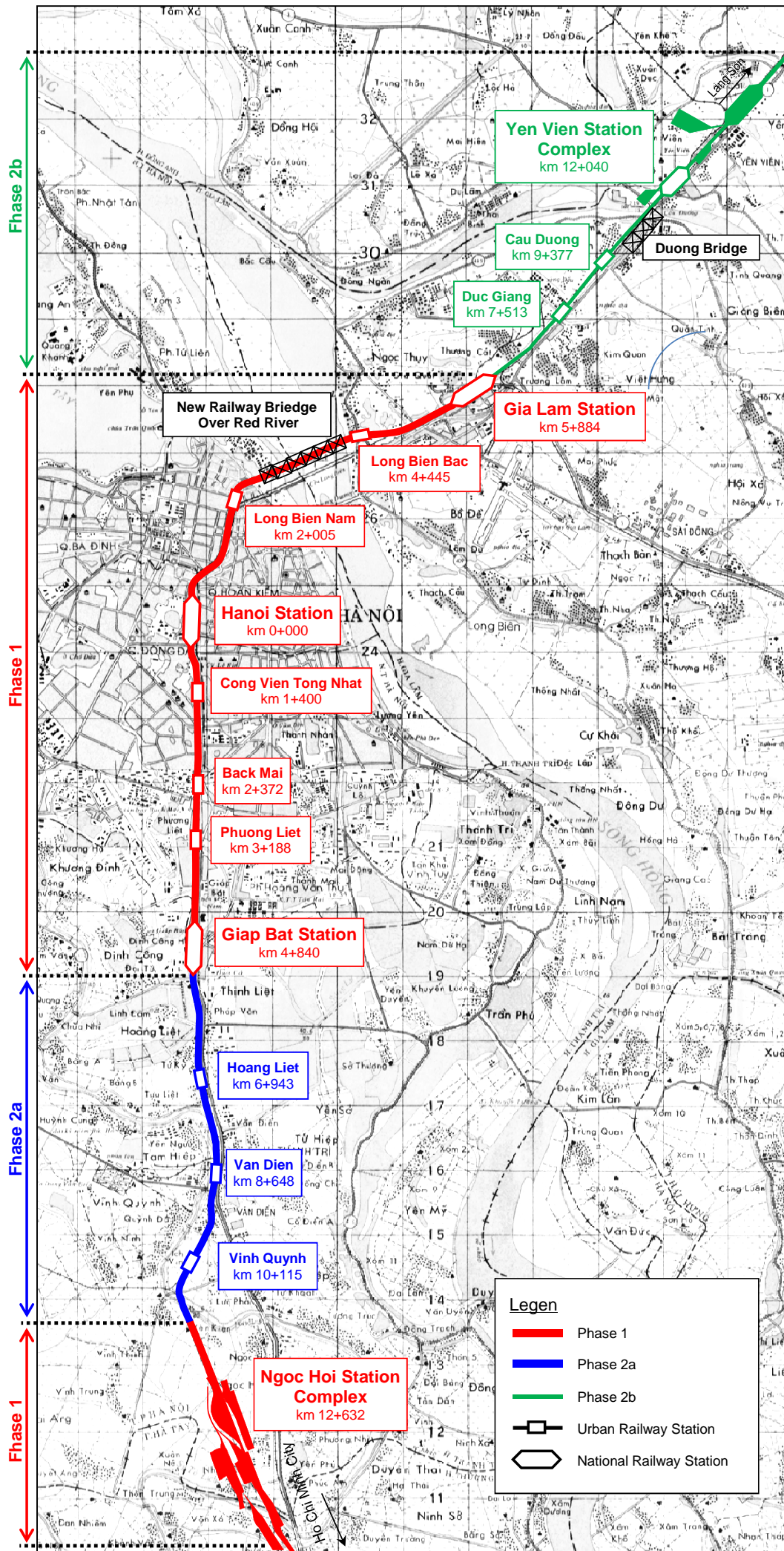
**Final Report
Summary**

April 2012

Japan International Cooperation Agency

**Japan Transportation Consultants, Inc.
Japan Railway Technical Service
JR East Consultants Co., Ltd.
The Japan Electrical Consulting Co. Ltd**

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HANOI CITY URBAN RAILWAY CONSTRUCTION PROJECT (LINE 1)
PROJECT LOCATION MAP

PROJECT LOCATION MAP
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ABBREVIATIONS

Relevant Organizations

ADB	: Asian Development Bank
EVN	: Electricity of Vietnam
DPC	: District People's Committee
DRCC	: Sub-consultant of Hanoi City Urban Railway Construction Project Line 1
GOV	: Government of Vietnam
HAPA	: Hanoi Authority of Planing and Architecture
HATEC	: Hanoi Telecom and Electricity
HPC	: Hanoi People's Committee
HRB	: Hanoi Metropolitan Railway Transport Project Board
HUPI	: Hanoi Urban Planning Institute
JBIC	: Japan Bank for International Cooperation
JETRO	: Japan External Trade Organization
JICA	: Japan International Cooperation Agency
JKT	: The Association of JTC, JARTS, JRC, JEC, KK, TRICC, TEDI and TEDI-S
MOC	: Ministry of Construction
MOF	: Ministry of Finance
MOT	: Ministry of Transport
MONRE	: Ministry of Natural Resources and Environment
MPI	: Ministry of Planning and Investment
PMULAR	: Project Management Unit of Land Acquisition and Resettlement
RPMU	: Railway Projects Management Unit
SAPI	: Special Assistance for Project Implementation
TRICC	: Transport Investment and Construction Consultant JSC
VNR	: Vietnam Railways
VNRA	: Vietnam Railway Administration
Vietnam	: The Socialist Republic of Vietnam
WB	: World Bank

Technical Terms etc.

AFC	: Automatic Fare Collection System
AT	: Auto Transfer
ATP	: Automatic Train Protection System
BD	: Basic Design

BOT	: Build-Operate-Transfer
BRT	: Bus Rapid Transit
CCTV	: Closed Circuit Television System
CBTC	: Communication Based Train Control
CDM	: Clean Development Mechanism
CTC	: Centralized Traffic Control
DCSRP	: Detail Compensation Support and Resettlement Plan
DD	: Detailed Design
EIA	: Environment Impact Assessment
EMU	: Electric Multiple Unit
ES	: Engineering Services
E&M	: Electrical and Mechanical
FS	: Feasibility Study
HAIDEP	: The Comprehensive Urban Development Programme in Hanoi Capital City
HAIMUD	: The Project on Integrated UMRT and Urban Development for Hanoi
IOL	: Inventory of Loss
LA	: Loan Agreement
MRT	: Mass Rapid Transit
OCC	: Operation Control Center
OCS	: Overhead Catenary System
ODA	: Official Development Assistance
OFF-JT	: Off the Job Training
OJT	: On the Job Training
O&M	: Operation and Management, Maintenance
PA	: Public Address System
PC	: Prestressed Concrete
PQ	: Pre-qualification
RAP	: Resettlement Action Plan
RC	: Reinforced Concrete
RLB	: Red Line Boundary
SSP	: Sub-sectioning Post
STEP	: Special Terms for Economic Partnership
SCADA	: Supervisory Control and Data Acquisition
TDM	: Traffic Demand Management
TOR	: Terms of Reference
UMRT	: Urban Mass Rapid Transit
UT	: Urban Train

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INTRODUCTION: Outline of the Project

Background of the Request for the Project

Because of the urbanization that has arisen as a result of economic development and population growth coupled with the increase of road traffic, Hanoi, the capital of Vietnam, is facing severe urban traffic problems such as traffic jams, a decrease in traffic safety, difficulty in access to urban services, etc. as well as environmental problems such as air and noise pollution; the combined effect of all these issues is now emerging as a great public concern. If measures are not taken promptly to resolve this situation, these problems will lower the urban functionality and productivity of the capital, limit the smooth and rapid economic growth it has so far enjoyed and adversely affect civic life. Due to the situation in which a wide-range of reinforcement of transport capacity of the existing public traffic and road network is difficult, the development of urban mass rapid transit system is becoming a very important policy objective.

Out of recognition that the construction of an urban mass rapid transit system is essential and a pressing need, the Vietnamese Government prepared the “Hanoi Traffic Plan till 2020” in 2003. Within this plan, first priority is given to the Hanoi elevated railway project Ngoc Hoi - Yen Vien and the pre-feasibility study for the project was done by Vietnam Railways (VNR) in July 2005. This survey was done based on the FS conducted by Japan External Trade Organization in March 2006. It was submitted to MOT as the final FS report and approved in March 2008.

In 2008, an engineering service loan (LA No.VNXV-2) was provided for Phase 1 of Hanoi City Urban Railway Construction Project (Line 1). At first, the procedures of yen loan for construction cost and construction supervisory consulting cost of Phase 1 section was planned to be carried forward. However, during the basic design stage, from the inauguration of the Phase 1 section to the inauguration of the Phase 2 section, difficulties in the operation plan and issues of construction cost of the temporary equipment were discovered, as a consequence, the VNR requested JKT to consider the simultaneous construction of Phase 1 and Phase 2a. Following assessment and evaluation, it was confirmed that simultaneous construction would result in cost savings in temporary equipment, operations, increase of passenger demand and so on. Based on this conclusion, approval to proceed with the simultaneous construction of Phase 1 and Phase 2a was agreed at a general meeting of MOT, HPC, VNR held in November 2011. As a result, the Phase 1 design work is being proceeding under the assumption that Phase 1 + 2a will open at the same time. It should also be noted that, VNR is preparing a FS report for Phase 2a.

VNR declared that they expected a JICA contact mission sent in August 2011 to accept a Yen loan for Phase 1 and Phase 2a at the same time. JICA side requested that Phase 2a FS must be accepted in the Government of Vietnam side and be included in the scope officially, and have been waiting for the official decision of the scope from VNR at the present time.

Purpose of the Project

The purpose of the project is to construct a double track railway that can work as an urban mass rapid transit system in the area between Ngoc Hoi and Yen Vien (25.5km), instead of the non-electrified single track railway running through the city of Hanoi, so as to mitigate urban traffic and environmental problems so that it may make for socioeconomic development of the country and for improvement of the current environment circumstances in the city.

Outline of the Project

The project consists of the construction of , double track • elevated • electrical railway between Ngoc Hoi~Yen Vien and the Ngoc Hoi Station Complex. In addition, the project also includes the construction of 5 terminal stations that are stops for urban railway as well as middle-distance and long-distance passenger trains (red circle in the figure below) and 10 urban railway stations (blue rectangle in the figure below) that are stops for only urban railway are constructed. The project is separated into the following 3 phases:

- Phase 1 : Giap Bat - Gia Lam (Approximately 12.6 km) and Ngoc Hoi Station Complex
 Phase 2a : Ngoc Hoi - Giap Bat (Approximately 5.6 km)
 Phase 2b : Gia Lam - Yen Vien (Approximately 7.3 km)

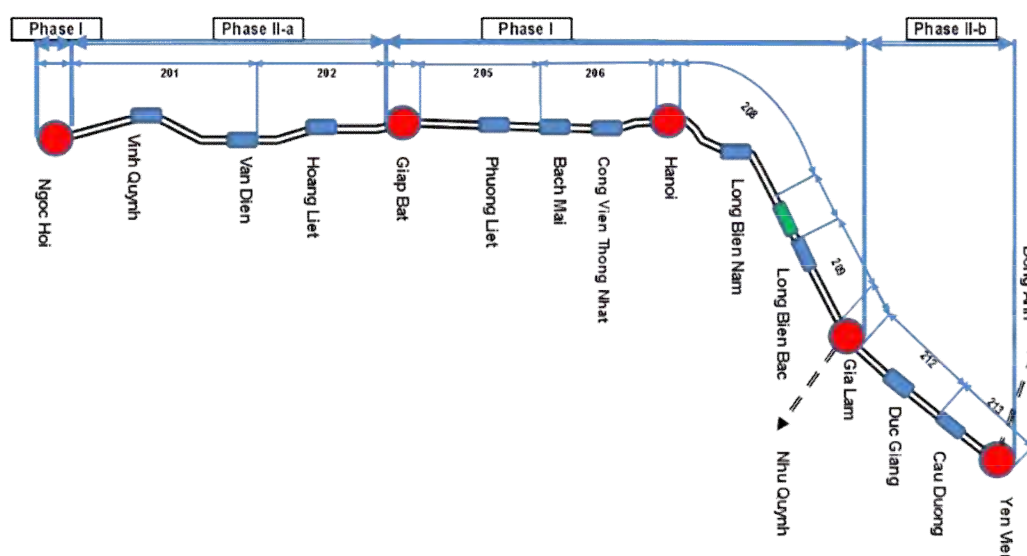


Fig. S-1 Hanoi City Urban Railway Line 1

Phase 1 Giap Bat – Gia Lam section runs north to south across residential areas in the center of Hanoi City. The areas along Phase 2a and 2b are located in the suburbs of Hanoi City. These areas are being developed along with expansion of residential areas.

Hanoi City Urban Railway Line 1 is constructed using standard gauge (1,435 mm). Operation of international passenger trains from China (1,435 mm) and domestic middle-distance and long-distance trains (narrow gauge 1,000 mm) by Hanoi Station is stipulated as precondition, therefore track construction will comprise of three-rail tracks to support the operation of both standard gauge and narrow gauge trains.

Purpose of Preparatory Study

The purpose of the Preparatory Study is to perform a preparatory survey in advance of and to support a Yen loan for the construction. The scope of the study includes:

- Review of the FS report for Phase 2a;
- Research and obtain information required for implementing the yen loan;
- Verification and validation of the information collected; and
- Verify the simultaneous implementation of Phase 1 and Phase 2a.

1. PRESENT STATE OF THE URBAN TRANSPORT SECTOR OF VIETNAM

1.1 Identification of the present state and tasks of the urban transport sector of Vietnam

The population of two large cities of Vietnam; Hanoi and Ho Chi Minh as of the year 2010 was 6.6 million for Hanoi and 7.4 million for Ho Chi Minh. In both cities, more than 80% of the households have motorcycles. The rate of households owning the passenger cars is still low at about 2%, which however is expected to increase in the future along with the growth of GDP per capita.

When compared with other Asian cities, the modal share of both cities indicates extremely higher ratio of private mode with motorcycles. The ratio of public mode is lower. Since traffic volume is growing yearly, road congestion has happened everywhere around city. If this trend is left as it is, road congestion of the inner core will become more and more serious, exerting adverse affect on the socioeconomic activities. Finally, it is highly possible that the competitiveness of the city will be deteriorated and the living environment will worsen.

Therefore, both cities need undertake the Transit Oriented Development. Development of signals, road signs, and pavement markings, as well as traffic regulations, improvement of intersections, provision of the parking area, and implementation of Transport Demand Management (TDM) are also necessary.

1.2 The Importance of Line 1 based on Existing Master Plan

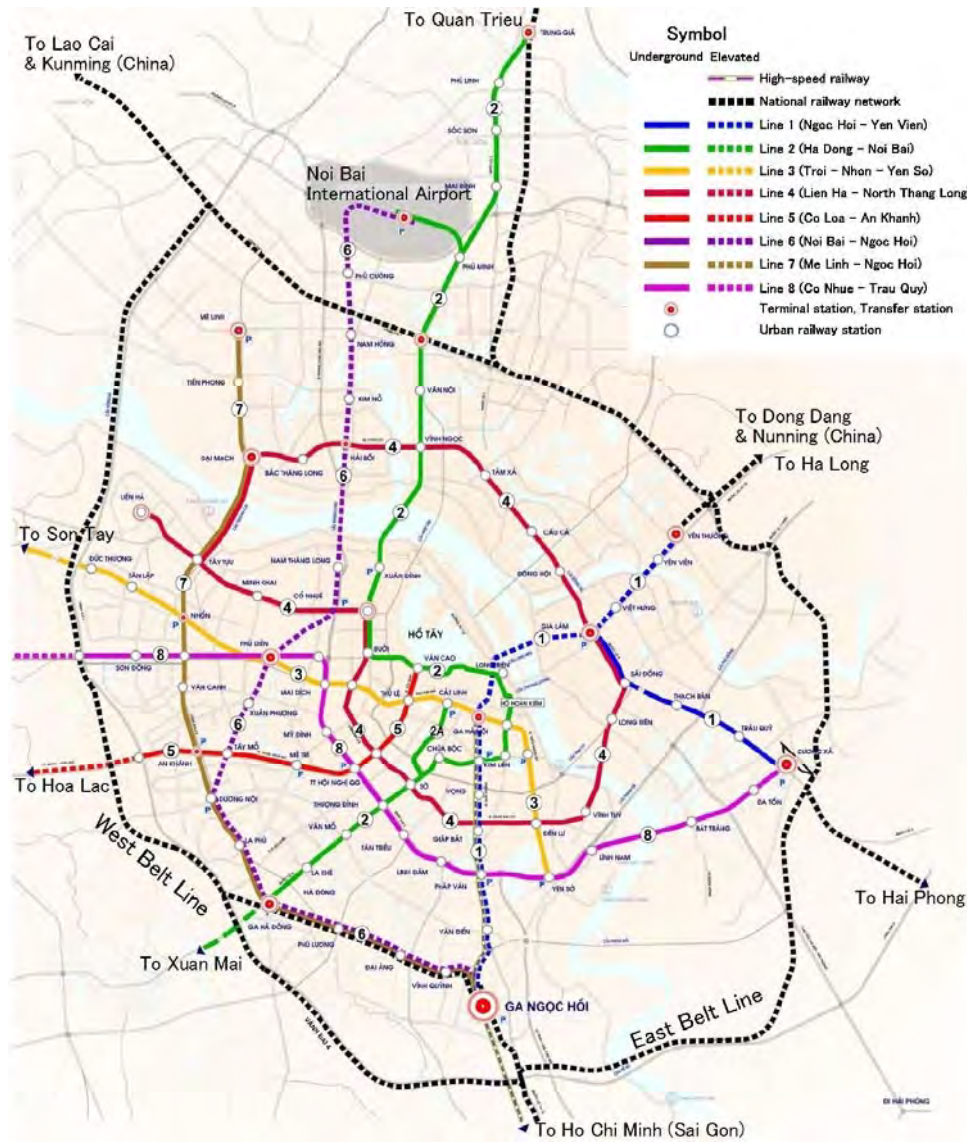
In 2003, Ministry of Transportation (MOT), Hanoi People's Committee (HPC) and Vietnam Railways (VNR) recognized that construction of urban mass rapid transportation system is indispensable, and then settled a decision named "Transportation Plan of Hanoi City to the year 2020". In this decision, the railway elevation project between Ngoc Hoi and Yen Vien is stipulated as a high-priority project.

JICA established a development master plan of Hanoi City to the year 2020 through Hanoi Integrated Development and Environment Program (HAIDEP) in March 2007. Development of public transportation facilities was decided as a basic strategy. Network of main line will be served by urban railway, metro and BRT. Meanwhile, secondary line and feeder line will be served by bus. A belt line will be developed with radius about 30km to 40km from the center Hanoi. Inter-city railway will serve outside area of the belt line and urban railway will serves inside area of the belt line. Eight railway lines, which stipulated in MOT's master plan, were suggested to be unified into UMRT Line 1 until Line 4. The section between Ngoc Hoi and Yen Vien is a part of UMRT Line 1. Both stations of Ngoc Hoi and Yen Vien will be nodal points of the future belt line. HAIDEP prepared demand forecast for urban railway line of UMRT Line 1 to Line 4. Among these UMRT lines, construction priority of UMRT Line 1 is high because this line has highest traffic density.

Afterwards, the Prime Minister settled a decision in July 2008 named, "The Planning on Development of Hanoi Capital's Communications and Transport till 2020". In this decision, urban railway Line 1 to Line 5 which located almost inside the Belt Line as shown in HAIDEP, are planned to be constructed before 2020. Only Line 1 is stipulated to be constructed in early

stage. Section between Ngoc Hoi and Yen Vien will be constructed until 2015, especially the Gia Lam – Hanoi section will be constructed until 2010.

In July 2011, the Prime Minister approved a Decision No. 1259/QĐ-TTg July 26, 2011: “General Construction Plan of Hanoi Capital City till the Year 2030 with a Vision to 2050”. This decision stipulated three additional lines besides the planned 5 lines above. These are the existing West Belt Line being used as a freight line as Line 6, a line from south to north in the west side of the city as Line 7 and a line from West to East as Line 8. Although priority level and development period of each urban railway line is not stipulated, Line 1, 2 and 3 are currently under development.



Source: General Construction of Hanoi Capital City till the Year 2030 with a Vision to 2050

Fig. S1-1 Railway network plan of Hanoi City

1.3 Confirmation of transport demand forecast for the Hanoi City area

The major surveys on future demand forecast in Hanoi urban area are “The Comprehensive Urban Development Programme in Hanoi Capital City” (HAIDEP, 2004 – 2007) conducted by JICA and “The Project on Integrated UMRT and Urban Development for Hanoi” (HAIMUD, 2009 – 2011). HAIMUD established the station facilities development plan and the strategy for its implementation and proposed the policy and framework for development of the area around the station for the UMRT 1 route (Yen Vien – Ngoc Hoi) and UMRT2 route Phase 1 construction section (Nam Thang Long – Thuong Dinh), for which the development based on UMRT yen loan and review are under way. The transport demand forecast of HAIMUD was based on the Do Maximum Case (demand forecast in case that all of the proposed projects are implemented) of 2020 of HAIDEP, and transport demand forecast in case that UMRT and development around stations are conducted together was calculated. The number of passengers by Line 1/2 is as shown in the table below.

Table S1-1 Number of UMRT Passengers by Line1/2, 2020

UMRT	No. of Pax (000/day)	
	Base Case	UMRT with integrated urban development
1	337	390
2	318	351

Source: HAIMUD (2011)

1.4 Assistance of other donors in urban transport sectors

Supports from other donors in Hanoi urban railway and summary of urban railway Line 1 to 8, are described in the table below.

Table S1-2 Supports From Other Donors in Hanoi Urban Railway

UMRT	Project	Route Length (km)	Total Cost (bil. VND)	Project Owner
1	Ngoc Hoi –Yen Vien –Nhu Quynh	38.7	38,390	VNR
2a	Hanoi –Ha Dong –Xuan Mai	38.0	26,675	VNRA
2	Noi Bai –City Center –Thuong Dinh	33.9	44,715	HPC
3	Son Tay –Nhon - Hanoi Sta. –Hoang Mai	41.0	67,659	HPC
4	Dong Anh –Sai Dong –Hoang Mai –Thanh Xuan –Tu Liem –Thuong Cat –Me Linh	53.1	6,107	HPC
5	South West Lake –Ngoc Khanh - Hoa Lac-Ba Vi	51.5	25,908	HPC
6	Noi Bai –Bac Hong	-	-	VNR
7	Me Linh –Ngoc Hoi	-	-	-
8	Co Nhue –Trau Quy	-	-	-

Sources: Prepared by JICA Survey Team based on Decision No.1436 dated September 10, 2009 and No. 1259 dated July 26, 2011

2. COLLECTION AND ANALYSES OF NECESSARY INFORMATION FOR IMPLEMENTATION OF YEN LOAN PROJECT

2.1 Outline of Hanoi City Urban Railway Construction Project (Line 1) and Background of the Request for the Project

2.1.1 Outline of the Project

Refer to Introduction Chapter (Page S-2)

2.1.2 Outline of the Project

The outline of the project is described in the Introduction Chapter (Page S-2), however, we provide below some additional information.

The consulting services for this project has been conducted by the Association of JKT (JKT) which is comprised of 8 companies including as Japan Transportation Consultants Inc., Japan Railway Technical Service, JR East Consultants Company, Japan Electrical Consulting Co., Ltd., and Koken Architects, INC., local consultants such as Transport Investment and Construction Consultant, JSC, Transport Engineering Design Inc., Transport Engineering Design Joint Stock Inc. South since October 2009. The scope of work for the Phase 1 section (Ngoc Hoi – Yen Vien) includes:

- The preparation of the basic design for the Ngoc Hoi – Yen Vien section
- The preparation of the detailed design for the Giap Bat – Gia Lam section; and
- Tender assistance for the construction work in the Giap Bat – Gia Lam section.

2.2 Necessity of implementation of this project

The current road traffic conditions, traffic accident and air pollution in Hanoi City has rapidly deteriorated in recent years due to a combination of the increase in the urban population and the increased use of motorcycles as a means of transport. Moreover, it is forecasted that, due to increases in income, a proportion of motorcycle traffic will be converted to cars. If this tendency will continue, it is forecasted that road congestion in Hanoi City will be more serious and exert greater impact on the socioeconomic activities. Furthermore, as a consequence of these changes, it is highly likely that both the competitiveness of the city and the living environment will deteriorate. To overcome this problem Hanoi City must create a sustainable urban transport system. A particularly successful means of achieving this goal, as experienced in other worldwide cities, is to give priority to the development and implementation of a public transport system that avoids reliance on private vehicles and to promote the Transit Oriented Development (TOD). Considering the scale of Hanoi City, to effectively reduce the reliance on motorcycles and motor vehicles, the UMRT must form the trunk transit line and integrate into its design a feeder bus routes and connections from the outset of the design.

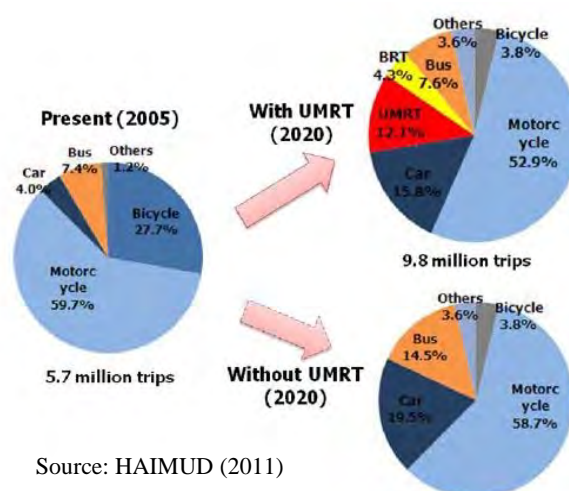


Fig. S2.2-1 Change in Transport Mode Composition

2.3 Review of outline of the plan of this project, materialization (Phase 2a)

2.3.1 Review of demand forecast

Our review of the demand forecast confirms the forecasted OD table (prepared by the HAIMUD study team) between stations in the UMRT line 1 in 2020. We also compared the forecasted Old Hanoi City population numbers in 2020 (prepared by HAIDEP). By using the annual average population growth rate of 2.2% for the seven years between 2000 - 2007 is 2.2%, and assuming the this ratio is constant for future predictions, we calculated that the population in 2020 will increase to 4.3 million people.

Comparing our calculated figure with the figure for population of 4.53 million calculated in the HAIMUD survey, we find that the population figure is 5% larger (230,000) people. However, with regard to demand forecasting, typically a 5% difference does not make a significant difference, therefore we conclude that the OD table between the stations in 2020 (forecasted in the HAIMUD survey) is appropriate.

2.3.2 Compatibility and necessary adjustments with other related lines and projects

2.3.2.1 Relationship with other related lines and projects

1) Other related lines

According to the Hanoi Capital Construction Master Plan in 2030 (Prime Minister's decision July 2011), the Phase 1 and Phase 2a sections of Line 1 intersect with Line 2, Line 3, Line 4 and Line 8 that have been newly added to transport network plan. As a consequence, the overlap with these facilities (station location, supplementary road, etc.) has already been defined and incorporated and hence there are no compatibility problems. However, we note that the horizontal and longitudinal locations of the intersections between Line 1 and Line 8 in Phase 2a are not yet defined. As a consequence, some adjustment will be needed in the future.

2) Items related to Phase 2b, Phase 3 and the East Ring Line

From our review of the Phase 2b, Phase 3 and East Ring Line, we note a difference in the definition of the sections. In the HAIDEP study, the Gia Lam~Nhu Quynh section (the station where the line heads for Hai Phong from Gia Lam intersects with the ring line) is regarded as part of Line 1 (Ngoc Hoi~Yen Vien). According to "The Planning on Development of Hanoi Capital's Communications and Transport till 2020" approved by the Prime Minister in July 2008), Line 1 is defined as the Ngoc Hoi~Yen Vien~Nhu Quynh sections (38.7km). Because VNR calls the Gia Lam~Nhu Quynh section Line 1 Phase 3, the same name will be used in this study.

Considerations related to the implementation of Phase 2b and Phase 3

VNR plans to double track, electrify and elevate the Gia Lam~Nhu Quynh section under Phase 3. This is related to the expansion of Hanoi and urban development plans which aim to create residential and industrial areas on the north-eastern side of the Red River.

In the first FS it was proposed that either the passenger trains from Hai Phong conduct shuttle operations at the station next to Gia Lam or that, as part of Phase 1, a temporary station is constructed to serve these operation. The FS also proposed that freight trains

enter the Phase 2 section using the shortcut line before Gia Lam station and then continuing to Yen Vien. As a result of JKT's negotiations with VNR, VNR decided on the construction of a new at-grade station at Gia Lam and an elevated station on the western side of this new at-grade station. VNR also decided on using the existing line of the Gia Lam~Long Bien section for as long as possible, and on using the existing Long Bien Nam station. This would enable passenger trains from Hai Phong to run to the new at-grade station at Gia Lam or to the existing Long Bien Nam station.

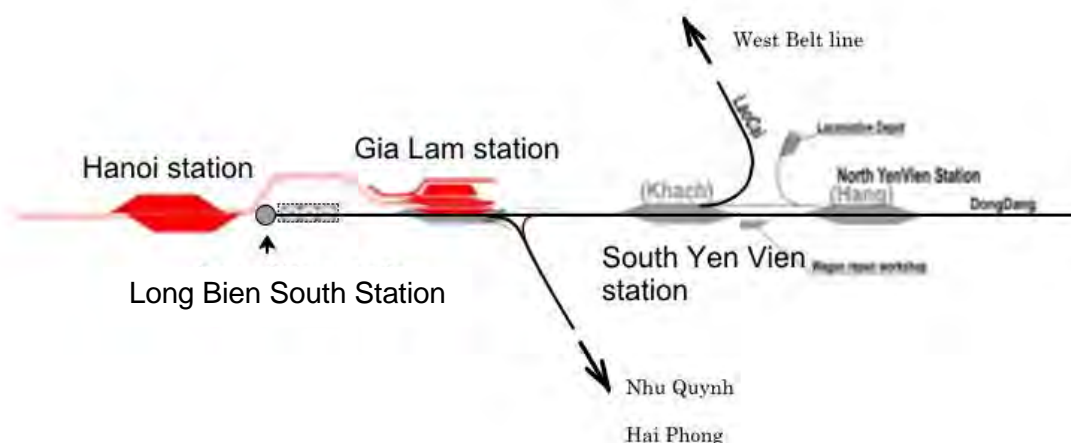


Fig. S2.3.2-1 Train Operation System around Gia Lam Station

Freight trains will run on the existing line to Yen Vien and then take the West Ring Line to the Ngoc Hoi depot. In the first FS, it was assumed that the existing line would have to be removed at the beginning of Phase 2b to make room for the Gia Lam~Yen Vien section, and that the construction of Phase 2b could therefore not begin before the opening of the East Ring Line for freight trains. However, in the meeting between MOT, VNR, HPC and DPC in November 2010, the widening of the ROW and the continued use of the existing line was basically approved, making a detour via Yen Vien possible with no impact from the Phase 2b construction.

VNR is already preparing the land acquisition required for double tracking and is currently negotiating with HPC regarding the connecting line to Gia Lam station. However, JKT's design for Phase 1 does not provide details on how this double tracked elevated line is connected to Gia Lam station or on how to operate the freight trains. As a consequence, this needs to be considered in order to avoid reconstruction of part of the works when Phase 3 is prepared.

Necessity of a swift review of the Phase 2b basic design

The decision to widen the ROW for the Phase 2b section outside the existing line means that train operations do not have to be stopped and can continue during construction. VNR is planning the double tracked railway for medium, long-distance • international trains coming from the north using the ROW of the existing line and part of the widened ROW. In addition, VNR is planning double tracking of Line 1 Phase 3, Hai Phong line and

construction of a new East Ring Line. Also, a new Yen Vien station is not constructed at current station's location but at Yen Vien north station. Although basic design of Phase 2b has already been completed, JKT has not considered how to connect the planned lines mentioned above to Line 1 at Gia Lam station in the detailed design for Phase 1. As a consequence of the above, we recommend the swift commencement of the detailed design for Phase 2b including the construction of new Yen Vien station is necessary.

Necessity of East Ring Line construction

The construction start for Phase 2b no longer depends on the opening of the East Ring Line. However, this does not mean that the necessity of the East Ring Line has been diminished. Freight trains from the north run from Yen Vien station on the West Ring Line to Ngoc Hoi freight station and freight trains from Hai Phong travel through the section between Gia Lam and Yen Vien and the West Ring Line to Ngoc Hoi freight station. Therefore, the importance of the West Ring Line as a freight route will increase. However, the route becomes long and transport efficiency is considered low when compared with the case where the East Ring Line is constructed. The West Ring Line will also be used by passenger trains running on Line 6 which increases the likelihood of problems if freight trains are allowed to share the same line. Additionally, the transport efficiency is considered low. Therefore, for operational flexibility and performance reasons, the East Ring Line will play an important role in the future.

3) Related projects

Line 1 will cross not only other railway lines, but also roads and rivers at 4 locations. The overlap with these facilities (horizontal and longitudinal location, landscape, future plan, etc.) has already been adjusted and we do not anticipate a compatibility problem.

4) Plan for station plazas

The Vinh Quynh, Van Dien and Hoang Liet urban train stations are located on the Phase 2a section. Station plazas are needed to integrate train services with other transport modes such as buses and taxis and to increase the convenience of passengers. Although HPC and VNR would basically be responsible for the development and maintenance of the station plazas, it is not clear how this work would be divided among the organizations and a detailed plan for station plazas has not yet been created. Also, the plan is not included in this project. If the station plazas cannot be completed before the commencement of train operations, integrating other transport modes will become difficult, the convenience of train passengers will decrease, and fare revenue will fall short of expectations. Because all this would have serious consequences for the operating company, it is very important to complete the station plazas before train operations begin. We recommend therefore that urgent consultations and meetings between HPC and VNR are held to resolve these issues.

2.3.2.2 Technical standards

In regard to technical railway standards, in Vietnam, the basic framework in the railway sector is the Railway Law (No. 35/2005/QH11). Other laws, ordinances and regulations include the Railway Technology Classification (Ministry of Transport: Ordinance 22TCN-362-07) which specifies the different classes of railway lines, the technical norms for the management of national railways (Ministry of Transport: Ordinance 22TCN-340-05) which form the by-laws of

the Railway Law. In addition, there are regulations for civil structures (bridge and drainage channel design based on limit state: 22TCN-18-79, etc.), electric power (Electricity Law: No. 28/2004/QH11, etc.), signaling (railway signaling regulations, etc.: 74/2005/QD-BGTVT), and communications (Communications Law: No. 41/2009/QH12, etc.).

However, no technical standards for urban railways or comprehensive technical railway standards or regulations exist. Because of this, JICA developed the “Technical Standards for Urban Railways” and “Technical Railway Standards” in 2009 as part of its railway technical standard development project and proposed them to the Vietnamese side. The “Technical Standards for Urban Railways” were issued and published as “TCVN8585:2011 General Requirements for Urban Railway Standards” by the Ministry of Science and Technology in Vietnam in February 2011, while the “Technical Railway Standards” is currently being deliberated the Vietnamese side.

Because standard (1435mm) gauge electric and international trains, as well as meter (1000mm) gauge national trains will share the same Line 1 track, the requirements of narrow gauge, standard gauge and all related standards have to be met, and the urban railway standard thus cannot be applied without modification. In order to resolve this issue, JKT has studied the differences between both existing Vietnamese and Japanese railway regulations. JKT has also examined regulations that require special approval in order to run rolling stock specified according to different standards on the same track. As a result of this, JKT has applied to VNR for special approval of two new items that cannot satisfy existing railway standards. The integration of urban and existing railway standards satisfies the basic requirements of running both urban and long-distance trains on the same track and is important in order to maintain safety.

2.3.2.3 Possibility of sharing equipment

IC Card system and AFC (Automatic Fare Collection Systems) and VNR Vocational College for the education & training of urban railway staff have the possibility of sharing equipment in Hanoi City urban railways. As a consequence, the education & training equipment at VNR Vocational College will need to be provided.

2.3.2.4 Operation and maintenance management

Regarding the operation and maintenance management entity, the integration of Lines 2, 2a and 3 in the O&M Organization appears to be relatively easy in “SAPI for establishment of an organization for the O&M of MRL in Hanoi” which JICA is carrying out. However, with regard to the unification of Line 1, this could present some difficulties since its owner is VNR.

Regarding the revenue for the operating, the fare setting depends not only on the bus fare, but should be considered after further examinations including affordability of the railway fares for people living in Hanoi and the incentive to switch from motorbikes, etc. to the railway.

It should be noted that the introduction of an IT system for the operating company has been already been examined for Ho Chi Minh City Line No. 1 and Hanoi Line No. 2. However, this has not been examined for Hanoi Line No. 1.

2.3.3 Project scope

As a result of review of Phase 2a FS report, we identified items in the technical specifications that are needed to be revised and we have attached in Annex 2, a comparison tables of these items. In summary, we noted several antilogies, where this occurred the technical consistency was checked and is assured. However, we propose that the items we have noted are revised as part of the approval process.

2.3.3.1 Route plan

Because existing trains (narrow and standard gauge) and electric trains (standard gauge) will run on the same (dual gauge) track on Line 1 of Hanoi City Urban Railway, the alignment, track, power, signaling and telecommunications systems, etc. have to comply with both existing railway regulations and new regulations that will be prepared for the electric trains.

Parameters on design, alignment and structure gauge are used for the whole length of the line. Therefore, the alignments of both Phase 1 and Phase 2a are compatible.

2.3.3.2 Vehicle design specifications

The validity of vehicle specifications indicated on the Phase 2a FS Report was analyzed.

Vehicle parameter

The vehicle is planned based on the STRASYA vehicle. The vehicle parameter is the following tables.

Table S2.3.3-1 Outline of vehicle parameter

No.	Item	Outline of parameter
1	Track gage	1,435mm
2	Car Width	3,380mm
3	Vehicle length (Length for two joining center)	20,000mm
4	Platform height	1,100mm
5	Gap between platform edge and car floor edge	100mm
6	Power supply	overhead contact line AC25KV, 50Hz
7	Design speed	120km/h
8	Max. axle load	18,000kg
9	Car height	3,655mm
10	Car floor height	1,100mm<H<1,150mm
11	Distance between bogeyes	13,800mm
12	Wheel diameter	860mm

Source: JKT

Installation of vehicles made in Japan

The following problems existed from a regulated difference of a Japan and a Vietnam:

- The issue of concerning setting of clearance gauge and rolling stock gauge.
- The issue of concerning the gap between overhead line and car body.

However, Vietnam is scheduling the revision of a domestic law and the requirements of the BD will be acceptable.

The car width is larger than general city railway vehicles. However, it is the same level as the width of the Shinkansen vehicle and is a range that can be produced in Japan.

2.3.3.3 Train operation Plan

The validity of Train operation Plan indicated on the Phase 2a FS Report was analyzed.

Train operation Plan

Construction site - The site of the four-track line between Ngoc Hoi - Giap Bat was secured between Gia Lam - Yen Vien. Therefore, an elevated route can be constructed while continuing (safely) the operation of the existing line. However, an elevated railway will be constructed by using the area in the existing line between Giap Bat - Gia Lam. Therefore, the operation of this section cannot continue during construction in this section. In addition, the following changes to the construction of the terminal station are necessary:

- The terminal station of the traveler train from the south is moved from the Hanoi station to the Giap Bat station.
 - ✓ The freight terminal at the Giap Bat station is moved to the Ngoc Hoi station.
 - ✓ The temporary terminal station of the traveler train from the south is constructed in the vacant site of freight in Giap Bat station.
- The terminal station of the traveler train from the North is moved from the Hanoi station to the Gia Lam station.
 - ✓ The stabling yard for terminal is constructed at the Gia Lam station.

After completing the above-mentioned terminal construction, the train between Giap Bat-Gia Lam can be stopped.

Validity of operation plan

The BD concerning the transportation change of an existing train obtains the approval of VNR. It was judged that commencement of construction is possible however, the following issues need to be addressed:

- The process of the abolition of the company that owns line of the Gia Lam station and the Van Dien station is not clear.
- It is necessary to revise the dwell time in each station on the city railway.

2.3.3.4 Civil facilities plan

The Phase 2a section comprises 4 bridges and 3 intermediate stations and the whole of the Phase 2a section consists of a PC girder viaduct. However, the section leading to Ngoc Hoi Complex uses a retaining wall structure because a viaduct structure would not provide sufficient clearance.

We conclude that since the civil facilities of Phase 2a are based on the same fundamental principles as those of Phase 1, the structures along the entire line are integrated and therefore should not present any related issues.

2.3.3.5 Depot, workshop and machinery/equipment

Phase 2a does not include the depot and workshop. However, the Phase 2a FS report mentions the machinery and equipment listed below but does not include detailed items such as air conditioning and ventilation equipment, fire protection and extinguishing equipment, emergency lighting equipment, elevators and passenger guidance systems which are all proposed in JKT's basic design.

- Automatic ticket machines Ticket machines should be capable of handling sales of one-way tickets, one-day tickets and all types of prepaid non-contact IC cards; charging and processing refunds for prepaid IC cards; displaying information for all types of tickets and IC cards.
- Fare adjustment machines Fare adjustment machines are used to adjust the fare after overruns.
- System monitoring Monitoring of automatic ticket machines, fare adjustment machines and fare collection equipment; monitoring of IC card information.
- Fare collection equipment Fare collection equipment for non-contact IC cards.
- Closed-Circuit Television Installation for the monitoring of passenger safety on platforms, in elevators and escalators, and in blind spots not visible to station staff.
- Broadcasting equipment Installation of speakers and sensors on platforms and concourses, in waiting rooms, elevators, etc.
- Passenger guidance systems Installation of monitors on platforms, concourses and ticket machines for the provision of information on departure times, train services and train schedules.

However, in Phase 2a FS report, it is proposed that (1) the same equipment in all stations along the line, (2) the AFC system approved in Phase 1, (3) machinery and equipment for Phase 1, should be used. Although some of the proposed systems, machinery and equipment differ from those in JKT's basic design, the same policies have still been followed. MOT has approved to use an AFC system compatible with the other planned lines in Hanoi and VNR has also agreed to this proposal.

2.3.3.6 Substation, OCS (Overhead Contact System), Power Distribution

The power supply system for Phase 2a section should be consistent with those of Phase I in planning, design and installation. Therefore, we propose the following corrections and additions.

- Integrate the Phase 2 equipment control and management with Phase 1; including the OCS, the distribution system and the electric power SCADA for supervising and control;
- The standby power source to the railway power substation, etc. and the the transmission line to the Ngoc Hoi railway power substation (The conflicting matter between the FS2a report and the updated JKT detailed design after Design change)
- The traction transformer capacity of Ngoc Hoi railway power substation is 25 x2 MVA/ traction transformer according to the FS2a report. To coordination with the contents of the electrification basic design, the % impedance should be modified to 13.6%.
- Perform a study of the capacity of AT (the capacity of AT is 8MVA by the calculation based on the JKT detailed design)
- The train operation diagram for a 4M4T train with a headway of 4 minutes was examined by the JICA team over the section of 1+2a. The FS2a report should include this performance requirement for the future traction power transformer capacity.
- Undertake a study of the consumed electric power and its cost for economical analysis.

2.3.3.7 Signaling and telecommunications

- 1) Consistency of signaling and telecommunications equipment with Phase 2a
Signaling and telecommunication equipment for Phase 2a section is almost consistent with those of Phase I in planning, design and installation. However the central systems (CTC, PRC, CMS) in the operation control center (OCC) for train operation, and monitoring and control of facilities, are not described and therefore must be added in the Phase 2a. Those systems must be renovated in accordance with the installation of signaling and telecommunication equipment on the Phase 2a section.
- 2) Signaling system to be applied
Basic operational conditions required on HURCP Line 1 is as follows.
 - Mixed operations of urban and existing trains
 - Design maximum speed: 120km/h, minimum operational headway: 4 minutes

CBTC (Communication Based Train Control) is discussed on HURCP Line 1. The following alternatives are considered.

To install a CBTC only system: All the possible national and international trains as well as urban trains to enter HURCP Line 1 are required to be equipped with on-board equipment for CBTC system. However, the number of cars that a locomotive can haul varies by train, therefore the train length is inconsistent. Under these conditions, to maintain safe operation, the CBTC system on the equipped trains would need to be configured for the worst-case combination of train length and braking performance. Whilst this is feasible, such an arrangement would reduce the capacity (trains per hour/throughput) of a CBTC system.

To apply both CBTC system and wayside signal system (Track Circuit + ATP): This would require additional wayside equipment and cost as dual wayside equipment (CBTC, track circuits, lineside signals etc) would be needed to facilitate the operation of fitted and unfitted trains. In addition, where two different independent signaling systems are employed, strict operating rules, and adherence to them, by the operations staff is needed in order to maintain safe operation.

To apply wayside signal system (Track Circuit + ATP) (JKT system): The JKT system fulfills basic operational conditions for all train types as required on HURCP Line 1.

In the event that only the urban trains operate on the HURCP Line 1, CBTC system is recommendable. However, if both urban and existing trains operate on the HURCP Line 1 concurrently, the JKT system is recommended. However, if it is planned to adopt CBTC system for mixed traffic operation (urban trains (EMU) and the existing trains (Locomotive train)) on the HURCP Line 1, it is recommended that an independent assessment and study is commissioned to assess the cost-benefit of such an arrangement.

2.3.3.8 Certification System for Scope of Works (Criteria • Standard • Specification) in Vietnam

Design Framework

The “Design Framework” describes the criteria and stipulations applied to this project and approval from MOT is needed. However, in the report for FS 2a, because the criteria and

stipulations applied for Phase 1 are the same as that of Phase 2a and 2b, it notes that the “Design Framework” of all sections is approved by “Design Framework”.

The “Design Framework” submitted to MOT and VNR was partially approved in November 2011 (No. 2520/QD-BGTVT) and the reason why the approval was partial is because both of MOT and VNR cannot confirm since there is no English translation of Japanese standards and criteria. It is assumed that if JKT translates this document into English, there may be a problem due to infringement of copyright. However, if “Design Framework” is not approved, then this will delay the project. Therefore, an outline description of the technical standards and criteria should be prepared and meetings convened between the MOT, VNR and JKT to approve the document.

Approval of Special Stipulation

Vietnamese as well as international criteria • standard can't be applied directly. In the case of applying new standards, the approval from Science and Technology Agency is necessary following “Law Concerning Standard and Technology Approval No.68/2006/QH11” . The approval procedure for new criteria • standard is as follows. Seminars in regard to the draft for new criteria • standard will be completed based on the public comments received in a period of not less than 60 days. The content of the draft will be adjusted in coordination with relevant departments and agencies and submitted to Ministry of Science and Technology for deliberation. The Ministry of Science and Technology will deliberate on the draft and give the notice of acceptance in 60 days after receiving. The official announcement will come in less than 30 days after the acceptance.

The application of new standard in regard to “Signal Principle • Signal System • Signal Display” as well as “Construction • Rolling Stock Limitation” for Line 1 Construction Project needs to be approved following the decree mentioned above. At the present, this new standard has been proposed to VNR with the report explaining the overview. The approval of the 2 new criteria • standards mentioned above requires at least 5 months. Therefore, it is necessary to accelerate the early approval for smooth implementation of the project.

2.3.3.9 Universal design

The FS report for Phase 2a does not include any sections on universal design. Therefore discussions in regard to the security, safety and comfort of all railway facility users including the elderly and disabled have been held with both general users and disabled people, and we proposed the universal design which reflects their opinions and wishes.

2.3.3.10 Station Facility Scale Confirmation

All the stations located in the section of Phase 2a are urban railway ones and only double track is planned because it is planned that no train outruns trains ahead at the section between Ngoc Hoi and Giap Bat. We conclude that this plan is reasonable.

Since these are the first urban railway stations built in Vietnam, there is no standard for station sizing. The station sizing in Phase 2a FS report was designed referring to urban railway stations of other countries. In order to avoid variations in sizing for stations on the same line, the

calculation of every station of Phase 2a should be based on the standard applied for JKT's detailed design. The station scale in JKT's detailed design was based on the estimated ridership in 2030 at every station calculated in HAIMUD's survey. The scale of platform, concourse, lifting and lowering facilities, walkway, toilet, etc. were calculated using this value estimated for 2030 and based on "JR relevant standards and so on". Calculation result of equipment scale for every station is shown below.

Table S2.3.3-2 Station Equipment Scale

Station Name	Platform Width (m)		Stair Width (m)		Number of Automatic Fare Collection Equipment		Number of Fare Adjustment Machine for Official Use	Number of Fare Adjustment Machine for Passenger
	Calculated Value	Using Value	Calculated Value	Using Value	General	Wide		
Hoang Liet	4.57	6.5	1.5	2x2.5	6	1	3	3
Van Dien	4.31	6.5	1.5	2x2.5	5	1	3	3
Vinh Quynh	5.13	6.0	1.5	2x2.5	6	1	4	3

Source: JKT

2.3.3.11 Relocation of Buried Objects and Overhead Wire

In the FS Phase 2a, relocation of interfering objects during construction period was not mentioned. In detailed design stage of Line 1, Relocation plans for electricity, telecommunication cable as well as water supply and sewerage facilities were prepared. After preparing them, it is planned that VNR coordinate with each facility administrator to obtain approval. However, each facility administrator will need to request finance from the HPC for the relocation work or self finance this work. We note that the relocation work is not included in Line 1 project.

Due to the cost of the relocation of power lines, VNR requested a yen loan for the relocation of 10 high-voltage lines (110kV and 22kV) that cross Line 1. Since delay of this relocation work will influence the overall project schedule, financing of this relocation work by yen loan is recommended.

2.4 Examination of Common Items for Phase 1 and Phase 2a

2.4.1 Traffic Management Plan and Safety Control Plan during Construction Period

A safety control system is needed to help assure safety during construction. In accordance with the construction requirements it is needed to be structured not only for the contractor but jointly with the project execution agency and construction supervisory consultant. We understand that plans are being considered to separate the safety management costs from indirect construction cost and make it an independent pay item in order to assure necessary safety measures are taken. We support this approach.

2.4.2 Procurement

2.4.2.1 Project Packages

When project is divided into several contract packages, geographical features, type (field) of works and contract, contract amount, construction schedule, status of Japanese contractors, STEP loan conditions, land acquisition etc. are mentioned as items to be considered. In JKT

plans, items above are considered, we evaluate they are reasonable except a part of integration. JKT plans are shown in the table below.

Table S2.4.2-1 Project Contract Packages Proposed by JKT

(This part was deleted to disclose information in certain period)

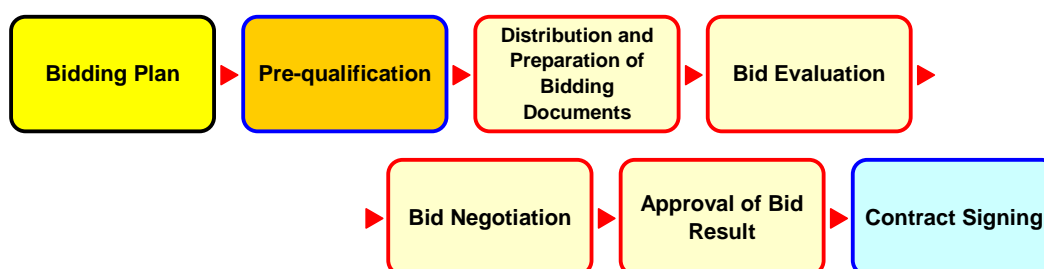
2.4.2.2 Regulation and Procedure for Procurement of Consultants and Contractors, and Approval Procedure in Vietnam

The following laws and decrees shall be applied to the procurement procedure and selection of consultants and contractors. The flow of procurement is shown in Fig. S2.4.2-1.

Table S2.4.2-2 Law and Decree on Procurement Procedure

Class	Name	Number	Issue Date
Law	Construction Law	No. 16/2003/QH11	26 Nov. 2003
Law	Bidding Law	No. 61/2005/QH11	29 Nov. 2005
Law	Law Amending and Supplementing a Number of Articles of the Laws Concerning Capital Construction Investment	No. 38/2009/QH12	19 Jun. 2009
Decree	Guiding the Bidding Law and the Selection of Construction Contractors under the Construction Law	No. 85/2009/ND-CP	15 Oct. 2009

Source: JICA Survey Team



Source: JICA Survey Team

Fig. S2.4.2-1 Flow of Bidding

Based on the laws and regulation, procurement process and duration of procurement in this project is considered with the following table.

Table S2.4.2-3 Procurement Process and Schedule of this Project

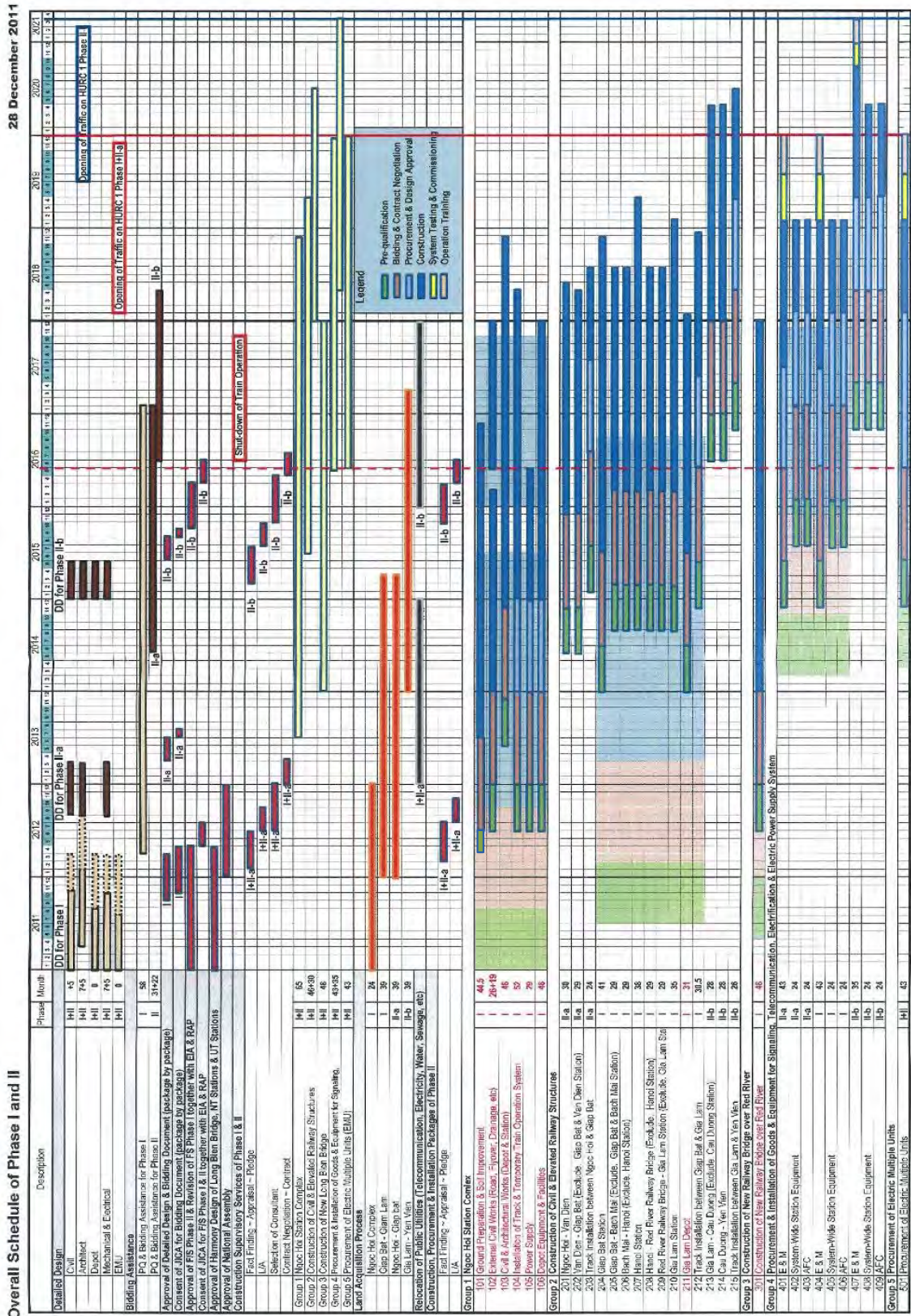
No	Procedure	Executing Agency	Decision Making Agency	Duration according to the Regulation	Duration expected by JICA
1	Bidding Plan	VNR/RPMU	MOT	10 days after submission	
2	Pre-qualification	RPMU/JKT	VNR/JICA	Maximum 45 days after closing	90 days from approval of the document until approval of evaluation result
3	Distribution and Preparation of Bidding Documents	RPMU/JKT	VNR/JICA	Preparation period is at least 30 days	Approval of documents: 90 days Preparation time: 60 days
4	Bid Evaluation	RPMU/JKT	VNR/JICA	Maximum evaluation period is 60 days Bid validity is at maximum 180 days but time is allowed to extend within 30 days	Evaluation by VNR: 60 days Evaluation by JICA: 30 days
5	Bid Negotiation	RPMU/JKT	VNR		60 days
6	Approval of Bid Result	RPMU	VNR/JICA		
7	Contract Signing	VNR/RPMU	MOT/JICA		Approval by JICA: 30 days

Source: JICA Survey Team

2.4.3 Project Implementation Schedule

According to overall project schedule, which prepared by JKT on 28th December 2011, PQ and bidding of package related to Ngoc Hoi Station Complex will be commenced in July 2012. Afterwards, viaduct, station buildings, tracks, E&M and EMU are procured sequentially, and then inauguration of Phase 1 + 2a is scheduled in January 2020. The aforementioned schedule is formulated by assuming that JICA appraisal mission is implemented in first batch of year 2012 and smooth progress of required process and approval in Vietnam. There are some issues that should be solved as mentioned in Chapter 5. By observing critical path of this Project, bidding and construction of Ngoc Hoi Station Complex, which has little problem, could be commenced first. In order to reduce delay of overall construction schedule, the aforementioned issues shall be solved before commencement of other packages.

Table S2.4.3-1 Project Implementation Schedule



Source: JKT

2.4.4 Project Cost Estimate

2.4.4.1 Calculation of Project Cost

Project cost of Phase 1 + 2a is calculated using JICA cost calculation system is shown in the following table. Construction cost was calculated based on basic design prepared by JKT, contingency ratio and tax rate regarding base year, exchange rate, price escalation rate and quantity change are calculated based on JICA. Schedule of construction schedule and land acquisition is stipulated in 2.4.3. Schedule and cost related to detailed design and construction supervision of Phase 2a is prepared based JKT proposal. Cost related to land acquisition is prepared based on FS which prepared by local consultant in Vietnam.

Table S2.4.4-1 Project Cost Calculation (Phase 1 + 2a)

(This part was deleted to disclose information in certain period)

2.4.4.2 Ratio of Local and Foreign Currency

(This part was deleted to disclose information in certain period)

million JPY). Since condition setting of this survey assumed high price escalation for local currency, high ratio of local currency will increase the total project cost. Additionally, the ratio of local currency and foreign currency of the contract amount is 1.64:1 (209,956 million JPY : 128,197 million JPY) which caused by difference of price escalation between local currency (12.6% per year) and foreign currency (1.6% per year).

2.4.4.3 Factors of Construction Cost Increase

Regarding total amount of construction cost for Phase 1 section, its cost based on JKT design is 2.35 times as high as FS stage. Comparison between main items in Phase 1 FS and JKT design, which possibly increase the construction cost, are as follows:

- 1) Price escalation: Price escalation rate in Vietnam has currently been over 10% and exchange rate between VND and JPY has continuously declined for recent years. These two factors lead to the increasing of construction cost, not because conversion into JPY.
- 2) Changes in Design and Quantity Increase by JKT: Change of given of design condition, safety improvement, review of train operation plan, construction conditions and design were caused specification change of structure and equipment, increasing of quantity, which resulted increasing of construction cost. The main factors of these changes are (1) soil improvement, civil, architectural and track of Ngoc Hoi Station Complex, (2) viaduct, (3) stations, (4) elevated Gia Lam Station and Depot, (5) Signal, telecommunication and electrification, and (5) EMU.
- 3) Additional Items by JKT Design: Items which are influenced by this Project, eligible items for the loan amount due to necessity of coordination of timing and connection, which were originally included in Phase 2a but are shifted to Phase 1. Those main additional items, which caused the increasing of construction cost, are: (1) Civil structures outside of Ngoc Hoi Station Complex, (2) Passenger car depot in Ngoc Hoi Station Complex, (3) Power supply equipment and facilities for Ngoc Hoi Station Complex.
- 4) Missing Items and Under-estimated Quantities and Unit Cost in FS: There are several items which are missing in FS and whose quantities and unit prices might be under-estimated even though they are essential items for the project, which caused cost increase. The main items are: (1) Soft soil improvement work of Ngoc Hoi Station Complex; (2) Unit price of depot equipment of Ngoc Hoi Station Complex; (3) Missing items of equipment for freight station in Ngoc Hoi station complex; (4) Unit price of new railway bridge over the Red River; (5) Unit price of turnout; (6) Unit price of signaling and telecommunication and AFC system; and (7) Quantity of EMU, etc.

2.4.4.4 Measurements to Reduce Project Cost (Loan Amount)

In August 2011, JICA Contact Mission strongly required VNR/RPMU to try to reduce the project cost. The possibility of the project cost (loan amount) reduction is examined as follows:

- 1) Implementing Construction Works with Vietnamese Own Fund: there are some construction packages which technically could be conducted by Vietnamese contractors. However, since possible delay of budgeting and construction, problems on quality and coordination between packages, etc. are highly expected, it is desirable that all the packages are eligible for the yen loan in order to smoothly proceed with entire project.

- 2) Reconsidering the number of packages: Increasing the package numbers will increase cost of construction supervision and overhead cost of contractor. However, by reducing the number of packages, scale of each package will become large and risk of contractors is also increased. Since the cost increases due to increasing of packages number are not excessive, and considering the appropriate bidding amount by Japanese Contractors, currently proposed package numbers is reasonable.
- 3) Use of low price material, equipment and construction method: If STEP conditions can be fulfilled, some of targeted item could be changed to cheaper ones from other countries, which possible to reduce construction cost. In addition, there is also possibility of the construction cost reduction in in soft soil improvement work when selecting an optimum method by comparing several construction methods about cost and period.
- 4) Change of Ratio of Local Currency and Foreign Currency: Price escalation rate of local currency is high while foreign currency is low, thus, project cost could be reduced by increasing portion of foreign currency. However, by changing goods which can be procured in Vietnam into imported ones will increase Base Procurement, which cannot be categorized into measurement of project cost reduction.
- 5) Re-consideration of Project Purpose and Design Concept: For significant reduction of project cost, it is necessary to drastically change the project purpose and design concept. One of the major factors of high construction cost is that the existing national railway trains and international trains come into the new urban railway, which requires most of tracks to be dual-gauge. However, to change the judgment of project purpose is not simple. For example, by installation of standard gauge only for elevated railway, several ten billion yen of construction cost could be reduced.

2.4.5 Ratio of Japan Origin Goods

The construction stage of this project is planned to be under STEP loan conditions. The STEP stipulates that total cost of goods and services to be procured from Japan must be no less than 30% of the total amount of contract(s) (excluding consulting services). However, a trial calculation shows that the rate of the total amount of goods under STEP, which a price escalation is taken into account in the expected total amount of contract (excluding consulting services), is 28.9%(Note: The estimation ratio will exceeds 30% by taking into account of steel for station building and factory as well as labor cost of Japanese contractors.). This rate does not satisfy the requirement of the STEP. Therefore, it may be necessary to revise (or add) the goods selection to meet STEP requirement along with monitoring change of price escalation and expected total amount of contract.

The reason of selecting and assumption of goods targeted by STEP are: (1) Design concept has adopted Japanese system (Signaling, telecommunication, OCC system, and AFC system); (2) Design standard has adopted JIS (material for civil structures); (3) Condition and constraints on design (some of depot equipment and facilities); (4) In order to fulfill STEP conditions (materials for architectural structures and buildings, materials and equipment for track structures, EMU).

2.4.6 Necessary Consulting Services for Project Implementation

Currently, detailed design of Phase 1 is being conducted and then bidding stage will be conducted accordingly. In case Phase 1 and 2a are simultaneously constructed, construction supervisory service for Phase 1, and detailed design, bidding assistance and construction supervisory service for Phase 2a are necessary. In addition, consulting services for education and training for new management company and for operation and maintenance are also required.

2.4.7 Examination of Project implementation structure and Operation & Maintenance Management structure

2.4.7.1 Review of project implementation structure and Proposal to secure operation & maintenance management capability in respect of technology & economy

1) Arrangement of jurisdiction task, organization structure, staffs organization and legal positioning

Jurisdiction task, organization structure, and staffs organization

Regarding the yen loan of this project, MOF is Borrower, MOT is Line Agency, VNR is Executing Agency, and RPMU is Implementing Agency. The duty of each organization is borne respectively. "Ngoc Hoi Urban Railway Company" will be established as VNR's internal organization to prepare for the commercial operation.

The issue of legal positioning

Under the Railways Law, the People's Committee is responsible for the urban railway.

2) Arrangement of Financial Affairs, Budget Structure and Technical Standards (Construction, procurement Capability, Etc.)

Financial affairs and budget structure

The total revenue of VNR in 2010 was 6,025,557 million VND (about 23 billion yen, at 1 yen = 250 VND), of which transportation revenue was 3,162,354 million VND (about 12 billion yen). The Vietnam government has put out the subsidy (the same amount subsidy as the transportation revenue) to maintain railway infrastructure to VNR. Each year, VNR's expenses increase and decrease almost in line with its income, Personnel expenses and fuel cost occupy big weight in cost. Comparing fixed assets between 2010 and 2003, since investments in recent years have increased, fixed assets and debts have increased. In addition, capital and capital reserves of equity are increasing, and the owner's equity ratio has also improved.

Technical standards (construction, procurement capability, etc.)

In each section of rolling stock and train operation, civil infrastructure and track, electric power and telecommunications system, etc. will go well if railway experts experienced in construction instruct and supervise the construction work. Moreover, it is necessary to consider education from the construction stage as part of the education and training of Vietnamese staff. Especially because this is the first railway electrification in Vietnam, it is necessary to be careful in construction involving electrification technology.

2.4.7.2 Role of relevant organizations, and Confirmation of contact system with the implementation organization

The main organizations related to construction and management of the Hanoi Urban Railway are shown below: Ministry of Transport (MOT, Line Agency), Vietnam Railway Administration (MOT-VNRA), Department of Planning and Investment (MOT-DPI), Ministry of Construction (MOC), Ministry of Natural Resources & Environment (MONRE), Vietnam Railways (VNR, Executing Agency), VNR Railway Project Management Unit (RPMU, Implementing Agency), Hanoi People's Committee (HPC), Hanoi Metropolitan Railway Transport Project Board (HPC-HRB), Land Acquisition Steering Committee of Hanoi (LASC Hanoi), Hanoi Authority of Planning and Architecture (HAPA).

2.4.7.3 Review of Operation & maintenance management structure, and Planning to secure operation & maintenance management capability in respect of technology & company management

- 1) Arrangement of Jurisdiction task, organization structure, staffs organization and legal positioning

Jurisdiction task and organizational structure

In Phase 1 and Phase 2a of the F/S, it is considered that two companies, Ngoc Hoi Infrastructure Management Company and Ngoc Hoi Urban Railway Company will be established as VNR's organization/parts for the operation and maintenance management of Line 1. However, it was then argued that an asset utilization company (railway property management company), to develop used land around Hanoi Station for example, should be established. But, establishment of VR Land Company to take charge of non-rail business and real estate as VNR's organization is also being considered. It has not yet been decided whether this asset utilization company will belong to O&M company or VNR's whole organization.

Staff organization

The number of personnel of Phase 1 + 2a is expected to be 537. At the proposal of the JKT team, the total number of personnel will be more than 2,000. These numbers are not needed for an urban railway fully equipped with safety and labor-saving equipment. Therefore, this matter should be reconsidered.

- 2) Arrangement of Financial Affairs, Budget Structure, and Technical Standards

Financial Affairs and Budget Structure

In reexamining the financial and economic efficiency assessment and the income-and-expenditure perspective, fare level, AFC and IC Card system, non-rail revenue and cost, personnel expenses, power cost and replacement cost, owner of assets, etc. are reviewed.

Technical standards (operation, maintenance management, etc.)

In each section of rolling stock and train operation, civil infrastructure and track, electric power and telecommunications systems, etc., there are many fields for which technical coaching by railway experts on operation and maintenance management is necessary for succeeding commercial operation. Regarding the education of related personnel in each section, JKT has carefully prepared an "Education & Training Plan for Operation and Management Staff". Therefore, it is necessary to check and adjust this training plan in detail from now on.

2.4.7.4 Provision of technical support for the executing and operating agencies

- 1) The personnel for Line 1 operation: The personnel required for the operation of Line 1 should be produced by increasing the efficiency of the present VNR as much as possible. At present, VNR has 40,000 or more personnel, which is not efficient management even compared with other Asian nations.
- 2) Company setup procedures and education & training system for employees: VNR has established many companies until now, and there is no problem occurring during the setup process. Line 1 will feature many new technologies used for the first time or rarely used in Vietnam, such as electrification, CTC, electronic linkage, ATP, train radio, elastic directly fastened track, continuous welded rail, and track circuit. Therefore, the company must provide training for related staff to master the new technology. It is very important to establish an education and training structure for these engineers, such as an organization within the company or a training center. The qualifications of existing railway staff are regulated clearly in Vietnamese law. Therefore, it is impossible to adopt a flexible education and training system which could increase the efficiency of personnel and employees' motivation as in the railway companies of Japan. The education and training system should be assigned to a company in the future.
- 3) Driving license issuance and MOT approval for certification for the training center as a driving educational facility: The driving license with MOT has already been discussed by Ho Chi Minh City Line 1. If the present view of MOT is applied, there is concern that a long training period for drivers in the urban railway equipped with security equipment will be required. This matter is not considered in Japan. We think that the experience of the driver's assistant in particular is almost meaningless. Because it is the loss of expense and time for Vietnam, the suitable training time should be arranged.
- 4) Technical assistance for educating and training related engineers: A personnel training plan in preparation for Hanoi Line 1 has already been made by JKT as mentioned above. The total expenses that these take will become remarkable, and this training is due to start about four years before starting revenue service. It is necessary to secure budget in order not to miss this timing. In addition, although the building of the VNR Vocational College has been improved, the education and training equipment is very old and even out-of-date. The equipment cannot meet the demand for training staff for the urban railway. A method of supplying equipment to improve the education and training, including operation simulators, should be considered, and with these equipments supply, dispatch of urban railway experts is also needed as lecturer. If this is fixed, it will be possible to also accept urban railway staff other than for Line 1.

2.4.8 Setting of Operation and Effect Indicators and Review of IRR

2.4.8.1 Setting of Operation and Effect Indicators

The indicators and target of year 2022 are set up as shown in Table 2.4.8.1-1

Table S2.4.8-1 Indicators

Indicators		Unit	Target Year 2022
Operation	Volume of transportation	Passengers-km/day	1,939,000
	Number of running trains	Trains/day	244
	Operation Rate	%	85.7
	Running distance of train (4,465km/train-sets x 6 trains/train-set)	Train-km/day	26,790
Effect	Running time between Ngoc Hoi and Gia Lam	Minutes	37

Source: JICA Survey Team

2.4.8.2 Review of IRR

The interview to TRICC regarding Chapter 12 (Assessment on Financial and Economic Efficiency) of the FS Report on Phase 2a prepared by TRICC revealed the wrong manners lying in the analysis. So, JICA Survey Team recommended TRICC to apply the appropriate manners; the economic and financial analysis in this preparatory survey is to be conducted in line with these manners.

1) Economic Analysis

The following 3 benefits are selected and quantified monetarily as economic benefits for this preparatory survey: 1) Saving of Time Travel Cost, 2) Saving of Vehicle Operation Cost and 3) Reduction of CO2 Emission. The economic project cost consists of 1) initial and additional investment cost, 2) replacement cost, and 3) operation and maintenance cost. The EIRR is figured out from the economic benefits and costs, and resulted in the level far below 10% of the opportunity cost of capital as shown in Table 4.7.2.2-1. Consequently, in order to attain the feasible level, a substantial amount of benefit increase and cost reduction is expected.

Table S2.4.8-2 Economic Evaluation

Items	EIRR	Initial Investment Cost Reduction to attain the Feasible Level (EIRR: 10%)
This Preparatory Survey		
Phase 1+2a	3.3%	Original cost: 61 trillion VDN → Reduction to 21 trillion VDN (65% reduction)
For Reference ^(note)		
Phase 1+2a+2b	6.2%	Original cost: 75 trillion VDN → Reduction to 56 trillion VDN (25% reduction)

Note: See Annex 11 for the data used to compute.

Source: JICA Survey Team

2) Financial Analysis

Through the discussion with VNR, the current concept regarding the ownership of the project assets and the borrower of the loan was revealed as shown in Table 2.4.8.2-2. According to this VNR concept, the Government owns all assets and the new company (NC) manages the operation; so the financial analysis is carried out for this NC as a “Base

Case” in this preparatory survey. In addition to Base Case, more 2 subjects are analyzed as references in this preparatory survey.

Assets	Owner	Borrower of Loan	Leasing Fee	Repair	Renewal
1. Infrastructure	VG	VG	Between 8% and 10% of Fare Revenue	VG	VG
2. Stations					
4. E&M				NC	
3. EMU					

Table S2.4.8-3 Current Concept of VNR regarding Owner of Assets and Borrower of Loan

Source: JICA Survey Team

- Reference 1: NC owns all assets with self-finance and operates.
- Reference 2: NC owns E&M/EMU with soft loan, and operates.

Additional conditions:

- 1) Exemptions of taxes due in the initial investment stage
- 2) Government subsidy for additional procurement of EMU after starting of operation

One-time fare is set at 7,500 VND that is the midpoint level between the minimum fare of bus (3,000 VND) and the initial fare of taxi (12,000 VND). Regarding a prepaid-ticket IC (Integrated Circuit) card, 50% (in 2020) and 90% (in 2049) of passengers are expected to buy it with a privilege of 10% discount on the one-time ticket. Non-fare revenue is estimated at 1% (note) of the fair revenue in 2020, 5% in 2021, 7% in 2022, and 10% in 2023 afterwards. The financial project cost consists of 1) initial and additional investment cost, 2) replacement cost, and 3) operation and maintenance cost. The FIRR are figured out from the above revenue and financial costs as presented in Table 2.4.8.2-3. The FIRR of base case is too high; meanwhile, the FIRRs of other 3 cases are resulted below 10% of the opportunity cost of capital. For reference, some suggestions for financial adequacy (for base case) and improvement measures (for other 3 cases) to attain 10% of FIRR are presented also in the table.

Table S2.4.8-4 Financial Evaluation

Items	FIRR	Suggestions: financial Improvement measures to attain 10% of FIRR
Base Case	400%	Extremely high level of FIRR if the fare is set at 7,500 VND. The fare can be lowered to 3,000 VND, which enables FIRR to sustain still the level of 10%.
Reference 1	-7.0%	Strong measures such as sharp cost cut, drastic upward-revision of fares and financially secure support of VG are suggested to be taken.
Reference 2	7.5%	FIRR cannot reach 10% even if expecting privileges such as exemption of taxes non-eligible for soft loan and VG subsidies for additional procurement of EMU after operation. So, another VG subsidy for replacement cost of E&M is suggested to be secured.
Phase 1+2a+2b	-5.9%	Strong measures such as sharp cost cut, drastic upward-revision of fares and financially secure support of VG are suggested to be taken.

Source: JICA Survey Team

2.4.9 Practical implementation of demand stimulation measures

UMRT are advantageous in safe and comfortable mass transport while keeping punctuality. However, most of citizens use convenient motorcycles enabling door-to-door trip, and it is considered difficult to shift the citizens accustomed to such convenience toward the public

transport mode. To promote shifting from private mode to UMRT and other public transport modes, suppression of private transport and establishment of the convenient and comfort transport system are essential.

- Suppression of ownership of vehicles
- Suppression of travel
- Suppression of parking
- Expansion of the public transport network
- Improving the transit convenience
- Improving the comfort

In addition, in order to improve attractiveness of UMRT, the following measures are required.

- Developing the commercial facilities, branch offices, day nursery within the UMRT station building
- Allowing the use of IC type travel card for payment for UMRT and BRT, buses, and inside the commercial facilities in the station building
- Urban development of the area around the station, along with UMRT construction
- Development of the garden city in the suburb along UMRT
- Promotion of development for deliberate arrangement of public facilities and guest attracting facilities along the route of UMRT

2.5 Review on Integration of Phase 1 and 2a

2.5.1 Review of Phase 2a FS Report and its Consistency with the Project

According to the review of Phase 2a Report, items relevant to Phase 2a section are described in Sub-chapter 2.3 and items relevant to both of Phase 1 and 2a section are described in Sub-chapter 2.4. In Phase 2a FS Report, some items and expression of technical specification shall be revised. The revision list is shown in Annex 2 attached to this report. Basically, there is no significant contradiction with Phase 1 and the technical consistency as a whole project is secured. In the final approval process of the Report in the Government of Vietnam, it is recommended to adopt indications of this survey and FS Report to be revised.

This study confirmed important items that shall be solved such as approval of Resettlement Action Plan and total project cost, which are described in Chapter 5.

2.5.2 Appropriateness of the Integration of Phase 1 and 2a (Simultaneous Inauguration)

1) Chronology of consideration on simultaneous inauguration

In the original FS, after commencement of operations for Phase 1, national and international trains from South will depart from and arrive at Ngoc Hoi Station, except trains from HCMC which will terminate at Hanoi Station. Freight trains that are operating over Line 1 to Northern part will detour from Ngoc Hoi Station Complex to Western Belt Line. Deadhead urban electrical trains (EMU) will be sent to Ngoc Hoi on the existing line from Giap Bat for inspection and maintenance in Depot. To facilitate the movement of the deadhead EMU from elevated Giap Bat Station to the at-grade existing line until inauguration of Phase 2a section, a temporary ramp structure (steel) to support the rail line will be required to be constructed to the south of Giap Bat Station. In addition, the

procurement of a diesel locomotive to haul deadhead EMU through non-electrified section will be required.

Following JKTs review of the FS and basic design, it was found that the gradient of the temporary ramp in south of Giap Bat Station would permit EMU operation. However, for long distance trains pulled by locomotive, the gradient was too steep for these trains to negotiate. Furthermore, the construction costs of a shallower grade ramp were prohibitive. In addition, in order to operate both the national trains and EMUs on the same line, dual-gauge track, i.e. standard-gauge (1,435mm) for EMU and narrow-gauge (1,000mm) for medium-long distance trains, must be laid. Furthermore, another issue was identified in that prior to the completion of Phase 2a construction work, switching work from temporary ramp to elevated track was necessary. During the switching work period (6 months), operation of long distance train had to be suspended through this section. Also deadhead operation of EMU from Giap Bat Station to Ngoc Hoi Station Complex became unavailable. As a consequence a problem in maintenance and inspection of EMU occurs.

In order to overcome this issue, the VNR requested JKT to examine the feasibility of the simultaneous construction of Phase 1 and Phase 2a. As part of this review, JKT conducted an operational examination based on the train operation planning, maintenance planning and demand forecast and concluded that simultaneous construction has the following advantages:

- Reduction of construction cost for dual-gauge deadhead line;
- Omission of procurement of diesel locomotive to pull EMU;
- Avoidance of returned operation of national train during switch-over work;
- Avoidance of difficulty in maintenance and inspection of EMU; and
- Increase of passengers between Ngoc Hoi and Hanoi that lead to increase of operational profit.

In addition, construction of Phase 2a section is not on the critical path for the overall construction schedule including Phase 1. Thus, there is no disadvantage of the simultaneous construction in terms of construction schedule.

Based on the above results, MOT, HPC and VNR conducted general meeting in November 2010 and agreed to carry out simultaneous construction of Phase 1 and 2a. As a result, detailed design of temporary slope in south of Giap Bat Station was excluded from the scope and detailed design work is in progress assuming simultaneous inauguration of Ngoc Hoi – Gia Lam section (Phase 1 + 2a section).

2) Appropriateness of civil works and operation planning

For the simultaneous execution of Phase 1 and 2a, the following temporary structures and facilities are unnecessary and the related cost could be reduced. Total cost reduction is about 2.5 billion yen.

Table S2.5.2-1 Cost reduction by simultaneous construction of Phase 1 and 2a

Item	Volume	Cost (JPY 1 = VND 250)	
		VND	JPY
Removal of existing rail of Giap Bat – Ngoc Hoi Section and construction of dual-gauge track	5,283m	▲ 165,401,000,000	▲ 661,604,000
Construction and removal of temporary ramp connected elevated Giap Bat Station with on-ground dual-gauge track	932m 900ton	▲ 177,623,000,000	▲ 710,492,000
Installation of temporary overhead catenary of above temporary ramp section	L/S	▲ 94,973,000,000	▲ 379,892,000
Renovation of existing superstructure of Van Dien Railway Bridge	50m 90ton	▲ 33,173,000,000	▲ 132,692,000
Procurement of diesel locomotive to pull deadhead EMU from Giap Bat to Ngoc Hoi	1set	▲ 91,875,000,000	▲ 367,500,000
Installation of a part of dual-gauge track and overhead catenary inside Gia Lam Depot	L/S	▲ 64,036,000,000	▲ 256,144,000
Total		▲ 627,081,000,000	▲ 2,508,324,000

Source: JICA Survey Team

3) Validity of implementing of Substation, OCS, Power Distribution equipment

When the power equipment is provided in two stages, a significant amount of temporary equipment (the centralized substation control system, OCS and the power distribution system) is required during the construction of Phase 1. The work for modification is also needed in the case of Phase 2a construction. This modification work is quite complex and causes a cost increase. Moreover, prudent consideration is needed for the safe execution of construction and the need for procedures and equipment to remove power for the energized sections and safely control the work on or near energized equipment. This work becomes a matter of great importance and careful attention must be paid since workers and supervisors in Vietnam are not familiar with working requirements for power isolations or working near energized equipment. Therefore, we conclude that if the construction of Phase 1 and the 2a is carried out simultaneously, additional cost to implement the process and procedures may increase costs and without them the risk to safety is increased.

The simultaneous construction work on an elevated structure is reasonable since the transmission cable is due to be installed in the side of the elevated structure. If the construction work is executed during Phase 1 only, the temporary underground cable work is carried out once and then the additional power cable installed on the elevated structure is further needed in the stage of Phase 2a although 110-kV cable work is very expensive. It also needs to have the exclusive temporary facilities to cross the river near Ngoc Hoi. This work makes increases the construction costs. Moreover, the field testing of the power cable and the tests to check the centralized substation control system after modification work are required. However, those additional works will not be needed if the construction work of phase 1 and the phase 2a is carried out at the same time.

4) Appropriateness of signal and telecommunication equipment

The installation of the signal and telecommunication equipment for Phase 2a is being conducted stage by stage after the operation of Phase 1 section, significant repair work is necessary for already constructed equipment (station and central equipment). This work is relatively complex and will lead to increased cost. In the case where Phase 1 and 2a are constructed simultaneously, the repair work and increased costs could be avoided.

5) Increase of passengers of urban train

According to the passenger demand forecast for 2020, operation of Phase 1 section will only will attract 105,000 passengers per day. However, simultaneous inauguration of Phase 1 and 2a will attract 233,000 passengers per day, more than 2 times compared to Phase 1. In addition, the average travel distance will also increase from 5.1 km to 7.7 km if both sections are operated at the same time. As a result, the difference in passenger - km will be very large: 0.540 million persons-km compared with 1.797 million passenger-km. In case of distance-based fare is adopted, fare revenues could be estimated based on passenger-km. Thus, fare revenues of simultaneous operation of Phase 1 and 2a is about 3.3 times more comparing with operation of Phase 1 only. Comparison of number of passengers is shown in the following table.

Table S2.5.2-2 Passenger number of urban train in 2020

Section	Only Phase 1 (10.7km)	Phase 1 + 2a (18.5km)	Increasing ratio
Passenger number (000 person)	105	232	2.2
Passenger – km (000 person)	540	1,797	3.3
Average traveling distance (km)	5.1	7.7	1.5

Sources: JICA Survey Team

6) Convenience improvement of existing railway line

If the original plan is adopted, Phase 2 operation will follow the completion of Phase 1, and the operation of the national train from the South to Hanoi will be as follows:

- During construction of Phase 1: arrive at and depart from the temporary Giap Bat Station;
- After construction of Phase 1: via a temporary ramp to enter the elevated section until Hanoi Station;
- During construction of Phase 2a, above temporary ramp will be removed and the elevated station at Giap Bat will be connected with elevated section: national train have to return again at temporary Giap Bat Station; and
- After operation of Phase 2a: through Ngoc Hoi Station and then same as EMU, enter the elevated section until Hanoi Station.

However, in the case where the construction of Phase 1 and 2a is executed simultaneously, operation of national train from South to Hanoi will be as follows:

- During construction of Phase 1 + 2a: depart from and arrive at temporary Giap Bat Station; and
- After operation of Phase 1 + 2a: through Ngoc Hoi Station and then similar with EMU, enter the elevated section until Hanoi Station.

The period to remove the temporary ramp noted above and to connect the elevated Giap Bat Station with elevated section is estimated as around 6 months. In light of the above, we conclude therefore that the simultaneous inauguration of Phase 1 and 2a has significant advantages and more convenience due to the avoidance of unnecessary train operation plan and passenger confusion.

2.5.3 Main issues and recommendations for smooth implementation of this Project

Chapter 2 describes the present situations, issues and the recommendations for their improvement in the smooth Project implementation. The following table shows the points considered particularly vital among those recommendations. Tasks facing the Project involve a wide scope of related fields, and require early actions for resolution. These actions should be conducted by not only the executing agency, VNR, but also the relevant authorities including MOT, HPC, MOF and MPI.

Table S2.5.3-1 Main issues and recommendations for smooth implementation of the Project

No	Main Issues	Recommendations	Implementation period of recommendation				
			Early execution	Until completion of DD Phase 1	Until construction commencement of Phase 1 + 2a	During construction of Phase 1 + 2a	After inauguration
1	Submission of English version of Japanese standard & regulations for approval of Design Framework	Discussion among MOT, VNR and JKT (Preparation of English translation of brief version of standards & regulations)		○			
2	Special approval by MOT regarding construction and rolling stock envelopes	Early examination		○			
3	Implementation of Phase 2a DD (including adjustment of Phase 1 to confirm with simultaneous inauguration of Phase 1 & 2a).	Early implementation	○				
4	Other projects related with the Project: <u>Relation with freight train of Western Belt Line and Ngoc Hoi Freight Station</u> ● Freight train operated in Western Belt Line pulls onto Ngoc Hoi Freight Station. <u>Track alignment and station structure of Gia Lam Station</u> ● Location of Yen Vien Station and location and scale of storage track for medium-long distance passenger trains ● Track alignment of Line 1, Phase 2b and 3, and structures of Gia Lam station, etc.	Early examination	○				
5	Determination of project implementation schedule (the matters below are mutually related with determination of the schedule): ● Approval of FS 2a Report & EIA Report ● Approval of Design Framework, BD, DD, RLB of Phase 1 ● Preparation of RAP (Phase 1 + 2a) ● Approval of project scope and cost ● Implementation of Project Adjustment ● Approval of project cost by National Assembly	Early resolution	○				

No	Main Issues	Recommendations	Implementation period of recommendation				
			Early execution	Until completion of DD Phase 1	Until construction commencement of Phase 1 + 2a	During construction of Phase 1 + 2a	After inauguration
6	Ascertain of plan and budget of public facilities relocation (electrical, telephone, water & sewerage, road, traffic sign, etc.) <ul style="list-style-type: none"> ● After preparation of relocation plan is finished by JKT, VNR will send it to each related authorities for approval ● Relocation work is not yet included in the Project ● Each related authority ensures budget for relocation work by requesting HPC or by his own arrangement ● VNR demanded a Yen loan for relocation work 	Implementation of the followings before construction commencement of the Project: <ul style="list-style-type: none"> ● Discussion about relocation plan between VNR and each related authorities ● Each related authority may consider a Yen loan as budget source for relocation work. ● Ascertain of budget for relocation. ● Completion of relocation work 	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
7	Relocation of 10 locations of high-voltage line (110kV and 22kV) which crossing the Line 1 <ul style="list-style-type: none"> ● Relocation plan and cost are not yet included in the Project 	Early implementation of preparation of relocation plan and cost estimation of relocation work (In Phase 2a DD) <ul style="list-style-type: none"> ● A large amount of cost is expected and thus, may be included in the Project 	<input type="radio"/>				
8	Allocation of tasks in preparation of station plaza development plan and construction work is unclear <ul style="list-style-type: none"> ● Preparation of development plan and its implementation is not yet included in the Project. 	Clarification of the followings <ul style="list-style-type: none"> ● Decision of executing agency ● Preparation of development plan ● Ascertain of budget and execution of construction 	<input type="radio"/>		<input type="radio"/>	<input type="radio"/>	
9	Unification of IC Card and AFC system	VNR follows final decision of MOT.		<input type="radio"/>			
10	Coordination with HPC and relevant authorities to increase number of passengers	Examination and implementation to stimulate demand <ul style="list-style-type: none"> ● Preparation of an action plan ● Management of transportation demand (suppression of private transportation mode) ● Development of station plaza and bus route for connection with public bus ● Fascination station design for attraction of passengers 	<input type="radio"/>			<input type="radio"/>	<input type="radio"/>
11	Decision of O&M structure of Line 1 (VNR is examining the following formation) <ul style="list-style-type: none"> ● Operator company of Line 1 ● Maintenance company of Line 1 ● Asset management company of railway 	Early decision is necessary from viewpoint of preparation of a business plan	<input type="radio"/>				

No	Main Issues	Recommendations	Implementation period of recommendation				
			Early execution	Until completion of DD Phase 1	Until construction commencement of Phase 1 + 2a	During construction of Phase 1 + 2a	After inauguration
12	Preparation of a business plan of O&M company for Line 1	Step-by-step examination for inauguration <ul style="list-style-type: none"> ● IT System ● Balance (Income & expenditure) ● Non-ticket revenue and expenditure ● Measures for revenue increase and demand stimulation ● Possession of assets 	<input type="radio"/>		<input type="radio"/>		
13	Preparation and implementation of education and training plan for O&M staff	Preparation of a comprehensive implementation & budget plan, and step-by-step implementation: <u>First period</u> <ul style="list-style-type: none"> ● Preparation of regulations, guidance & manuals for O&M of urban railway ● Driver training plans and its approval by MOT ● Trainings in Vietnam/Japan ● Dispatch plan of instructors ● Education and training facilities ● IT system of O&M company <u>Second period</u> <ul style="list-style-type: none"> ● Finalization of above matters ● Implementation of education and training (start about 4-5 years before inauguration) 	<input type="radio"/>			<input type="radio"/>	
14	Provision of education and training facilities for urban railways	Development of education and training facilities (driving simulator, etc.) for VNR Vocational College			<input type="radio"/>		
15	Supporting in technical and knowledge transfer in O&M after project inauguration	Dispatch of experts to support O&M as well as dealing with expected and unexpected circumstances within 3 or 4 years after inauguration (Railway administration, management of train operation, operation system, financial, train operation planning, power & electricity, signal, communications, EMU maintenance, EMU maintenance machinery, etc.)					<input type="radio"/>

3. REVIEW ON SOCIAL AND ENVIRONMENTAL CONSIDERATIONS

The EIA report covering Phase 1 and Phase 2a was already approved by MONRE in 2008. A supplement EIA report with updated data was compiled in 2011, however, by the new EIA regulations, the EIA report should be now submitted to the Ministry of Transport - Environmental Division by each phase for approval. RPMU is planning to submit the EIA

report on Phase 1 in March 2012, and, for Phase 2, after March 2012 when a draft FS report for Phase 2a is ready.

The existing EIA reports (2008 and 2011) are reviewed based on the JBIC guidelines for Environmental and Social Considerations (2002) and revised as one document to be submitted to JICA. RPMU is to incorporate the result of review into the EIA reports to be submitted to MOT and to recalculate the costs related to mitigation measures, monitoring, etc. so that these costs are included in the total project cost.

In terms of land acquisition and resettlement, documents with cost estimation were prepared at FS stage for each phase. However, for JICA appraisal, a detailed RAP based on the results of census survey on all affected households is required. The existing documents do not meet the requirement. Presently, HUPI is preparing Red Line Boundary (final boundary of the land to be acquired based on ROW) documents that need to be approved by HPC. After HPC's approval, each DPC will conduct census survey to prepare a detailed RAP. For the Ngoc hoi complex, it is already approved in February 2012, and a detailed RAP based on the results of census survey will be ready in March 2012.

RPMU should prepare a detailed RAP based on census survey for all sections and all the costs related land acquisition and resettlement should be calculated and included into the total project cost. After studying the process and activities completed so far, it is understood that there is no confirmation or agreement on application of JBIC guidelines to land acquisition and resettlement process with HPC/HPC, the responsible authorities in this matter. For a timely process of land acquisition and resettlement in order to promote the procedure of Yen loan and to meet the project schedule, it is important to confirm the application of JBIC guidelines between VNR/RPMU and HPC/DPC.

4. EVALUATION OF CLIMATE CHANGE MITIGATION EFFECT

The project has effects of GHG (Greenhouse Gas) emission reductions by realizing modal shift from existing transport system such as cars, motorbikes and buses to a MRT (Mass Rapid Transit) system. JICA Climate-FIT (JICA Climate Finance Impact Tool), which was developed based on existing methods such as CDM methodology, is used for estimation of CO₂ emission reductions in this survey. Values based on the demand forecasting and transportation plan shown in this survey and parameters in previous studies (see table S4-1 and table S4-2) are used for the estimation with JICA Climate FIT

The amount of CO₂ emission reductions are 11,408 tCO₂/year in 2020, 20,196 tCO₂/year in 2030, 38,052 tCO₂/year in 2040 and 64,155 tCO₂/year in 2050 (see Fig. S4-1). The amount increases about 5.6 times in the 31 years due to the increase of passengers of the new railway system. The total and the average amount of reductions over the 31 years are 1,014,284 tCO₂ and 32,719 tCO₂ respectively.

Table S4-1 Data used to estimate baseline emissions (phase1+2a)

Items	Values			Units
	Car	Motorbike	Bus	
Passengers of existing transport systems 1/	Depend on the year			passengers/year
Average occupation rate of existing vehicles 1/	2.02	1.36	30	passengers/vehicle
Average trip distance driven by existing vehicles 1/	7.74	7.74	7.74	km/vehicle
Specific fuel consumption of existing vehicles 2/	Gasoline	12.987	55.556	km/l
	Diesel	15.152	-	
CO2 emission factor of fuels 3/	Gasoline	2,313		gCO2/l
	Diesel	2,661		
Percentage of gasoline and diesel 2/	Gasoline	0.85	1.00	-
	Diesel	0.15	0.00	
Mixing ratio of befouls 4/	Gasoline	0.05	0.05	-
	Diesel	0.05	0.05	

Source: 1/ JICA Survey Team

2/ Measuring the Invisible Quantifying Emissions Reductions from Transport Solutions Hanoi Case Study, Lee Schipper etc. ,2008

3/ Defined values of JICA Climate-FIT

4/ Status and Potential for the Development of Biofuels and Rural Renewable Energy, Nguyen Do Anh Tuan etc. ,2009

Table S4-2 Data Used to Estimate Project Emissions

Items	Values	Units
Total annual trip distance by new train 1/	Depend on the year	train km/year
Electric power consumption 1/	Depend on the year	kWh/train km
CO2 emission factor 2/	576.4	gCO2/kWh

Source: 1/ JICA Survey Team, 2/ A published value of the Government

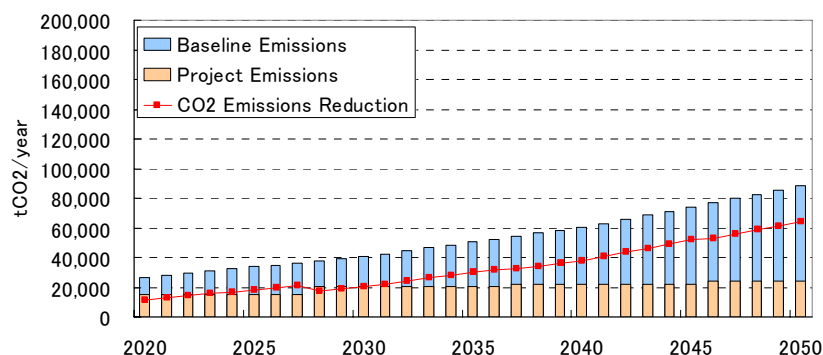


Fig. S4-1 Estimated Amount of GHG (CO2) Emission Reductions

5. CONCERNED ISSUES FOR SMOOTH PROJECT IMPLEMENTATION

5.1 Scale and Validity of Project

(This part was deleted to disclose information in certain period)

Table S5-1 Comparison between Project Cost and IRR

(This part was deleted to disclose information in certain period)

Source: JICA Survey Team

In Vietnam, according to Decree No.12/2009/ND-CP, where the total project cost and/or project objectives are changed subsequent to the approval of the FS, a procedure entitled “Project Adjustment” is required to be followed in order to obtain approval from government. In addition, based on Resolution No.49/2010/QH12, June 19, 2010, in cases where the total project cost exceeds VND 35 trillion, approval of National Assembly is mandatory. .

It should be noted that in Vietnam, the time taken to complete the Project Adjustment process for the MRT Project in HCMC took a long time. In the case of this Project, Project Adjustment is unavoidable because total project cost is drastically increased. The survey team conducted a hearing from MOT and VNR for procedure of the Project Adjustment, but the exact timing of the procedure could not be confirmed. Approval from the Government of Vietnam concerning the increased project cost is a precondition for smooth implementation of this Project.

5.2 Approval Procedure of Project Cost in Vietnam

VNR has already informed MOT that the scale of the Project cost has drastically increased, and the MOT have agreed in principle in the form of a letter dated 20 December 2011 (No.528/TB-BGTVT). In this letter, MOT requested VNR to carefully study the total project cost, then report it to MOT for approval procedure to the Prime Minister and National Assembly.

1) Procedure of Project Adjustment

According to Decree of Vietnamese Government for Management of Investment Projects on the Construction of Works: No.12/2009/ND-CP Article 14, an investment project for construction of a work can be adjusted under the following cases:

- It is affected by natural disaster;
- There arise elements which bring about higher efficiency for the project;
- Changes in construction planning directly affect the project's location, size, nature and objective; and
- There are abnormal fluctuations in prices of raw materials, materials or fuel or in exchange rates with respect to foreign-currency capital amounts.

When a project adjustments result in changes in the project's location, size or objective or an increase in the approved total investment, investor shall report thereon to investment deciders for decision. In this Project, VNR is "investor" and MOT is "investment decider".

The MOT and VNR understand that Project Adjustment is necessary and VNR will select a consultant to carry out the Project Adjustment for the Project. However, based on letter No.528/TB-BGTVT of MOT, approval of basic design, red line boundary and architectural alternative are preconditioned for beginning of Project Adjustment. Therefore, acceleration of this approval is necessary.

Approval of the Project Adjustment is not only required from the MOT as investment decider, but shall also be agreed by the government (prime minister). In this process, opinion from MOF and MPI also shall be obtained. In case of the MRT Project in HCMC, the investment decider is HCMC People's Committee. Procedure of the Project Adjustment is finalized after the Prime Minister approved changes of project's contents proposed by HCMC People's Committee by taking into consideration of opinions from MOF, MPI and MOT. In that case, MOT submitted opinion as a responsible line ministry for transport sector. However, in the case of this Project, MOT itself is "investment decider".

2) Approval Procedure of National Assembly

In 2010, the National Assembly published a Resolution No.49/2010/QH12 in June 19, 2010 related to projects and works of national importance. The resolution title is "Projects and works of national importance to be submitted to the National Assembly for decision on their investment". The criteria of projects which are subject to this resolution are as follows.

- Having a total investment capital of VND 35 trillion or more, including a state capital amount of VND 11 trillion or more
- Greatly affecting the environment or having a latent risk of seriously affecting the environment
- Requiring change of the use purpose of a land area of 500 ha or more currently used for two rice crops every year
- Requiring resettlement of 20,000 inhabitants or more for mountainous areas, or 50,000 inhabitants or more for other areas
- Being located in a geographical area which exists a national relic of specially important historical-cultural significance or a scenic place ranked as a national one
- Being located in a geographical area of special national defense or security importance
- Requiring a special mechanism or policy which must be decided by the National Assembly

In article 10 of the resolution, on-going projects relevant to the above conditions shall also be submitted and considered by the National Assembly. Therefore, although scale of the project was not relevant with the above conditions, the case for this project is that the FS was already approved and the Project is on-going, when the total project cost becomes relevant to above condition after Project Adjustment, it shall be submitted to National Assembly for consideration.

The total cost of this Project in the original FS was less than VND 20 trillion. However, currently it has become clear that the total project cost will exceed VND 35 trillion, and as a consequence shall be submitted to National Assembly. However, in Article 10 of the aforementioned resolution, there is a stipulation “consideration and decision to suit reality” for on-going project, which implies treatment between the new project and on-going project is slightly different.

3) Approval of Total Project Cost

According to the total project cost, the MOT and VNR stated that the cost estimate for Ngoc Hoi Station Complex is below the original approved cost estimation in FS. Thus, construction could commence if a loan is provided, and in parallel with construction commencement, the Project Adjustment process will be commence. The VNR stated that before the accumulated project cost exceeds the approved total project cost, approval on revised project cost will be inevitable. In addition, the MOT and VNR stated that for on-going projects whose project cost exceed VND 35 trillion, approval from National Assembly is not necessary like MRT Project in HCMC. During the discussion with JICA Contact Mission in February 2012, VNR requested to consider Phase 1 and 2a as two different projects which will be inaugurated in the same time.

Both of the Project Adjustment and National Assembly approval are issues that might become bottlenecks to the smooth implementation of the project. Thus, prompt attention from concerned authorities in Vietnam is required. JICA Contact Mission in February 2012 also requested VNR to obtain consensus with MOF and MPI.

5.3 Procedure of Land Acquisition

The necessary land acquisition for the Project, following PMULAR for each area prepared by the RAP, detail compensations are assessed and decided based on negotiation between affected persons and related institution. Land acquisition cost is included in the total project cost although excluded from yen loan. Currently, the allocation for land acquisition cost is VND

3.25 trillion (JPY 12.03 billion yen) according to FS. The cost for land acquisition will be calculated based on the compensation cost for relocation as decided by HPC. Land acquisition cost is financed from national budget. In the first instance, the HPC calculates the cost based on RAP, then VNR allocate it to the total project cost, and finally, MOT will secure the estimated budget. Since the Project is implemented referring to the JBIC Guidelines published in 2002, calculation of compensation cost will follow the decision of Hanoi City. This policy was notified to VNR in March, 2012 by JICA.

5.4 Approval of EIA Report

The EIA Report for Phase 1 and 2a section were approved by MONRE in 2008. However, since the project has not started within 2 years of approval, according to the regulation of EIA in Vietnam at that time, a supplemental EIA Report was prepared in 2011. In this Report, design changes of the Project consisting of width of Ngoc Hoi Station Complex and relocation of Red River Bridge were already reflected. Subsequent to this the supplemental EIA Report should have been submitted to MONRE. However, the regulation of preparing EIA was revised in September 2011, and according to the new regulation, the existing EIA Report shall be separated and reorganized phase by phase, and then submitted to MOT Environmental Division to obtain approval.

Currently, RPMU is still selecting consultants to prepare the EIA Reports. The EIA Report for Phase 1 will be submitted in March 2012, and for Phase 2a is expected after March 2012. The approval period is usually within 30 business days. A draft of relevant section of the FS Report should be attached to the EIA Report in order to obtain approval, but FS Report of Phase 2a is still not completed and thus submission is awaiting completion. As the approval of EIA is a precondition to obtaining approval of the FS Report, if submission of EIA Report is delayed, final approval of FS will also be delayed.

The Project is referring to JBIC guidelines published in 2002. This survey will ensure and suggest that the EIA Report for JICA shall be prepared in accordance with the guidelines. EIA Report to be submitted to MOT is also suggested to reflect this suggestion. In addition, necessary cost for environmental and social consideration (mitigation, monitoring, etc.) shall be calculated based on EIA Report, and then included in the total project cost.

5.5 Approval of Phase 2a FS

During the JICA Contact Mission in August 2011, VNR requested to receive yen loan that covers Phase 1 and Phase 2a. JICA intend to review the contents of FS Phase 2a after the report is approved by Vietnamese Government and since approval from government is time consuming, VNR decided to submit a draft English version before final approval by Vietnam side and the preparatory survey was implemented. However, the period to obtain approval of this FS remains unclear. The RPMU has stated that to completion of the FS Report is expected in February 2012 and approval from MOT is estimated by April 2012. However, approval of EIA Report is a precondition to obtain approval of FS and JICA requested that appraisal for the following term of yen loan, approval of Phase 2a FS Report by the Government of Vietnam is indispensable condition.

Procedures to obtain approval of Phase 2a FS Report are as follows:

- VNR contracts a consultant to carry out FS, then the mentioned consultant prepare and submit report to VNR;
- Appraisal consultant assists VNR to review the FS contents;
- VNR approves the FS, then submits to MOT;
- Parallel with the previous procedure, VNR also select a consultant to carry out EIA.

Once complete, the EIA Report, attached with Draft FS Report, is submitted to the MOT for approval. Finally, after EIA Report is approved, FS Report attached with approved EIA Report is submitted to MOT and Prime Minister Office to obtain approval.

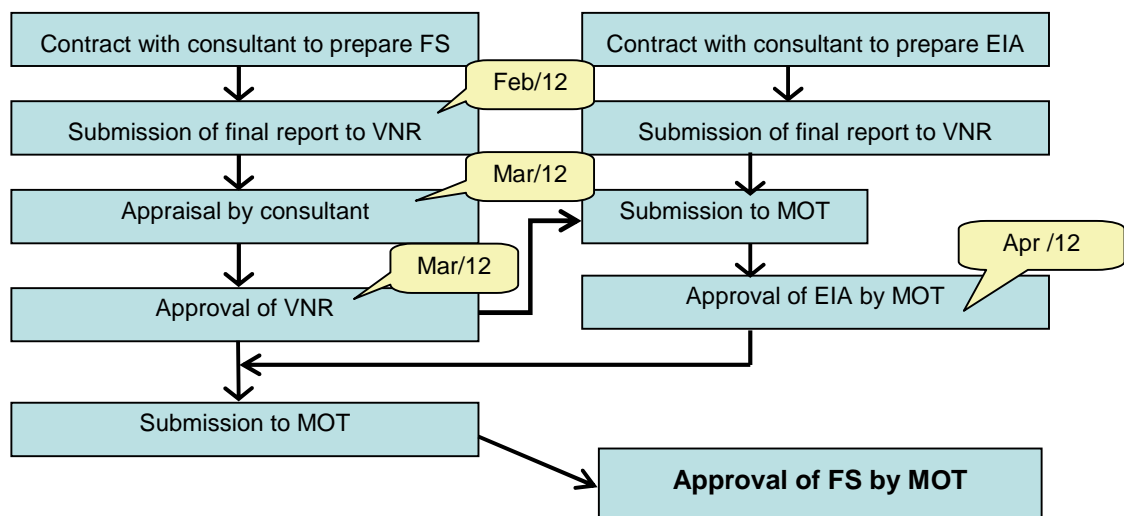


Fig. S5-1 Approval Procedure of FS and EIA

5.6 Various Matters related to the Project Implementation

According to analysis of the relationship of various matters of the project approval, as aforementioned in sub-chapter 5.2, approval of total project cost by the Government of Vietnam is necessary and the total project cost shall be calculated. Generally, the appropriateness of the total project cost is conducted based on an FS level estimation. However, since this Project has already entered the detailed design for Phase 1, the estimation of project cost will be more accurate if it is calculated based on detailed design. However, the basic design of the Project was already submitted more than a year ago and is still not yet approved by the HPC, thus the detailed design cannot be finalized. In addition, as RAP is based on census that has not yet been carried out, the land acquisition cost element of the total project cost is still not clear.

Sequential resolution of the necessary procedures, considering Project Adjustment and National Assembly's approval is inevitable and are shown in the left hand side of the following figure. Related to the context after a yen loan is implemented, only after Ngoc Hoi Station Complex is developed, existing railway facilities for freight transport in Giap Bat Station could be relocated. Following this, train operation of existing line can cease to commence construction of viaduct

and station building. In addition, the power lines, water supply and sewerage facilities, that cross the project site and become construction obstacles, can be completely relocated.

Related to the context after yen loan is implemented, only after Ngoc Hoi Station Complex is developed, existing railway facilities for freight transport in Giap Bat Station could be relocated. Following this, train operation of existing line is stopped to commence construction of viaduct and station building. In addition, the power lines, water supply and sewerage facilities, that cross project site and become construction obstacles, shall be completely relocated.

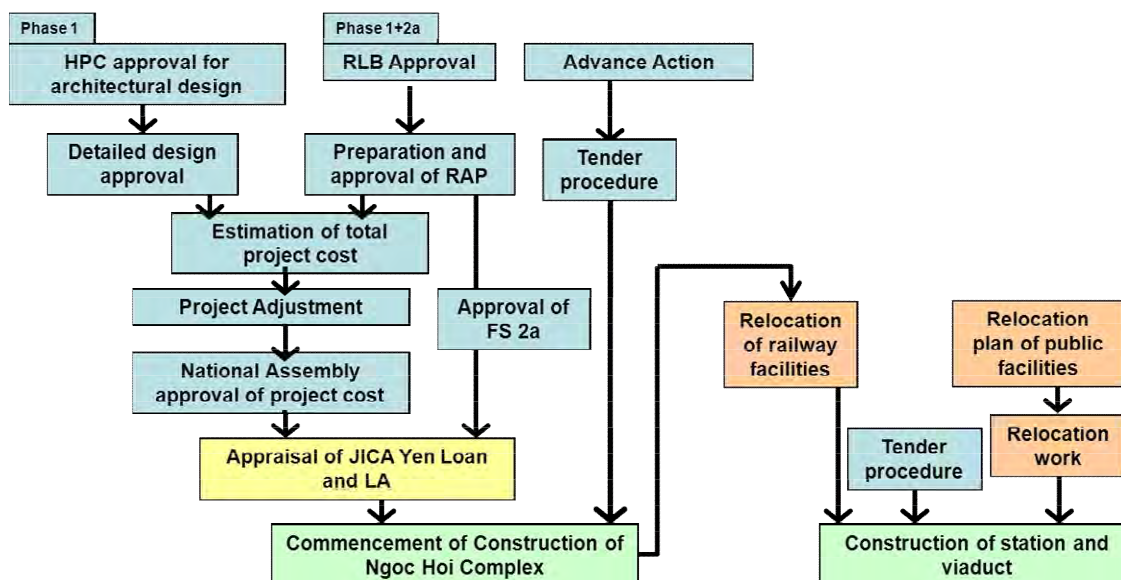


Fig. S5-2 Relation of Various Matters for Project Implementation

Advance Action, as shown above, is a special procedure in Vietnam, which allows a part of procurement step of consulting service or contractor to proceed even before LA is signed, which shall be executed only after LA is signed and coming into effect in principle. Thus, commencement of Ngoc Hoi Station Complex, which is needed to be commenced first possible earlier than the case without Advance Action. In March 2012, the final decision for the targeted contract package is to be conducted by VNR and then reported to MOT for obtaining JICA's concurrence. However, since the Advance Action is not systematically established in Vietnam, further progress shall be carefully monitored.

After approved by the VNR, the basic design prepared by JKT shall be approved by MOT. However, parts of basic design, consisting of track alignment, station location, ROW drawing, Red Line boundary drawing, architectural design of station, Red River Bridge and viaduct are subject to approval by HPC. In view of this a long lead time is anticipated to obtain these approvals. According to the architectural designs for each station, the location of the 5 terminal stations and the 10 dedicated urban railway stations as well as the station plaza designs are all mostly aligned with the HAIMUD plan. All of these matters were reflected in the application drawing for building permission (Master Layout Plan, etc.) and has been submitted to HAPA. However, in March 2012, none of the station designs have been approved. Because the Master Layout Plan is part of the Basic Design, the architectural detailed design work has been put on hold.

The critical path in the construction schedule are the packages for Ngoc Station Comple and the commencement of this package will greatly impact the overall construction schedule. In addition, progress of resettlement of residents, relocation of interfered facilities as well as approval time of project cost also will influence the construction schedule.

5.7 Existing Condition of Each Section

The following table shows the current condition approval progress of ROW and RLB, preparation of RAP, difficulty level in resettlement, and estimation of construction cost of each section of Hanoi Line 1. In the column of Expected Difficulty in Resettlement, quantitative judgment is uneasy because census to the influenced residents is not yet implemented. Thus, it is assumed that ⊙ means number of resident to be resettled is small, and on the contrary, × means number of resident to be resettled is large.

Table S5-2 Current Condition of Various Procedures of Hanoi Line by Each Section

	Phase	BD	DD	BD/DD D Appro -val	ROW Aprv	RAP Preparation	Difficulty level of Resettlement
					by VNR/ RLB by HPC		
Yen Vien	2b	Done	-	×/-	Done/×	×	△ 1/
Gia Lam	1	Done	Ongoing (report in Feb)	×/×	Done/×	Draft (w/o census, IOL)	×
Hanoi	1	Done	Ongoing (report in Mar)	×/×	Done/×	Draft (w/o census, IOL)	△
Giap Bat	2a	Done	-	×/-	Done/×	Draft (w/o census, IOL)	○
Ngoc Hoi	1	Done	Ongoing (Submit -ted)	×/×	Done/×	Draft (w/o census, IOL)	⊙

Note: 1/ In case of separate implementation of Phase 1 and 2a, 65.5 billion yen

5.8 Recommendation to Accelerate Project Implementation

In order to execute the Project, resolution of the critical issues are summarized in the following.

- Decision of project scope and phasing;
- Determination of the total project cost;
- Procedure for Project Adjustment;
- Preparation of the RAP by HPC
- Approval of the Basic Design by VNR and HPC
- Design for early construction commencement of Ngoc Hoi Station Complex, approval procedure of RLB, RAP and Project Adjustment as well as other necessary works to accelerate the Project implementation.

The JICA Contact Mission focused on the above matters, and agreed to accelerate the implementation of the Project and prepared Minutes of Meeting confirming the following issues.

- 1) Project Scope
Considering the project effectiveness, JICA judged that the integration of Phase 1 and 2a is appropriate. However, the VNR considered this as two different projects that will be inaugurated at the same time. In addition, the VNR also requested to prioritize the construction commencement of Ngoc Hoi Station Complex as part of Phase 1.
- 2) Project Cost Increase and Project Adjustment Procedure
Both parties agreed that Project Adjustment is necessary. Although JICA mentioned that the Project Adjustment shall be finished prior to the construction commencement and that approval by National Assembly is required. The VNR expressed that the construction of Ngoc Hoi Station Complex could be started because the cost estimation is within the range the original project cost of Phase 1. In addition, approval from National Assembly is not necessary for on-going project. JICA stated that even if a loan is financed for the construction of Ngoc Station Complex only, consensus from MOF and MPI is necessary. VNR agreed to obtain agreement from both ministries.
- 3) Preparation of RAP
The VNR agreed to prepare the RAP in accordance with the JICA guidelines. Regarding compensation for removal, JICA agreed that Hanoi City's price shall be adopted, not reacquisition price. The VNR also agreed to prepare the RAP for Ngoc Hoi area before appraisal mission is dispatched.
- 4) Existing condition of Ngoc Hoi Station Complex
JICA understands the necessity of early commencement of Ngoc Hoi Station Complex as explained by VNR. As a consequence, JICA requested VNR to take necessary steps on the Vietnamese side.
- 5) Detailed design of Phase 2a
JICA took note of the necessity for early commencement of the detailed design for Phase 2a as explained by the VNR.
- 6) Additional request of Loan Coverage Item
JICA took note of the additional request from VNR regarding loan coverage items for relocation of high-voltage power line, relocation of public utilities crossing the alignment, construction cost for resident resettlement site.