Socialist Republic of Vietnam
Vietnam Railways

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

Final Report (Simple Binding)

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Japan International Cooperation Agency

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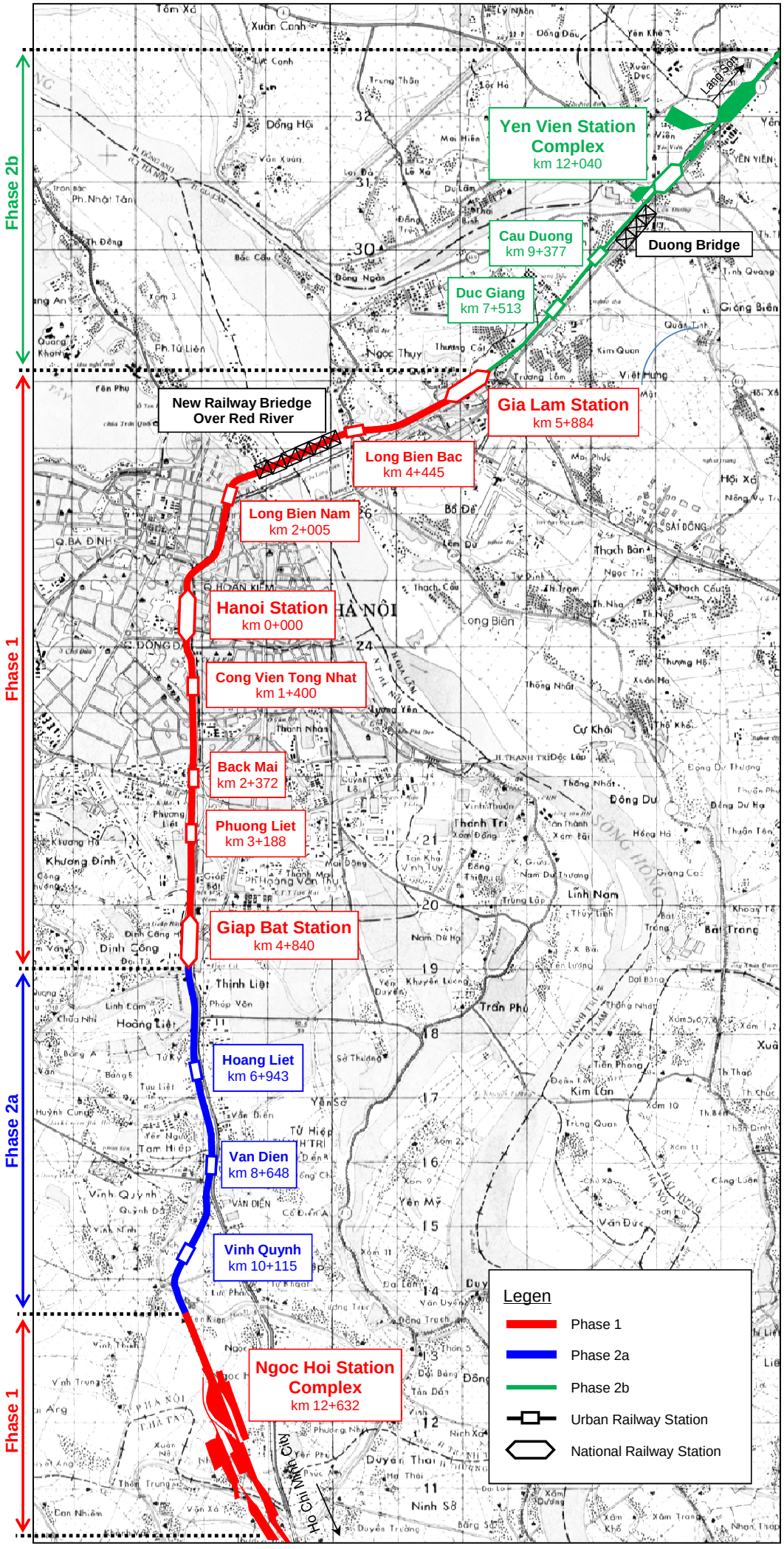

HANOI CITY URBAN RAILWAY CONSTRUCTION PROJECT (LINE 1)

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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5. CONCERNED ISSUES FOR SMOOTH PROJECT IMPLEMENTATION

1. PRESENT STATE OF THE URBAN TRANSPORT SECTOR OF VIETNAM

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

1.1.1 Present state of the urban transport sector

The present state of the urban transport sector in two large cities of Vietnam; Hanoi and Ho Chi Minh is shown below.

1) Population and density

The population of both cities as of the year 2010 was 6.6 million for Hanoi and 7.4 million for Ho Chi Minh. The population density is not so high; 1,960 persons/km2 for Hanoi and 3,530 persons/km2 for Ho Chi Minh. When viewed in terms of the urban[1] area only, the density becomes high at 14,550 persons/km2 and 12,470 persons/km2 respectively, which is nearly equivalent to other Asian cities. In Hanoi, 41% of city residents live in the urban area accounting for 6% of the city area while the rest of residents live mostly on the fringe of the urban area.

Table 1.1-1 Population and Density in Asian Cities

Item	Hanoi in 2010		HCMC in 2010		Manila in 2007 1/	Jakarta in 2010 2/	Singapore in 2011 3/
	Urban	Total	Urban	Total			
Population (000 persons)	2,709.9 (41%)	6,561.9 (100%)	6,157.6 (83%)	7,396.5 (100%)	1,660.7	9,607.8	5183.7
Area (km2)	186.2 (6%)	3,344.6 (100%)	494.0* (24%)	2,095.5 (100%)	38.55	661.5	714.3
Density (persons/km2)	14,552	1,962	12,465	3,530	43,079	14,524	7,257

Source: General Statistics office of Vietnam

1/ General Statistics office of Philippine, 2/ General Statistics office of Indonesia,

3/ General Statistics office of Singapore

2) GDP per capita

In terms of national average, GDP per capita increased by annual 6% in average or by 1.8 times for the past decade from 2000 to 2010.

[1] Urban area: Local administrative area in Vietnam is divided into provinces and centrally governed cities, and provinces are divided into districts, provincial cities and towns. And districts are divided into rural districts area and urban district areas

Table 1.1-2 Real GDP, Real GDP per Capita in Vietnam

	Real GDP (1994 price) (Billion VND)	Population (000 persons) 1/	GDP per Capita (000 VND)
2000	273,666	78,758	3,475
2010	551,609	87,848	6,279
Ratio (2010/2010)	2.0	1.1	1.8
Avg. Growth Rate	1.07	1.01	1.06

Source: General Statistics office of Vietnam

1/ UN data

3) Vehicle ownership rate

In both cities, more than 80% of the households have motorcycles, among which more than 40% of households have two or more 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.

Table 1.1-3 Vehicle Ownership Rates among Hanoi and HCMC Households

Vehicle Type		Hanoi in 2005	HCMC in 2002
Car		1.8%	1.7%
Motorcycle	Two or more	44.7%	58.9%
	One	39.8%	33.8%
Bicycle		11.5%	4.4%
None		2.3%	1.3%
Total		100.0%	100.0%

Source: The Comprehensive Urban Development Programme in Hanoi Capital City (HAIDEP) (2007)

4) Traffic modal share

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.

Table 1.1-4 Modal Share in Asian Cities

Mode	Hanoi in 2005	HCMC in 2002	Manila in 1996	Jakarta in 2002	Singapore in 1993	Tokyo 23 wards in 1998
Private	**93.3%**	**94%**	**28%**	**42%**	**34%**	**64.1%**
Bicycle	25.3%	17%	-	4%	-	-
Motorcycle	63.2%	75%	1%	21%	6%	21.5%
Car/Taxi	3.6%	1%	25%	15%	19%	42.6%
Others	1.1%	1%	2%	2%	9%	-
Public	**6.7%**	**6%**	**72%**	**58%**	**66%**	**35.9%**
Bus	6.7%	2%	17%	51%	42%	3.1%
Railway	-	-	2%	2%	12%	32.8%
Others	-	4%	53%	5%	12%	-
Total	100.0%	100%	100%	100%	100%	100.0%

Source: HAIDEP (2007)

5) Road network

The inner core of both cities has the road coverage ratio of 10% or more, which is nearly equivalent to other Asian cities. However, the road coverage ratio in areas other than the inner core of both cities is low.

Table 1.1-5 Road Coverage Ratios in Asian Cities

Item	Hanoi in 2005		HCMC in 2002 1/		Singapore	Bangkok	Tokyo
	Inner core	Total	Inner core	Total			
Road Coverage Ratio (%)	10.3	4.2	11.9	0.6	12.0	8.5	15.8

Source: HAIDEP (2007)

1/ The Study on the Urban Transport Master Plan and Feasibility Study in Ho Chi Minh Metropolitan Area (HOUTRANS) (2004)

6) Public transport

The principal transport mode of both cities is the bus running along the predetermined route and taxis. In Hanoi, the model bus policy started in 2002, and new bus routes, bus fleets, bus stops, bus information guide board were introduced. As a result, the share of bus users increased by 5% from the time before introduction of the policy. The share of public transport is low at 6 to 7% as shown in Table 1.1-4, but the Government of Vietnam has set a goal of increasing this share. For example, "Hanoi Capital City till the year 2030 with a vision to 2050," which was approved by prime minister in 2011, set a goal of increasing the share of public transport in the inner core of Hanoi to 35% by 2020 and 55% by 2030 and called for investment while giving priority to UMRT, BRT, and bus route construction.

7) Congestion state

The peak ratio[2] of both cities is high at 13% or more and the transport is mostly concentrated in the commuting time in the morning. However, the average commuting time to work is as short as 18～20 minutes, with the commuting trip being short. The daily average volume/capacity of old Hanoi is 0.4, with the average travel speed being 26km/h. This means that no chronic congestion is occurring.

Table 1.1-6 Road Congestion in Hanoi and HCMC

Item	Hanoi in 2005	HCMC in 2002 1/
Peak Ratio (%) Peak Hour	16 (n/a)	13 (6-7h)
Average Travel Speed (km/h)	26.0	n/a
Average Volume/Capacity	0.40	n/a
Average Time to Work (min)	18-20	

Source: HAIDEP (2007)
1/ HOUTRANS (2004)

Principal factors for road congestion include on-street parking of motorcycles and passenger cars, traveling of sight-seeing Cyclos, electric vehicles, and bicycles, undeveloped sidewalks, pedestrians' crossing of roadway because of illegal occupation of sidewalk by motorcycles, insufficient signals, undeveloped traffic signs, and loose control of the police authority, in addition to the large volume of motorcycle traffic.

8) Traffic safety

In both cities, traffic accidents have increased along with increase in the traffic volume. In the case of Hanoi, 60% or more of traffic accidents involve motorcyclists as victims. Principal causes of accidents are human, including carelessness, lack of driving experience, drunken driving and traffic violations. In both cities, drivers do not observe the safety rules. Particularly, in many locations in the city, motorcycles are observed to dare reverse running, ignoring red light, running on the sidewalk, running without helmet, running with lots of cargos, and riding in tandem of two or three. To reduce the number of traffic accidents, it is essential to enhance the traffic safety awareness of drivers through strengthening of traffic regulations, strictness in granting the driver's license.

9) Traffic control

The principal object of traffic control is to reduce traffic accidents and to ensure smooth traffic. For this purpose, policies, such as traffic regulation, signal control, measures to control parking, and shifting to public mode, are generally required. However, in both cities, the traffic regulations are not so many, with many

[2] Peak ratio: Peak ratio is calculated by dividing the one-day traffic volume by the peak-hour traffic volume.

intersections requiring installation of the signal. In addition, there is not enough parking area. Even the business of allowing parking of motorcycles on the sidewalk is observed in the inner core of the city. Since both cities are expected to suffer much severer road congestion due to increase in the traffic volume in the future, stricter traffic regulations along with development of traffic facilities are necessary.

10) Air quality environment

According to the air quality environment survey done at five intersections of Hanoi by HAIDEF in March, 2005, total suspended particles (TSPs) and carbon monoxide (CO) were found to exceed the standard level of Vietnam. On the other hand, polycyclic aromatic compound (PAHs) and volatile organic compounds (VOCs), which are considered to be mutagenic agents and carcinogen, are reported to be far below the WHO standard. Since the traffic volume is growing yearly, the air quality environment is going from bad to worse. At present, many of motorcyclists in both cities are wearing the mask to protect themselves from the polluted air. To improve the air quality environment it is necessary to mitigate traffic congestion and to improve vehicles by introducing the vehicle inspection system while taking measures to reduce the number of motorcycles and bicycles.

1.1.2 Tasks of the urban transport sector

The urban transport state of both cities is deteriorating day by day because of increase in the transport demand along with growing population and GDP and due to growing private mode along with increasing ownership ratio of motorcycles and passenger cars. 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.

Principal problems of the public transport sector of both cities are listed below:

- The population of both cities will grow, but the growth of the inner core will be limited. The population growth in the suburb is expected to be accelerated. Since road development in areas other than the inner core is lagging, the road network must be developed in the suburb and to connect the suburban areas with urban areas.
- Increase in GDP per capita will cause increase in the number of passenger cars, replacing motorcycles, which in turn makes the capacity of road and parking area deficient, resulting in further congestion of the road and worsening of air quality environment.
- Chronic congestion will exert adverse affect on the socioeconomic activities, with competitiveness of the cities deteriorating and the life environment worsening.

Principal measures to the problems are listed below:

- Both cities need undertake the Transit Oriented Development.
- Construction of roads in the suburban area and roads and public transport route between suburban and midmost city will be needed.
- To enhance the drivers' consciousness of safety rules, review of the license system and intensified police regulation will be needed.

- For traffic control, 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 necessary.

1.2 The Importance of Line 1 based on Existing Master Plan

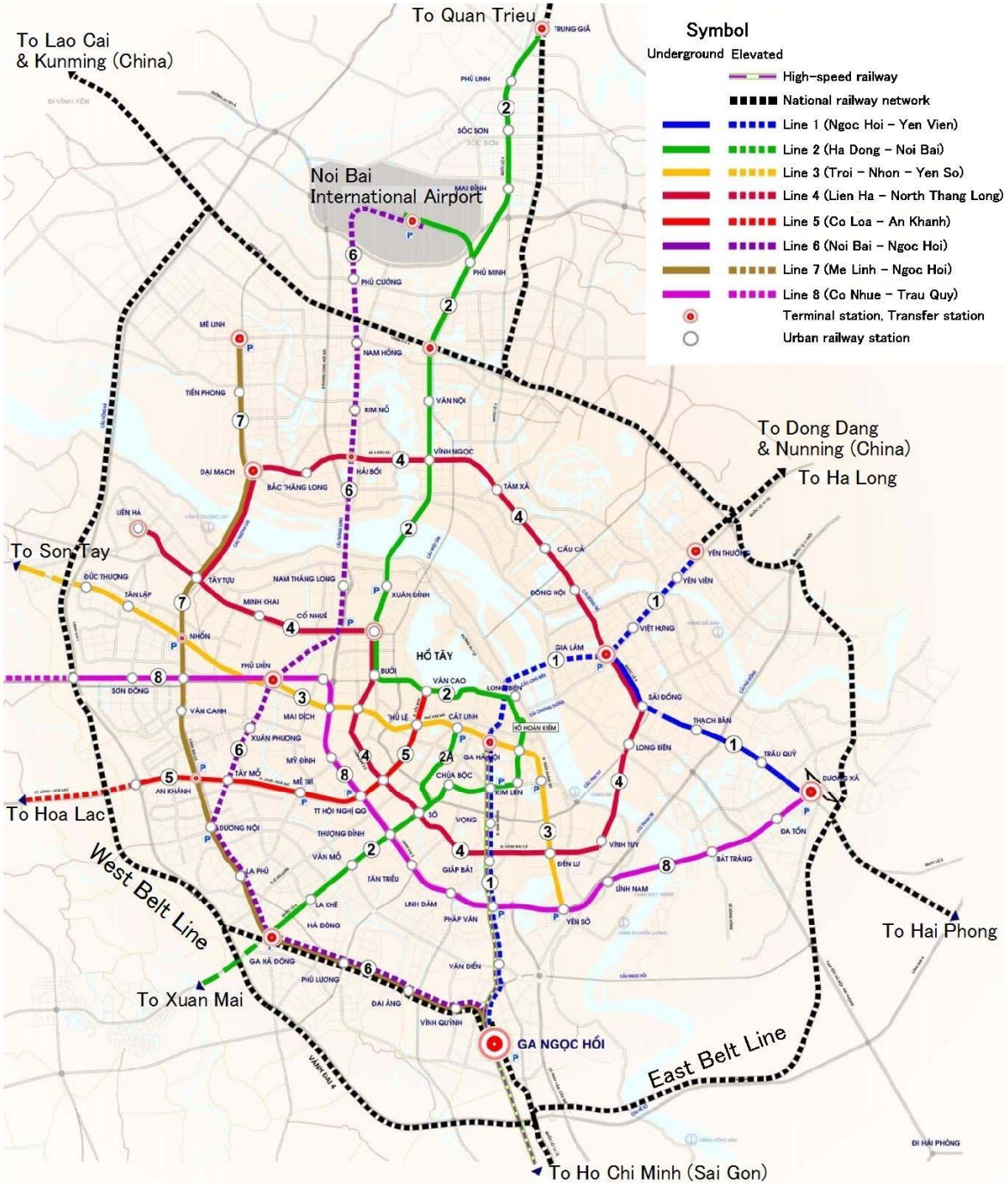
Track elevation of railway line from Ngoc Hoi to Yen Vien, which is part of railway line crossing Hanoi City from South to North, was firstly planned by Swedish International Development Cooperation Agency (SIDA) in 1992. Afterwards, some surveys were conducted by consultants from Germany and Japan Transportation Consultants Association (JTCA).

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. In this master plan, development of high-level of public transportation system 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. However, Line 4 will be initially served by bus before construction of railway line in the future. Among these railway lines, 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/QD-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 were already approved by the Government of Vietnam and currently under development.



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

Fig. 1.2-1 Railway network plan of Hanoi City

1.3 Confirmation of transport demand forecast for the Hanoi City area

1.3.1 Confirmation of the transport demand forecast of HAIDEP

HAIDEP conducted the door-to-door survey of 20,000 households of old Hanoi and surrounding area, which is equivalent to 2.23% of the population, then performed in-depth present situation analysis, preparation of the future transport demand model, and make of the urban transport master plan. Finally, the future transport demand was calculated for three cases; the case in which the present state is left as it is up to the year 2020 (Do Nothing Case), the case in which only the existing projects are implemented (Do Something Case), and the case in which all of projects proposed in the master plan are implemented (Do Maximum Case).
Among these cases, the Do Maximum Case calculates the demand when 43 urban road projects, six traffic control projects, and eight public transport projects are completed. These public transport projects include construction of four UMRT routes and BTR to connect UMRT with principal routes as shown below.

UMRT Line 1	(Ngoc Hoi to Yen Vien, Nhu Quynh)	39 km
UMRT Line 2	(Ha Dong to Noi Bai, Soc Son)	75 km
UMRT Line 3	(Nhon, Hoa Lac to Hai B Trung & Ba Dinh)	33 km
UMRT Line 4	(Tu Liem to Co Bi and Noi Bai, Circumferential, by BRT)	53 km

The transport demand on UMRT in 2020 after completion of all projects is as shown in Table 1.3-1.

Table 1.3-1 Number of UMRT Passengers by Line, 2020

UMRT	Pax-km (000/day)	No. of Pax (000/day)	Avg. Trip Length (km)
1	5,968	704	8.5
2	7,278	866	8.4
3	2,521	488	5.2
4	4,463	526	8.5
Total	20,230	2,584	7.8

Source: HAIDEP (2007)

1.3.2 Confirmation of the traffic demand forecast of HAIMUD

HAIDEP prepared the master plan covering the entire Hanoi city, but it did not review the specific regional development and station facilities development plans centering on UMRT.
Accordingly, 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 of 2020 of HAIDEP. The forecast of HAIMUD was executed in the similar manner as HAIDEP after review of the socioeconomic frame value based on the calculation of how much the nighttime population and the employee population within the

radius of 500 m from the station increases when the integrated development of UMRT and the area around the station is completed. Table 1.3-2 shows the number of passengers of UMRT 1 and 2 routes.

Table 1.3-2 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 the urban transportation sector, especially in the railway sectors are described hereafter. Summary of urban railway Line 1 to 8, each support from donor institutions and their progress are described in Table 1.4-1.

1) World Bank

Role of policy, operation & maintenance, regulation, administration, etc. between VNR and other related institutions (Vietnam Railway Administration (VNRA), Ministry of Planning and Investment (MPI), MOT) are not clear. Meanwhile, many supports are provided by ADB, Japan, Germany, etc. Since participation niche for World Bank is unclear, no support is provided in sub-sectors of railway. However, World Bank is providing supports in the transportation sector consist of highway, inland waterway transportation and port improvement.

2) Asian Development Bank (ADB)

ADB is provising joint financing with Germany Bank for Reconstruction and Development (KfW) and European Investment Bank (EIB) to support construction of HCMC Line 2. In addition, ADB is also conducting join financing with France Government for Hanoi Line 3. Other financings in the urban transportation sector by ADB consist of HCMC Line 3, Line 4, and HCMC highway. ADB is also providing supports in sub-sector of railways in the improvement of railway between Yen Vien and Lao Cai, which located in transit corridor of the Kunming – Hai Phong section.
In addition, ADB is also providing joint financing with JICA to support construction of highway for the Noi Bai – Lao Cai section and the HCMC – Long Thanh – Dau Giay section.

3) France

As aforementioned, France Government is joined with ADB to support construction of Hanoi Line 3. France Government also supports modernization project of signal and telecommunication of the Hanoi – Vinh section. This project consists of replacement of the existing signalling system and cables with optical fiber cable. This signaling system is planned to be installed until Giap Bat Station. Since Hanoi Line 1 is planned to introduce different signaling system, interface of signaling system shall be examined.

In addition, improvement project of the Yen Vien – Lao Cai section which is financed by ADB is supported through France Development Agency (AFD). Since this project also will introduce different signaling system, examination of interface is necessary for the Gia Lam - Yen Vien section and Yen Vien Station of Hanoi Line 1 Phase 2b.

4) Germany

Technical assistance in railway sector is being conducted by Germany since 1990 era and since 2000 gradually focused in railway modernization and regulation. In 2008, supports from Germany consist of a) establishment of enforcement and detail regulation for a new railway, b) structure reform of fare, and c) modernization of railway regulation. In addition, KfW is also providing supports for construction of HCMC Line 2.

5) Others

a) China provided financing for construction of Hanoi Line 2a by Engineering, Procurement & Construction (EPC) method. China is also supporting a modernization project of signal and telecommunication in north part of National Railway Lines. Since scope of this project is until Yen Vien Station, signaling interface with Line 1 Phase 2b in Yen Vien Station shall be examined.

b) Spain expressed to support the construction of HCMC Line 5.

c) Although concrete support is not yet conducted by Korea, they conducted a feasibility study of double tracking and electrification plan of the Hanoi – Vinh section.

Table 1.4-1 Summary of Urban Railway Projects in Hanoi City

No	List of Projects	Route Length (km)	Total Investment (bil VND)	Scale of Investment	Expecting Financing Sources	Project Owner	Current Status							Note
							P	FS	TA	BD	DD	AIT	CS	
1	Ngoc Hoi - Yen Vien - Nhu Quynh (Urban Railway Line 1)	38.7	38,390		JICA ODA Loan, state budget	VNR	✓	✓	✓	✓	✓			ES (BD, DD and AIT) by JKT
2	Hanoi - Ha Dong - Xuan Mai (Urban Railway Line 2a)	38.0	26,675		Chinese government, state budget	VNRA	✓	✓	✓	✓	✓	✓	✓	EPC by Chinese company
3	Noi Bai - city center - Thuong Dinh (Urban Railway Line 2)	33.9	44,715	LRT, Metro	JICA ODA Loan, state budget	HPC (HRB)	✓	✓	✓					GCS (BD, AIT and CS) started
4	Son Tay - Nhon - Hanoi Railway Station - Hoang Mai (Urban Railway Line 3)	41.0	67,659	LRT, Metro	French government, ADB Loan, state budget	HPC (HRB)	✓	✓	✓	✓				ES by Systra
5	Dong Anh-Sai Dong-Hoang Mai-Thanh Xuan-Tu Liem-Thuong Cat-Me Linh (Urban Railway Line 4)	53.1	6,107	LRT, Metro	State budget, private investment or BOT	HPC (HRB)	✓							
6	South of West lake - Ngoc Khanh - Hoa Lac - Ba Vi (Urban Railway Line 5)	51.5	25,908	LRT, Metro	State budget, private investment or BOT	HPC (HRB)	✓							
7	Noi Bai - Bac Hong (Urban Railway Line 6)	-	-		State budget, private investment or BOT	VNR								
8	Me Linh - Ngoc Hoi (Urban Railway Line 7)	-	-		-	-								
9	Co Nhue - Trau Quy (Urban Railway Line 8)	-	-		-	-								

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

Notes: P: Planning, Master Plan and Pre-Feasibility Study, FS: Feasibility Study, TA: Technical Assistance such as SAPROF, SAPI and Preparatory Survey etc, BD: Basic Design, DD: Detail Design, AIT: Assistance in Tender, CS: Construction Supervision, ES: Engineering Services, EPC: Engineering, Procurement, and Construction Contract, GCS: General Consulting Service,
VNR: Vietnam Railways, VNRA: Vietnam Railway Administration, HPC: Hanoi People's Committee, HRB: Hanoi Metropolitan Railway Board, JKT: Association of JTC, JARTS, JRC, JEC, Koken, TRICC, TEDI and TEDIS

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

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

The purpose of the project is to mitigate urban traffic and environmental problems by constructing urban railway as mass rapid transit system between Ngoc Hoi and Yen Vien on the single track railway across Hanoi City so that it may contribute to further socio-economic development and improvement of environmental problems. This project covers a double track elevated railway with an electrification (Ngoc Hoi - Yen Vien, approximately 29.3km), and the construction of Ngoc Hoi Station Complex. The project is divided into 3 phases as follows.

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)

The project location map is shown in Fig. 2.1-1.

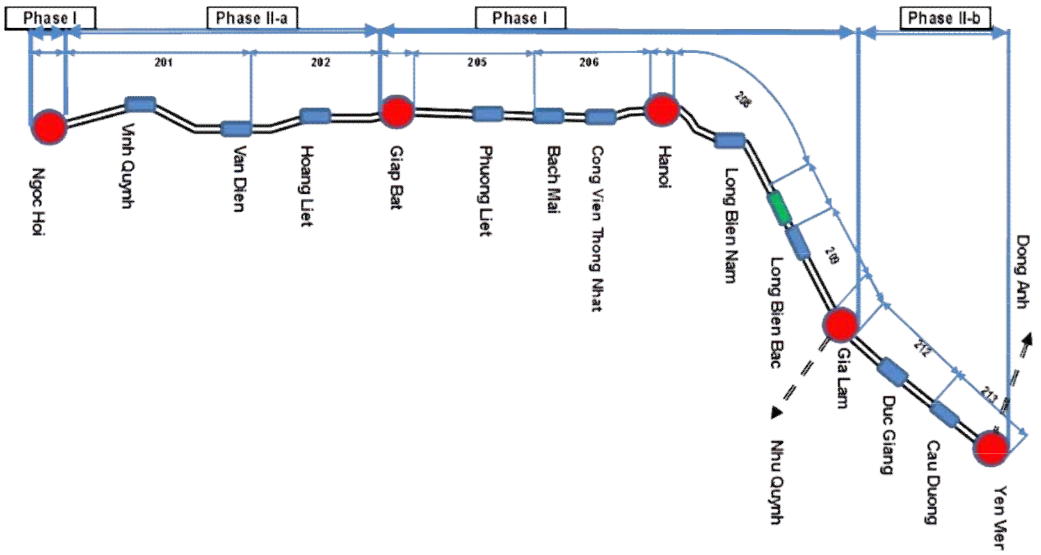


Fig. 2.1-1 Location Map of Hanoi City Urban Railway Line 1

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

The existing line is a non-electrified single track railway. Middle-distance and long-distance trains for various destinations such as long-distance trains traveling between Hanoi Station and Ho Chi Minh City on the south are operated on this line. Also, International trains are operated between China on the north and Hanoi City, but they cannot drive into narrow gauge (1,000 mm) rail sections which are used on a lot of lines in Vietnam because the trains have standard gauge (1,425 mm). Therefore, the trains are operated by Gia Lam Station. Region north from Hanoi have standard gauge rail sections, and also have three-rail track sections where both of trains having standard gauge and narrow gauge can be operated.

In Vietnam, using standard gauge rail on new railway lines is stipulated in the law. Thereby, Hanoi City Urban Railway (Line 1) is supposed to be constructed using standard gauge rail. Also, operation of international trains (1,435 mm) and domestic middle-distance and long-distance trains (1,000 mm) by Hanoi Station is stipulated as precondition, and three-rail track with standard and narrow gauge rail is used on Line1.

In addition, because Ngoc Hoi Station Complex needs a certain space, it is planned 500 m away from the existing line, and guide way sections around it are built, and construction of the west ring line which is used as a freight line and also shortcut line are planned in Phase 1.

2.1.2 Background of the Request for the Project

MOT, HPC, and VNR formulated "Hanoi Transportation Plan 2020" in 2003, and they gave the highest priority to the elevated railway project, Ngoc Hoi - Yen Vien. Afterward, a Vietnamese consultant implemented the Pre-FS of this project based on the instruction of VNR, and made "The General Plan for Making Investment to Hanoi Elevated Railway Project, Ngoc Hoi – Yen Vien (9^{th} Edition)" in July 2005. In response to this, MOT and HPC agreed early implementation of the project based on the instruction of the prime minister in October 2005.

FS was started by Japan External Trade Organization (JETRO) from September 2005, and demand forecast, preliminary design, implementation plan, environmental impact assessment, economic and financial analyses were conducted, and MOT agreed the contents of them in March 2006.

In this survey, as divide patterns of implementation of the project, the plan which had 3 sections such as 1) from Ngoc Hoi to outside of the Red River, 2) from the Red River Bridge to Gia Lam, 3) from Gia Lam and Yen Vien, and the plan which had 2 sections such as 1) from Giap Bat to Gia Lam, 2) from Ngoc Hoi to Giap Bat and from Gia Lam and Yen Vien were created. Also, the plan which used three-rail track with standard gauge and narrow gauge, and the plan which used only narrow gauge were created against above 2 plans. Accordingly, 4 alternative plans were proposed in total.

Pre-FS which was agreed in 9^{th} Edition in October 2005 was reviewed based on the survey results of JETRO afterward, and submitted as a FS final report in June 2007. At that time, the Phase divide pattern of implementation of the project was decided to be 2 steps 1) from Giap Bat to Gia Lam, 2) from Ngoc Hoi to Giap Bat and from Gia Lam to Yen Vien, and three-rail track, DC 1500 V electrified system. MOT applied for divide of Phase 1) and 2) into sub project

of Project 1 and Project 2 to the prime minister, and it was accepted in September 2007. A Vietnamese consultant created Project 1 FS, and VNR accepted this in March 2008.

In advance of this, JBIC (at that time) carried forward procedures required for loan in order to respond to request for yen loan submitted by the Government of Vietnam, and signed LA (No.VNXV-2) which was limited by 4,683,000,000 yen as a project cost for consulting services such as detailed design, tender assistance and etc, on March 31st 2008. The debtor was the Government of Socialist Republic of Vietnam, the implementation agency was VNR, the project section was between Giap Bat and Gia Lam and also Ngoc Hoi Station Complex.

As a result of VNR's consultant selection procedures, The Association of JKT (JKT) composed 8 companies such 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 acquired the right to negotiate a contract, and the consultant contract was signed. The scope of work was basic design of Ngoc Hoi and Yen Vien section, detailed design of Phase 1 section and tender assistance.

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 in accordance with the progress of the preparation of tender documents, but at the stage of basic design, from the inauguration of Phase 1 section to the inauguration of Phase 2 section, difficulties in operation plan and issues of construction cost for temporary equipment were detected, and VNR requested JKT to consider the simultaneous construction of Phase 1 and Phase 2a. In response to this, as a result of JKT's consideration of train operation plan, maintenance plan and management based on demand forecast, it was confirmed that the simultaneous construction has advantages in saving temporary equipment construction cost, reasonable operation plan, increase of passenger demand and so on.

Based on the conclusion above, proceed of preparation for the simultaneous construction of Phase 1 and Phase 2a was agreed at a general meeting of MOT, HPC, VNR held in November. As a result of it, equipment such as temporary slope for siding track at the south of Giap Bat Station which was required for the opening of Phase 1 section was excluded from the scope of the detailed design, and the section between Ngoc Hoi and Gia Lam, which meant that design work of Phase 1 is being proceeded assuming the opening of Phase 1 + 2a at the same time.

VNR declared that they expected JICA contact mission sent in August 2011 to accept yen loan of 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.

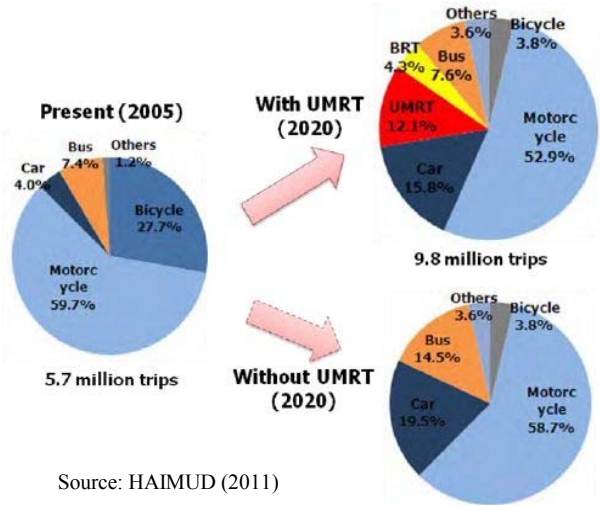
2.2 Necessity of implementation of this project

Road traffic situation in Hanoi City has been deteriorated by the increase of urban population and the spread of motorcycle rapidly in recent years. According to HAIDEP study report, 85% of households in Old Hanoi City had the motorcycle, of which 45% of households had two or more motorcycles, and 2% of households had the car in 2005. According to the transport mode composition in 2005, 64% of trips use the motorcycle, 25% use the bicycle, 7% use the bus and 4% use the car and taxi. As the motorcycle is easy and convenient vehicle to drive door-to-door directly, share of motorcycle is increasing. However rapid increase causes the traffic congestion, traffic accidents and air pollution.

It is forecasted that road congestion in Hanoi City will be more serious when this tendency will continue and some traffic will be converted from motorcycles to the cars accompanied by the income's increase. According to the HAIDEP study, average congestion in the center of Old Hanoi City was 0.57 in 2005, and it is forecasted to be 1.00 and to fall into almost chronic road congestion. In case any traffic measures will not be implemented, it is expected that socioeconomic activity in Hanoi City will stagnate, competitive edge of the City will deteriorate, and living condition will be poor.

The population in Hanoi City is 6.55 million people in 2010, and it is forecasted that it will reach to 790-800 million people by 2020 according the "Decision on approval of master plan for socioeconomic development in Hanoi Capitan till 2020, with orientation towards 2030".
If Hanoi City wants to decrease the urban traffic problems and to have the sustainability of the urban system, it is necessary to aim the society which will give priority to public transport, to avoid relying on the private vehicles and to promote the Transit Oriented Development (TOD), though it is clear from the experience and the lesion of the big city in the world.
Furthermore, when we consider the scale of Hanoi City, it is necessary to formulate the trunk transit line by the construction of UMRT with the transport capacity of 5,000 passengers or more per one day per one direction, and to connect the feeder bus networks to the UMRT lines at the early stage.

According to the result of HAIMUD study in 2011, the share of the motorcycle will decrease by 6 points from 59 to 53 % and the share of public transport will increase by 9 points from 15 to 24% in 2020 when the Phase-1 sections of UMRT Line 1 and Line 2 will be opened. In case UMRT lines will not be opened, it is forecasted that the share of motorcycle and car will go up to as much as 78%, roads in Hanoi City will be congested chronically and it will have a critical impact on urban functions. That's why it's necessary to construct UMRT at the early stage, especially Line 1 which priority is especially high.



Source: HAIMUD (2011)

Fig. 2.2-1 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

In this survey, the validity of the forecasted OD table between stations in the UMRT line 1 in 2020, which was calculated by HAIMUD study team and which was quoted to the LINE 1 Phase II Feasibility Report by TRICC, is confirmed.
Future demand forecast result was forecasted at HAIMUD study by following the same method as forecasted at HAIDEP study, and the forecasted number of passengers getting on and off on the UMRT 1 has increased more than HAIDEP study because the population of the zone that relates to the station increases by the urban redevelopment for the area around the stations.
On the other hand, the population in merged new Hanoi City will be around 7.9 – 8.0 million people by 2020 and approximately 9.2 million people by 2030, according to "Decision on approval of master plan for socioeconomic development in Hanoi capital till 2020, with orientation towards 2030".

It is usually necessary to compare the official Hanoi City future population approved in July, 2011 and the future population which was set by HAIMUD study when the validity of demand forecasted by HAIMUD study is conducted. However, two population numbers were not compared because future population of new Hanoi City is not disclosed by HAIMUD study team, and some of neighboring city and towns of old Hanoi City were not included as the study zone at the HAIDEP study, though future population by zone was published by HAIDEP study team. As UMRT Line 1 will pass through the old Hanoi City, the validity of OD table between stations is checked by comparing the population of Old Hanoi City.
Concretely, population numbers in 2020 of old Hanoi City forecasted by using the growth rate of the population of past Old Hanoi City and set by HAIDEP study are compared, because there was no population forecast value of Old Hanoi City from which the Prime Minister had been approved. Table 2.3.1-1 shows the transition of the population of old Hanoi City.

Table 2.3.1-1 The transition of the population of Old Hanoi City

(Unit: 1,000 people)

Year	2000	2001	2002	2003	2004	2005	2006	2007	Annual Average Growth rate
Population	2,767.7	2,852.9	2,928.3	3,000.3	3,071.4	3,133.4	3,184.8	3,228.5	2.2%

Source: General Statistics Office of Vietnam

The annual average growth rate of the population of Old Hanoi City for seven years until 2000 - 2007 is 2.2%. When this ratio will assume it is constant during the future, the population in 2020 will become 4.3 million people.
On the other hand, as the population number of Old Hanoi City of 2020 that had been set by the HAIMUD survey is 4.53 million people, it turns out that the population set by the HAIMUD survey is 230,000 people (5%) larger compared with estimated 4.3 million people.
As the difference of 5% doesn't make much effect for demand forecasting, it is judged that the OD table between the stations in 2020 forecasted by HAIMUD survey team is appropriate because of the setting of the population is appropriate.

The OD table between the stations in 2030 is made by JKT team with taking advice from HAIMUD Study team by interpolating the OD tables between in 2020 and in 2040, which is calculated as a reference, made by HAIMUD Study team.

As the socioeconomic frame in 2040 is closed-door, OD table in 2040 can't be verified. But its calculating method is as same as for OD table in 2020, therefore OD table in 2040 is judged to be appropriate one.
Meanwhile, OD table in 2040 is forecasted assuming that all effective projects which were considered by HAIDEP Study will be completed until 2040. Therefore, the number of passengers in phase 2b section (YenVien – Gia Lam) is included in the OD table in 2030.
When economic and financial analysis is implemented in this study, phase 2b section assume closed.

Table 2.3.1-2 shows the number of daily passengers by phase that is used by JICA survey team.

Table 2.3.1-2 Daily passengers in 2020 and 2030

(Unit: Pax/day)

	Phase 1 Only	Phase 1 + 2a
Year 2020	105,000	232,000
Year 2030	-	324,000

Source: JICA Survey Team

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

The Hanoi Capital Construction Master Plan in 2030 and vision to 2050 (Prime Minister's decision No.1259/QD-TTg July 26, 2011) is the transportation and traffic plan that can currently be used in Hanoi. The Plan for Hanoi's Urban Transport Network in 2030 which is included in this Master Plan is presented in Fig. 1.2-1 (page 1-7).

The Hanoi City Urban Railway Line 1 corresponds to Line 1 in the Transport Network Plan (Fig. 1.2-1). The following table shows which other railway lines intersect with the Phase 1 and Phase 2a sections of Line 1. The other intersecting lines are planned to be constructed underground (except Line 8 which is still pending).

Table 2.3.2.1-1 UMRT Lines Crossing with Line 1

Line 1	UMRT	Location of Intersection	Transfer Station
Phase 1	Line 2	South of Long Bien Kim Lien	Long Bien Nam Cong Vien Thong Nhat
	Line 3	North of Hanoi Station	Hanoi
	Line 4	Kim Dong	Giap Bat
Phase 2a	Line 8	Ring Road No3	

Source: JICA Survey Team

Line 1 will be connected with the existing line at the south of Ngoc Hoi. Currently, freight trains from the south stop at the existing Giap Bat station or some of them bound for the north and west go back to the south and branch off from the main line at the point of 470m south from Van Dien station, connecting to the West Ring Line. However, before construction of the Line 1 viaduct begins, freight trains from the south will branch off from the main line south of Ngoc Hoi depot and stop at the Ngoc Hoi freight station, while north- and west-bound trains will take the Ngoc Hoi depot~connecting line~West Ring Line route.

During construction of the Line 1 viaduct, passenger trains from the south will use the existing line (and perform shuttle operations at the Giap Bat temporary station). After completion of the viaduct, the Giap Bat temporary station will be turned into a station plaza.

After the Phase 1 and Phase 2a sections have been opened for traffic, first class passenger trains will run on the Line 1 viaduct from Ngoc Hoi to Hanoi station, while normal passenger trains will stop at Ngoc Hoi.

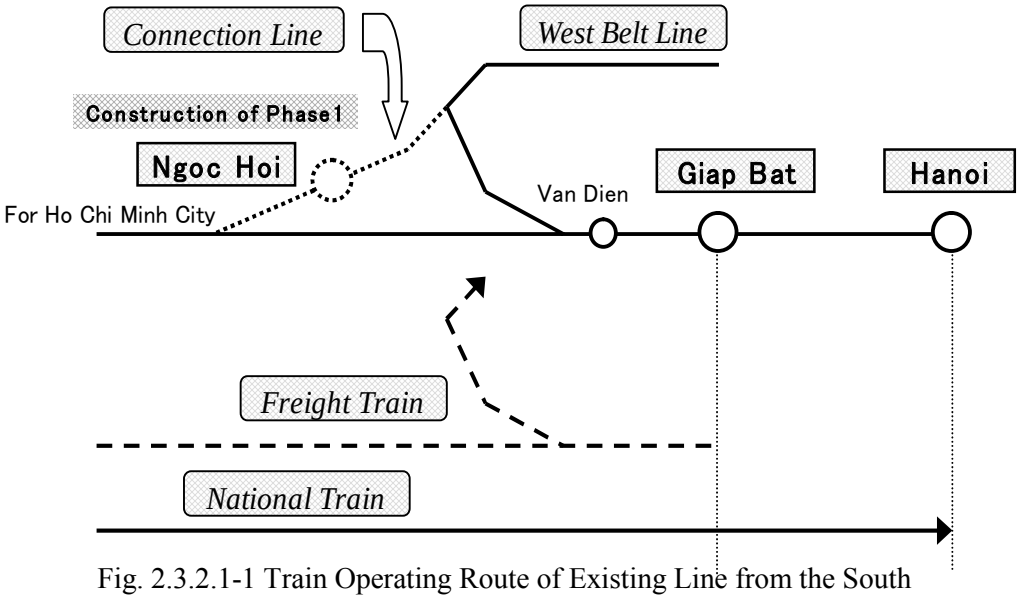


Fig. 2.3.2.1-1 Train Operating Route of Existing Line from the South

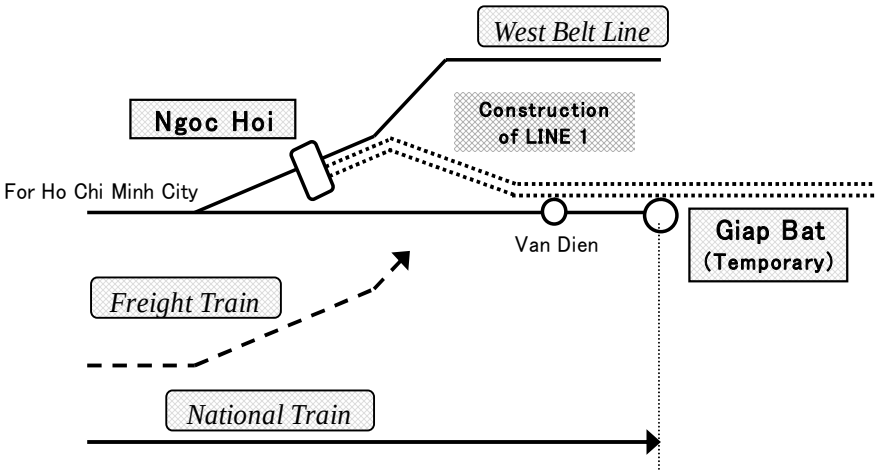


Fig. 2.3.2.1-2 Train Operating Route during Phase 1 + 2a Construction

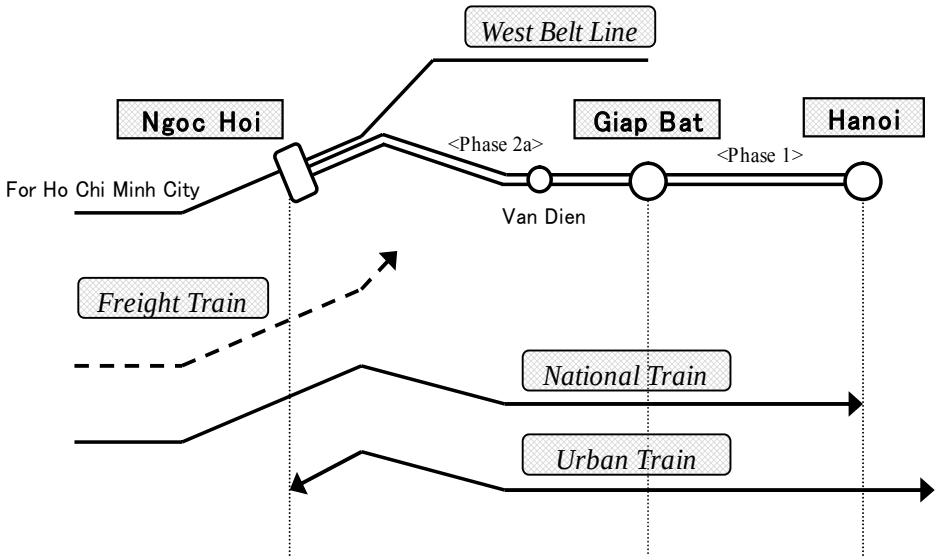
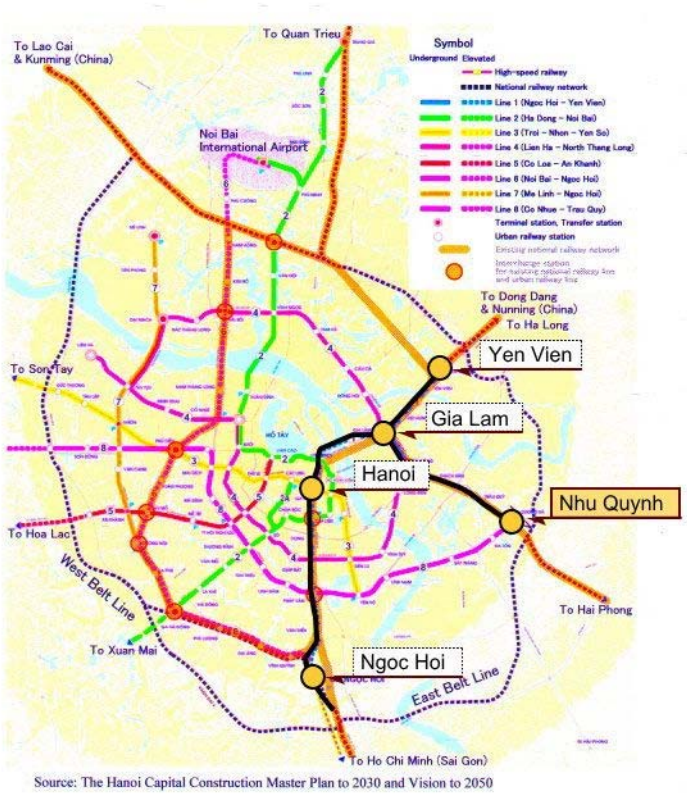


Fig. 2.3.2.1-3 Train Operating Route after Completion of Phase 1 + 2a

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

The HAIDEP study which was implemented by JICA in March 2007 lists the integration with urban planning, network formation and gradual development as important points when planning Urban Mass Rail Transit (UMRT) systems. However, the study also considers the functional and operational differences of urban and intercity rail systems, and limits intercity services to the area outside and urban services to the area inside the planned future ring line.

Both Ngoc Hoi and Yen Vien station on Line 1 form nodes with the ring line and have been properly planned and integrated as such. The line that branches off to the east from Gia Lam and heads for Hai Phong crosses the ring line at Nhu Quynh station. In the HAIDEP study, the Gia Lam~Nhu Quynh section is regarded as part of Line 1 (Ngoc Hoi~Yen Vien). "The Planning on Development of Hanoi Capital's Communications and Transport till 2020" study (prepared in Vietnam and approved by the Prime Minister in July 2008) also defines Line 1 as covering the Ngoc Hoi~Yen Vien~Nhu Quynh sections (38.7km). Later internal Vietnamese government documents also use the same definition of Line 1. Because VNR calls the Gia Lam~Nhu Quynh section Line 1 Phase 3, the same name will be used in this study.



Source: The Hanoi Capital Construction Master Plan to 2030 and Vision to 2050

Fig. 2.3.2.1-4 Hanoi Urban Railway Line 1 Gia Lam~Nhu Quynh Section

a) 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 of the currently single-tracked Gia Lam~Hai Phong line under Phase 3 of Line 1. 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. Local developers are already active constructing residential areas especially around Gia Lam station and nearby ring roads and the construction of an urban train line between Gia Lam and Nhu Quynh would therefore be a way to meet future demand.

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 to be connected to Gia Lam station.

The first FS proposed having passenger trains from Hai Phong conduct shuttle operations at the station next to Gia Lam or constructing a temporary station for them during the construction of Phase 1. The FS also proposed having 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 review of the FS and negotiations with VNR, VNR decided on the construction of a new at-grade station with 1 platform and 2 tracks 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 (including the existing Long Bien bridge) as long as possible, and on using the existing Long Bien Nam station (on the Hanoi station side of the Red River). 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. However, passengers from Hai Phong would still have to transit from the new at-grade station to the elevated station also after the latter is completed.

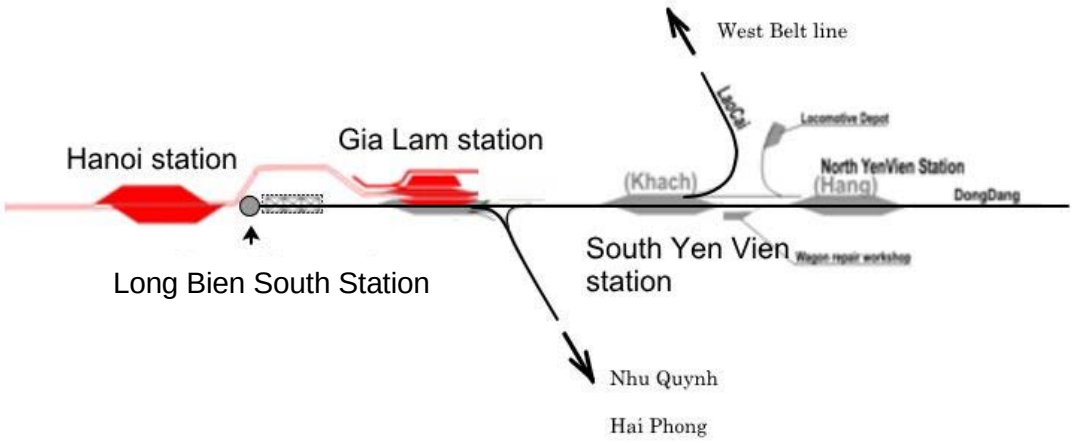


Fig. 2.3.2.1-5 Train Operation System around Gia Lam Station

Until completion of the East Ring Line, 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 general 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.

In order to avoid having to redo part of the construction work, the handling of freight trains, the alignment in Gia Lam station and the elevated station structure under Phase 3 all have to be considered already during the design of Phase 1.

At VNR's request, JKT has prepared a rough plan that covers the connection of the Gia Lam~Nhu Quynh urban railway line with the elevated Gia Lam station.

b) 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. Provided progress can be made

on the land acquisition process and the design work, it seems possible to start construction in 2018 as originally planned. After the Phase 2b section of Line 1 has been completed, VNR has plans to double track the national train lines coming from the north using the ROW of the existing line and part of the widened ROW (although no FS has been carried out China is interested). As a result of consultations between VNR and JKT, JKT has already completed a tentative basic design (alignment) of Phase 2b. However, in the detailed design for Phase 1, JKT has not considered how to connect the double-double tracked lines (double tracked urban railway line and double tracked national and international lines) proposed by VNR to Gia Lam station.

When preparing the detailed design of Gia Lam and Yen Vien station, the relationships between the East Ring Line, Phase 2b and Phase 3 have to be considered without losing sight of the planned January 2018 construction start of Phase 2b.

Because of the clearance requirements of the railway bridge over the Red River, Gia Lam station had to be elevated instead of constructed at grade (on an embankment) as proposed in the FS. In the original FS, passenger trains from the north were to conduct shuttle operations at Yen Vien station during the construction of Phase 1, while freight trains were to arrive at the Yen Vien freight yard.

As previously mentioned, based on JKT's review of the FS and negotiations with VNR, VNR decided on the construction of a new at-grade station with 1 platform and 2 tracks 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 (including the existing Long Bien bridge) as long as possible, and on using the existing Long Bien Nam station (on the Hanoi station side of the Red River). This would enable medium- and long-distance trains from the north to run to the new at-grade station at Gia Lam or to the existing Long Bien Nam station. Until opening of the East Ring Line, freight trains from the north will take the West Ring Line from Yen Vien to the Ngoc Hoi complex.

Although VNR has different future plans that include constructing dedicated double tracking for national and international trains on the Yen Vien~Gia Lam section, double tracking the Hai Phong line, constructing a double tracked and elevated urban railway line between Gia Lam and Nhu Quynh (Line 1 Phase 3), and constructing a new East Ring Line, no comprehensive and concrete studies have so far been carried out. However, as mentioned in section a) above, JKT has at VNR's request prepared rough plans that cover the connection of the Gia Lam~Nhu Quynh urban railway line and the double-double tracked Yen Vien~Gia Lam section with the elevated Gia Lam station.

The existing Yen Vien station will be used during the construction period of Phase 2b. However, construction of a temporary station at the location of the existing freight yard and a siding track for the maintenance of passenger trains at Yen Vien north station is required.

Although the above issues have been discussed between VNR and JKT at the basic design stage, the swift commencement of the detailed design of Phase 2b is desirable.

c) Necessity of East Ring Line construction

As mentioned above, the widening of the ROW of the Phase 2b section and the continued use of the existing line have basically been approved, so the construction start of 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 operations require freight trains from the north to run from Yen Vien station on the West Ring Line to Ngoc Hoi freight station, while freight trains from Hai Phong will travel north on the existing line between Gia Lam and Yen Vien and then take the West Ring Line to Ngoc Hoi freight station.

Freight trains will thus run on the West Ring Line to Ngoc Hoi freight station, but this lengthens the route for the freight trains coming from Hai Phong which in turn diminishes transport efficiency. Although the importance of the West Ring Line as a freight route will increase after the completion of the Line 1 project, the West Ring Line will also be used by passenger trains running on Line 6 (Noibai airport access line) which increases the likelihood of problems if freight trains are allowed to share the same line. The East Ring Line has the same function as the Musashino Line in Tokyo had when it was constructed and will therefore come to play an important role in the future.

3) Related projects

When determining the type and dimensions of the structures required for Phase 1 and Phase 2a of Line 1, the geometry, aesthetics, environmental considerations, etc. of any intersecting structures such as bridges have been considered. All Line 1 structures are therefore compatible with those of related projects.

Line 1 will cross not only other railway lines, but also roads and rivers. The three bridges listed below will cross other facilities on the Phase 2a section of the Project. There are also some other narrow future roads on this section but these can be crossed using standard span PC girders and do thus not require special bridges. When determining each bridge span, the current conditions and future plans for the crossing in question have been considered in order to limit any negative impact on road and river traffic. These plans have already been explained to VNR, and the basic design has been submitted and is now waiting for approval.

a) Ring Road No. 3 Intersection (Km6+278)
There are plans to make the crossing of Ring Road No. 3 and National Highway No. 1 into a major intersection. Line 1 will cross not only the grade separated Ring Road No. 3 but also a parallel urban road. The Ring Road No. 3 flyover will be 70m long so as not to limit future traffic on the intersecting road. For aesthetic reasons, a Lohse arch structure was selected for the girder. However, it is difficult to employ PC girders because of the long span length.

Because Ring Road No. 3 is already in use, steel girders that need minimal falsework will be used for the installation of the railroad girder in order to limit the impact on car traffic. The clearance required for Ring Road No. 3 was taken into consideration when the height of the bridge was decided. Fig. 2.3.2.1-4 shows a side view of the Ring Road No. 3 Intersection.

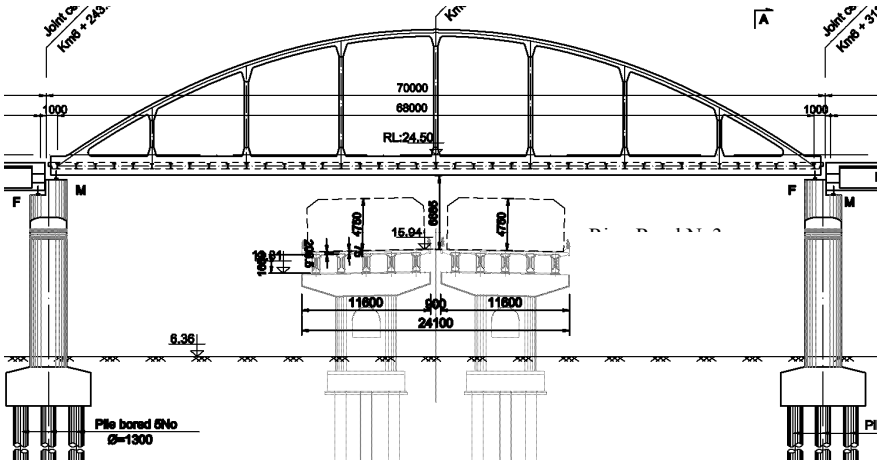


Fig. 2.3.2.1-6 Ring Road No.3 Intersection

According to the Plan for Hanoi's Urban Transport Network in 2030, urban railway Line 8 will run parallel to Ring Road No. 3. Because the exact horizontal location and height of Line 8 are not known at present, the alignment and structure of Line 8 and Line 1 will have to be adjusted in the future.

b) Van Dien Bridge (Km7+913)

As for Van Dien Bridge, a new elevated bridge will be constructed in a location about 9m from and parallel to the existing line. There are plans to increase the width of To Lich River which Van Dien Bridge intersects to 59.4m. The new Van Dien Bridge will be made 60m long because the existing pier foundations cannot be used and the widening of the river has to be considered. Although there is enough clearance under the girder because the river is not used for shipping, the height of the rail level is determined by surrounding stations and the bridge thus cannot be lowered any further. PC box girders are employed for the bridge. PC box girders have a pleasing appearance because they form a typical and continuous viaduct, and they are also the most economical alternative. Cast-in-place girders have to be used because of the long spans. A side view of Van Dien Bridge is shown in Fig. 2.3.2.1-5.

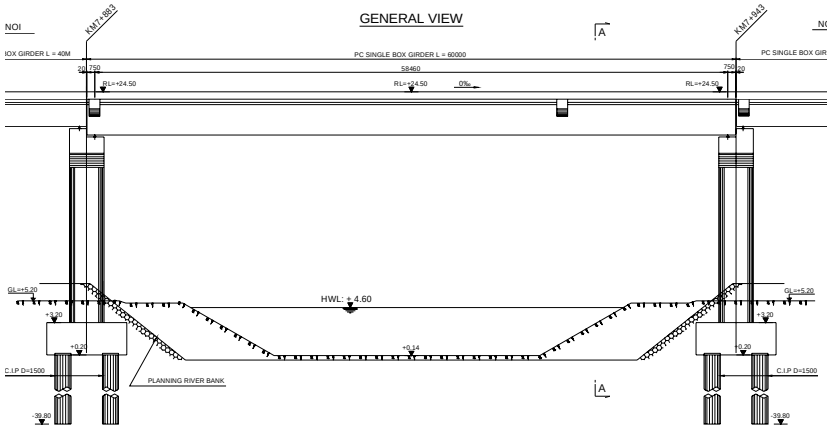


Fig. 2.3.2.1-7 Van Dien Bridge

c) Van Dien Intersection (Km8+794)

The existing line south of Giap Bat station will be used as a temporary line and the new elevated bridge will be constructed in a location about 9m from and parallel to it. Van Dien Intersection consists of a bridge straddling Regional Road 70 which in turn crosses National Highway No. 1. This flyover is planned to be constructed after the completion of the Hanoi viaduct. A 60m simple girder will be employed for Van Dien Intersection so as not to obstruct the planned future roads. Because of aesthetic and economic reasons, the bridge will use the same PC box girders as Van Dien Bridge. PC box girders are employed in order to make the appearance the same as that of the typical viaduct. Although cast-in-place girders have to be used because of the long spans, this poses no problem as the flyover will be constructed in the future. A side view of Van Dien Intersection is shown in Fig. 2.3.2.1-6.

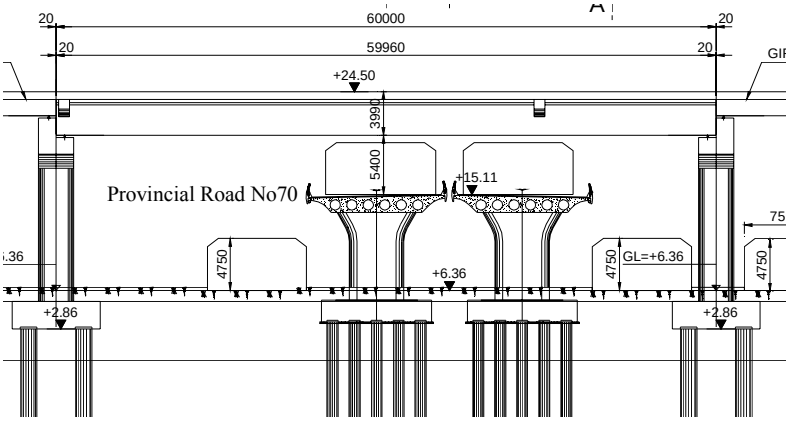


Fig. 2.3.2.1-8 Van Dien Intersection

d) Development of station plazas

The Vinh Quynh, Van Dien and Hoang Liet urban train stations are located on the Phase 1 + 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 train passengers. Land use for station plaza development is considered in Red Line Boundary (RLB) which is currently under review by HUPI, but station plaza development plans are not at present included in this project.

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. The issue of securing financial resources for construction and maintenance will also need to be discussed. 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 management company, it is very important to complete the station plazas before train operations begin. Solving this problem requires urgent consultations and meetings between HPC and VNR.

2.3.2.2 Technical standards

Technical railway standards show the compliance requirements for railway facilities, rolling stock structure, maintenance and operations that are needed in order to ensure the safety of train operations. 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.). Although there are technical standards and regulations for each of these, 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 national trains, standard gauge international trains and all related standards have to be met, and the urban railway standard thus cannot be applied without modification. In order to solve this problem, 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 carried out by JKT 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

1) IC Card system and AFC (Automatic Fare Collection Systems)

The specification of AFC and IC card should be arranged so that users can use the same IC card whether or not the management company is the same in the urban railway constructed in Hanoi from now on,. Hanoi and Ho Chi Minh City People's Committee asked MOT to issue regulations related to the specification of AFC and IC card. Therefore, final decision of the specification is waiting the regulations.

2) VNR Vocational College

Although the VNR Vocational College's building is improved, the education & training equipment is very old and even out-of-date. The equipment cannot meet demands of educating staffs for urban railway. The equipment supply for improving education and training equipment including an operation simulator etc. should be considered by a certain method. If this is fixed, it will be possible to also accept urban railway staffs other than Line 1.

2.3.2.4 The operation & maintenance management

1) The operation & maintenance management entity

About the operation & maintenance management entity, the examination about the whole Hanoi city urban railways is made in "SAPI for establishment of an organization for the O&M of MRL in Hanoi" which JICA is carrying out. In which, it's desirable that Hanoi city urban railways built from now on will be managed by one O&M Company if possible. The following is described as the reason.

- Common fare system can be realized easily.
- Deficit of a line can be filled up by the profit obtained from another line automatically.
- Human resources in the operator can be utilized efficiently.
- Staff numbers of common or indirect departments can be saved.
- Integration of OCC can be done easily.

From the study of current situations of each line, it was found that integration of Line-2, 2a and 3 in the O&M Organization seems to be relatively easy. It is because Line-2 and 3 is constructed by HRB under HPC and Line-2a can be transferred to HPC from MOT/VNRA after completion. According to "SAPI for establishment of an organization for the O&M of MRL in Hanoi", since the owner of Line-1 and 5 are not

HPC: Line-1's owner is VNR, and line-5's is private, it may be rather difficult to unify these two lines. The operation & maintenance management plan of the Hanoi city urban railway No. 1 line was concretely mentioned at 2.4.7.

2) Fare Level

The starting fare in 2019 is set at 6,000 VND in Phase 2a FS report made by TRICC. The fare is based on the current bus fare. The current bus fare is 3,000VND so the urban railway fare is calculated 6,000VND in 2019 by the inflation rate of 8 % and after that by the annual inflation rate of 5 %. This fare level is still low in comparison with fare level currently considered in "SAPI for establishment of an organization for the O&M of MRL in Hanoi" mentioned above. The base of the company management, fare setup not only is simply dependent on bus fare but also should be taken into consideration of further examinations including affordability for the railway fare of people living in Hanoi and the conversion incentive to the railway from motorbikes, etc.

3) IT system for company management

In the Ho Chi Minh City, Line No. 1 and the Hanoi Line No. 2, introduction of IT system for company management is considered, but in the Hanoi Line No. 1, it has not been examined. In order to manage urban railway efficiently, it is considered that IT system is indispensable. Although presently the general IT systems such as accounting system used by non-public companies are taken in VNR, the application of the IT technologies especially those concerned to railway operation is not timely satisfactory. The reservation system of ticket, etc. has just been adapted recently. Moreover, integrating systems to possibly supply various information for business management is not implemented neither. It's a must to estimate the fixed investment expense to adapt the IT System to Hanoi Line No. 1, and it is necessary to examine it including the method of giving birth to the expense.