HA NAM PROVINCE PEOPLE'S COMMITTEE

PREPARATORY SURVEY ON HA NAM PROVINCE INVESTMENT CLIMATE IMPROVEMENT PROJECT IN VIETNAM

FINAL REPORT

VOLUME I
MAIN REPORT

MARCH 2019

JAPAN INTERNATIONAL COOPERATION AGENCY

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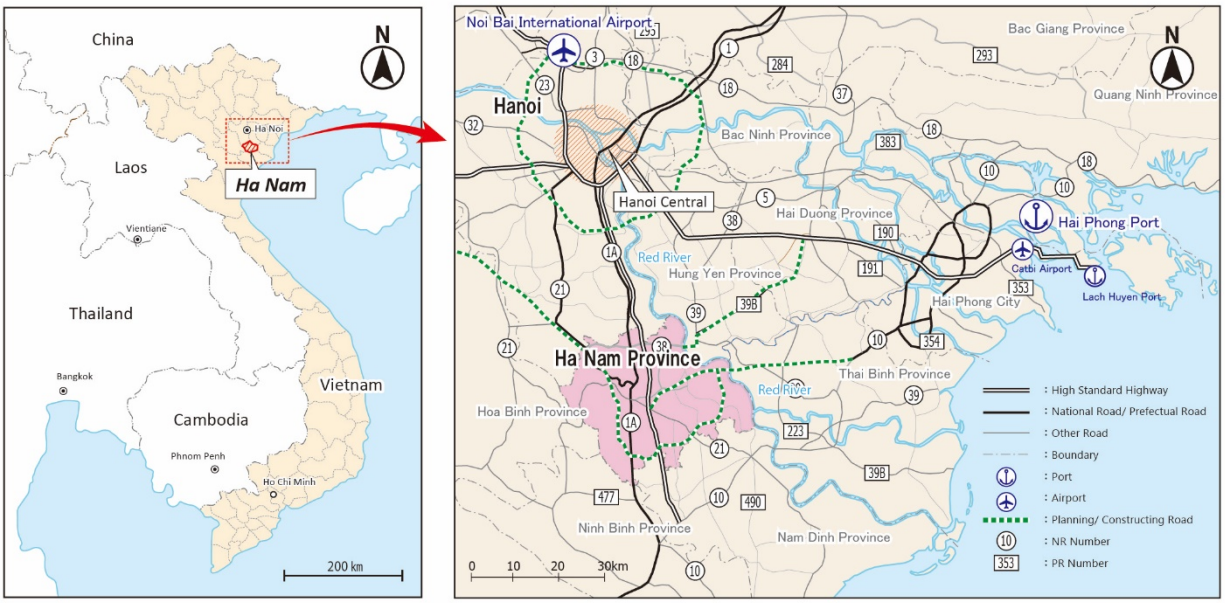
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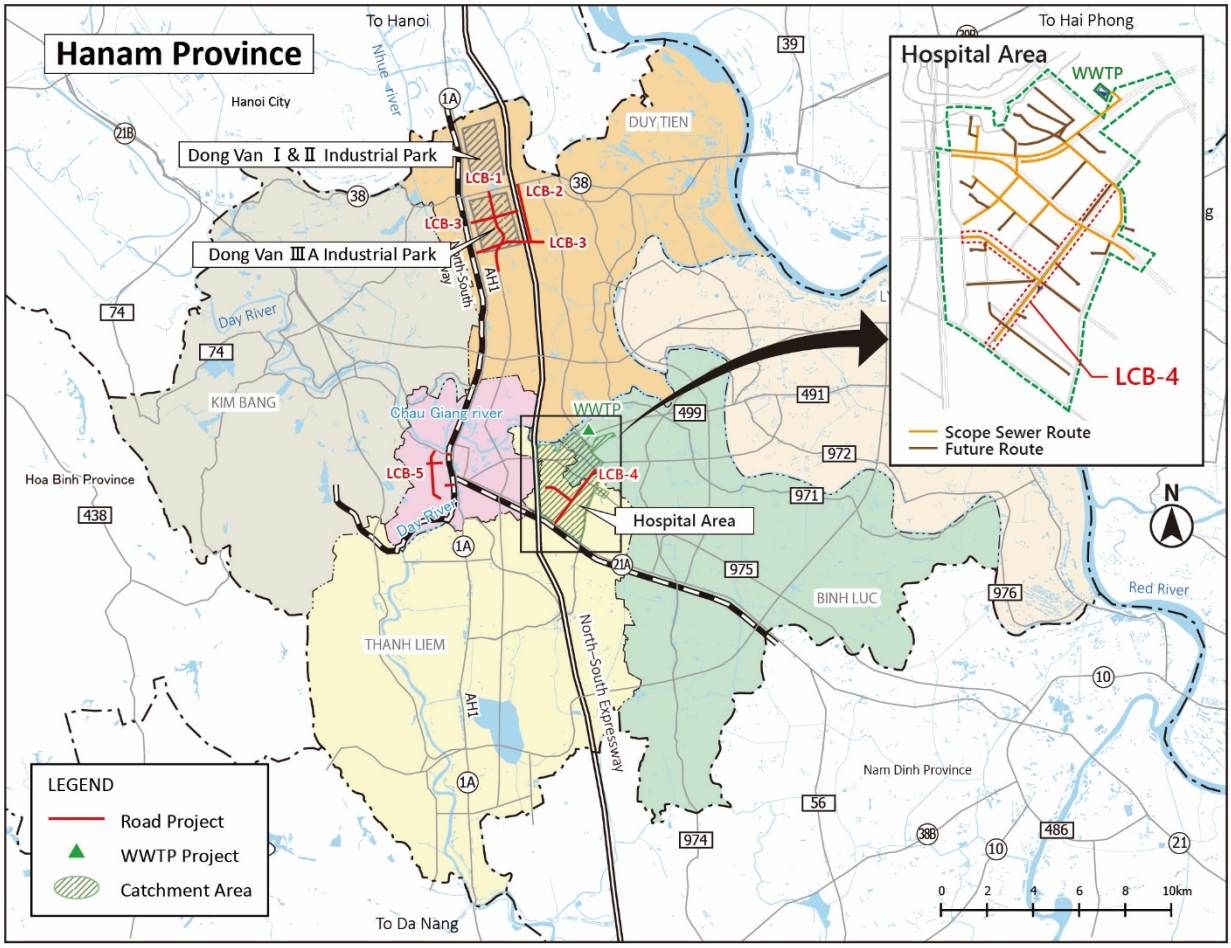
Hanam Province
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Hanoi City
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Dong Van ⅢA Industrial Park
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KIM BANG
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Chau Giang river
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ABBREVIATIONS

AASHTO	:	American Association of State Highway and Transportation Officials
A-RAP	:	Abbreviated Resettlement Action Plan
ASTM	:	American Society for Testing and Materials
B/C	:	Benefit per Cost
BOD	:	Biochemical Oxygen Demand
BOT	:	Build Operate Transfer
CAS	:	Conventional Activated Sludge process
CAGR	:	Compound Average Growth Rate
CIP	:	Cast Iron Pipe
CP	:	Counter Part
CPI	:	Consumer Price Index
CRF	:	Capital Recovery Factor
CSR	:	Compensation Support and Resettlement
DCIP	:	Ductile cast-iron pipe
DD	:	Detailed Design
DMS	:	Detailed Measurement Survey
DO	:	Dissolved Oxygen
DOC	:	Department of Construction
DOF	:	Department of Finance
DONRE	:	Department of Natural Resource and Environment
DOT	:	Department of Transport
DP	:	Displaced Persons
DPC	:	District Peoples Committee
DPI	:	Department of Planning and Investment
DRC	:	District's Resettlement Committees
DRVN	:	Directorate for Road of Vietnam
EC	:	Electric Conductivity
EIA	:	Environmental Impact Assessment
EIRR	:	Economic Internal Rate of Return
FDI	:	Foreign Direct Investment
F/S	:	Feasibility Study
FSF	:	Floating Sponge Filter
FIRR	:	Financial Internal Rate of Return
GDP	:	Gross Domestic Product
GoV	:	Government of Vietnam
HANWACO	:	Ha Nam Clean Water Joint Stock Company
HDPE	:	High Density Polyethylene
HNPPC	:	Ha Nam Province People's Committee
HTF	:	High-rate Trickling Filter
ICB	:	International Competitive Bidding
IEE	:	Initial Environmental Examination
IMA	:	Independent Monitoring Agency
IOL	:	Inventory of Loss
IVA	:	Independent Valuation Agency
IPMB	:	Industrial Park Management Board
JICA	:	Japan International Cooperation Agency

JIS	:	Japanese Industrial Standards
JPY	:	Japanese Yen
JSC	:	Joint Stock Company
LA	:	Loan Agreement
LCB	:	Local Competitive Bidding
LCC	:	Life Cycle Cost
LFDC	:	Land Fund Development Center
LOS	:	Level of Service
LPCD	:	Litter per capita per day
LRMC	:	Long Run Marginal Cost
LUR	:	Land Use Right
MAD	:	Mean Absolute Difference
MOC	:	Ministry of Construction
MOF	:	Ministry of Finance
MOE	:	Ministry of Health
MOLISA	:	Ministry of Labour, Invalids and Social Affairs
MONRE	:	Ministry of Natural Resource and Environment
MOPI	:	Ministry of Planning and Investment
MOT	:	Ministry of Transport
NGC	:	Northern Grid Company
NGO	:	Non-Governmental Organization
NPC	:	Northern Power Corporation
NPV	:	Net Present Value
NUAMBA	:	New Urban Area Management Board Association
OD	:	Origin and Destination
OD	:	Oxidation Ditch
ODA	:	Official Development Assistance
OECF	:	Overseas Economic Cooperation Fund
O&M	:	Operation and Maintenance
PAC	:	Poly Aluminum Chloride
PAP	:	Project Affected People
PCU	:	Passenger Car Unit
PIB	:	Public Information Booklet
PMU	:	Project Management Unit
PPP	:	Public Private Partnership
PTF	:	advanced pre-treated trickling filter system
PVC	:	Polyvinyl Chloride
RAP	:	Resettlement Action Plan
SBR	:	Sequential Batch Reactor
SES	:	Socio-Economic Survey
SLS	:	Final Solids-liquid Separator
SPC	:	Special Purpose Company
SS	:	Suspended Solid
TA	:	Tender Assistance
TSP	:	Total Suspended Particles
TTC	:	Traveler’s Time Costs
TVW	:	Traffic Volume of Working Area
TVC	:	Traffic Volume of Commercial Area

TVR	:	Traffic Volume of Residence Area
TWG	:	Technical Working Group
UPI	:	Urban Plan Institute
USD	:	United State Dollars
VOC	:	Vehicle Operating Costs
VDB	:	Vietnam Development Bank
VEA	:	Vietnam Environmental Agency
VEC	:	Vietnam Expressway Corporation
VGF	:	Viability Gap Funding
VND	:	Vietnam Dong
WB	:	World Bank
WWTP	:	Wastewater Treatment Plant

CHAPTER 1 INTRODUCTION

1.1 Background of the Survey

Since the beginning of 1990s, the Social Republic of Vietnam has achieved roughly 6% Gross Domestic Product (GDP) growth every year and became a middle-income country in 2008. In order to achieve the rapid and continuous growth, more support directly focusing on regional economic development and supporting industry establishments are necessary.

When considering the potential region to cooperate with most intensively, it is most efficient to select a region where future solid regional economic development can be expected throughout the cooperation. In addition, the region needs to be in line with the strategy of Official Development Assistance (ODA) to support both existing and potential Japanese Foreign Direct Investment (FDI) companies. When taking into account the factors such that the region is located close to huge markets such as Hanoi and Ho Chi Minh City, availability of deep sea ports for exports, and intensity/tendencies of Japanese companies' accumulation, Ha Nam Province is one of the most promising provinces in the country.

Ha Nam Province is one of the important economic areas in the Northern Vietnam and plays the role as the southern gate of the Capital. Transportations through National Highway 1A, North-South Expressway, North-South Train, etc., are developed and access to Hai Phong Port and Noi Bai Airport are being developed. The Province consists of Phu Ly City and 5 Districts. Phu Ly City complements the role of Hanoi City and it is positioned as the sub center of the Capital in Vietnam. As a part of projects to enhance its capacity as a core city, a branch hospital of Bach Mai Hospital has been established. In addition, Hanoi University of Industry was transferred to the Province.

Furthermore, four industrial parks are already operating and three more are planned to be formulated. Currently, 130 projects from foreign companies are in operation and 45 are from Japan among them (shown in **Table 1.1-1**). Those Japanese companies have invested in the Province after the strong investment promotion activities in Japan by the provincial government during recent years.

As mentioned above, investment climate in Ha Nam Province has gradually been improved. However, surrounding infrastructure such as water supply, sewerage system, electricity distribution lines and road in the Province, are insufficient. Therefore, Ha Nam Province aims to enhance the infrastructure to receive further FDI and accelerate economic development.

In the precedent survey, namely, "Data Collection Survey on Improvement of Investment Environment Utilizing PPP in Ha Nam Province", clarified that: (i) out of the surrounding infrastructure, the power transmission facilities and water supply facilities covering industrial zones will be developed by Northern Power Corporation (NPC) and private sector fund respectively, and water supply facilities are scheduled to be completed by the end of 2017, and thus (ii) Yen Loan project should be formulated for sewerage and road sector.

Table 1.1-1 FDI to Ha Nam Province during Period of 2011-2015 (Unit: Projects)

Year	Number of FDI projects	
	Total FDI	from Japan
Before 2011	30	7
2011	12	7
2012	13	9
2013	20	9
2014	27	4
2015	28	9
Total	130	45

Source: Ha Nam province Board of Industrial Zones Management

1.2 Objective of the Survey

The objective of the Preparatory Survey is to conduct preliminary design, cost estimation, to formulate implementation schedule, procurement and construction plan, implementational set-up including O&M,

to conduct survey on environmental and social considerations as well as necessary procedures in Vietnam for appraising the projects by Yen Loan, focusing on targeted sectors (sewerage and road sectors).

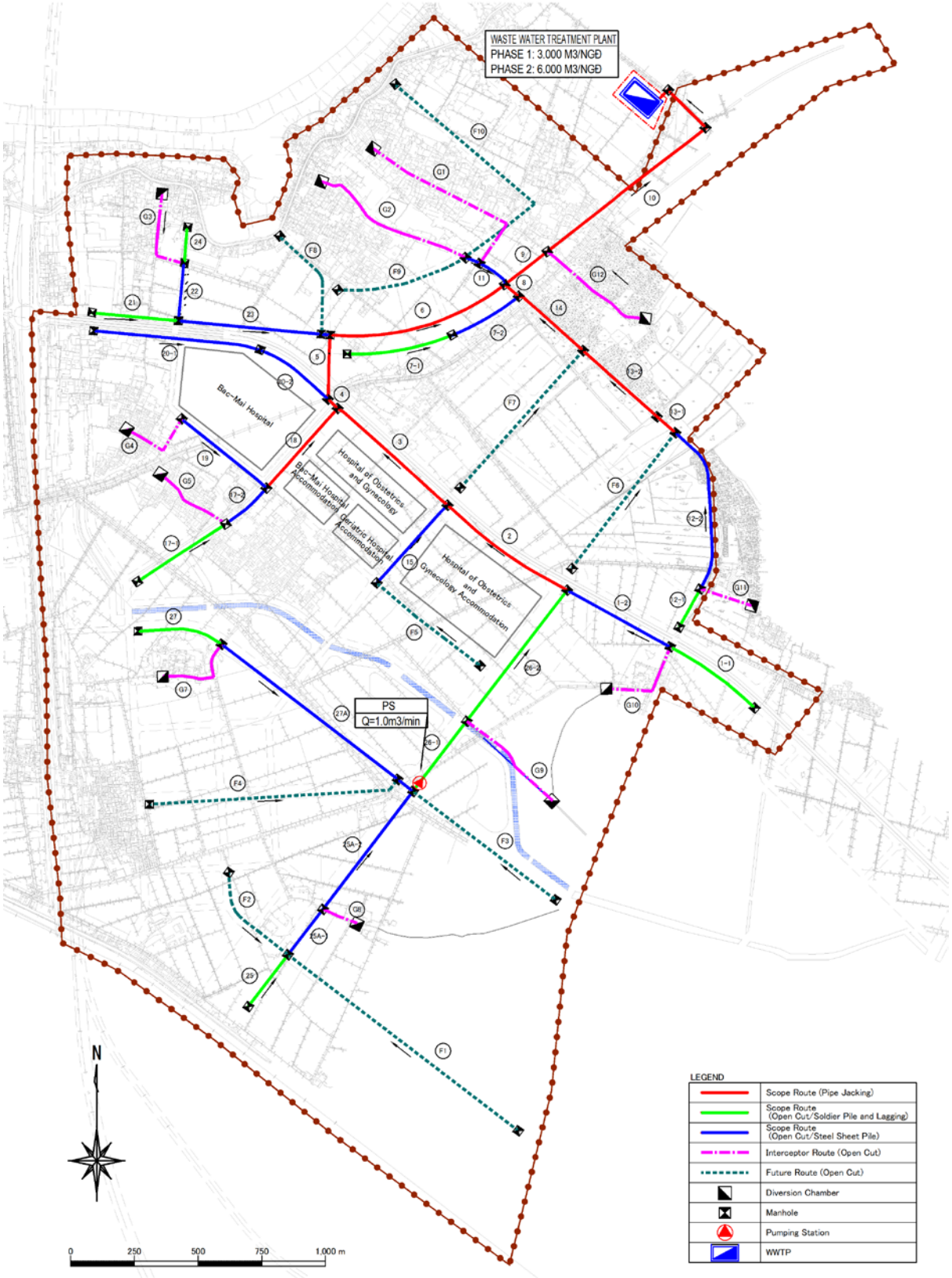
1.3 Terms of Reference in This Preparatory Survey

JICA Survey Team carried out detailed survey for sewerage and road sector in this preparatory survey and major works in Terms of Reference (TOR) are described as following;

- Planning and Design of Sewerage and Road Project
- Cost Estimation based on the Basic Design
- Environment Impact Assessment (EIA) and Resettlement Action Plan (RAP)
- Economic and Financial Analysis
- Project Evaluation
- Supporting Preparation for Local F/S and EIA
- Draft TOR for Detailed Design, Tender Assistance and Supervision

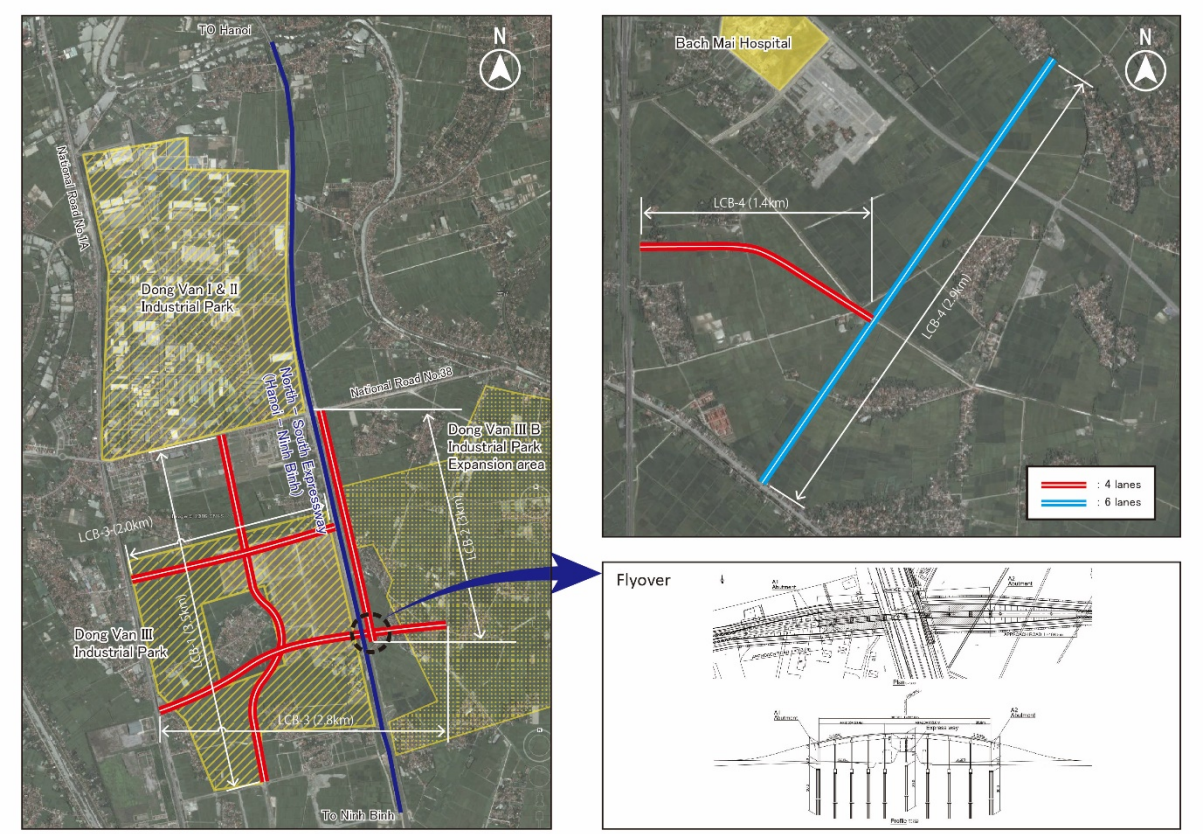
1.4 Preparatory Survey Area

Preparatory survey area is shown in **Figure 1.4-1** and **Figure 1.4-2**.



Source: JICA Survey Team

Figure 1.4-1 Wastewater Treatment Plant (WWTP) and Sewer Pipe



Source: JICA Survey Team

Figure 1.4-2 Subject Roads with Flyover

1.5 Selected Scope of Work for Yen Loan Project

Selected scope of work for Yen Loan Project of sewerage sector and road sector are shown in the following table.

Table 1.5-1 Selected Scope of Work for Yen Loan Project <Sewerage Sector>

Items		Scope
ICB-1	Wastewater Treatment Plant (WWTP)	• Wastewater treatment facility Daily Maximum Q=3,000 m^3/day (Maximum Daily Wastewater Flow) Raw Water Pump Pit Floating Sponge Filter (FSF) High-rate Trickling Filter (HTF) Final Solids-liquid Separator (SLS) Chlorination tank Outfall Pump Pit • Sludge treatment facilities Sludge Thickening Tank Sludge Dehydration Unit
ICB-2	Main Sewer	• Span of Gravity flow φ300 mm L = 15.5 km (Open Cut: 14.6 km, Pipe Jacking: 0.9 km) φ400 mm L = 2.6 km (Pipe Jacking: 2.6 km) φ500 mm L = 1.2 km (Pipe Jacking: 1.2 km) Manhole pump (Q=1.0 m^3/min)

Source: JICA Survey Team

Table 1.5-2 Selected Scope of Work for Yen Loan Project <Road Sector>

Items		Scope
LCB-1	Center Road (Road Section)	• 3.5km (design speed 60km/h), 4-lanes (W=68.0m) with center strip
LCB-2	Expressway East Bypass Road (Road Section)	• 3.0 km (design speed 60km/h), 2-lanes (W=10.5m)
LCB-3	Feeder Road North and South (Road Section)	• Feeder Road North 2.0km (design speed 60km/h), 4-lanes (W=42.0m) with center strip • Feeder Road South 2.8km (design speed 60km/h), 4-lanes (W=42.0m) with center strip
	Feeder Road North and South (Bridge Section)	• Flyover across the Expressway (337m), 2-lanes (W=12.0), approach road 332m, 2-lanes (W=12.0)
LCB-4	North-South and East-West Cross Road (Road Section)	• North-South Cross Road 2.9km (design speed 60km/h), 6-lanes (W=54.0m) with center strip • East-West Cross Road 1.4km (design speed 60km/h), 4-lanes (W=48.0m) with center strip
LCB-5	Phu Ly City Road Rehabilitation	• Chau Son Bridge Improvement of bridge surface pavement (L=0.5km), replacement of ramp (28 nos) • Hon Phu Bridge Improvement of bridge surface pavement (L=0.38km), replacement of ramp (22 nos) • Ly Thai To Road Overlay on existing pavement with AC pavement C12.5*8 with an average thickness of 7cm (48,300 m^2), Resurfacing of sidewalks on both sides (29,440 m^2) • Tran Van Chuong Road Overlay on existing pavement with AC pavement C12.5*8 with an average thickness of 7cm (7,420 m^2), Resurfacing of sidewalks on both sides (7,000 m^2)

Source: JICA Survey Team

1.6 Executing and Concerned Agencies

(1) Counterparts of this Preparatory Survey

Ha Nam Province People's Committee (HNPPC) allocates counterparts for this Preparatory Survey, as shown in **Table 1.6-1**.

(2) Concerned Agencies

In this Preparatory survey, the following agencies are involved.

- Ha Nam Province People's Committee (HNPPC), in charge of supervising the Preparatory Survey.
- Department of Planning and Investment (DPI), counter part of the Preparatory Survey.
- Department of Construction (DOC), in charge of technical analysis on sewerage sector in the Preparatory Survey.
- Department of Transport (DOT), in charge of technical analysis on road sector in the Preparatory Survey.
- Department of Finance (DOF), in charge of financial analysis of the Preparatory Survey.
- Department of Natural Resources & Environment (DONRE), in charge of environmental and social consideration in the Preparatory Survey.
- New Urban Area Management Board Association (NUAMBA), in charge of analysis on strategy for wastewater treatment of hospitals in the Preparatory Survey.
- Japan Desk of Ha Nam Province, in charge of investment promotion for Japanese companies in the Preparatory Survey.

Table 1.6-1 Ha Nam Province Counterpart Team for the Survey

No.	Name	Title	Organization	In Charge
1	Mr. Vu Dai Thang	Vice Chairman	HNPPC	Leader
2	Mr. Nguyen Van Oang	Director	DPI	Sub Leader
3	Mr. Le Duc Phuc	Director of Project Verification and Investment Monitoring	DPI	Sewerage Sector, Road Sector, Coordinator

Source: JICA Survey Team

1.7 Related Plans and Documents

Related plans and documents to be referred for sewerage and road planning in this preparatory Survey are listed below.

- Data Collection Survey on Improvement of Investment Environment Utilizing PPP in Ha Nam Province, 2016, JICA
- Sewerage Master Plan of Phu Ly City (General Map only)
- Prime Minister Decision on Approving the Master Plan on Socio-Economic Development of Ha Nam Province to 2020, No. 1226/QD-TTg

1.8 JICA Survey Team Member

JICA Survey Team member with assigned task is shown in **Table 1.8-1**.

Table 1.8-1 JICA Survey Team Member

Name	Assigned Task
Hitoshi Shimokochi	Team Leader/Sewerage Planning (1)
Masami Shirai	Deputy Team Leader/Sewerage Planning (2)
Shin-ichi Nishiura	Sewerage Facility Design (Wastewater Treatment Plant, Pumping)
Hiroshi Obata	Sewerage Facility Design (Sewer)
Nakatake Tetsu	Sewerage Facility Design (Sewer)
Kazuhiro Asano	Machine and Electric Facility Planning
Shingo Gose	Road Planning
Hiroshi Kaneko	Road Design
Noriaki Sunouchi	Bridge Design
Yuka Kato	Economic and Finance Analysis
Kenichi Ogomori	Natural Environment
Tsuyoshi Ito	Social Environment/Gender
Hikaru Takatsu	Cost Estimation
Kyohei Hosono	Investment Promotion Strategy Planning
Yasutoshi Ishizuka	Municipality Network Supplement

Source: JICA Survey Team

CHAPTER 2 WASTEWATER FORECAST

2.1 Introduction

Firstly, this Chapter presents the overview of sewerage system in Ha Nam Province. Then, wastewater amount of is forecasted focusing on Hospital Area, based on the discussion conducted between Ha Nam Province and JICA in October 2017. Wastewater is in principle forecasted based on Sewerage Master Plan of Phu Ly City.

2.2 Overview of Sewerage System in Ha Nam Province

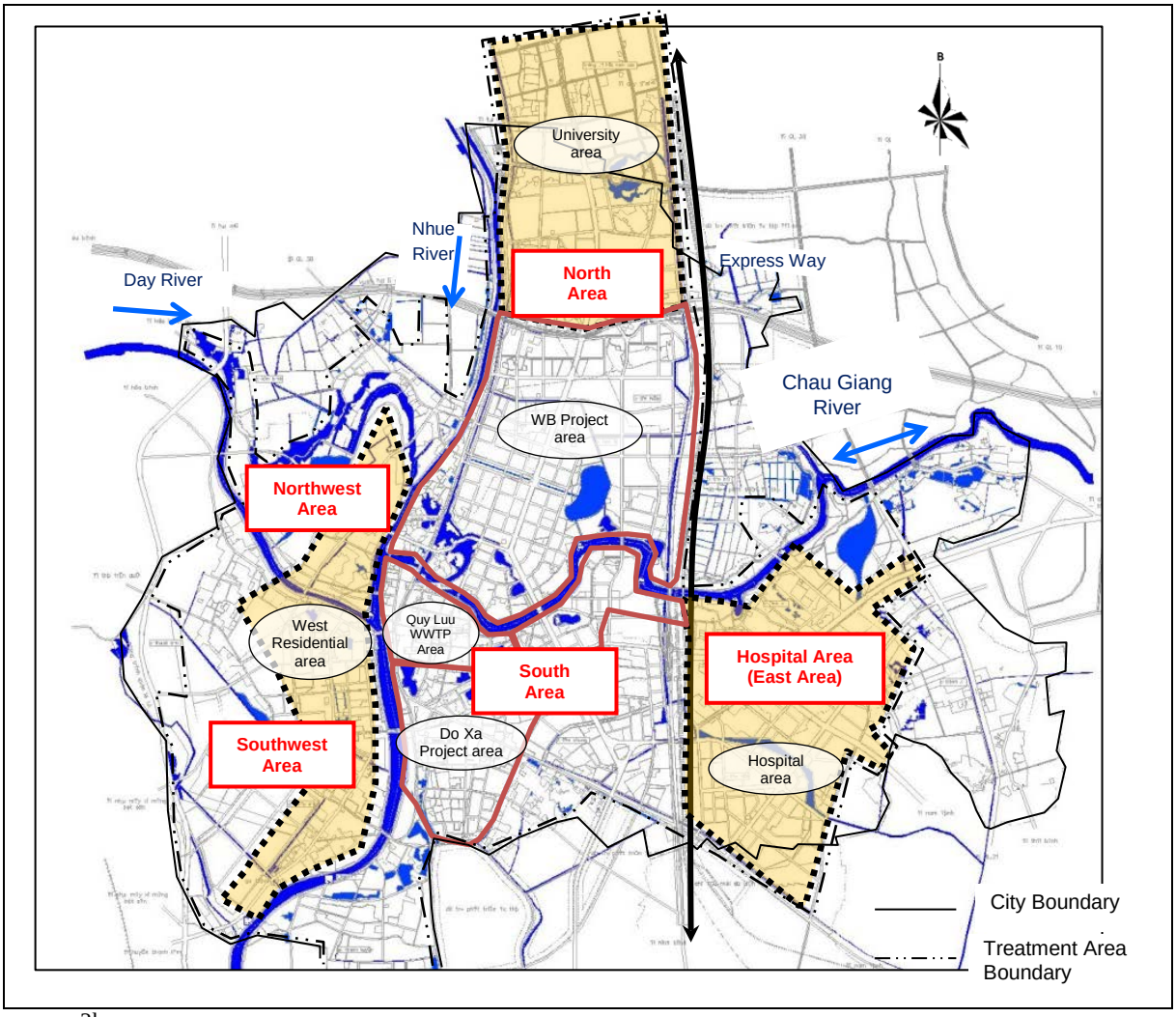
In Ha Nam Province, several industrial parks[1] were developed and their wastewater is treated by their own wastewater treatment plants. On the other hand, in order to treat domestic wastewater treatment, Phu Ly City, the capital city of Ha Nam Province, subdivided the City into five wastewater treatment areas, namely, North Area, East Area, South Area, Southwest Area and Northwest Area, bordered by Day River, Nhue, Chau Gaing River and expressway, as shown in **Figure 2.2-1**.

Out of the wastewater treatment area, South Area which covers built-up area of central Phy Ly City, a wastewater treatment plant (Quy Luu WWTP) has been in operation and one more wastewater treatment plant was constructed by Belgium fund and the WWTP waits for their commencement of operation. Moreover, in North Area, new wastewater treatment plant will be constructed by the fund of WB to treat wastewater from newly developed residential area. Therefore, wastewater collection and treatment system in South Area and North Area has been established step-by-step.

At present, Phu Ly City has been developing new development areas, namely, University Area and Hospital Area to attract investors related to educational and medical care sectors. University Area is located on the northern part of the above-mentioned WB project area. On the other hand, Hospital Area is located in East Area (Hospital Area, which is the target area of this Preparatory Survey. The East Area is hereinafter referred as to “Hospital Area”). In the University Area and Hospital Area, infrastructure including wastewater collection and treatment system is required, because no existing sewer network is established. Further, wastewater treatment of built-up areas in Southwest and Northwest Areas, namely, West Residential area, which includes Hong Phong, Chau Son and Phu Van, is also required to improve water environment and living condition of Ha Nam Province including Phu Ly City. (Present condition of Quy Luu WWTP, as well as projects funded by Belgium and WB, are outlined in **Chapter 3**)

In addition to the overview mentioned above, high priority for development sewerage system in the Hospital Area is given in the discussion conducted between Ha Nam Province and JICA in October 2017. Therefore, Hospital Area is targeted for forecasting wastewater amount to establish sewerage system in the Area.

[1] No industrial parks exist in the Hospital Area.



Source: JICA Survey Team

Figure 2.2-1 Sub-region of Sewerage Service Area in Phu Ly City

2.3 Wastewater Forecast in Hospital Area

2.3.1 Target Year

Sewerage Master Plan of Phu Ly City set target year of 2020 and 2030. However, the target year of 2020 is no longer applicable for planning and designing of sewerage system in the Project, because the estimated project completion year will be after 2020. Therefore, in this Project, target years of 2030 and after 2035 are set, considering actual development progress in the Hospital Area. For WWTP designing, target years of 2030 and after 2035 are considered. On the other hand, target year of after 2035 is considered for pipe designing.

2.3.2 Population Projection

Sewerage Master Plan of Phu Ly City projects population in the Hospital Area for years of 2020 and 2030 as shown in **Table 2.3-1**. The population is projected with being subdivided into new residential area and existing residential area.

Table 2.3-1 Population Projection in Sewerage Master Plan of Phu Ly City

Year	New Residential Area	Existing Residential Area	Total
2020	15,350	11,050	26,400
2030	29,190	11,760	40,950

Source: DOC

In consideration of the population projection in Sewerage Master Plan of Phu Ly City in **Table 2.3-1** and actual progress of the development in Hospital Area, as well as population projection conducted in "Data Collection Survey on Improvement of Investment Environment Utilizing PPP in Ha Nam Province, 2016, JICA",[2] population projection for year 2030 and after 2035 is proposed in **Table 2.3-2**. Population projection for year 2030 is intermediate one of years of 2020 and 2030 in the Sewerage Master Plan of Phu Ly City. For the year after 2035, it is noted that 2,000 out of 29,190 (population in new residential area) is allocated to existing residential area with an emphasis on the population projection of existing residential area (13,920 people) in the above "Data Collection Survey".

Table 2.3-2 Population Projection in this Project

Year	New Residential Area	Existing Residential Area	Total
2030	22,270	11,410	33,680
After 2035	27,190	13,760	40,950

Source: JICA Survey Team

2.3.3 Average Daily Per-Capita Wastewater Generation

In the Sewerage Master Plan of Phu Ly City, average daily per-capita wastewater generation of 165, 130 and 110 L/capita/day were applied, as shown in **Table 2.3-3**. Then, average daily per-capita wastewater flow to WWTP was calculated, multiplying 80% of wastewater conversion ratio as shown in **Table 2.3-4**. The wastewater conversion ratio of 80% is applied based on TCXDVN-51 2008.7.2 to deduct sprinkling water and wastewater not reaching sewer pipe.

Table 2.3-3 Average Daily Per-Capita Wastewater Generation in the Sewerage Master Plan of Phu Ly City

Category	Unit	Year 2020	Year 2030
New Residential Area	L/capita/day	130	165
Existing Residential Area	L/capita/day	110	130

Table 2.3-4 Average Daily Per-Capita Wastewater Flow to WWTP in the Sewerage Master Plan of Phu Ly City

Category	Unit	Year 2020	Year 2030
New Residential Area	L/capita/day	104[1)]	132[2)]
Existing Residential Area	L/capita/day	88[3)]	104[4)]

Note:
1) 104 L/capita/day=130 L/capita/day×80%
2) 132 L/capita/day=165 L/capita/day×80%
3) 88 L/capita/day=110 L/capita/day×80%
4) 104 L/capita/day=130 L/capita/day×80%

On the other hand, JICA Survey Team sets at 150[3] L/capita/day of average daily per-capita wastewater generation for both new and existing residential areas for year 2025 and 2035, as shown in **Table 2.3-5**.

Then, (i) public use (10% of domestic use) and (ii) small-size production and handicraft industry (10% of domestic use), are considered in accordance with the Planning on Orientation to supply Treated Water in Ha Nam Province by 2030. Also, groundwater inflow (equivalent to 10% of domestic use) is considered. Thus, average daily per-capita wastewater flow to WWTP is calculated, multiplying 80% of wastewater conversion ratio as shown in **Table 2.3-6**.

[2] Reference: In "Data Collection Survey on Improvement of Investment Environment Utilizing PPP in Ha Nam Province, 2016, JICA", population of existing residential area in 2015 was estimated at 13,920 people and same value is applied to future population in the existing residential area.
[3] 150 L/capita/day is a value estimated, referring the "Planning on Orientation to supply Treated Water in Ha Nam Province by 2030" in "Data Collection Survey on Improvement of Investment Environment Utilizing PPP in Ha Nam Province, 2016, JICA"

Table 2.3-5 Average Daily Per-Capita Wastewater Generation estimated by JICA Survey Team

Category	Unit	Year 2025	Year 2035
New Residential Area	L/capita/day	150	150
Existing Residential Area	L/capita/day	150	150

Source: JICA Survey Team

Table 2.3-6 Average Daily Per-Capita Wastewater Flow to WWTP estimated by JICA Survey Team

Category	Unit	Year 2025	Year 2035
New Residential Area	L/capita/day	158	158
Existing Residential Area	L/capita/day	158	158

Note:
158 L/capita/day=150 L/capita/day×1.2 (public use + small-size production and handicraft industry)×80%×1.10 (groundwater inflow),
Source: JICA Survey Team

In comparison with the average daily per-capita wastewater generation and wastewater flow to WWTP in Sewerage Master Plan of Phu Ly City and JICA Survey Team, JICA Survey Team newly proposes the values as shown in **Table 2.3-7**, with the following considerations.

- Values of average daily per-capita wastewater generation in the Sewerage Master Plan of Phu Ly City (165, 130 and 110 L/capita/day) only considers domestic use and do not consider public use, small-size production and handicraft industry as well as groundwater inflow.
- Therefore, JICA Survey Team newly proposes average daily per-capita wastewater flow to WWTP, considering public use (10% of domestic use), small-size production and handicraft industry (10% of domestic use), as well as groundwater inflow (equivalent to 10% of domestic use).
- Value for year 2020 and year after 2035 are proposed based on values of year 2020 and 2030 in Sewerage Master Plan of Phu Ly City, respectively. On the other hand, the value for year 2030 are set at interpolated values of year 2020 and after 2035.

Table 2.3-7 Proposed Average Daily Per-Capita Wastewater Flow to WWTP

Category	Unit	Year 2020 (Reference)	Year 2030	After 2035
New Residential Area	L/capita/day	138[1)]	157	175[2)]
Existing Residential Area	L/capita/day	117[3)]	128	138[4)]

Note:
1) 138 L/capita/day≒130 L/capita/day×1.2 (public use+small-size production and handicraft industry)×80%×1.10 (groundwater inflow)
2) 175 L/capita/day≒165 L/capita/day×1.2×80%×1.10
3) 117 L/capita/day≒110 L/capita/day×1.2×80%×1.10
4) 138 L/capita/day≒130 L/capita/day×1.2×80%×1.10
Source: JICA Survey Team

2.3.4 Wastewater for Public Service, Restaurant and Hotel

As discussed in the last section, wastewater for public use, small-size production and handicraft industry, is considered in the average daily per-capita wastewater flow. Therefore, wastewater for public service is not estimated independently. In addition, wastewater from new restaurant and hotel in the hospital area are not considered because the amount of the wastewater will be negligible.

2.3.5 Wastewater from Hospital

Wastewater from hospital shall be treated in the hospital to the Level A of QCVN28:2010/BTNMT, and be discharged directly to drainage pipe, in accordance with the decision No. 2677/QD-BTNMT, MONRE; therefore, wastewater from hospital is not included in the Project.

2.3.6 Daily Maximum Ratio

Based on TCVN 7957, daily maximum ratio of 1.15-1.30 shall be applied, depending on the scale of sewerage system (The larger the system becomes, the smaller the peak factor becomes). Considering

size of sewerage system of the project, the daily maximum ratio of 1.20 is applied in the Project.

2.3.7 Ratio of Connecting and Occupation

Ratio of connecting and ratio of occupation (ratio of people who actually settle in the area) are proposed considering the values of the Sewerage Master Plan of Phu Ly City and actual progress of development in the Hospital Area, as shown in **Table 2.3-8**.

Table 2.3-8 Proposed Ratio of Connecting and Occupation

	Category	Year 2030	After 2035
Ratio of Occupation	New Residential Area	0.40 (0.70)	0.75 (-)
	Existing Residential Area	1.00 (1.00)	1.00 (-)
Ratio of Connecting	New Residential Area	1.00 (1.00)	1.00 (-)
	Existing Residential Area	0.60 (0.70)	0.70 (-)

Note: Values in parenthesis are the ones in the Sewerage Master Plan of Phu Ly City
Source: JICA Survey Team

2.3.8 Summary of Proposed Wastewater

Based on the above discussion, wastewater for year 2030 and after 2035 is forecasted as summarised in **Table 2.3-9** and **Table 2.3-10**. As a result, design wastewater for WWTP, pipe designing is enumerated as follows.

[WWTP]

- **3,000 m^3/day (daily maximum wastewater)**, which is rounded up of 2,730 m^3/day for year 2030, is applied for WWTP designing (of stepwise construction) in this Project.
- **6,000 m^3/day (daily maximum wastewater)**, which is rounded up of 5,878 m^3/day for year after 2035, is applied for WWTP designing (of stepwise construction) in this Project.

[Pipe]

- **8,300 m^3/day (5.8 m^3/min or 96 L/s) (hourly maximum wastewater),** which is rounded of 8,263 m^3/day in hourly daily maximum) for year after 2035, is applied for pipe designing in this Project.

Table 2.3-9 Wastewater Forecast for Year 2030

	Unit	New Residential Area	Existing Residential Area	Total
Population	People	22,270	11,410	33,680
Wastewater Per-Capita	L/capita/day	157	128	-
Ratio of Occupation	-	0.40	1.00	-
Ratio of Connecting	-	1.00	0.60	-
Population connected	People	8,910	6,850	15,760
Average Daily Wastewater	m^3/day	1,399	876	2,275
Daily Maximum Wastewater	m^3/day	1,679	1,051	**2,730**

Note: Daily maximum wastewater = 1.2×(Average Daily Wastewater)
Source: JICA Survey Team

Table 2.3-10 Wastewater Forecast for Year after 2035

	Unit	New Residential Area	Existing Residential Area	Total
Population	People	27,190	13,760	40,950
Wastewater Per-Capita	L/capita/day	175	138	-
Ratio of Occupation	-	0.75	1.00	-
Ratio of Connecting	-	1.00	0.70	-
Population connected	People	20,390	9,630	30,020
Average Daily Wastewater	m^3/day	3,569	1,329	4,898

	Unit	New Residential Area	Existing Residential Area	Total
Daily Maximum Wastewater	m^3/day	4,283	1,595	**5,878**
Hourly Maximum Wastewater	m^3/day	6,021	2,242	**8,263**

Note: Daily maximum wastewater = 1.2× (Average Daily Wastewater)
Hourly maximum wastewater = 1.687× (Average Daily Wastewater). 1.687 is set based on the standard in **Table 5.2-1**

Source: JICA Survey Team

2.4 Design Influent Wastewater Quality

Design influent wastewater quality in this project is computed, employing existing study results of Hue City Water Environment Improvement Project implemented by the Overseas Economic Cooperation Fund (OECF, Japan) and average daily wastewater flow of year after 2035 in **Table 2.3-10**, as shown in **Table 2.4-1**, because the existing data on pollution load per capita in Vietnam is scarce. The design wastewater quality is utilized to design of WWTP for year 2030 as well as year after 2035.

Table 2.4-1 Design Influent Wastewater Quality

	Pollution load per capita[1)] (A) (g/capita/day)	Wastewater per capita[2)] (B) (L/capita/day)	Calculation (C)=(A)/(B)x1000 (mg/L)	Design influent wastewater quality (D) (mg/L)
BOD	36	164	219.5	220
SS	41		250.0	250
T-N	7		42.7	43
T-P	1.1		6.7	7

Note1: Pollution load per capita is obtained from existing study results of Hue City Water Environment Improvement Project.
Note2: 164 L/person/day is obtained from the equation
[(4,898 m^3/day)/(27,190 people×1.00×0.75+13,760 people ×0.70×1.00) ×1,000]

Source: JICA Survey Team

Allowable effluent water quality for WWTP is summarized in **Table 2.4-2** in accordance with C value:A[4] in QCVN 14:2008/BTNMT, since the proposed WWTP in this project discharges treated water to Chau Giang River.

Table 2.4-2 Allowable Effluent Water Quality for WWTP in the Project

	Allowable effluent water quality (mg/L)
BOD	30
SS	50
T-N	20
T-P	6

Source: JICA Survey Team

[4] C value:A is the standard applied to discharge point is located at upstream of water source.

CHAPTER 3 ROAD MAP OF RELATED PROJECTS

3.1 Introduction

In this chapter, existing sewerage system in Phu Ly City is summarized and present condition of the Belgium Project and the WB project are outlined especially for the purpose of evaluating the necessity of branch sewer installation in this project.

3.2 Existing Wastewater Treatment Plant in Phu Ly City

In Phu Ly City, there exists combined sewer networks in residential area as shown in **Figure 3.3-1** with a wastewater treatment plant, namely, Quy Luu wastewater treatment plant (WWTP). Quy Luu WWTP was constructed under the budget of Ha Nam and started operation in 2015. HNPPC outsources operation and maintenance of this wastewater treatment plant to Environment Urban Construction Joint Stock Company. Outline of Quy Luu WWTP is shown in **Table 3.2-1**.

Table 3.2-1 Outline of Quy Luu Wastewater Treatment Plant

Name	Treatment method	Construction period	Capacity (m3/day)	Fund	Contractor
Quy Luu Wastewater Treatment Plant	Aerobic and Anaerobic (combined)	2010-2012 (operation started in 2015)	2,500 (combined system)	Vietnam (DONRE)	Vietnamese Company

Source: JICA Survey Team

Mixing Tank

Dehydrator

Quy Luu WWTP

3.3 The Belgium Project (Do Xa Project)

The Belgium Project (Do Xa Project) is implemented in the area shown in **Figure 3.3-1**. The Project includes installation of main sewer of 12,100 m and the construction of wastewater treatment plant (Thanh Chau WWTP) with the capacity of 5,000 m^3/day. Aerobic and anaerobic method is applied to the Thanh Chau WWTP. Contractor of this project is Vietnam Water Supply and Drainage and Environment Corporation.

The installation of main sewer was started in 2010 and 8,900 m of main sewer has been completed. The remaining main sewer of 3,200 m is to be completed in 2017, as shown in **Table 3.3-1**. Wastewater treatment plant was completed in 2013. Operation of the WWTP will be started at the end of year 2019 and O&M of the WWTP will be implemented by HANWACO.

Table 3.3-1 Annual Accomplishment of Main Sewer Installation in the Belgium Project (Do Xa Project)

	2008	2009	2010	2011	2012	2013	Remaining Length	Total
Length per year (m)	1,000	1,100	1,500	1,100	2,200	2,000	-	8,900
Length accumulated (m)	1,000	2,100	3,600	4,700	6,900	8,900	3,200	12,100

Source: PMU of Do Xa Project

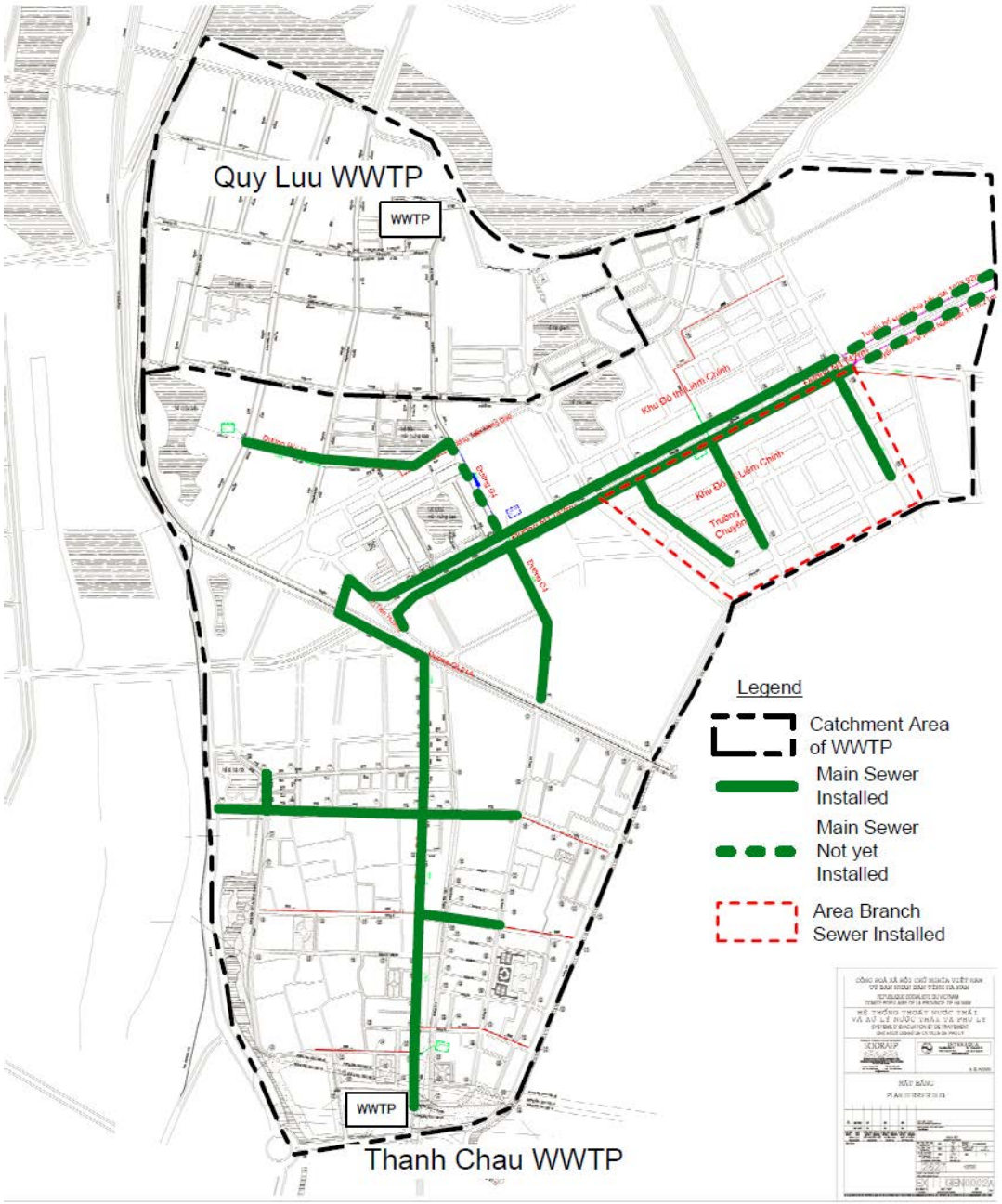


Figure 3.3-1 Location of Do Xa Project Area and Catchment Area of Quy Luu WWTP

Reactor and Clarifier

Dehydrator

Thanh Chau WWTP

Branch sewers in the project area are, in general, installed by the developer in a newly developed area. On the other hand, branch sewers in existing residential areas, where population density has become high, are installed by Ha Nam Province. However, the installation of branch sewers in the project area is limited to the area as shown in broken line in **Figure 3.3-1.** Moreover, the road map of branch sewer installation has not been prepared yet. The reason of the delay in installation of main sewer and branch sewer are as follows.

- House relocation in the alignment of main sewer was delayed.
- Development in newly developed area are not in progress
- In the existing residential area, growth of population is smaller than expected.

3.4 The WB Project

The World Bank (WB) implemented sewer installation works, as shown in bold brown line in **Figure 3.4-1** and currently another new Project targeting WWTP and trunk sewer which is shown by bold green line in **Figure 3.4-1**, will be implemented. The project components and the roadmap are as summarized in **Table 3.4-1**.

Based on the updated information as of March 2019, name of the WWTP is Bac Chau Giang WWTP. Operation of the WWTP will be started from second quarter of year 2019. O&M of the WWTP will be conducted by Environment Urban Construction Joint Stock Company.

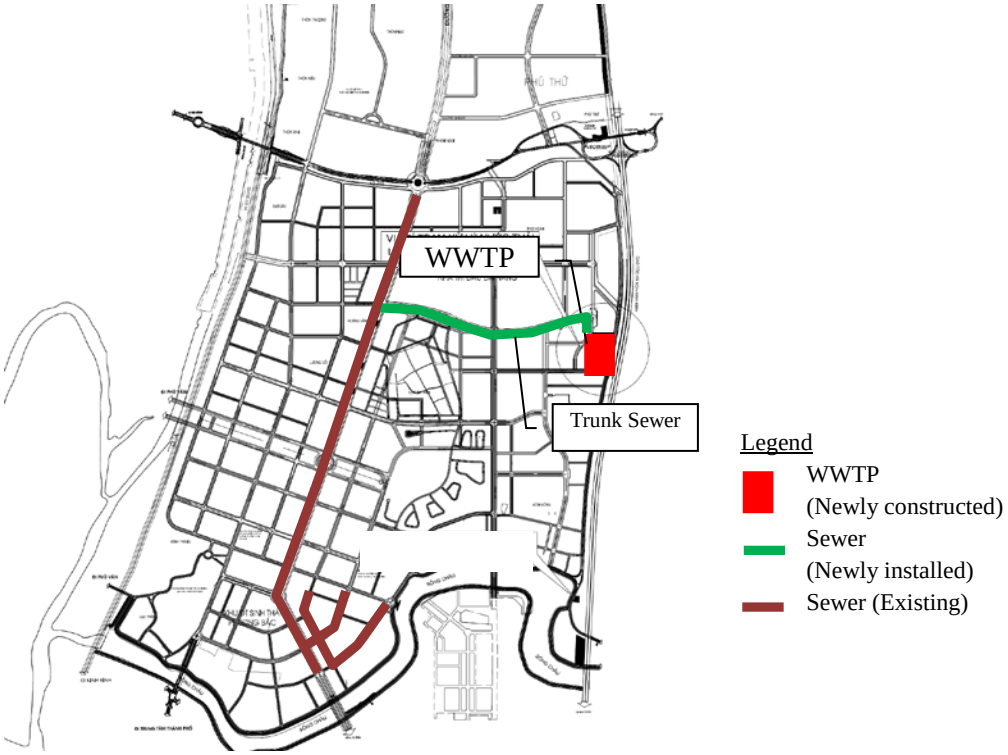


Figure 3.4-1 Location of the World Bank (WB) Project

Table 3.4-1 Project Components and Road Map of the World Bank (WB) Project

Item	Components	Remarks
Project Components	- Wastewater Treatment Plant (Capacity: 1,500 m^3/day) - Trunk sewer installation (φ600 mm, about1,800 m)	Initially, WWTP is designed with capacity of 3,000 m^3/day based on wastewater forecast. However, WWTP with capacity of 1,500 m^3/day is constructed, based on the refinement of wastewater forecast. Main reason of decrease in the capacity is that delay in development of residential area.
Project Road Map	- Construction Works: 12 months from December 2016 - Commencement of Operation: January 2018	
Branch Sewer Installation	Branch sewer of total length of 8,000 m-10,000 m will be implemented in a year (from June 2017 to June 2018), with the supplemental loan agreement with WB.	Ha Nam Province will implement the branch sewer installation using supplemental loan agreement with WB due to the lack of own budget. Ha Nam Province intends to have the supplemental loan agreement approved and executed as fast as possible, because (i) initial loan agreement with WB will expire in December 2017, and (ii) Ha Nam Province intends to complete the branch sewer installation by the beginning of year 2018 to catch up with the commencement of the Wastewater Treatment Plant (WWTP) operation.

Source: PMU of WB Project

CHAPTER 4 SELECTION OF SEWERAGE SYSTEM

4.1 Selection of Sewerage Collection System

A wastewater collection system for the Hospital area is planned as separate collection system based on the Sewerage Master Plan of Phu Ly City.

However, some circumstances are expected as below under applying separate collection system:

1) Takes much time for installing branch sewers for existing residential area.
2) Takes much time for existing household connection due to negotiation with each household.
3) Untreated wastewater from existing residential area is discharged into the river until all connection is done.
4) Low wastewater inflow due to low connection ratio.
5) In the worst case, no wastewater inflow from existing area is treated.

These circumstances are not just concerns but similar cases are occurred on the Belgium project (Do Xa project) and WB project as mentioned in **Chapter 3.3** and **3.4**. It is a big concern for the JICA as a lender.

In order to avoid the above-mentioned situation, it is recommended to apply stepwise sewer installation as summarized in **Table 4.1-1** and illustrated in **Figure 4.1-1**.

As shown in **Figure 4.1-1**, in the first stage (in the Yen loan project), interceptor system is introduced to collect wastewater as much as possible, especially from existing residential area. However, as shown in **Table 2.3-9**, connection ratio to the sewer is estimated at 60% in the existing residential area because all the wastewater may not be collected by the interceptor, depending on the location of each house. Ha Nam Province should start to install branch sewer in the existing residential area in a timely manner. Also, Ha Nam Province or developers should start to install branch sewer in the new residential area in a timely manner.

In addition, from the second stage to the final stage, prompt branch sewer installation by Ha Nam Province and developer is recommended to collect wastewater from entire sewerage service area.

Table 4.1-1 Strategy of Stepwise Sewer Installation

Stage	Time Frame	Strategy of Sewer Installation		
		Main Sewer	Branch Sewer	
			New Residential Area	Existing Residential Area
First Stage	Up to 2030	All main sewers (sewer pipe and interceptor) are installed under Yen loan project.	Some branch sewer installation applying separate system is started by own budget of Ha Nam Province or developers.	By own budget of Ha Nam Province, some branch sewer applying separate system is started after the completion of JICA loan project.
Second Stage	2030 to 2035	-	Branch sewer installation applying separate system is continued by own budget of Ha Nam Province or developers.	Branch sewer installation applying separate system is continued by own budget of Ha Nam Province.
Final Stage	After 2035	-	Branch sewer installation applying separate system is completed by own budget of Ha Nam Province or developers.	Branch sewer installation applying separate system is completed by own budget of Ha Nam Province.

Source: JICA Survey Team

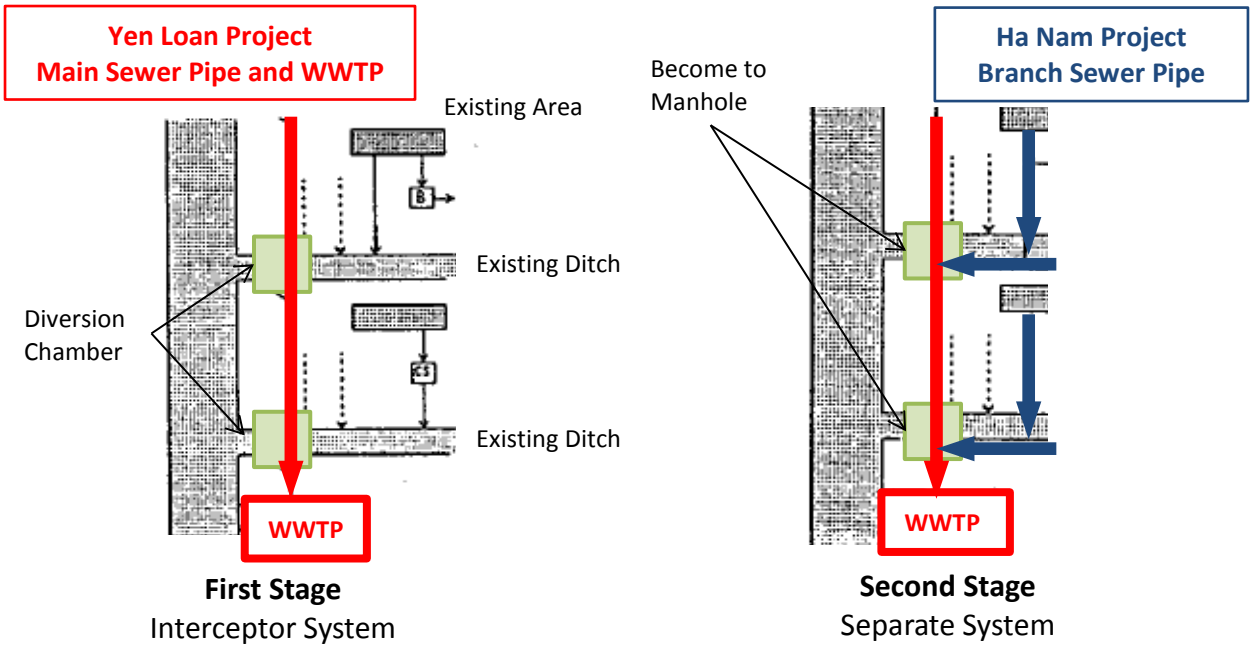


Figure 4.1-1 Image of Stepwise Sewer Installation applying Interceptor System

If interceptor system is applied, sewer pipes shall be designed considering rainwater inflow ratio, however, the separate system will be applied in the final stage. Therefore, the pipe will be designed as separate system in accordance with the Vietnamese standard to save additional investment. In addition, inflow volume of combined wastewater in wet weather should be restricted in order not to overflow considering flow capacity of down-flow pipe.

Sewer pipe plan is studied based on the mentioned stepwise sewer installation strategy, however location of diversion chambers and interceptor pipes were not studied and will be studied on next detailed design stage.

4.2 Selection of Treatment Method

Oxidation Ditch process with aerobic and anaerobic operation method has been applied for the Thanh Chau WWTP and WB's WWTP. For ensuring smooth operation by Phu Ly city's maintenance staff, applying the same process as other wastewater treatment plants would be desired. However, Oxidation Ditch process with aerobic and anaerobic operation method requires elaborated O&M skills. Therefore, comparing the wastewater treatment method and sludge treatment process would be necessary to select the suitable method.

4.2.1 Wastewater Treatment Method

Conventional Activated Sludge process (CAS), Oxidation Ditch process (OD), and Sequencing Batch Reactor process (SBR) are commonly adopted and have sufficient track records in Japan, which has a similar natural climate and conditions as Vietnam. Moreover, the advanced pre-treated trickling filter system (PTF) has been adopted at the demonstration facility in Da Nang city, Vietnam. It has been confirmed that an effluent water quality has met the Vietnamese standards. The comparison of the four treatment processes has been examined. **Table 4.2-1** shows the comparison outcomes, and the detail comparison description is attached in Appendix. The outline of each process is mentioned below.

- CAS process
  This process is used in facilities with a scale of 1,000 m^3/day to 1,000,000 m^3/day which ensures good water quality. This process permits good stability in large-scale facilities.
- OD process

This process uses the same principles as the CAS process, however, it requires retention for 24-48 hours with low sludge load (F/M ratio). Since the area of structures becomes larger in line with the longer retention time, this process is mainly adopted in small-scale treatment plants.

- SBR process

  More than two tanks are installed. These tanks are operated as reaction tank and as sedimentation tank over several hours for each. Operation management is complicated and sufficient experience is required to conduct operation.

- PTF process

  It has been developed recently, and the unit processes are used in combination. Specifically, filtration is performed in the pre-treatment; a sprinkling filtration bed is adopted in the middle stage; and a sedimentation tank is used in the latter stage. This process has a treatment performance similar to the three previous processes. The core element of the process is the adoption of an improved sprinkling filtration bed for removing organic substances such as BOD.

Table 4.2-1 Comparison of Treatment Processes

	CAS process	**OD process**	**SBR process**	**PTF process**
Process Flow	Primary settling tank Reaction tank Final settling tank	Oxidation Ditch (Reaction tank) Final settling tank	Sequencing Tank	Floating Sponge Filtration, High-rate Trickling Filtration, Final Solids-Liquid Separator.
Construction cost (Compare with PTF)	Middle 99	Low 91	High 109	Middle 100
Power consumption	0.4 – 0.5 kWh/m^3	0.8 kWh/m^3	0.9 kWh/m^3	0.05 – 0.1 kWh/m^3
O & M cost (Compare with PTF)	Middle 315	High 650	High 750	Low 100
Life Cycle Cost (15years) (Compare with PTF)	Middle 108	Middle 115	High 137	Low 100
Effluent quality	SS 25 mg/l; BOD: 22 mg/l	SS 25 mg/l; BOD: 22 mg/l	SS 25 mg/l; BOD: 22 mg/l	SS 25 mg/l; BOD: 22 mg/l
Installation area	Small	Large	Middle	Small
Operator skill level	High	Low	High	Low
Merits	・Stable treated effluent quality ・Flexible response to fluctuations in raw water ・Small installation area	・Easy maintenance ・Stable treated effluent quality ・Flexible response to fluctuations in raw water ・Little excess sludge generated	・Stable treated effluent quality ・Flexible response to fluctuations in raw water ・Little excess sludge generated	・Stable treated effluent quality ・Little power consumption ・Low construction cost ・Easy maintenance ・Small installation area
Weaknesses	・High construction cost ・Advanced maintenance needed	・Application to large-scale facilities is difficult ・Large installation area ・Large power consumption	・High construction cost ・Application to large-scale facilities is difficult ・Complex operation is required for sludge maintenance, etc. ・Large power consumption	・Limited track record of use
Evaluation	**Not Efficient with O&M skill level and O&M cost**	**Not Efficient with O&M skill level and O&M cost**	**Not Efficient with O&M skill level and O&M cost**	**The best option**

Note: Value of construction cost means ratio of construction cost in case of construction cost of PTF is 100.
Construction cost is estimated by using previous study, WB report and other project conducted in the Vietnam

The effluent quality of PTF process is set by quoting the design removal rate of "Advanced Energy Saving Wastewater Treatment Process (Japan sewage works Agency)".
Power consumption is estimated based on Technical report of energy saving technology for activated sludge method, Advanced Pre-treated Trickling Filter (PTF) technical data (Meta Water Co., Ltd.).
Source: JICA Survey Team

Table 4.2-1 shows that the PTF process has been chosen since it offers inexpensive construction cost and maintenance cost. Not only does the PTF process offer least life cycle costs, but it permits easier maintenance than the other processes; hence the maintenance staffs do not require experience and it is possible to conduct continuous maintenance after short-term maintenance training.

4.2.2 Sludge Treatment and Disposal Method

The treatment plant is a small-scale facility for mainly treating household wastewater and it has a design flow rate of 6,000 m^3/day as maximum daily wastewater flow after 2035. The water quality is estimated to have BOD of 220 mg/L and SS of 250 mg/L with minor impact from industrial wastewater.

(1) Sludge Treatment Method

As discussed in the previous section, the PTF process has been selected. The sludge generated in this process is comprised of the settled sludge from the primary treatment and biological membrane sludge from the secondary treatment. Assuming a design sanitary sewerage flow of 6,000 m^3/day as the maximum daily wastewater flow and effluent wastewater quality of 22 mg/L for BOD and 25mg/L for SS, it is estimated that dewatered sludge volume of approximately 4.7 m^3/day (1,716m^3/year) by average daily flow rate will be generated. By comparing the treatment processes and systems shown in **Table 4.2-2**, the appropriate process and system will be selected according to the physical properties of the sludge and the final disposal method.

Table 4.2-2 Sewerage Sludge Treatment Processes and Useable Equipment

Treatment process	Treatment system
Thickening process	1) Gravity thickening 2) Mechanical thickening
Digestion process	1) Anaerobic digestion 2) Aerobic digestion
Dewatering process	Mechanical dewatering 1) Pressurized filtration 2) Centrifugal filtration 3) Belt press system 4) Other
Volume reducing processes	1) Incineration equipment ・ Multi-stage ・ Fluidized bed furnace ・ Rotary kiln ・ Stoker furnace 2) Melting equipment 3) Compost equipment ・ Mechanical composting

Source: JICA Survey Team

(2) Selection of the Sludge Treatment and Disposal Method

1) Sludge Utilization Method

The areas around Phu Ly City in Ha Nam Province are surrounded by green farmland. The surrounding environment shows that it is possible to compost the sludge and use it as fertilizer or soil improvement material on this farmland.

Moreover, the cement plant (Kim Bang: Nghi Son Plant) with the daily production capacity of 4,000 m^3 has been operating in Kim Bang, Ha Nam Province since 2011, and negotiations will be conducted with the Ha Nam People's Committee with a view to receiving sludge for environmental protection and recycling. The advantages of this process are that wastes can be treated by a method of combining environmental plant and cement plant technologies and does not require separated treatment or treatment of ash.

However, sludge that is supplied for incineration in a cement plant must first be dried to a water

content of around 10%.

2) Proposal of the Sludge Treatment and Disposal Methods

The below screening table shows that thickened sludge undergoes mechanical dewatering and mechanical drying, both Option C (disposal on suitable land as soil improving material) and Option D (use as fuel and prevention of environmental pollution) in a cement plant are deemed to be favorable.

However, the Option A is an applicable option at the beginning stage, as the amount of sludge is small at the beginning of operation. Therefore, the Option A of gravity thickening and mechanical dewatering is applied to this project.

Table 4.2-3 Sludge Treatment and Disposal Method

Appearance of the final disposal sludge	Assessment	Applicability to the Project
Option A Landfill disposal of dewatered sludge	Baseline	Applicable from the start
Option B Compost sludge (for agricultural use)	There have been reports of high heavy metal concentrations in soil on farms, etc.	Confirm the future properties of sewerage (quantity, quality) and then determine applicability.
Option C Soil improvement material (dried sludge)	This is a low-cost, safe and sustainable method.	Judge when the applicable economic scale is reached.
Option D Dried sludge (cement plant fuel)	Sustainable and environmentally harmonious technology	Judge when the applicable economic scale is reached.
Option E Incineration ash (construction material)	Incinerator LCC is expensive	Due to the small size of the treatment plant, this is not an effective facility.

Source: JICA Survey Team

3) Landfill Disposal Site

Sludge from WWTP are properly treated and disposed after dewatering process to sanitary landfill sites at Thung Dam Gai in Thanh Lien District and newly developing landfill site called “Thung Co Chay”, with total area of 25.8 ha. 2.5 ha out of 25.8 ha is for the landfill site and its depth is 12-15 m. Thung Co Chay, which was developed for 4 WWTPs, Quy Luu WWTP, Thanh Chau WWTP, WB WWTP and WWTP of JICA project, has started its operation since 2018 and will receive sludge and waste for over 10 years.

CHAPTER 5 DESIGN OF SEWERAGE FACILITIES

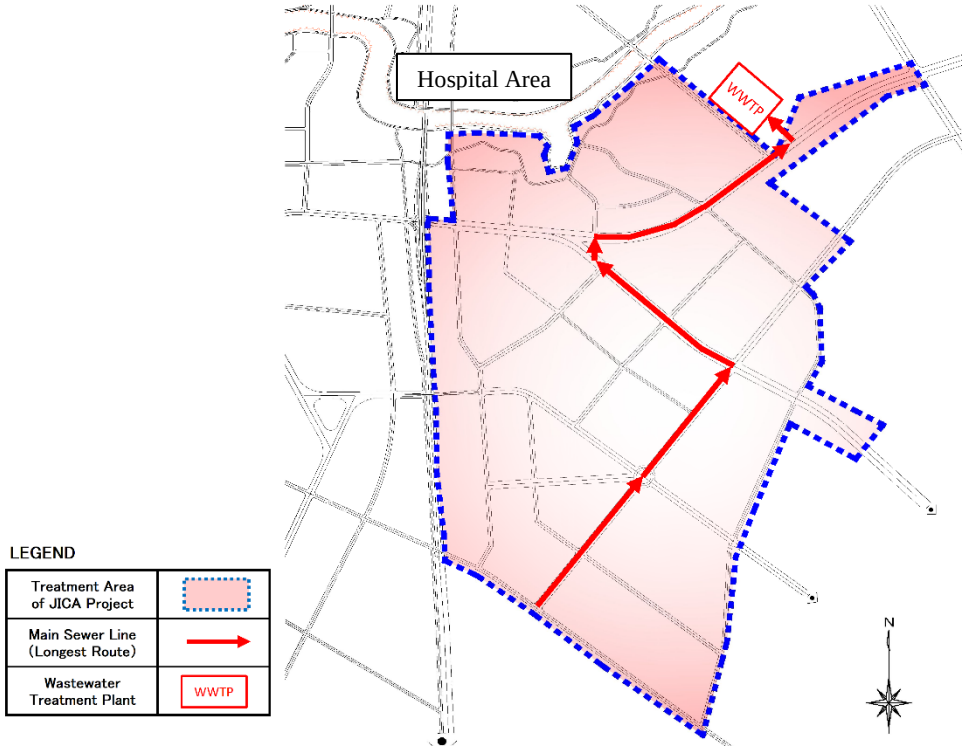
5.1 Introduction

In this Chapter, sewerage facilities (Sewer pipe and Wastewater Treatment Plant) are designed, based on the result of wastewater forecast in **Chapter 2** and sewerage system discussed in **Chapter 4.** As for the sewer network design, main sewer is designed.

5.2 Design of Sewer Pipeline

5.2.1 Proposed Sewerage System

Separate system is applied in the hospital area where there is no existing main sewer or branch sewer pipes to collect wastewater. The proposed sewerage area is as indicated in **Figure 5.2-1**.



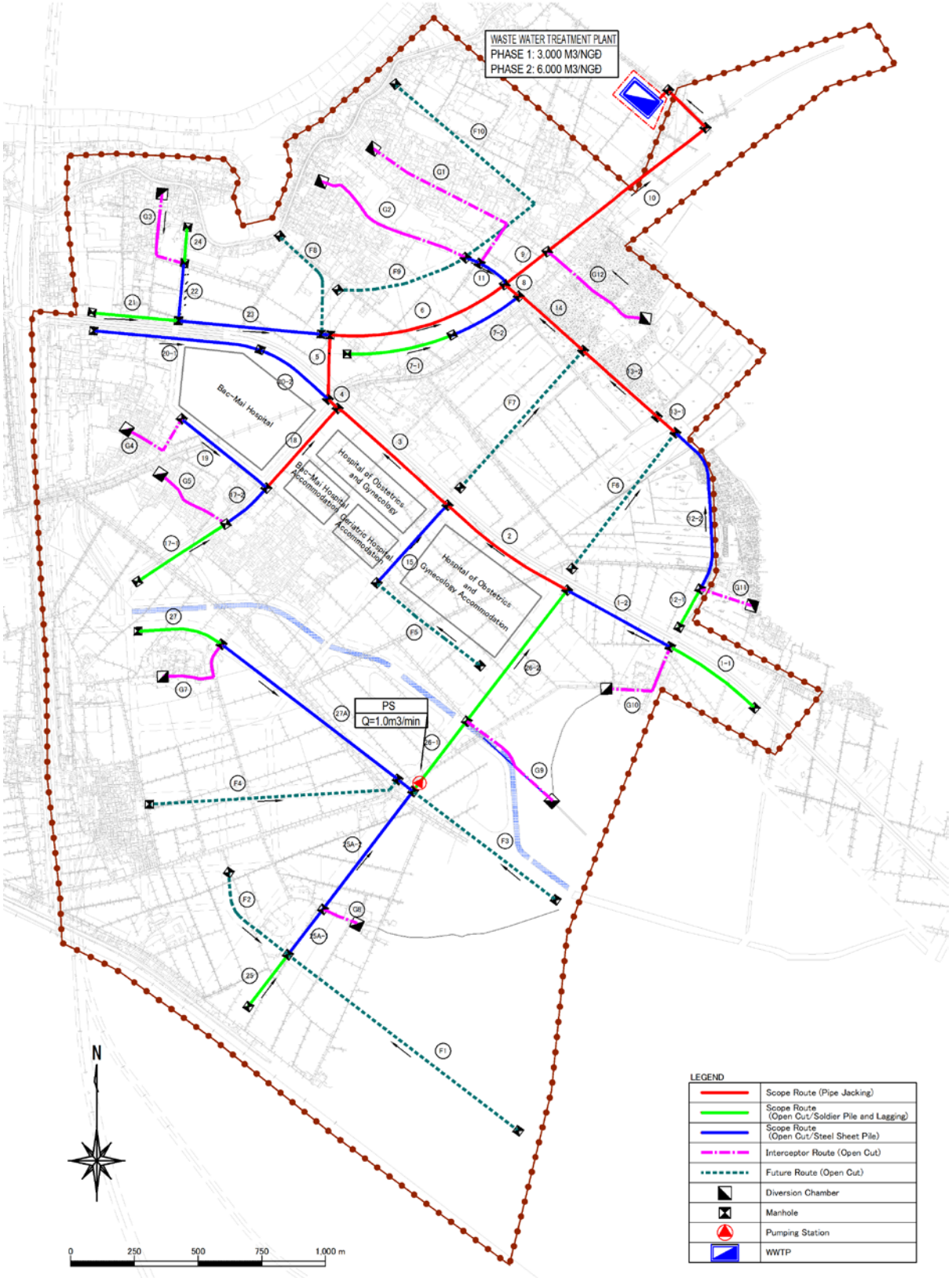
Source: JICA Survey Team

Figure 5.2-1 Proposed WWTP

5.2.2 Route of Main Sewer in Hospital Area

In the Hospital Area, routes of main sewer are as proposed as **Figure 5.2-2** .

- Route of main sewer is planned to minimize the total length of the sewer network including branch sewers.
- Road network construction is planned in this treatment area. However, the road network will be not always established on schedule and thus the proposed sewer in this project might not be constructed due to the delay in the construction of roads. Accordingly, the main sewer is, in principle, proposed along the roads which is construction schedule was decided (include existing roads) in the development areas to avoid delay in the installation of proposed sewer system. On the other hand, the undecided road of the construction schedule is outside this plan scope.



Source: JICA Survey Team
Note: MH symbol shows starting and confluence points only.

Figure 5.2-2 Route of Main Sewer in Hospital Area

5.2.3 Flow Calculation

(1) Maximum Hourly Design Flow

Design wastewater flow is composed of domestic wastewater, handicraft industry wastewater, groundwater and so on. The total design wastewater flow is to be converted into the design wastewater flow per unit hectare. Then, design wastewater flow of each pipe is calculated by multiplying wastewater volume per hectare and the hectare area allocated for the pipe.

In this project, separated sewer system is selected for Hospital Area. Pipe diameter of separated sewer system shall be determined by maximum hourly design flow. Sewerage design standard in Vietnam (TCVN7957-2008 4.1.2) specifies peak hourly factor for the daily average flow as shown in the following Table.

Table 5.2-1 Maximum Hourly Design Flow Factor

Average daily flow (L/s)	5	10	20	50	100	300	500	1000	>5000
K_{omax} (max.)	2.5	2.1	1.9	1.7	1.6	1.55	1.5	1.47	1.44
K_{omin} (min.)	0.38	0.45	0.5	0.55	0.59	0.62	0.62	0.69	0.71

Source: TCVN7957-2008

Considering the above-mentioned conditions, unit wastewater flows per hectare are calculated as shown in the following table.

Table 5.2-2 Unit Wastewater Flows per Hectare

Treatment area	Average daily wastewater flow		Total area of treatment area	Peak hourly factor	Intercepting ratio	Maximum hourly wastewater flow	Maximum hourly wastewater flow per Hectare
	(m^3/d)	(L/s)	(ha)			(L/s)	(m^3/s/ha)
Hospital area	4,898	56.69	930.0	1.687	1	95.64	0.000103

Source: JICA Survey Team

(2) Flow Calculation Formula and Roughness Coefficient

For flow calculation, Manning's formula is employed with roughness coefficient by pipe type, in accordance with 4.3.1 of TCVN 7957-2008, as shown in the following table.

In this project, HDPE pipe is applied for small diameter pipes of 300 mm or less, because the roughness coefficient is smaller than that of reinforced concrete pipe and thus pipe gradient and coverage depth can be smaller. The roughness coefficient of 0.011, which is the same as the resin type PVC pipe, is adopted for HDPE pipe.

Table 5.2-3 Roughness Coefficient

Material of pipe	Roughness coefficient
Reinforced concrete pipe (RC)	0.013
Iron Pipe	0.012
Polyvinyl Chloride Pipe (PVC) High Density Polyethylene Pipe (HDPE)	0.011

Source: TCVN7957-2008

(3) Minimum Velocity

In accordance with TCVN 7957-2008 4.6.1, minimum velocity is determined by pipe diameter, as shown in the following table.

Table 5.2-4 Minimum Velocity

TCVN 7957-2008		Minimum gradient (‰)	
Pipe diameter (mm)	V min (m/s)	RCP (RC)	Resin pipe (PVC,HDPE)
200	0.7	3.9	2.8
300	0.8	3.0	2.1
400	0.9	2.4	1.7
500	0.9	1.7	1.2
600	1.0	1.7	1.2
700	1.0	1.3	―

Source: Calculated by JICA Survey team based on TCVN7957-2008

(4) Diameter and Gradient of Sewer

Diameter of sewer is determined by the "total" maximum hourly wastewater flow, which includes wastewater volume of the ultimate stage (after 2035). Design water depth by diameter is determined in accordance with 7957-2008 4.5.2, as shown in the following table.

Table 5.2-5 Design Water Depth

Pipe diameter (mm)	Design water depth (m)
200-300	0.6D
350-450	0.7D
500-900	0.75D
900-	0.8D

Source: TCVN7957-2008

5.2.4 Construction Method (Comparison of Open-Cut Method and Pipe Jacking Method)

(1) General Condition of Sewer Pipe Installation in Ha Nam Province

In this section, demarcation between the open cut method and pipe jacking method was determined considering construction cost, ease of construction, impact on local area, safety and so on. Before entering into the demarcation, general conditions of sewer pipe construction in Ha Nam province are summarized as follows.

1) Pipe jacking method has never been used in the province; hence, cost estimation of the pipe jacking method shall be based on the examples in other cities in Vietnam.
2) Steel sheet piles are generally adopted to open-cut method, because (i) soft soil (Clay, Nmin=2, see **Figure 5.2-3**) dominates and groundwater level is high in Ha Nam Province; and (ii) the safety of workers and cut-off performance cannot be guaranteed without steel sheet piles.
3) In general, earth retaining is applied for excavation depth of 3 to 4 m considering soft soil (Clay, Nmin=2, see Figure **5.2-3**) and to reduce excavation area (in Ha Nam Province, the slope gradient of 1:1 is applied. In this case, about 8 m in width will be excavated for excavation depth of 3 meters). Therefore, open-cut method is applied only for the area in which soil condition is good and no building is found in the neighboring area.
4) Occasionally, support foundation by bamboo is required to prevent uneven settlement. In this case, cost of open-cut method increases and the pipe jacking method might be cheaper.
5) According to TCVN7957-2008, pipe diameter of less than φ300 mm can be used, but actually sewer with less than 200 mm of diameter is clogged with the garbage illegally dumped. Therefore, minimum diameter of φ300 mm is applied in Ha Nam Province, including Do Xa, World Bank and the other sewerage projects.
6) HDPE pipe is widely adopted to sewer pipe with diameter of less than 400 mm, while Hume pipes are adopted to sewer pipe of 500 mm or more for cost reduction and ease of execution.

(2) Price Validity of the Pipe Jacking Method

Data on cost of pipe jacking method in other cities in Vietnam were collected and the unit rates per meter were compared as in **Table 5.2-6**. As shown in the table, no great difference in price is found between cities.

Table 5.2-6 Cost Comparison of Unit Cost of Pipe Jacking Methods in Vietnam

Diameter (mm)	Ho Chi Minh Project	Other Projects
	JPY/m	JPY/m
700	163,000	180,000
800	194,000	220,000
1,200	283,000	230,000
1,800	461,000	430,000

Source: JICA Survey Team

(3) Cost Comparison (Unit Cost per Meter)

Considering the above-mentioned general conditions related to the installation of sewers in Ha Nam Province, cost comparison of the open-cut method and pipe jacking method was carried out under the following conditions:

1) Steel sheet pile method is adopted to open-cut method with pile types of III and IV (steel sheet pile type IV is widely used for open-cut sections of sewer constructions in Ha Nam Province).
2) Penetration depth of sheet pile is set at 3 m.
3) Pipe material is reinforced concrete with diameters from φ300 to φ1,000 mm.

The following tables show the results of comparison. Open-cut method is cheaper than pipe jacking method, but the difference between the methods are small at diameters of φ600 mm or less.

Table 5.2-7 Comparison of Pipe Jacking and Open-Cut Methods

Unit price per meter (JPY/m)

Diameter of Pipe		D300mm		D400mm		D500mm	
Construction Method		Open Cut with steel sheet pile	Pipe jacking method	Open Cut with steel sheet pile	Pipe jacking method	Open Cut with steel sheet pile	Pipe jacking method
Excavation Depth	4 m	109,447	113,000	110,149	121,000	113,124	129,000
	5 m	112,521	113,000	113,224	121,000	116,369	129,000
	6 m	115,595	113,000	116,298	121,000	119,615	129,000

Source: JICA Survey Team

(4) Typical Boundary for Adoption of Tunneling Method in Other Vietnamese Cities

Typical boundary for adopting tunnel methods in other Vietnamese cities are as follows:

- Hanoi: Excavation depth is generally 4 m
- Ho Chi Minh: Excavation depth is 5 m
- Da Nang: 4-5 m

(5) Conclusion

Demarcation between open-cut and pipe jacking methods are set at 5 m, considering the examples in other cities in Vietnam and the following reasons (Based on ease of construction, impact on local area, safety and so on):

1) Cost of the pipe jacking method greatly differs, depending on the number of shafts and soil quality. Similarly, cost of the open-cut method greatly differs, depending on the soil quality and groundwater level, which influence the penetration depth of sheet piles and the type of jacking machine applied. Accordingly, it is difficult to set boundary by depth between open cutting and pipe jacking based only on cost.
2) Due to soft soil in Ha Nam, support foundations using bamboo are sometimes required to prevent uneven settlement. In that case, the cost of open cut method increases and the differences of cost between pipe jacking and open cut method becomes small.
3) In other cities in Vietnam, excavation depth of 4 to 5 m is set as the boundary for adopting the pipe jacking method under the following reasons:

   (i) To reduce excavation area and construction period to minimize impact on residents.
   (ii) To minimize traffic hindrance.
   (iii) To maintain safety of the works.
   (iv) To minimize impact on underground facilities

(v) To avoid risk of accidents (There exist past records that (i) cars fell down to excavated holes at night and (ii) children fell down to flooded holes and drowned. In Hanoi, even though open cutting is less expensive, the pipe jacking method from depth of 4 m is adopted, emphasizing safety reasons).

4) Pipe jacking method is applicable to Ha Nam Province, in consideration with soil condition in Ha Nam Province: (i) the soil mainly comprises clay, and boulders and gravel which hinder pipe jacking work is scarce; and (ii) groundwater level is high.

5.2.5 Profile Design

Profile of the sewer is designed according the following design conditions.

(1) Minimum Earth Covering Depth

According to TCVN 7957-2008, minimum earth covering depth of 0.3 m is set for pipes with diameter of less than 300 mm installed at area without passing vehicles. On the other hand, minimum earth covering depth of 0.7 m is set for pipes in areas with passing vehicles.

In this project, minimum covering depth is set at 1.0 m considering depth of house connection, construction method and other technical factors.

(2) Manhole Step (Difference of Elevation between Upstream and Downstream Pipes)

In the detailed design stage, manhole step need 2 cm at a minimum. In case of pipe jacking method, the step is secured at 5 cm, considering construction error.

(3) Crossing of Existing Underground Utilities

No other small sized rainwater culvert to affect elevation of main sewer has been identified in this Preparatory Survey, but detailed survey on small sized rainwater culverts shall be done in the detailed design stage.

Lots of water supply pipe run in Phu Ly City with depths of about 1.0 m. Therefore, the water supply pipes will not affect the elevation of main sewer because they are deeper than water supply pipes. However, detailed survey on water supply pipes shall be done in the detailed design stage.

In general, telephone and electric cables in Phu Ly City are wired by overhead line and few telephone and electric cables are installed underground. In case telephone and electric cables are installed underground, the covering depth of the cables shall be 1.0 m with diameter at maximum. Therefore, telephone and electric cable will not affect the elevation of the main sewer. However, detailed survey on these telephone and electric cables shall be done in the detailed design stage.

(4) Manhole Type Pumping Station

There is a type of pumping station called manhole pump system (hereinafter called as MHP) that pump devices can be accommodated inside of a manhole. Applying MHP to sewer pipe line, the depth of sewer pipe can be shallower. However, due to the system of accommodated in manhole, the maximum capacity of pump system is limited. The maximum capacity is set at 2 m^3/min of hourly maximum volume (about 3,000 m^3/day) based on "Plan and Design Standard for Small Scale Sewerage System by Japan Sewage Works Association" in Japan. MHP cannot have grid chamber and screening equipment due to limited space, therefore, in case of inflow wastewater volume is higher than the maximum capacity, speed of soil accumulation become high and volume of particles inflow into MHP become large. Then MHP will deteriorates soon and requires many maintenance, overhaul and replacement. In addition, basically MHP can be applied to separate sewer system because much volume of soil inflow will occur in combined sewer system and deteriorates pump devices.

Considering this condition, the maximum capacity of MHP should be set at 2 m^3/min as same as Japanese standards.

MHP can be planned only at a relatively up-flow area due to the limitation of the maximum capacity. On the other hand, by installing MHP, sewer pipe depth can be shallower and construction cost can be reduced. As a result of studying an appropriate location for MHP, one MHP is proposed at a main sewer pipe as shown in **Figure 5.2-2**. Wastewater flow volume to the MHP is 1.0 m^3/min and pipe diameter

is 300 mm at the connection point of the MHP.

5.2.6 Manhole

Manholes are designed considering function, construction method and depth of manhole, as summarized in **Table 5.2-8**. In this survey, the maximum interval of manhole is set at 150 m considering the possible maximum construction interval of pipe jacking methods.

Table 5.2-8 Types of Manhole

Diameter of Sewer Pipe (mm)	Depth of Manhole (m)	Internal Dimension of Manhole (m)		Thickness of Wall (mm)	Number of Manholes
		Width	Length		
300-700	H<1m	0.8	0.8	200	0
	1m≦H<3m	0.9	0.9	250	68
	3m≦H<7m	1.2	2.5	600	427
	7m≦H<15m	1.2	2.5	750	75
	15≦H	1.2	2.5	900	0

Source: JICA Survey Team

Regarding the maximum interval between manholes, the following specifications are stipulated by National technical regulation.

Table 5.2-9 Maximum Interval between Manholes

Diameter	Maximum interval between manholes (m) Vietnam regulation (TCVN7957-2008, QCVN07-2:2016/BXD)
150 mm – 300 mm	20-30
400 mm – 600 mm	30-40
700 mm – 1,000 mm	60

Source: TCVN7957-2008, QCVN07-2:2016/BXD

In this preparatory survey, the arrangement of manholes is planned in open cut sections according to the above Vietnamese standard. As for the pipe jacking sections, considering the maximum possible construction distance of the pipe jacking method, the maximum interval between manholes is set at 150 m for sewer maintenance purposes based on pipe jacking distance of 150 m per span.

5.2.7 Materials of Sewer Pipe

As for the material of sewer pipe, the following is adopted considering general procurement situations of sewer installation in Ha Nam Province and neighboring cities such as Ha Noi City, as shown in the following table.

The reinforced concrete pipe used for jacking methods is different from ordinary reinforced pipe used for open cut methods because it is difficult to predict the stress generated in the jacking pipe when the jacking pipes go through the ground. But recently, production of the Hume jacking pipes used for jacking methods has been started in Vietnam by support of Japanese jacking-pipe manufacturer companies.

Table 5.2-10 Materials of Sewer Pipe

Pipe Installation Methods	Diameter (mm)	Material of Pipe
Open cut method	100 ≦ D ≦ 450	High Density Polyethylene (HDPE) Pipe
	D ≧ 500	Reinforced Concrete Pipe
Pipe jacking method	D ≧ 300	Reinforced Concrete Pipe for pipe jacking methods
Pressure pipe	D ≧ 100	Ductile Iron Pipe

Source: JICA Survey Team

5.2.8 Retaining Work Method for Open Cut

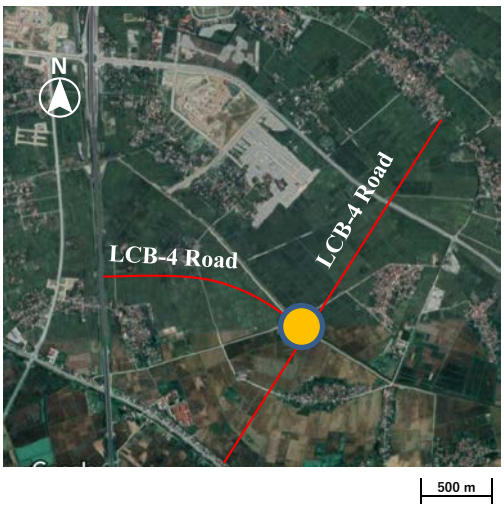
The soil condition in this project area is very soft (N-value=2-5, see **Figure 5.2-3**). Based on construction safety, solider pile and lagging method is adopted only where excavation depth is shallow.

The retaining work method for each excavation depth shall be as follows.

- Earth covering ≦ 2.5m (Excavation depth ≦ 3.0m) : Soldier pile and lagging method
- Earth covering ＞ 2.5m (Excavation depth ＞ 3.0m) : Steel sheet pile method

As the reference, one of the results of boring survey for this project area is shown below (this survey was conducted in this preparatory survey. This survey results are shown in page A-5-14 of **Appendix 5**).

Symbol of layer	Level of layer bottom	Depth of layer bottom	Thickness of layer	STRATUM COLUMN SCALE 1/100	Number of sample / Depth of sample (m)	SPT TEST: Depth (m)	N1	N2	N3	NSPT (N2+N3)	NSPT Diagram (0 4 8 12 16 20)	SOIL CLASSIFICATION
1	-0.60	0.60	0.60									Surface
2	-1.70	1.70	1.10		UD1 1.0-1.2	1.20 / 1.65	2	2	3	5		Clay
3	-4.30	4.30	2.60		UD2 2.0-2.2	2.20 / 2.65	1	1	2	3		Clay
					UD3 3.0-3.2	3.20 / 3.65	1	1	2	3		
					UD4 4.0-4.2	4.20 / 4.65	1	1	1	2		
4	-5.00	5.00	0.70		UD5 4.8-5.0	5.00 / 5.45	1	2	2	4		Sand mixed clay



Source: JICA Survey Team based on Google Map

Location of Boring

Figure 5.2-3 Geologic Columnar Section

5.2.9 Outline of Sewer Pipeline in Hospital Area

The proposed main sewer are as summarized in the following tables.

Table 5.2-11 Outline of Sewer Facilities

Area	Construction Method	Item	Spec	Unit	Total Length	Maximum Span Length	Earth Covering	Remarks
East Main Sewer (Hospital Area)	Gravity flow (Open cut method)	Pipeline	HDPE Φ300	m	4,583	30.0	2.0-2.5	Soldier pile lugging
					9,972	30.0	2.5-4.5	Sheet pile
		Manhole		Place	534	-	-	
	Gravity flow (Pipe jacking method)	Pipeline	RC Φ300	m	902	150.0	4.5-6.0	
			RC Φ400	m	2,605	150.0	6.0-14.0	
			RC Φ500	m	1,214	150.0	14.0-15.5	
		Steel sheet pile shaft		Place	36	-	-	-
		Manhole		Place	36	-	-	-

Source: JICA Survey Team

Table 5.2-12 Quantity of Sewer Pipe

Item	Open Cut	Pipe jacking	Total	Remarks
Pipeline	14,555 (m)	4,721 (m)	19,276 (m)	D300-500 (mm)
Manhole	534 (set)	36 (set)	570 (set)	
Manhole Type Pumping Station	-	-	1 (place)	1.0m^3/min-3.7kW 2units (1 Duty/1 Standby)

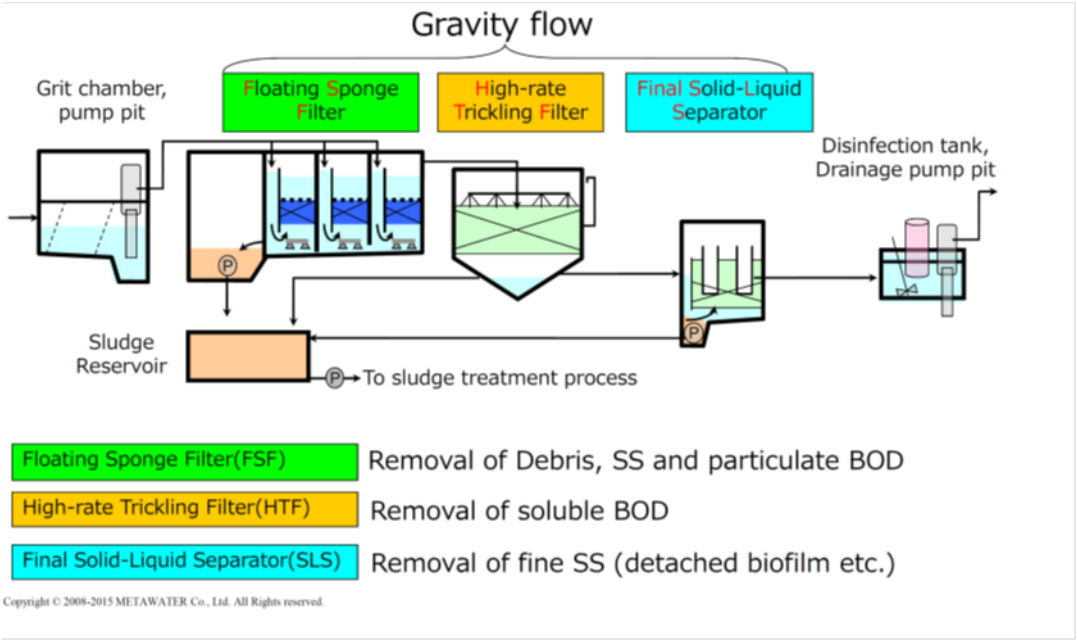
Source: JICA Survey Team

5.3 Design of Wastewater Treatment Facilities

5.3.1 Design of Wastewater Treatment Facilities

(1) Overview of PTF Process

PTF consists of floating sponge filtration, high-rate trickling filtration, and final separation tank. Process flow of PTF is shown in **Figure 5.3-1.**

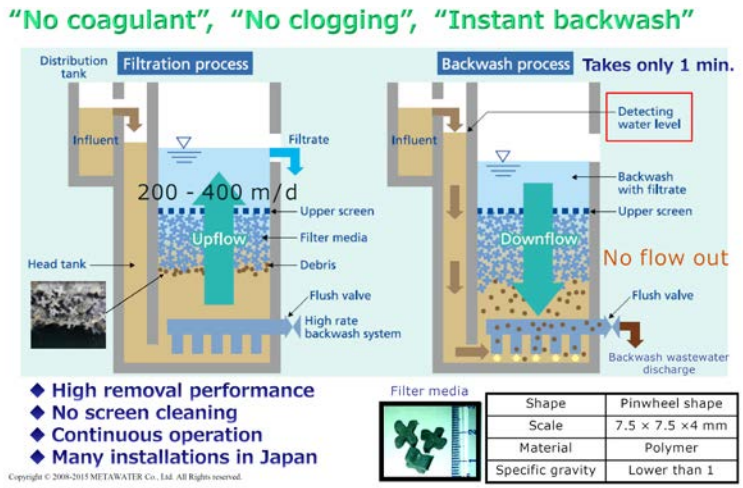


Source: Metawater Co.,Ltd.

Figure 5.3-1 Process Flow of PTF

1) Floating Sponge Filter (FSF)

The FSF of high rate filtration process has a removal function of BOD and SS in sewerage as primary treatment. The process is operated with a filtration speed at 200m/d ~400m/d by plastic media. The removal efficiency of BOD and SS is estimated at 50% and 75% respectively (according to Data of B-DASH (2011)).

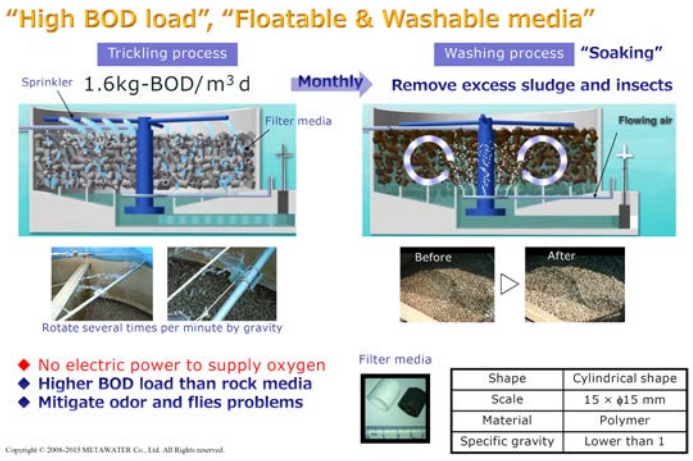


Source: Metawater Co.,Ltd.

Figure 5.3-2 Features of FSF

2) High-Rate Trickling Filter (HTF)

The HTF uses new filter media having treatment stability based on a conventional basic principal. It also uses the trickling filter process which has been practiced for stone filters. The Process is operated with BOD volumetric loading of 1.6kg-BOD/m3/day by floatable and washable media. Treatment efficiency of BOD and SS removal can be estimated at 70% and 40%, respectively. The advantages of the treatment plant are as follow; 1: compact structure, 2: low offensive smell, 3: less air supply and energy consumption.

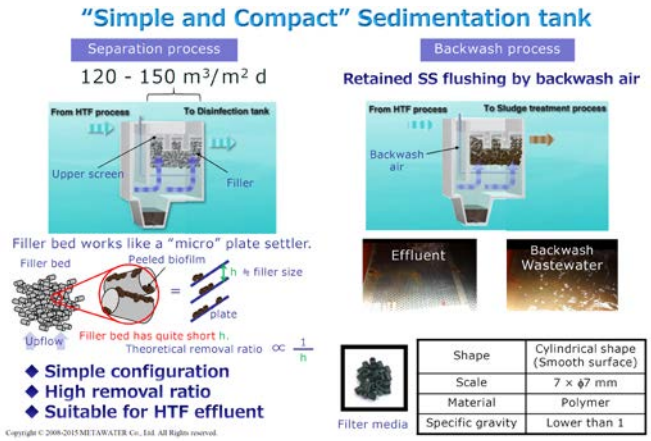


Source: Metawater Co.,Ltd.

Figure 5.3-3 Features of HTF

3) Final Solid-Liquid - Separator (SLS)

The SLS is used for secondary sedimentation of biological sludge suspended in treated water of HTF. Since the sludge features humus sludge and pin-floc, double deck is designed for the sedimentation, which is composed of gravity sedimentation zone and contact plastic media zone for pin-floc removal. The Process is operated with filtration speed at 120 m/d ~150 m/d by plastic media. In compliance with QCVN14:2008/BTNMT C value A, the proposed treated water quality are BOD of 30mg/L or less and SS of 50mg/L or less.



Source: Metawater Co.,Ltd

Figure 5.3-4 Features of SLS

(2) Wastewater Treatment Facility Planning

The wastewater treatment facility is planned up to 2030 of the first stage and the future plan of year after 2035.

1) Design Flow Rate

Flow rate in dry weather flow is used for design flow rate on this study, considering the collecting

system of waste water.

Design flow rate is maximum hourly flow rate (HM) in dry weather at raw water pump pit and maximum daily flow rate (DM) in dry weather at wastewater treatment plant.

① First Stage (up to 2030)

- Maximum Hourly Flow rate (HM) in dry weather : Q=3,900m^3/d,
- Maximum Daily Flow rate(DM) in dry weather : Q=3,000m^3/d

② Future Plan (year after 2035)

- Maximum Hourly Flow rate (HM) in dry weather : Q=8,300m^3/d,
- Maximum Daily Flow rate(DM) in dry weather : Q=6,000m^3/d

2) Design Wastewater Quality

Design wastewater quality (influent and effluent) for WWTP is summarized in **Table 5.3-1**, with allowable effluent water quality (in accordance with C value:A in QCVN 14:2017/BTNMT). Design effluent water quality by the PTF process is set based on a removal ratio of wastewater in the report of "Advanced Energy Saving Wastewater Treatment Process (Japan Sewage Works Agency)". In **Table 5.3-1**, design water quality of Ammonia (NH_4-N) is also shown as a reference. Additional study on removal of Ammonia (NH_4-N), including study on whether to install additional treatment facilities, will be conducted in the detailed design stage because allowable effluent water quality of Ammonia (NH_4-N) in the standard is relatively stringent.

Table 5.3-1 Design Wastewater Quality for WWTP in the Project

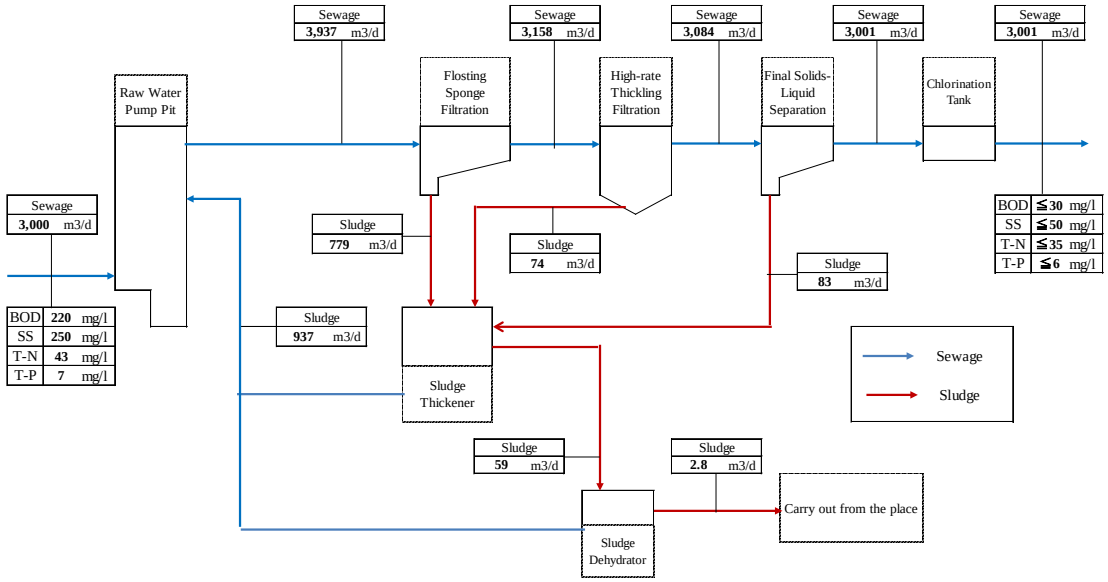
	Design influent wastewater quality (mg/L)	Design effluent water quality (mg/L)	Allowable effluent water quality
BOD	220	22	30
SS	250	25	50
T-N	43	19	20
NH_4-N	26[1)]	4.4[2)]	5
T-P	7	1	6

Note:
1) NH_4-N is assumed at 60% of T-N (43 mg/L×0.6=26 mg/L)
2) 83% of NH_4-N is removed (26 mg/L×(1-0.83)=4.4 mg/L)
in accordance with experimental result in "Advanced Energy Saving Wastewater Treatment Process" Japan Sewage Works Agency, March 2014.

Source: JICA Survey Team

3) Flow of Sewage and Sludge

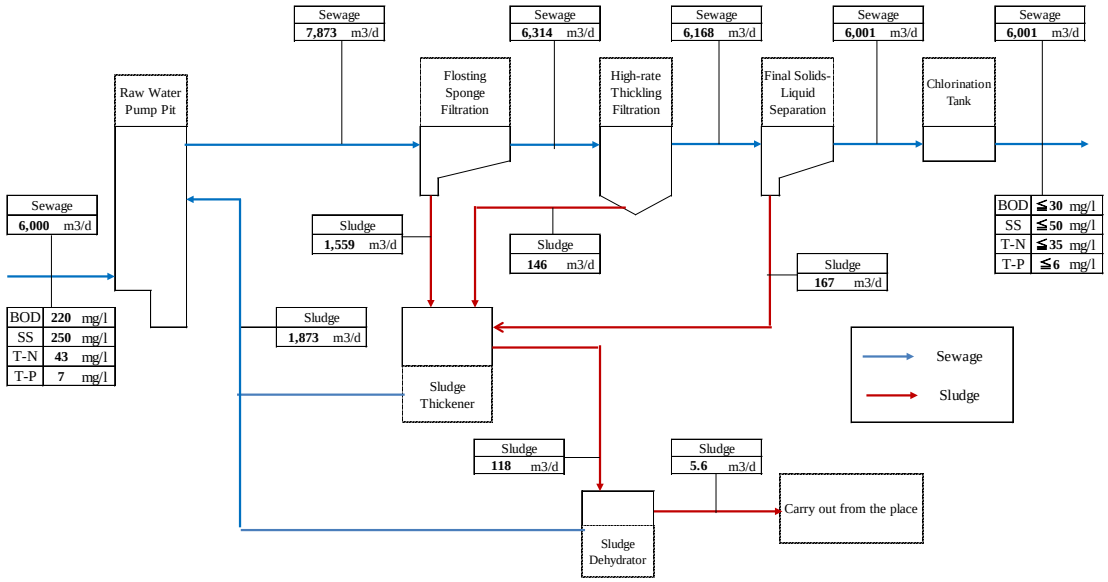
The flows of sewage and sludge from the wastewater treatment facility are shown in **Figure 5.3-5** and **Figure 5.3-6**.



Sewage・Sludge Flow (Financed by JICA(up to 2030))

Source: JICA Survey Team

Figure 5.3-5 First Stage (up to 2030)



Sewage・Sludge Flow (After Future Expansion(year after 2035))

Source: JICA Survey Team

Figure 5.3-6 Future Plan (year after 2035)

4) Outline of Sewerage Treatment Facility and Equipment

The recommendable unit process, configurations, equipment and size for this treatment plant are shown in **Table 5.3-2**.

Table 5.3-2 Outline of Sewerage Treatment Facility and Equipment

Item	First Stage (up to 2030)	Future Plan (year after 2035)
1.Required land area	2.3ha	
2.Design Flow rate		
(1)Average Daily Flow rate(DA)	2,300m3/d=1.60m3/min=0.027m3/sec	4,900m3/d=3.40m3/min=0.057m3/sec
(2)Maximum Daily Flow rate(DM)	3,000m3/d=2.08m3/min=0.035m3/sec	6,000m3/d=4.17m3/min=0.069m3/sec
(3)Maximum Hourly Flow rate (HM)	3,900m3/d=2.71m3/min=0.045m3/sec ***1**	8,300m3/d=5.76m3/min=0.096m3/sec
3.Design Influent Quality		
(1)BOD	220mg/l	
(2)SS	250mg/l	
(3)T-N	43mg/l	
(4)T-P	7mg/l	
4.Design Effluent Quality		
(1)BOD	22mg/l ≦ 30mg/l (QCVN14:2008/BTNMT:C value A)	
(2)SS	25mg/l ≦ 50mg/l (QCVN14:2008/BTNMT:C value A)	
(3)T-N	19mg/l ≦ 35mg/l (QCVN14:2008/BTNMT:C value A)	
(4)T-P	1mg/l ≦ 6mg/l (QCVN14:2008/BTNMT:C value A)	
5.Removal Ratio is assumed (Total System)		
(1)BOD	90.0% (220mg/l×(1 - 90.0/100)=22mg/l)	
(2)SS	90.0% (250mg/l×(1 - 90.0/100)=25mg/l)	
(3)T-N	55.0% (43mg/l×(1 - 55.0/100)=19mg/l)	
(4)T-P	80.0% (7mg/l×(1 -80.0/100)=1mg/l)	
6.Influent Pipe	φ500mmHP I＝ 1.7‰ Pipe Bottom High：GL-9.683M (Planned ground height：GL+3.65M)	
7.Sewage Pump ( ):standby	φ200×4.0m3/min×25m×30kw×2(1)unit	φ200×4.0m3/min×25m×30kw×3(1)unit
8.Overgrand Grit Chamber	W1.5m×L2.0m×1pond	W1.5m×L2.0m×2pond
9.Floating Sponge Filter(FSF)	W2.5m×L3.5m××2tanks	W2.5m×L3.5m×4tanks
10.High-rate Trickling Filter(HTF)	W9.0m×L9.0m×H2.3m×2tanks	W9.0m×L9.0m×H2.3m×4tanks
11.Final Solids-Liquid Separator (SLS)	W3.0m×L3.5m×2tanks	W3.0m×L3.5m×4tanks
12.Drain Tank	350m3×1tanks	350m3×2tanks
13.SLS Washing Drainage Tank	25m3×1tanks	25m3×2tanks
14.Sludge Thickener	φ6.5m×H4.0m×1tank	φ6.5m×H4.0m×2tank
15.Sludge Dehydration	20kg/hr×3.95kw×2unit ・Sludge volume=59m3/d (Sludge concentration=1.0%) ・Sludge weight=590kg/d ・Operation condition：24hr/d and 7day in week ・Supply solid weight=590kg/d÷24hr/d×(7d/7d)÷ 2units= 12kg/hr/unit → 12kg/hr/unit ×2units＝24kg/hr≦40kg/hr OK ・Dewatered Sludge:560kg/d (SS Recover Rate 95%) ・Water Content：80% ・Dewatered Sludge:560kg/d÷(1-0.8)÷1000＝2.8m3/d	20kg/hr×3.95kw×3unit ・Sludge volume=118m3/d (Sludge concentration=1.0%) ・Sludge weight=1180kg/d ・Operation condition：24hr/d and 7day in week ・Supply solid weight=1180kg/d÷24hr/d×(7d/7d)÷ 3units=16kg/hr →16kg/hr/units×3units＝48kg/hr≦60kg/hr. OK ・Dewatered Sludge:1120kg/d (SS Recover Rate 95%) ・Water Content：80% ・Dewatered Sludge:1120kg/d÷(1-0.8)÷1000＝5.6m3/d
16.Chlorination Tank	W1.5m×L30.0m×H1.5m×1tank	
17.Polishing Pond	・T(Retention time) ＝ 48hr(2day) ・V(Storage amount)＝6,000m3 ・ W：50.0m×L：83.0m ×D：4.5m(Effective water depth 2.0m) ×1Pond (Slope gradient 1: 1)	・T(Retention time) ＝ 48hr(2day) ・V(Storage amount)＝12,000m3 ・ W：50.0m×L：83.0m ×D：4.5m(Effective water depth 2.0m) ×2Ponds (Slope gradient 1: 1)
18.Outfall Pump ( ):standby	φ250×3.0m3/min×11m×11.0kw×2(1)unit	φ250×3.0m3/min×11m×11.0kw×3(1)unit

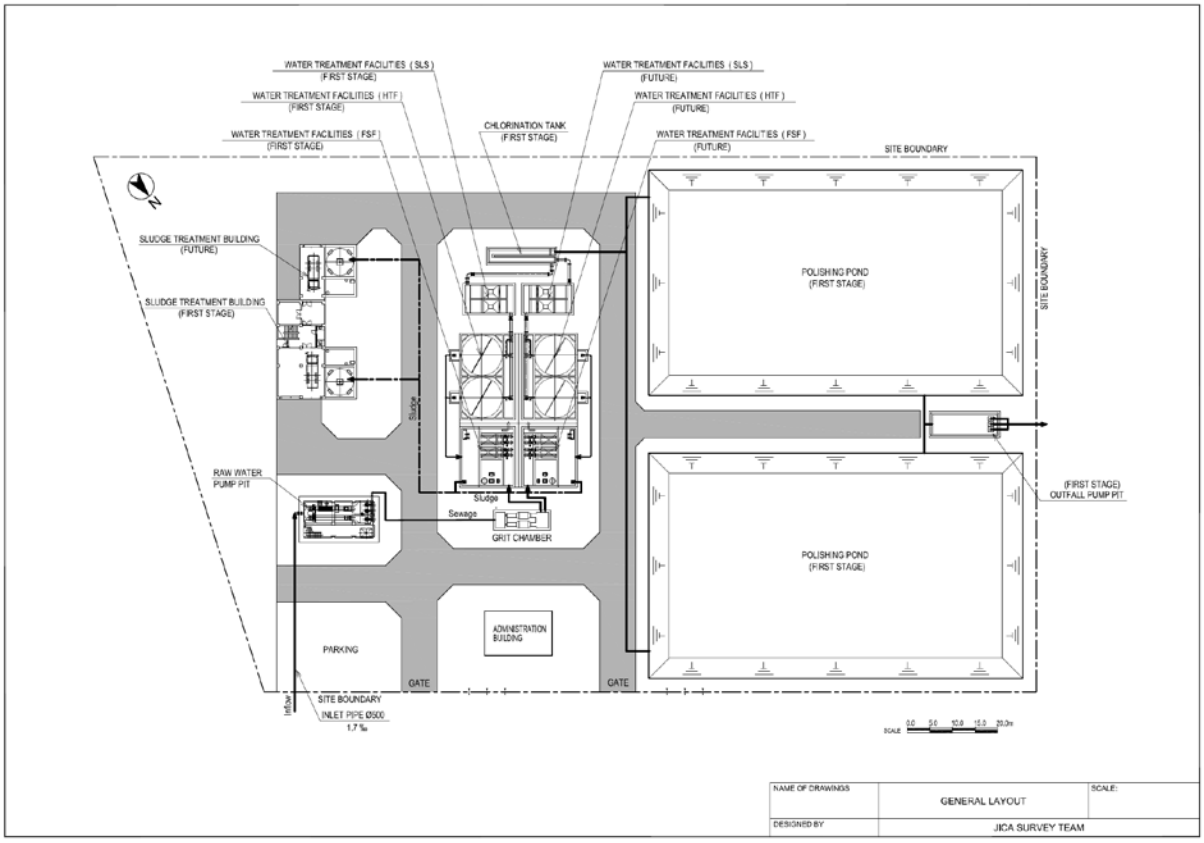
***1**: 2,300m3/d×1.687＝3,880→3,900m3/d

Source: JICA Survey Team

5) Layout Plan of Wastewater Treatment Facility

PTF wastewater treatment facility is proposed to be constructed as shown in **Figure 5.3-7**.

The size of the area for wastewater treatment facility is about 2.3 ha.



Source: JICA Survey Team

Figure 5.3-7 Layout Plan of Wastewater Treatment Facility

5.3.2 Design of Polishing Pond

(1) Overview

The polishing pond is installed after the chlorination tank, which is requested by Ha Nam Province in Vietnam.

(2) Design condition

① Q(Storage amount)=6,000m3/d

② T(Retention time)=48hr (2day)

(3) Design content

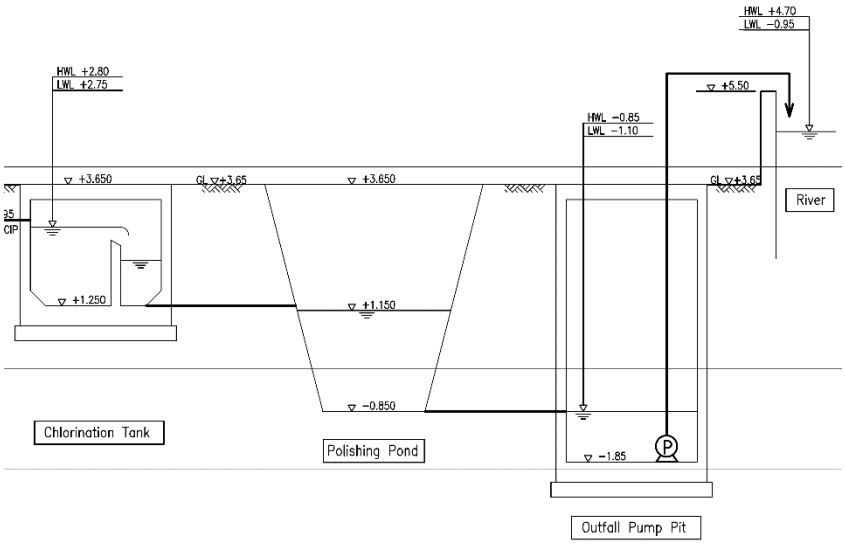
①V(Polishing pond capacity) =(Q × T) ÷ 24 = 12,000m3

②Size=W 50.0m×L83.0m×D4.5m(Effective water depth 2.0m)×2Ponds (Slope gradient 1:1)

③Flow of Treated water

The treated water flows from the chlorination tank to the polishing pond by gravity flow. After that, it has been kept in the pond for 2 days and it flows into outfall pump pit by gravity flow. It is pumped up by pump equipment from the outfall pump pit and then it is discharged into the river.

The water level relationship diagram is shown in **Figure 5.3-8**.



Source: JICA Survey Team

Figure 5.3-8 Water Level Relationship Diagram

④Location of the Polishing Pond

The polishing pond is located in the WWTP construction site as shown in **Figure 5.3-9**.

Source: JICA Survey Team based on Google Map

Figure 5.3-9 Planned Site for the Polishing Pond

5.3.3 Stepwise Construction Plan

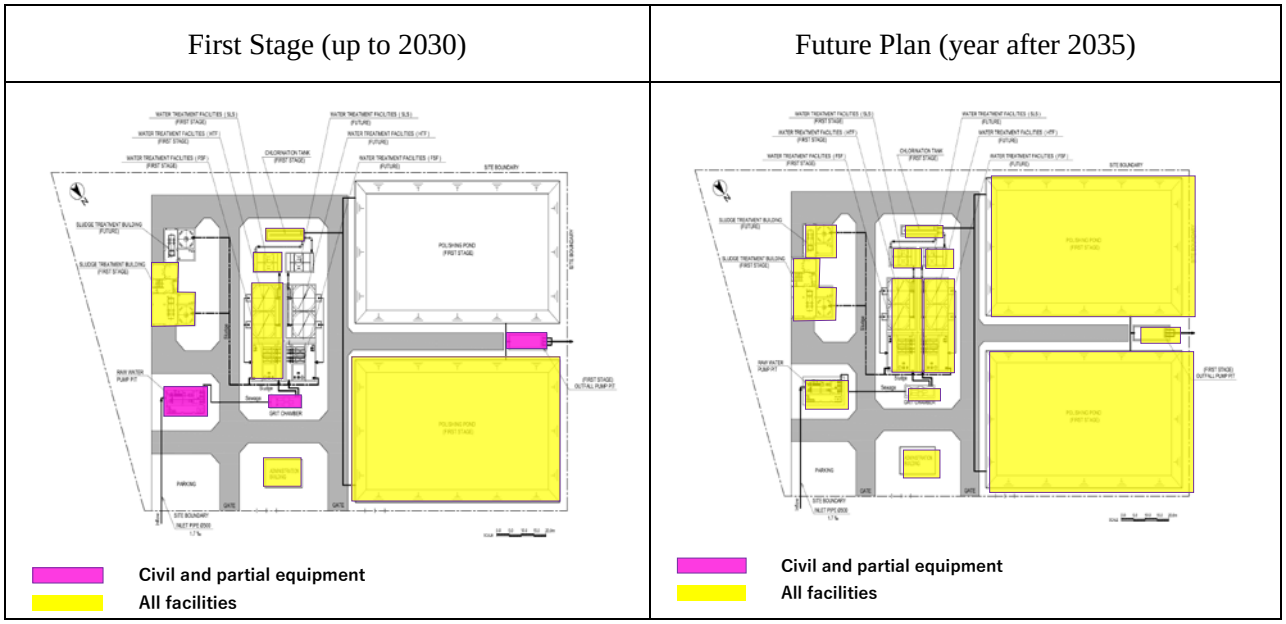
It is recommended that mechanical and electrical equipment of raw water pump pit and grit chambers, and outfall pump pit shall be installed in order to deal with phased demands. It is also recommended that civil engineering structures and architectural structures are constructed at one time for the capacity of final stage. Stepwise construction plan is shown in **Figure 5.3-10**.

Stepwise construction plan of the wastewater treatment plant and sludge treatment building are shown in **Figure 5.3-11** and **Figure 5.3-12**. The capacities of each facility are summarized in **Table 5.3-3**.

Table 5.3-3 Design Capacity for Facilities

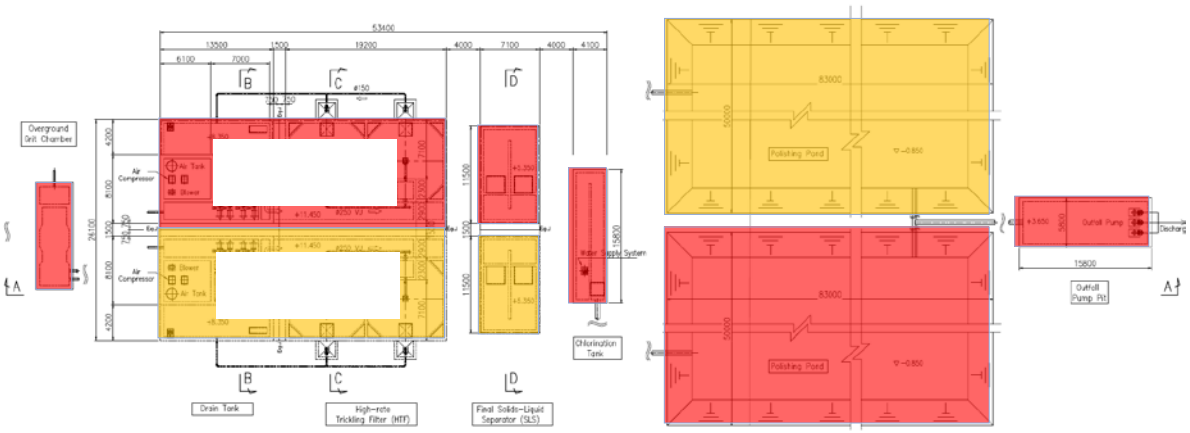
Item			Design Capacity	Remarks
First Stage (up to 2030)	Raw Water Pump Pit	Civil and Architect	8,300 m^3/day	Maximum Hourly Flow rate (HM)
		Mechanical and Electrical	3,900 m^3/day	Maximum Hourly Flow rate (HM)
	Wastewater Treatment Plant	Civil and Architect	3,000 m^3/day	Maximum Daily Flow rate(DM)
		Mechanical and Electrical	3,000 m^3/day	Maximum Daily Flow rate(DM)
Future Plan (year after 2035)	Raw Water Pump Pit	Civil and Architect	8,300 m^3/day	Maximum Hourly Flow rate (HM)
		Mechanical and Electrical	8,300 m^3/day	Maximum Hourly Flow rate (HM)
	Wastewater Treatment Plant	Civil and Architect	6,000 m^3/day	Maximum Daily Flow rate(DM)
		Mechanical and Electrical	6,000 m^3/day	Maximum Daily Flow rate(DM)

Source: JICA Survey Team



Source: JICA Survey Team

Figure 5.3-10 Stepwise Construction Plan



Source: JICA Survey Team

Figure 5.3-11 Stepwise Construction Plan of the Wastewater Treatment Plant

Source: JICA Survey Team

Figure 5.3-12 Stepwise Construction Plan of the Sludge Treatment Building

CHAPTER 6 CONSTRUCTION PLANNING AND COST ESTIMATION

6.1 Construction Planning

6.1.1 Overall Construction Planning

The construction package consists of two parts: Part1 (ICB1), constructing the treatment plant, Part2 (ICB2), constructing the manhole pump station and installing the main sewer pipe in the Hospital Area. The project components in the packages is based on the project scope summarized in **Table 1.5-1**. The packages are designed with continuity of the work. The schedule of construction for sewerage sector is planned as shown in **Table 6.1-2**. Contents and schedule of the construction for sewerage sector are shown below;

ICB1

- Construction period of civil work for treatment plant is generally estimated 6 months in Japan. however, the period is estimated nine (9) months depending on installation depth of pump station.
- Construction period of building work for treatment plant is estimated 6 months based on a track record in Japan and the estimated period is including mechanical and electrical works.
- Duration of mechanical works of treatment plant is estimated eleven (11) months as six (6) months of manufacturing period and five (5) months of importation procedure, transportation and installation period.
- Duration of electrical works is estimated eleven (11) months as six (6) months of manufacturing period and five (5) months of importation procedure, transportation and installation period.

ICB2

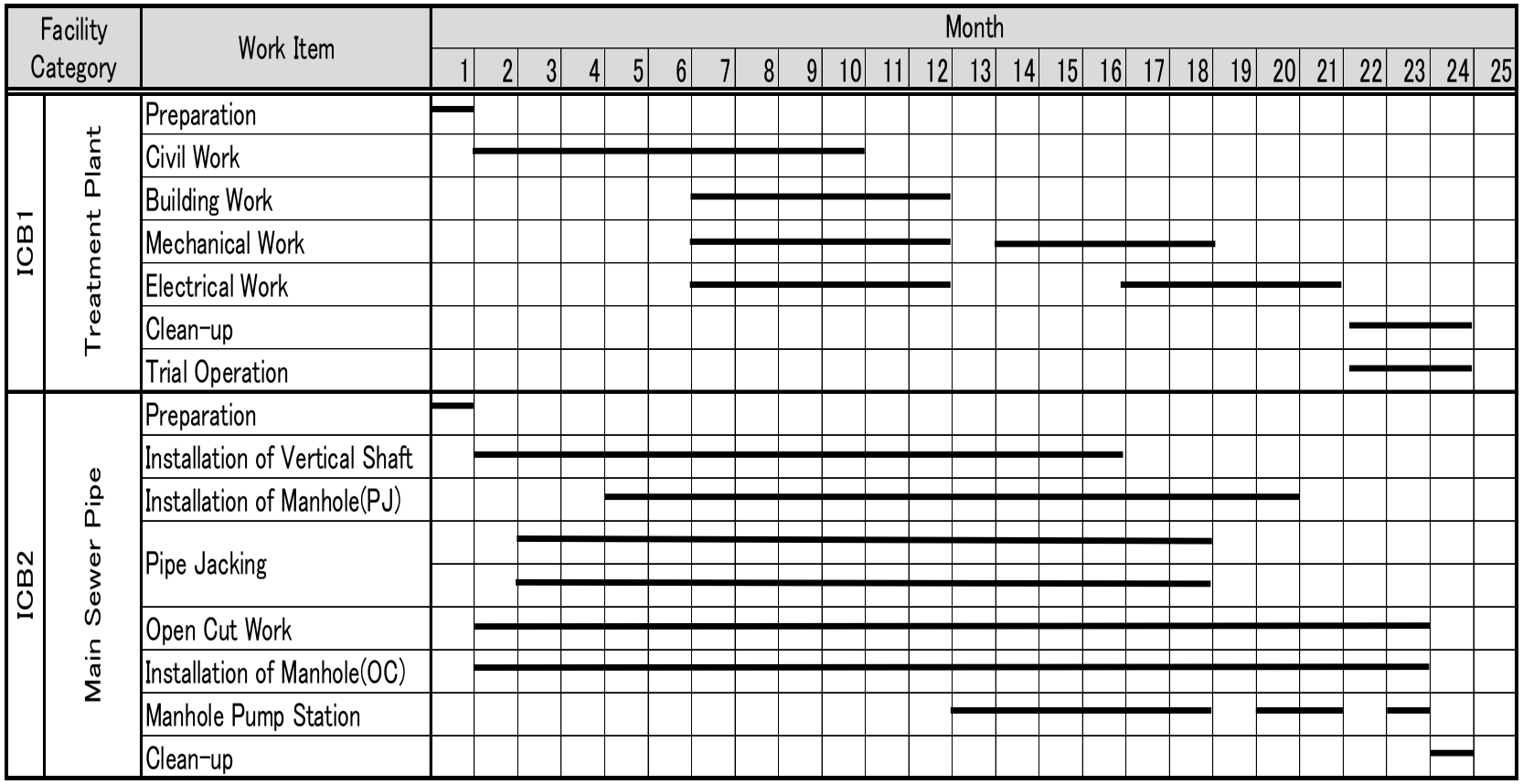
- Construction period is calculated by unit which refers to the volume of work and a track record for construction period in Vietnam. Unit which refers to the volume of work is shown in **Table 6.1-1**.

Table 6.1-1 Daily Quantity of Work

Work Item	Daily Quantity of Work	Remark
1. Installation of Vertical Shaft	0.15 no.	6.7 day/no.
2. Pipe Jacking (φ300 to 500)	About 5.0 m	
3. Installation of Manhole	0.1 no.	10 day/no.
4. Open Cut Work	10.0 m	Shallow section
	2.5 m	Deep section

Source: JICA Survey Team

Table 6.1-2 Construction Schedule for Sewerage Sector



6.1.2 Construction Planning of ICB-2

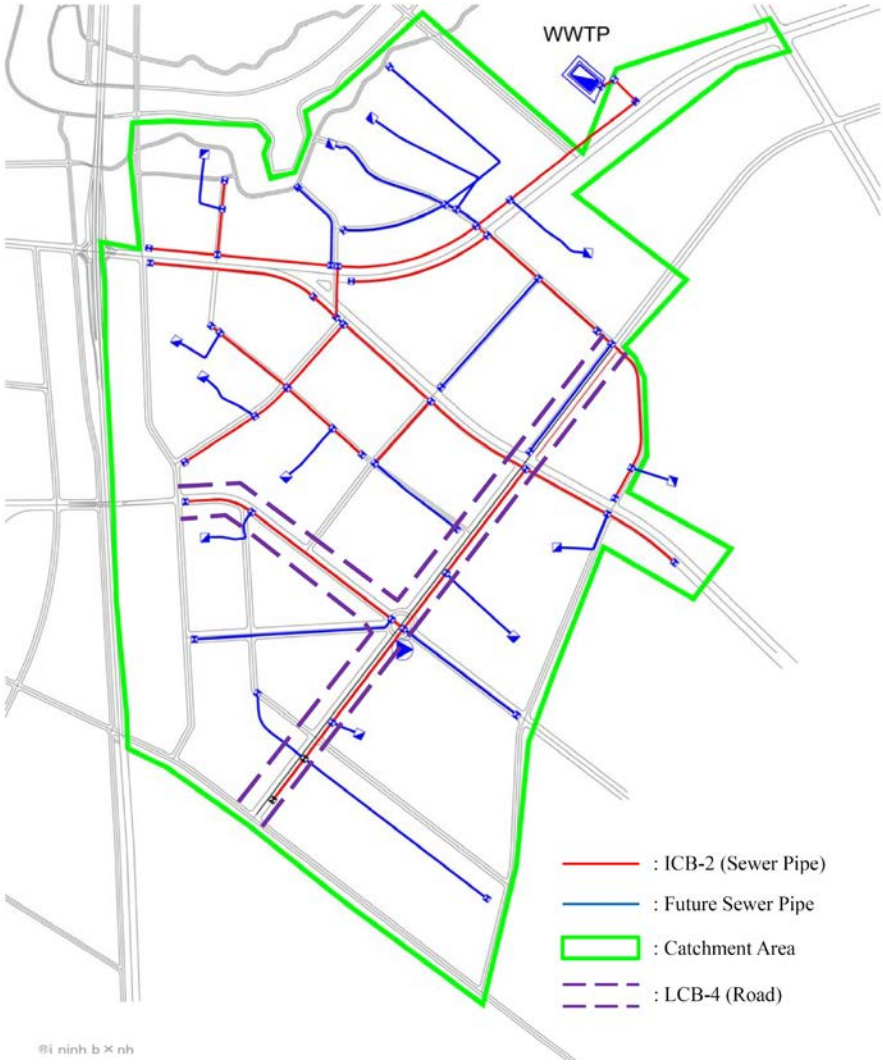
(1) Basic Concept

According to request of the local government of Ha Nam Province, it is recommendable to install the main sewer pipe under the sidewalk of LCB-4 (see **Figure 6.1-2**) in order to realize prompt operation of the road constructed in this project, reduce sewer pipe installation cost by applying open cut method and ensure sewer pipe installation work does not hinder road construction work. Thus, basic concept of construction for road of LCB-4 and sewer pipe installation (ICB-2) is formulated below.

(i) Sewer pipe is installed under the sidewalk of LCB-4, based on the request of local government of Ha Nam Province.

(ii) Demarcation of construction part between road sector (LCB-4) and sewerage sector (ICB-2) is proposed as shown in **Figure 6.1-3** and **Figure 6.1-4**.

(iii) All the road construction will be completed after installation of sewer pipe and construction of sidewalk.



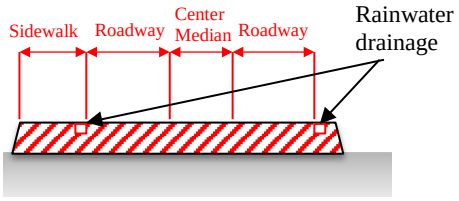
Source: JICA Survey Team

Figure 6.1-1 Location of LCB-4 and ICB-2

(2) Demarcation of Construction between LCB-4 and ICB-2

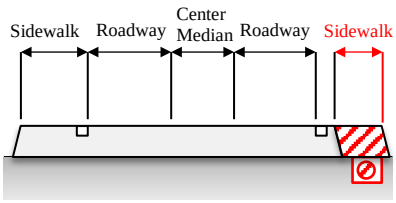
Demarcation of construction between the road construction (LCB-4) and sewer pipe installation (ICB-2) is shown in the figure below. Detailed technical and safety issues for the construction should be discussed in the detailed design stage.

LCB-4. Roadway including one side sidewalk and rainwater drainage is constructed



* Roadway including one sidewalk is constructed by the contractor of road package (LCB-4).
** Operation of the road is started after construction of roadway.

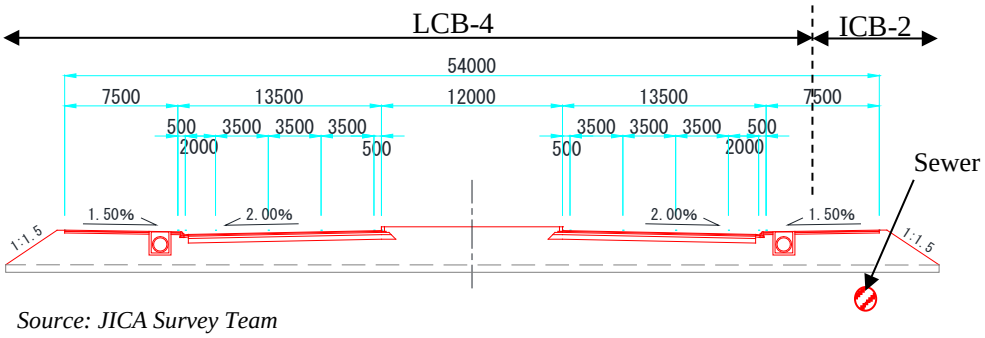
ICB-2. Sewer pipe is installed by open-cut method and remaining sidewalk is constructed in parallel with the sewer installation



* Sewer pipe is installed by open cut by the contractor of sewerage package (ICB-2)
** Remaining sidewalk is constructed by the contractor of sewerage package (ICB-2) together with sewer installation.
*** Sewer installation and remaining sidewalk construction (ICB-2) is completed simultaneously.

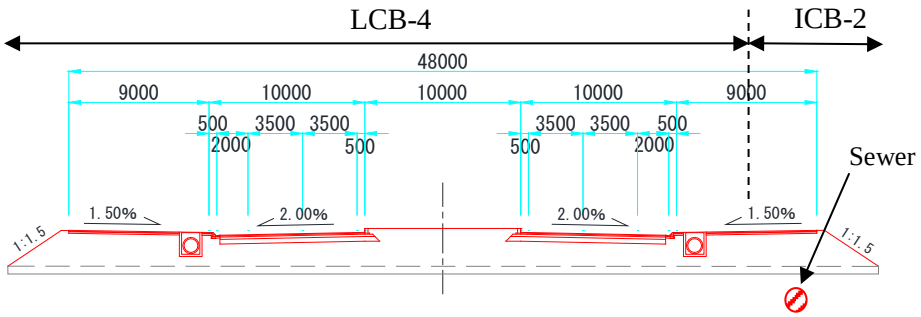
Source: JICA Survey Team

Figure 6.1-2 Demarcation of Construction between LCB-4 and ICB-2



Source: JICA Survey Team

Figure 6.1-3 Typical Cross Section of North-South Cross Road (LCB-4)



Source: JICA Survey Team

Figure 6.1-4 Typical Cross Section of East-West Cross Road (LCB-4)

(3) Allocation of Direct Cost to Sewerage Sector

Allocation of direct cost of road sector to sewerage sector is estimated at 13,683,163,614 VND as shown in the following below. This cost was estimated to avoid overlapping of cost between road and sewerage sector. This cost allocation is reflected in the tables for summarizing the construction cost for ICB-2.

Table 6.1-3 Allocation of Direct Cost from Road to Sewerage Sector

	Items	Price in VND
Direct Cost	Embankment for Sidewalk	8,696,447,750
	Pavement Work for Sidewalk	4,986,715,864

	Items	Price in VND
	Total	13,683,163,614

Source: JICA Survey Team

6.2 Procurement Plan of Construction Material

The contractor is able to procure main construction material such as mixed concrete, aggregate, soil, stone and asphalt for sewerage sector in Vietnam. However, jacking machine, or some materials for treatment plant is imported from Japan or neighboring countries of Vietnam. The list of the source of the other materials is shown in **Table 6.2-1**.

Table 6.2-1 List of the Source of Materials

Item		Procurement			Remarks
Name	Specification	Local	Japan	Third Country	
High Density Polyethylene (HDPE) Pipe	ϕ 300 ㎜	○			
Reinforced Concrete Pipe for Pipe Jacking	ϕ 300 ㎜	○			Local
	ϕ 400 ㎜	○			Ditto
	ϕ 500 ㎜	○			Ditto
Jacking Machine			○		Japan
Manhole		○			Local
Sheet Pile		○			Ditto
PHC Pile	ϕ 600mm	○			Ditto
Gate	Motor drive□400 ×400 ,Manual drive□500×500		○		Japan
Screen (Fine)	Motor drive		○		Ditto
Pump	ϕ 200mm	○		○	Local or China
Deodorization Equipment	10m^3/min		○		Japan
Odor absorption Fan	10m^3/min		○		Ditto
Pump general service Water	1m^3		○		Ditto
Filtering Materials			○		Ditto
Washing Pump	ϕ 100	○		○	Local or China
Sludge Treatment Equipment			○		Japan
Sludge transporting Pump	ϕ 80～150	○		○	Local or China
Discharging pump	ϕ 250A	○		○	Ditto
Electrical Instrumentation Facility			○		Japan

Source: JICA Survey Team

6.3 Basic Condition of Cost Estimation

6.3.1 Base Year for Cost Estimation

The base year for cost estimation is February 2019.

6.3.2 Exchange Rate

Exchange rates are shown as follows.

- US$1 = ¥109.0
- US$1 = VND22,900
- VND1 = ¥0.00476

6.3.3 Currency for Cost Estimation

The cost component shall consist of foreign currency and local currency portions. Vietnam Don shall be used as the monetary unit for the local currency portions. But Japanese Yen shall be used as the monetary unit for foreign currency portions.

(1) Local Currency Portion

- All labor costs
- Costs of construction materials and equipment lease locally procured
- Value added tax (VAT)

(2) Foreign Currency Portion

- Cost of construction materials, equipment and service procured form Japan and/or third counties.

6.3.4 Reference Guidelines and Manuals

The cost estimation is referred to the following guidelines or manuals indicated below.

- Announcement No.9/2016/CBGVL-LS: DOC & DOF Ha Nam PPC, September 27th 2016 (Announcement for Construction Material Cost)
- Circular No.06/2016/TT-BXD: Ministry of Construction, March 1st 2016 (Circular for Guiding Formulation and Management of Costs of Investment In Work Construction)
- Circular No. 02/2015/TT-BLDTBXH: Ministry of Labor, Invalids and Social Affairs, 02nd February 2015 (Guiding the Employer's Compensation, Benefit and medical Expenses for Employees Suffered from Occupational Accidents and Diseases)
- Circular No. 05/2016/TT-BXD: Ministry of Construction, 10th March 2016 (Determination Labor Cost the Construction Cost Management 2016)

6.4 Direct Cost

6.4.1 Labor Cost

The labor rates are estimated based on the minimum labor rate by the Ministry of Construction. The labor wages used in the cost estimates exclude social insurance, medical insurance, union funds, and unemployed insurance. These insurance fees have been counted in the general costs.

6.4.2 Material Cost

In accordance with "Announcement for Construction Material Cost by Ha Nam PPC 27th September 2016", Material cost is the maximum cost included transportation fee and other cost to the construction site.

6.4.3 Machine Cost

Machine cost is calculated by "Price chart of machine day work and construction devices of Ha Nam province" that Ha Nam PPC published. This price chart is calculated based on equipment ownership cost.

6.5 Indirect Cost

6.5.1 General Costs

The rate applicable to general costs is shown in **Table 6.5-1**. The project using ODA capital applies the rate of civil works in the table. General costs range from 5.2 % to 6.5 % of the estimated direct cost. This includes insurance fee such as social insurance, medical insurance, union funds, and unemployed insurance.

Table 6.5-1 Rate for General Costs

Unit: %

No	Types of works	Gxd (no TAX) in approved general construction investment (billion dong)				
		≤15	≤100	≤500	≤1000	>1000
1	**Civil works**	**6.5**	**6.0**	**5.6**	**5.4**	**5.2**
	Particularly renovations/ restoration of cultural, historic relics	10.0	9.0	8.6	8.4	8.2
2	Industrial works	5.5	5.0	4.6	4.4	4.2
	Particularly construction works for tunnels, pits	6.5	6.3	6.0	5.8	5.7
3	Transport works	5.5	5.0	4.6	4.4	4.2
	Particularly underground traffic works	6.5	6.3	6.0	5.8	5.7
4	Agricultural and rural development works	5.5	5.0	4.6	4.4	4.2
5	Technical infrastructure works	5.0	5.0	4.1	3.9	3.7

Source: Circular no. 06/2016/TT-BXD: Guidance of defining and managing investment cost by Minister of Construction on 10th of March, 2016

6.5.2 Taxable Income Advance

The rate applicable to taxable income advance is shown in **Table 6.5-2**.

Table 6.5-2 Rate for taxable Income

Unit: %

No	Types of works	Taxable income
1	**Civil works**	**5.5**
2	Industrial works	6.0
3	Transport works	6.0
4	Agricultural and rural development works	5.5
5	Technical infrastructure works	5.5
6	Installation technology equipment in construction works, line assemble, material/ components/ construction structure experimental testing	6.0

Source: Circular no. 06/2016/TT-BXD: Guidance of defining and managing investment cost by Minister of Construction on 10th of March, 2016

6.5.3 Construction Cost for Each Packages (ICB1 to ICB2)

Construction cost for 2 packages are shown as in **Table 6.5-3** and **Table 6.5-4**. It is noted that procurement of 2 units of sewer maintenance equipment, including training for staff to operate and maintain the equipment by the supplier, is included in ICB1. In addition, training for operation and maintenance of the installed facilities in WWTP, including PTF, is conducted by the Contractor in the trial operation period in ICB1.

Table 6.5-3 Construction Cost of ICB1

No	Item	Cost	
		VND	JPY
I	Direct Cost	201,493,886,360	959,110,899
II	General Costs (I*5.9%[1)])	11,888,139,295	56,587,543
III	Taxable Income Advance ((I+II)*5.5%[2)])	11,736,011,411	55,863,414
	Construction Cost (I+II+III)	225,118,037,066	1,071,561,856

Note: 1) Interpolated value of Civil works (6.0 and 5.6) in Table 6.5-1
2) Value of Civil work 5.5) in Table 6.5-2
Source: JICA Survey Team

Table 6.5-4 Construction Cost of ICB2

No	Item		Cost	
			VND	JPY
I	Direct Cost	Installation of Sewer Pipe (Local Currency Portion)	393,241,444,981	1,871,829,278
		Installation of Sewer Pipe (Foreign Currency Portion)	76,663,701,681	364,919,220
		Sub-total	469,905,146,662	2,236,748,498
		Allocation from road sector of LCB-4	13,683,163,614	65,131,859
	Sub-total		483,588,310,276	2,301,880,357
II	General Costs (I*5.6%)		27,080,945,308	128,905,300
III	Taxable Income Advance ((I+II)*5.5%)		28,086,808,998	133,693,211
	Construction Cost (I+II+III)		538,756,064,582	2,564,478,867

Note: 1) Interpolated value of Civil works (6.0 and 5.6) in Table 6.5-1
2) Value of Civil work 5.5) in Table 6.5-2
3) Cost allocation from LCB-4 to ICB-2 is shown in Table 6.1-3.
Source: JICA Survey Team

Total construction cost for sewerage sector is shown in **Table 6.5-5**.

Table 6.5-5 Total Construction Cost for Sewerage Sector

No	Item	Cost	
		VND	JPY
I	ICB1	225,118,037,066	1,071,561,856
II	ICB2	538,756,064,582	2,564,478,867
	Total Construction Cost (I+II)	763,874,101,648	3,636,040,723

Source: JICA Survey Team

6.6 Other Cost

6.6.1 Land Acquisition Cost

Land acquisition cost for sewerage sector is estimated as shown in **Table 6.6-1**.

Table 6.6-1 Land Acquisition Cost

No.	Item	Cost	
		VND	JPY
I	Land acquisition and compensation cost	2,915,450,000	13,877,542
II	Independent monitoring = 1% of I	29,154,500	138,775
III	Replacement cost survey expense = 1% of I	29,154,500	138,775
IV	Management cost = 2% of I	58,309,000	277,551
V	Contingency (10% of I)	291,545,000	1,387,755
	Total	3,323,613,000	15,820,398

Source: JICA Survey Team

6.6.2 Administration Cost

The rate of administration cost is 5.0%.

6.6.3 Consultancy Service Cost

Consultancy service cost is estimated for two stages, namely Detailed Design and Tender Assistant, and Construction Supervision.

(1) Detailed Engineering Cost

The Detailed Design requires ten (10) months and the Tender Assistance requires thirteen (13) months.

(2) Construction Supervision Cost

The Construction Supervision requires duration of construction period which is estimated for thirty-six (36) months, including defect liability period of twelve (12) months after the completion of the construction. The summary of consultancy service cost is estimated as shown in **Table 6.6-2**.

Table 6.6-2 Consultancy Service Cost

Consultancy Item	Foreign Currency (Mil. JPY)	Local Currency (Mil. VND)	TOTAL	
			Mil. VND	Mil. JPY
Total of Detailed Design, Tender Assistance and Construction Supervision	346	30,563	103,292	492

Source: JICA Survey Team

6.6.4 Price Escalation Cost

The rate of price escalation is 1.83% for foreign currency portion and 2.86% for local currency portion.

6.6.5 Physical Contingency Cost

The rate of physical contingency cost is 5.0%.

6.7 Summary of Project Cost

The construction cost of ICB1 to ICB2 is estimated as shown in **Table 6.7-1**.

Table 6.7-1 Summary of Project Cost of Sewerage Sector

Item	Foreign Currency (Mil. JPY)	Local Currency (Mil. VND)	TOTAL	
			Mil. VND	Mil. JPY
1. Construction Cost	989	556,122	763,874	3,636
2. Land Acquisition Cost	0	3,490	3,490	17
3. Price Escalation	51	45,576	56,357	268
4. Physical Contingency	52	30,085	41,012	195
5. Consultancy Service	373	33,445	111,704	532
6. Administration Cost	0	48,822	48,822	232
7. VAT	0	86,124	86,124	410
8. Tax on Consulting Services	0	16,756	16,756	80
9. Import Tax	0	6,884	6,884	33
10. Interest during Construction	40	0	8,315	40
11. Front end Fee	9	0	1,946	9
GRAND TOTAL	1,514	827,303	1,145,283	5,452

Source: JICA Survey Team

6.8 O&M Cost

As shown in **Table 6.8-1** and **Table 6.8-2**, total operation and maintenance cost is about 2.6 billion VND. The annual revenue of Ha Nam Province in 2015 was 7,923 billion VND (see **Chapter 15**), generating a surplus of 2,784 billion VND, so it deems that the province can afford to pay the 2.5 billion VND.

Table 6.8-1 O&M Cost (WWTP)

Fixed Cost					
	1. Personnel Cost				
	Manager	1 person *	18,121,000 VND/month	=	18,121,000 VND/month
	Monitoring and Analysis	1 person *	8,323,000 VND/month	=	8,323,000 VND/month
	Mechanical Engineer	1 person *	8,323,000 VND/month	=	8,323,000 VND/month
	Electrical Engineer	1 person *	8,323,000 VND/month	=	8,323,000 VND/month
	Operation & Maintenance staff	8 person *	3,938,000 VND/month	=	31,504,000 VND/month
			Total	=	74,594,000 VND/month
					895,128,000 VND/year
	2. Maintenance Cost				
	Annual Maintenance Cost	100,907 million VND *	0.5 %	=	504,535,000 VND/year
		(Cost of M&E Works)			
					1,399,663,000 VND/year
	Daily Wastewater				2,300 m3/day
		1,399,663,000 VND/year /	2,300 m3/day	=	1,667 VND/m3
Variable Cost					
	1. Electric Cost				
	Daily Electricity Consumption				1,316 kWh/day
	Daily Wastewater				2,300 m3/day
		1,316 kWh/day /	2,300 m3/day	=	0.57 kWh/m3
	Electricity rate				1,485 VND/kWh
		0.57 kWh/m3 *	1,485 VND/kWh	=	850 VND/m3
	2. Chemical Cost				
	Daily Consumption				
	Polymer	62,000 VND/kg *	4.7 kg/day	=	291,400 VND/day
	Ferric Polysulfied	5,000 VND/kg *	35.0 kg/day	=	175,000 VND/day
	Sodium Hypochlorite	10,000 VND/kg *	57.6 kg/day	=	576,000 VND/day
			Total	=	1,042,400 VND/day
	Daily Wastewater				2,300 m3/day
		1,042,400 VND/day /	2,300 m3/day	=	453 VND/m3
	3. Sludge Disposal Cost				
	Daily Sludge Volume for daily average wastewter volume				2.2 m3/day
	Disposal unit cost to disposal site				65,000 VND/m3
	Daily Disposal Cost	2.2 m3/day *	65,000 VND/m3	=	145,600 VND/day
	Daily Wastewater				2,300 m3/day
		145,600 VND/day /	2,300 m3/day	=	63 VND/m3
	Sub-Total				1,366 VND/m3
	Daily Wastewater				2,300 m3/day
		1,366 VND/m3 *	2,300 m3/day	=	3,142,854 VND/day
					1,147,141,710 VND/year
Total O&M Cost					**2,546,804,710 VND/year**
					3,034 VND/m3

Source: JICA Survey Team

Table 6.8-2 O&M Cost (Pumping Station)

Fixed Cost					
	1. Manhole Type Pumping Station				
	(1) Maintenance Cost				
	Annual Maintenance Cost	627.14 million VND *	0.5 %	=	3,135,700 VND/year
		(Cost of M&E Works)			
	Average Daily				854 m3/day
		3,135,700 VND/year /	854 m3/day	=	10 VND/m3
Variable Cost					
	1. Manhole Type Pumping Station				
	(1) Electric Cost				
	Daily Electricity Consumption				59.2 kWh/day
	Daily Pumping	59.2 kWh/day /	854 m3/day	=	0.07 kWh/m3
	Electricity rate	0.07 kWh/m3 *	1,485 VND/kWh	=	103 VND/m3
Total O&M Cost					
1. Manhole Type Pumping Station					**114 VND/m3**
		114 VND/m3 *	854 m3/day	=	97,356 VND/day
					35,534,940 VND/year

Source: JICA Survey Team

CHAPTER 7 IMPLEMENTATION AND O&M STRUCTURE

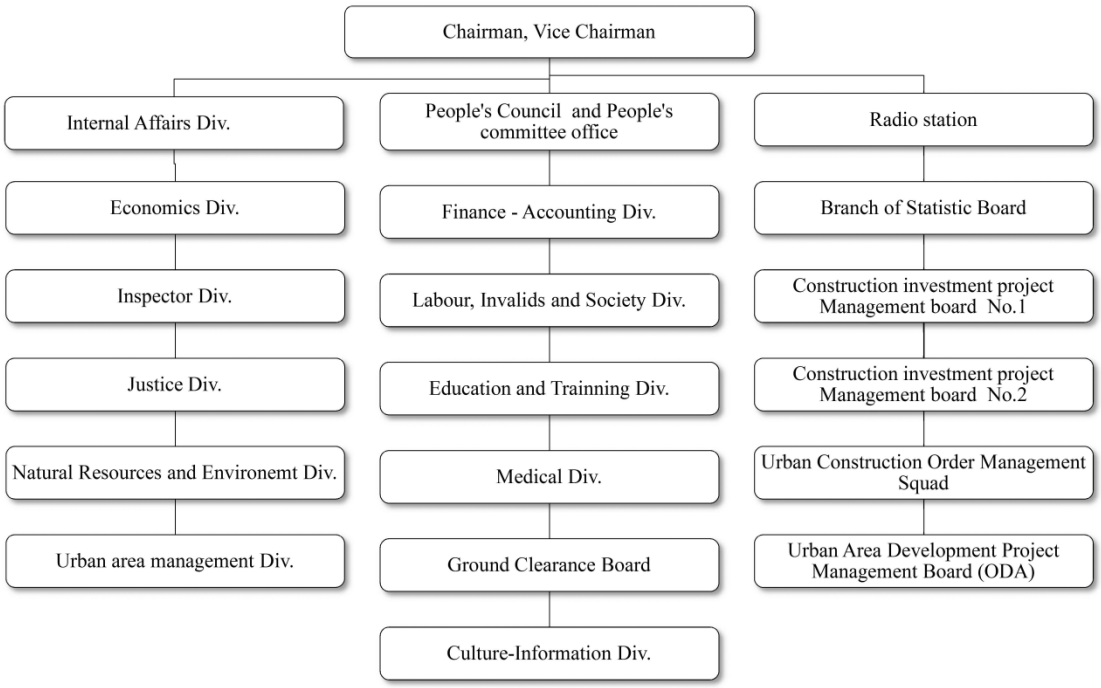
7.1 Implementation Structure

(1) Main Executing Agencies

The main executing agencies and roles responsible for the sewerage facilities are as follows.

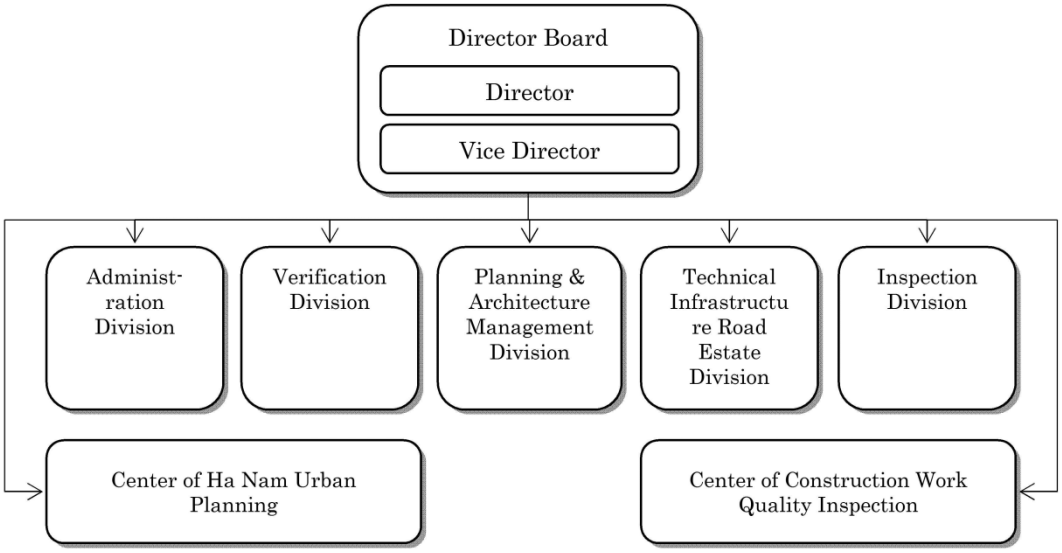
As in the case of Japan, if the sewerage facility is located in Phu Ly City, Phu Ly City (**Figure 7.1-1**) will have jurisdiction, however, if it is located across the cities and municipalities, the People's Committee of Ha Nam province will have jurisdiction (**Figure 7.1-3**). Since this project area is only located in Phu Ly City, Phu Ly City will have the jurisdiction. Based on the interview with the Department of Planning and Investment (DPI), Ha Nam PPC will establish a Project Management Unit with leader to be assigned from DPI to manage implementation the project. The organization of a PMU includes the University Area Management Board, which plans new universities, and the New Urban Area Development Management Board, which is in charge of hospital planning.

Other concerned agencies are the Department of Finance (**Figure 7.1-4**), which conducts budget planning and management, and the Department of Natural Resources and Environment (**Figure 7.1-5**), which monitors the treated water quality from wastewater treatment plants.



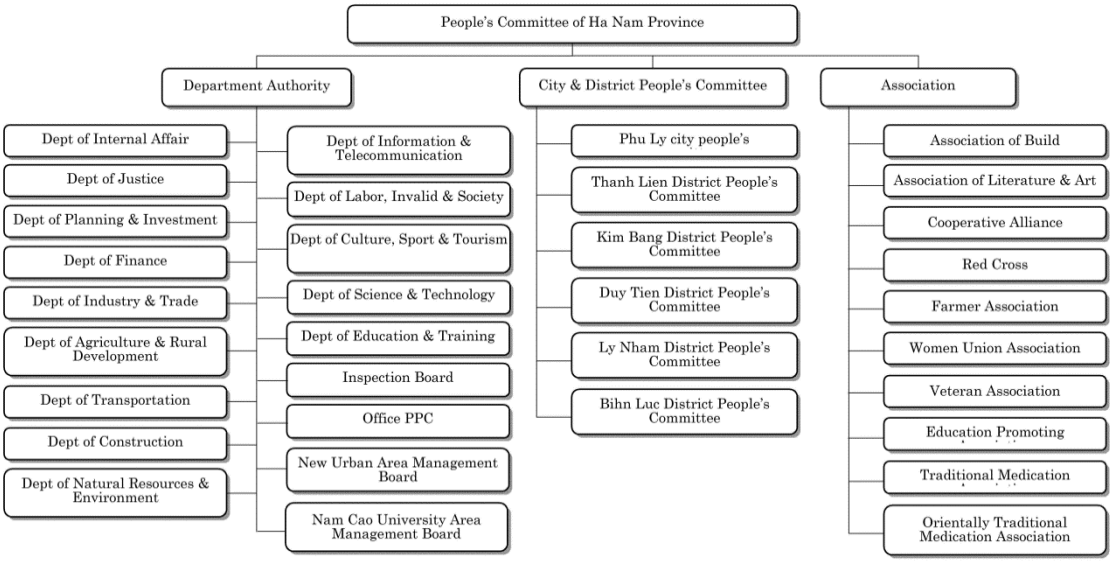
Source: DPI

Figure 7.1-1 Organization of Phu Ly City



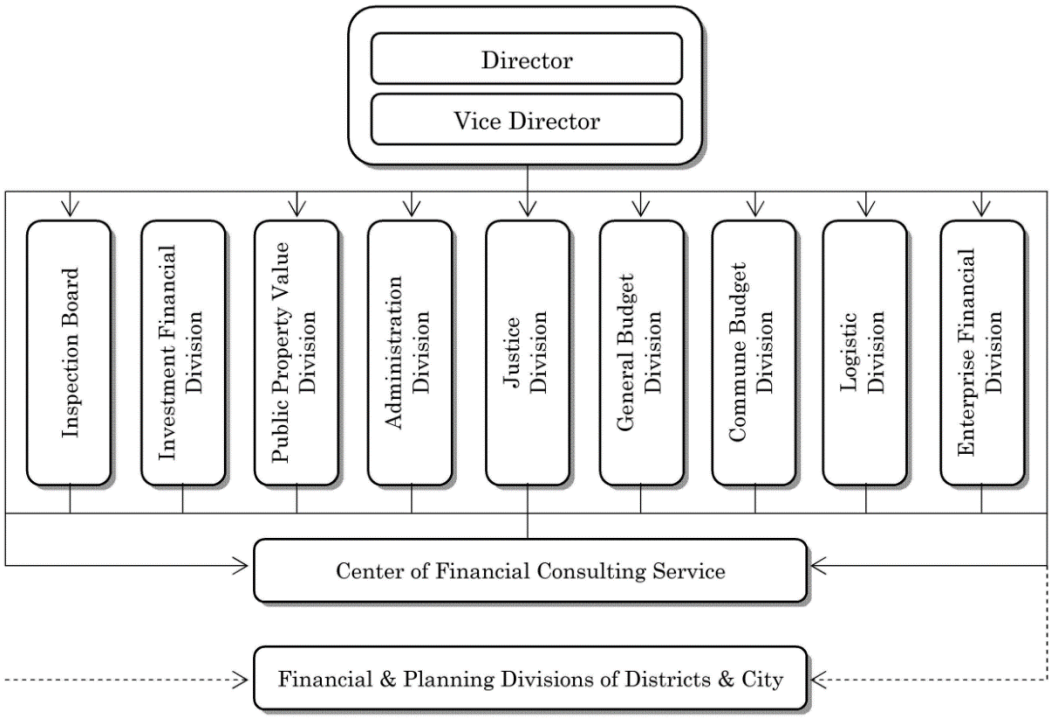
Source: DPI

Figure 7.1-2 Organization of Department of Construction



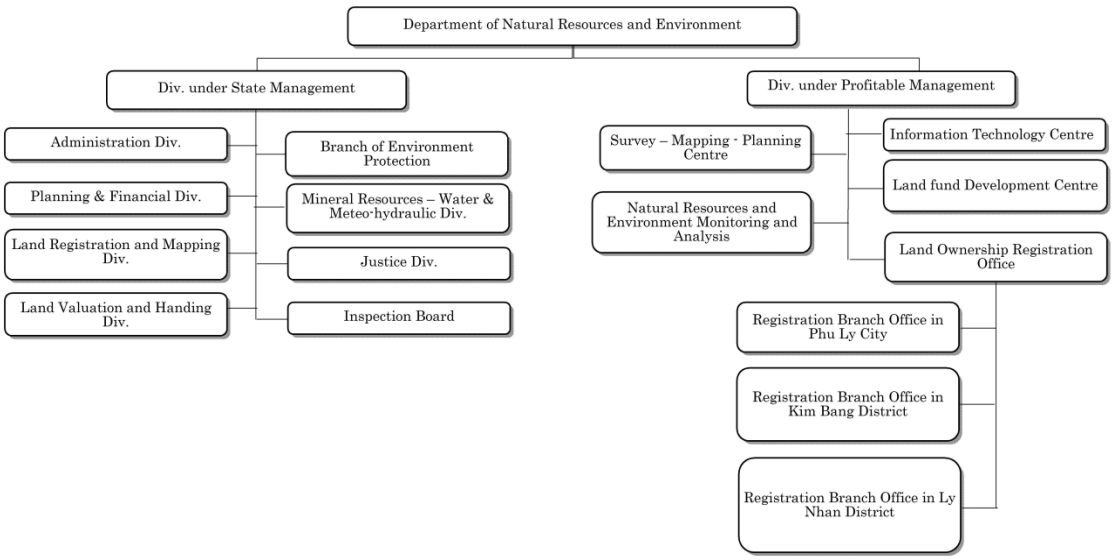
Source: DPI

Figure 7.1-3 Organization of Province People's Committee



Source: DPI

Figure 7.1-4 Organization of Department of Finance



Source: DPI

Figure 7.1-5 Organization of Department of Natural Resources and Environment

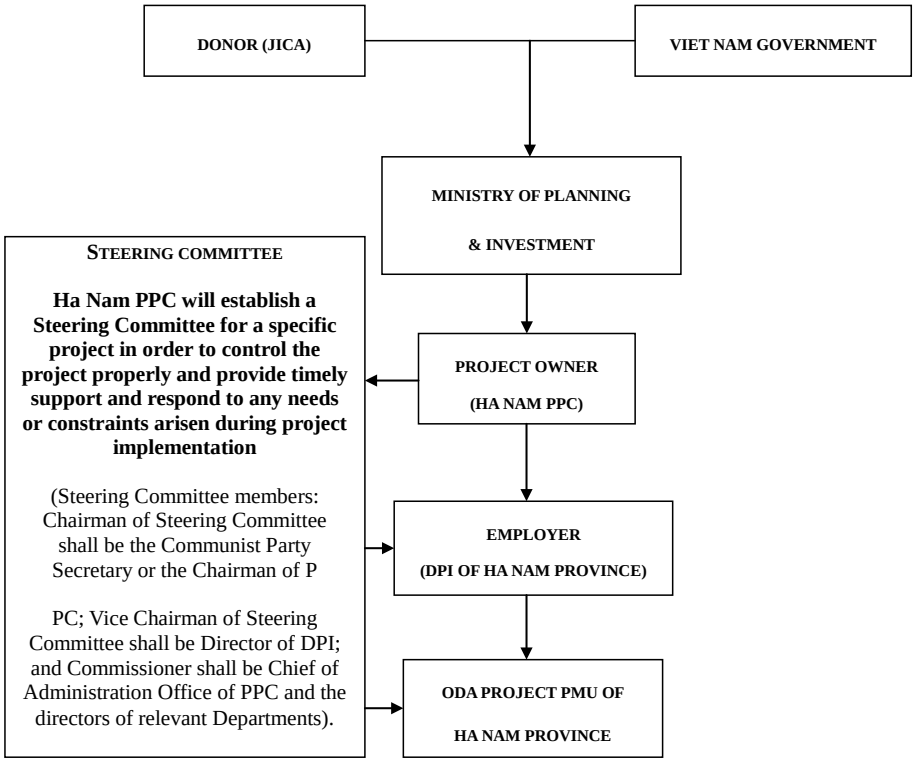
(2) Organization Chart of PMU

The management mod

el for the project province has been planned as **Figure 7.1-6**.

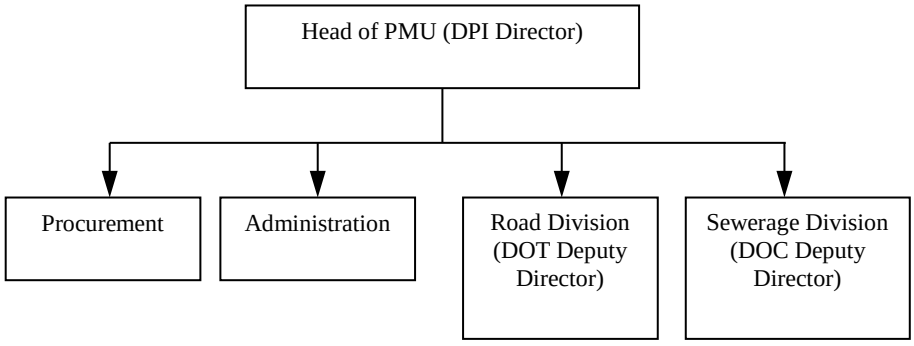
Ha Nam Province People's Committee will establish a Project Management Unit under the Department of Planning and Investment to implement the project. The Director of DPI will also serve as Director of PMU. PMU will have four divisions, namely 1. Procurement, 2. Administration, 3. Road, and 4. Sewerage. A deputy director of the Department of Transportation will be the chief of the Road Division and a deputy director of the Department of Construction will be the chief of the Sewerage Division.

And the Structure of ODA Project PMU of Ha Nam Province is shown in **Figure 7.1-7**.



Source: DPI

Figure 7.1-6 Management Model for the Project on Investment Environment Improvement in Ha Nam Province



Source: DPI

Figure 7.1-7 Structure of PMU for ODA Projects

(3) Branch Sewer Installation and House Connection

As with the sewerage service area such as Do Xa and WB project, in which separate system is applied, branch sewer installation will be required in Hospital Area after installation of main sewer in this project (Yen Loan Project).

Ha Nam Province has responsibility of branch sewer installation in the existing residential area, and Ha Nam Province or developers have responsibility of the branch sewer installation in new residential area.

As for house connection, each house in Phu Ly City has obligation of house connection to branch sewers, and Phu Ly City government will enforce house connection to branch sewers.

7.2 Operation and Maintenance Structure

The management style of WWTP O&M has two options, one is to entrust to a third party, and another is to carry out O&M by the Natural Resources and Environment Division, or Urban Area Management Division of Phu Ly City. The advantage of the former scheme is to invite an experienced private operator to O&M, and if the latter scheme is introduced, a training period will be required for the O&M staff of Phu Ly City due to their lack of experience and know-how. It is considered that the capacity and experience of the Phu Ly staff is not enough for the time being. Therefore, the most realistic option is to entrust a third party for O&M works. Bidding will be held to select the O&M executing agency of the sewerage facilities in this project as well.

Ha Nam Provincial People's Committee is planning to open a tender for authorizing a private company to operate and maintain the plant, and a tender will be processed based on "Law on Bidding", Law No. 43/2013/QH13. Ha Nam Provincial People's Committee has already started to commission private companies for wastewater treatment plant O&M. The two private companies, namely Ha Nam Clean Water Joint Stock Company (HANWACO) and Environment Urban Construction Joint Stock Company, have been operating sewerage plants in Ha Nam.

Table 7.2-1 Private Companies Authorized to Operate Sewerage Plants

Company Name	HANWACO	Environment Urban Construction Joint Stock Company
Location	Dong Van I Industrial Zone	Quy Luu WWTP (Tran Hung Dao ward, Phu Ly City)
Capacity (m^3/day)	1,000 (proposed to upgrade to 2,000)	2,500
Start Operational Year	2016	2015

Source: JICA Survey Team

Based on the interview with the DPI of Ha Nam Province, several companies are expected to participate in a tender and the financial viability and relevant experience will be assessed. The company overview and financial status of both HANWACO and Environment Urban Construction Joint Stock Company are described below as possible candidates for participating in a tender.

1) HANWACO

- Overview

In Ha Nam Province, the water treatment plants (WTPs) have been operated and managed by private companies or semi-public companies. Out of these companies, Ha Nam Clean Water Joint Stock Company (HANWACO) operates the biggest WTP with the capacity of 40,000 m^3/day in Ha Nam Province. HANWACO has recently started the O&M of sewerage plant; in 2016, it has won the tender of Dong Van I Industrial Zone wastewater treatment plant O&M with the capacity of 1,000 m^3/day, and it has proposed to upgrade to 2,000 m^3/day.

HANWACO was originally established with 100% of the stocks belonging to Ha Nam Province People's Committee in 1978, though HANWACO was converted to joint stock corporations with approximately 30% private stocks from 2011, and became a private company with 100% private stock in September, 2014.

The head office of HANWACO is located in Phu Ly City with 140 staff. Its business covers water supply and sewerage services including operation of the water treatment and sewage treatment facilities.

2) Environment Urban Construction Joint Stock Company

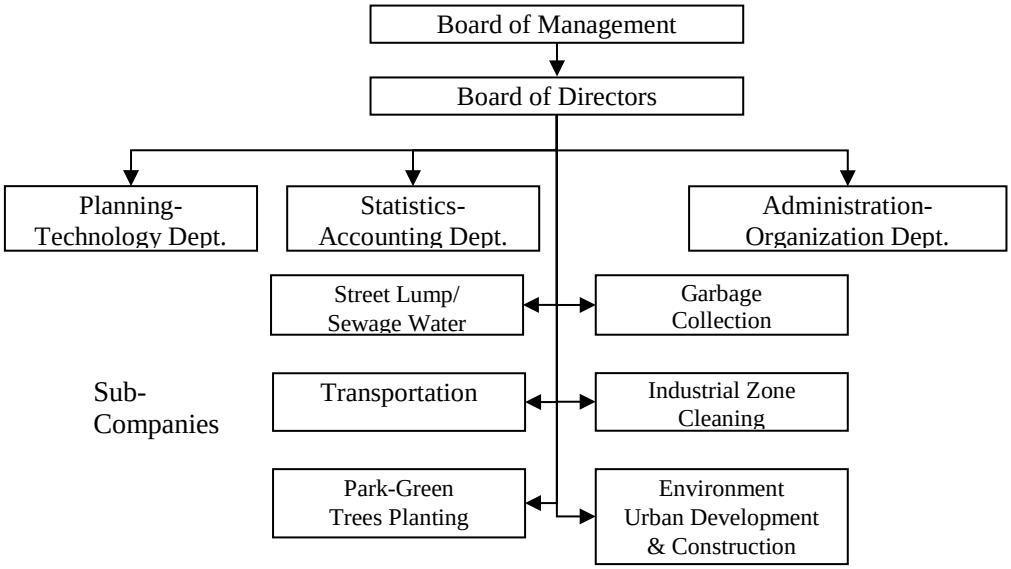
- Overview

Environment Urban Construction Joint Stock Company is the first private company which started O&M of the sewerage plant owned by Ha Nam Province. They have operated and maintained the wastewater treatment plant in Phu Ly City (Quy Luu WWTP) with the capacity of 2,500 m^3/day since 2015.

Environment Urban Construction JSC was originally established with 100% of the stocks belonging to Ha Nam Province People's Committee in 1993, though Environment Urban Construction JSC was converted to joint stock corporations with approximately 49% private stocks from 2009, and now has

increased private stocks up to 57%. Environment Urban Construction JSC became a private company with 100% private stocks in 2016.

The head office of Environment Urban Construction JSC is located in Phu Ly City with 340 staff, and they have sub-companies to implement the tasks for operation and maintenance of the Sewerage, management of the street lamps, and development on the environment of public facilities such as planting trees along roads. They also have business fields in garbage collection in a city and industrial zone cleaning. The garbage collection business has been subsidized by Ha Nam Provincial People's Committee.



Source: Environment Urban Construction JSC

Figure 7.2-1 Organization Chart of Environment Urban Construction JSC

Since maintenance work has only just started, the technical prowess of HANWACO and JSC is still not high. In the Project, it will be necessary to conduct training in Japan and training using actual equipment.

In addition, selecting an executing private company should be conducted considering the financial capacity, technical capacity and experience for operation and maintenance works of WWTP.

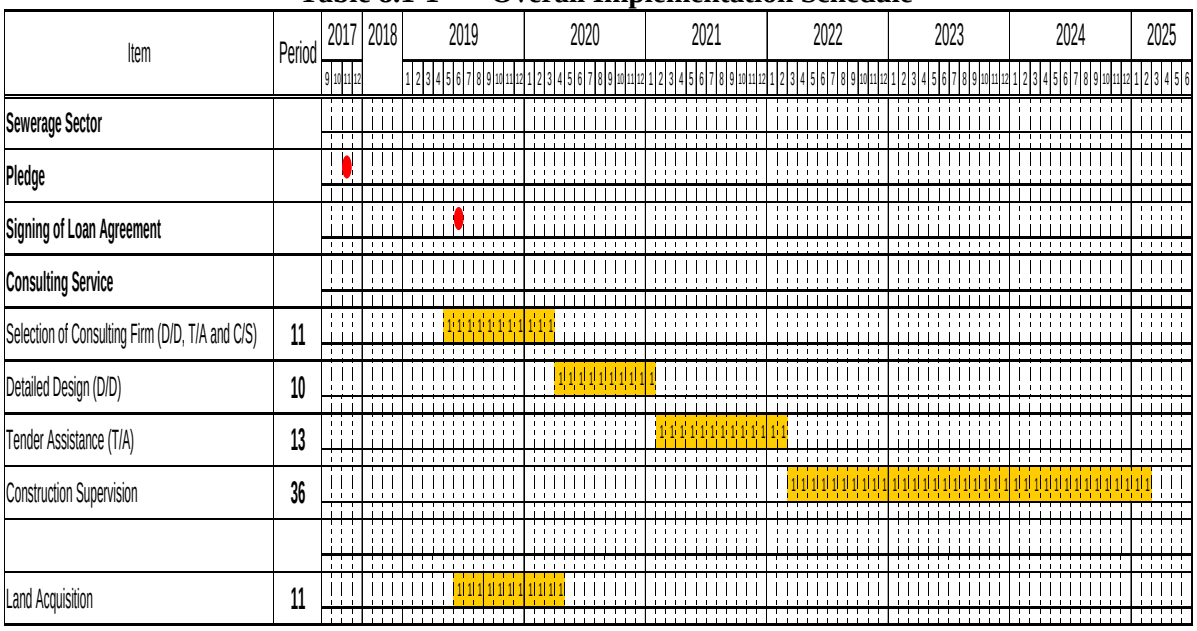
CHAPTER 8 IMPLEMENTATION SCHEDULE

8.1 Overall Project Implementation Schedule

The proposed overall project implementation schedule is shown in **Table 8.1-1.** The contents are as outlined below.

- Construction of the sewerage sector will be divided into two (2) packages; namely, two (2) International competitive biddings.
- Pledge is made in November 2017.
- Signing of a loan agreement will be conducted in June 2019.
- Selection of a consultant for the detailed design will be conducted for a duration of eleven (11) months from May 2019.
- Selected consultant will carry out the detailed design of the sewerage sector during ten (10) months from April 2020.
- The consultant shall assist in the tender document preparation from February 2021.
- Construction supervision will be conducted for thirty-six (36) months from March 2022, including the defects liability period of 12 months.
- Details of consultancy services are in the **Appendix**.
- Construction will be conducted from March 2022 for twenty-four (24) months, after which the defects liability period of twelve (12) months will start.

Table 8.1-1 Overall Implementation Schedule



CHAPTER 9 TRAFFIC DEMAND FORECAST

9.1 Introduction

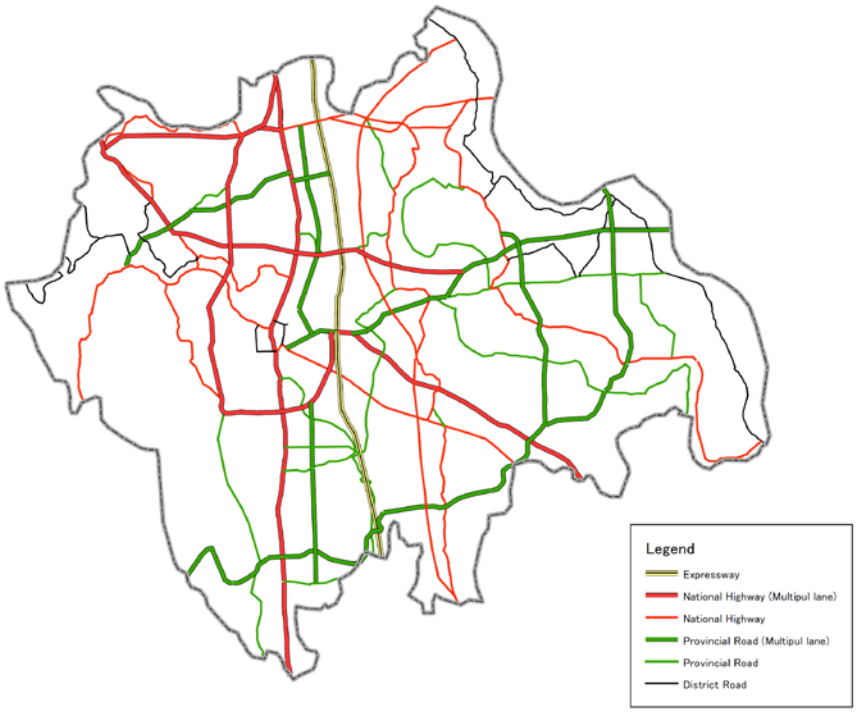
The road sector survey is composed of traffic demand forecast, road/bridge design, cost estimation, implementation structure and schedule. This chapter presents the amount of traffic demand estimated for the target years 2021 and 2031, based on traffic survey (traffic count survey and roadside OD interview survey). The JICA Survey Team reviewed the generation and attraction of development area and road network by the previous survey (Data Collection Survey on the investment environment development utilized PPP in Ha Nam Province), and re-estimates the traffic demand in this chapter.

9.2 Main Road Network related to the Project Roads

The DOT formulated the road development plan under the master plan targeting year 2025 for regional development in Ha Nam Province in 2010, which is the mid-term development plan mainly for provincial roads. This road development plan was prepared based on the traffic demand growth forecast taking account of such area development plans as industrial park development, educational zone development and medical care zone development plans. The JICA Survey Team prepared the future trunk road network plan as shown in **Figure 9.2-1** and **Figure 9.2-2** based on the information from the DOT and DOC, because there is no concrete future road network shown in the plan. Due to budgetary constraints, Ha Nam Province recently has been utilizing the BOT scheme for road development so as to accelerate the planned road construction.

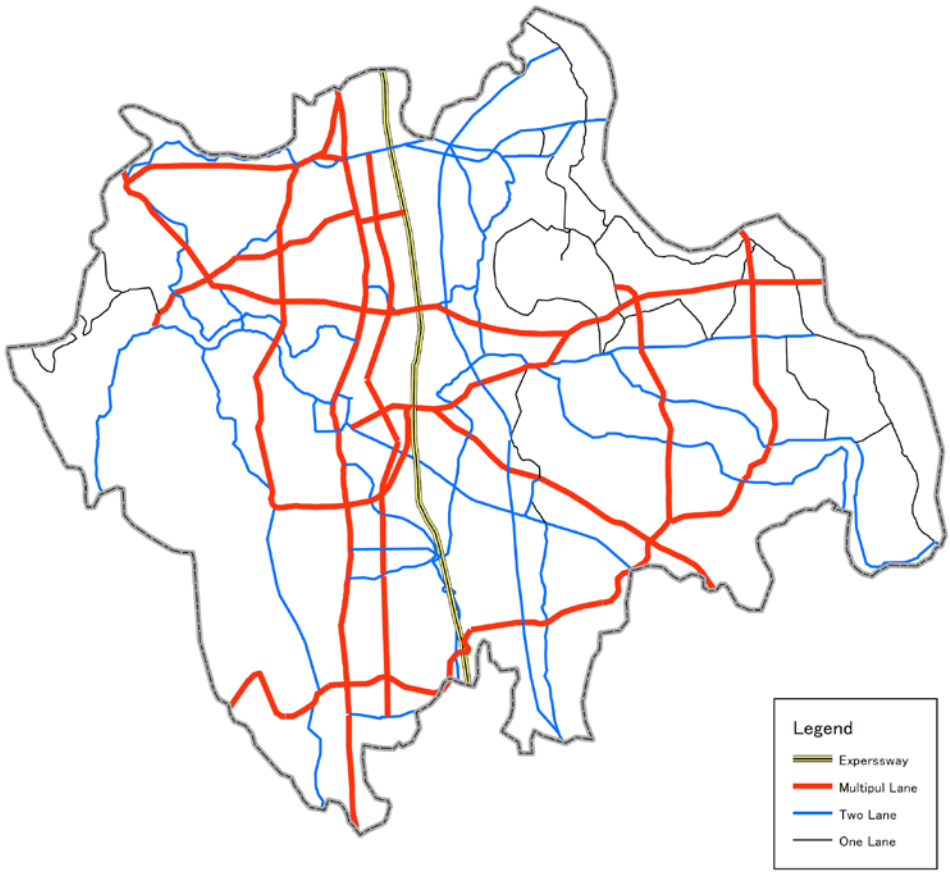
Through the series of discussions with organizations concerned in Ha Nam Province and the Japan side, roads shown with package names such as LCB-1, LCB-2, etc., in **Table 9.3-1** have been recommended as subject roads for the project. Functions of the subject roads are expected as follows, referring to **Figure 9.2-1,** which shows the main road network within and around Ha Nam Province connecting Hanoi Metropolitan Area, Hai Phone International Port and southern important areas with major development area in the province.

- The subject roads lie on the major development areas and are to be connected with main road network, which means that constructing the subject roads provides smooth logistics going to such major attraction areas as Hanoi Metropolitan Area and Hai Phone International Port, etc.
- Constructing the subject roads will promote and accelerate the planned and on-going development activities for major facilities, contributing to economic and industrial enhancement in Ha Nam Province.
- The above situations will attract foreign investors including Japanese enterprises, which results in job creation in the province.



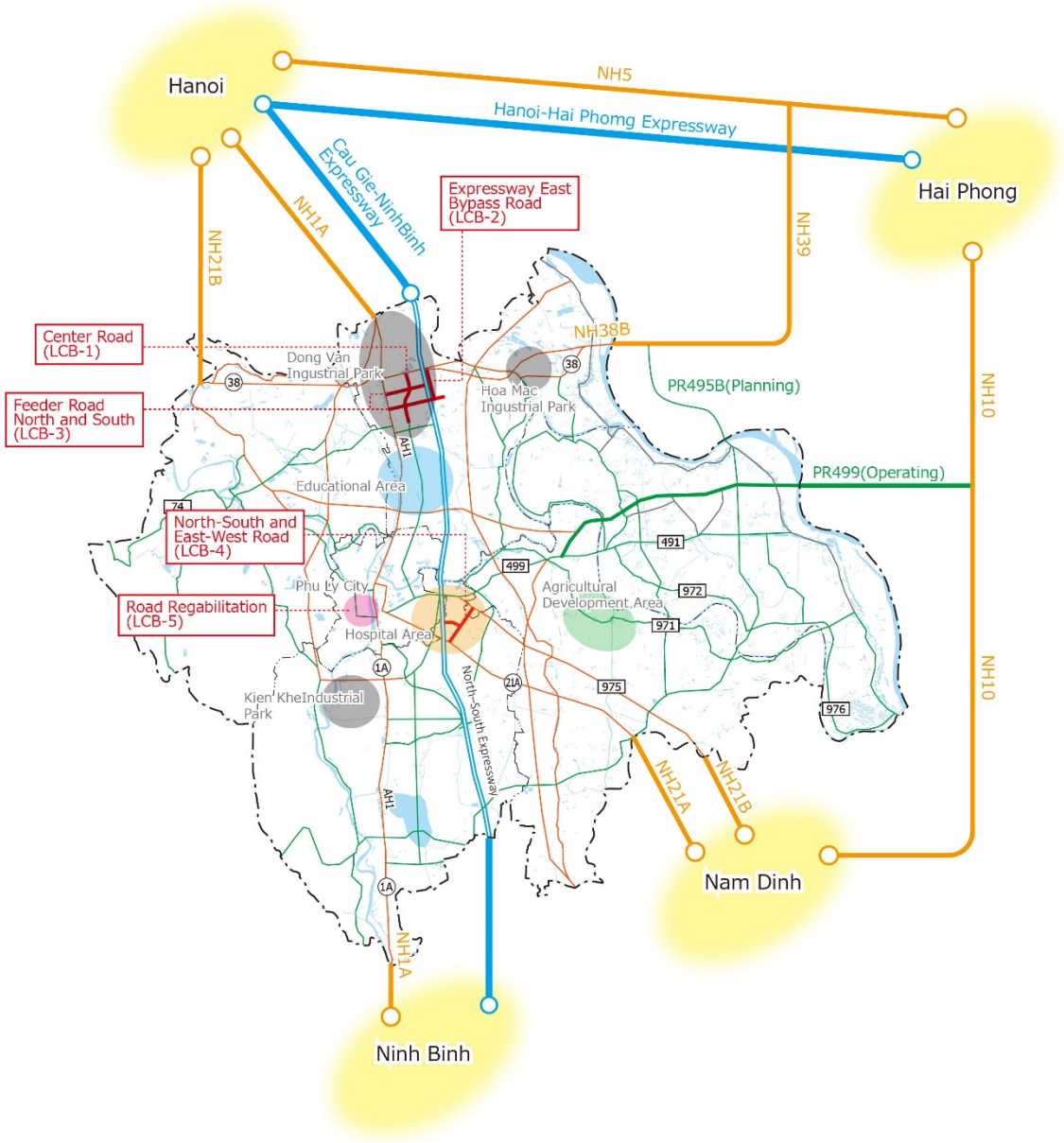
Source: JICA Survey Team based on Department of Transport data and site survey

Figure 9.2-1 Future Road Network in 2025



Source: JICA Survey Team based on Department of Transport data and site survey

Figure 9.2-2 Future Road Network with Number of Lanes in 2025



Source: JICA Survey Team and DPI

Figure 9.2-3 Subject Project Road in Ha Nam Province and the Arterial Road Network

9.3 Outline of the Project Roads

The outline of the subject roads is given in **Table 9.3-1**.

Table 9.3-1 Outline of Subject Roads

Package Name	Project Name	Description	Project Area	Specifications	Status of Social Environmental Issues		Remarks
					Land Area for Acquisition[*2] (land acquisition completed)[*2]	No. of Households to be relocated[*2]	
LCB-1	Center Road (**Section 10.2.1**)	To cross from NH 38 to University area passing through Dong Van III Industrial Park.	Dong Van Industrial Zone	* Length: 3.5km * Width: 68m * No. of Lanes: 4 lanes with center strip	208,291 m^2 (26,975 m^2)	none	Land Acquisition Compensation: 41.7 Billion VND Critical point is described in **Figure 10.3-1**
LCB-2	Expressway East Bypass Road (**Section 10.2.2**)	To be along Expressway, Dong Van III industrial expansion area.		* Length: 3.0 km * Width: 10.5 m * No. of Lanes: 2 lanes	9,641 m^2 (0 m^2)	none	Land Acquisition Compensation: 1.9 Billion VND Critical point is described in **Figure 10.3-2**
LCB-3	Feeder Road North and South (**Section 10.2.3**)	To cross Dong Van III Industrial Park from west and east at north and south sides.		Feeder Road North * Length: 2.0 km * Width: 42.0 m * No. of Lanes: 4 lanes	44,145 m^2 (44,108 m^2)	none	Land Acquisition Compensation: 8.8 Billion VND (North) Critical point is described in **Figure 10.3-3**
				Feeder Road South * Length: 2.8 km * Width: 42 m * No. of Lanes: 4 lanes * Flyover: 2 lanes with 337m long and 12m wide	128,123 m^2 (0 m^2)	3 public Building	Flyover: 9 Spans Super T PC bridge. Land Acquisition Compensation: 25.6 Billion VND (South) Critical point is described in **Figure 10.3-3**
LCB-4	North-South and East-West Cross Road (**Section 10.2.4**)	To pass through Hospital area, not crossing expressway	Medical Area	North-South Cross Road * Length: 2.9 km * Width: 54 m * No. of Lanes: 6 lanes	158,083 m^2 (0 m^2)	2 households	4 Lanes for Automobiles 2 Lanes for Motorcycles Land Acquisition Compensation: 12.4 Billion VND (North and South) Critical point is described in **Figure 10.3-4**
				East-West Cross Road * Length: 1.4 km * Width: 48 m * No. of Lanes: 4 lanes	61,865 m^2 (0 m^2)	none	Land Acquisition Compensation: 31.6 Billion VND (North-south and East-West) Critical point is described in **Figure 10.3-4**
LCB-5	Phu Ly City Road Rehabilitation (**Section 10.2-5**)	Rehabilitation of roads	within Phu Ly City	* Refer to **Section 10.2.5**	none (No land acquisition and resettlement is expected because of rehabilitation of existing roads)		-

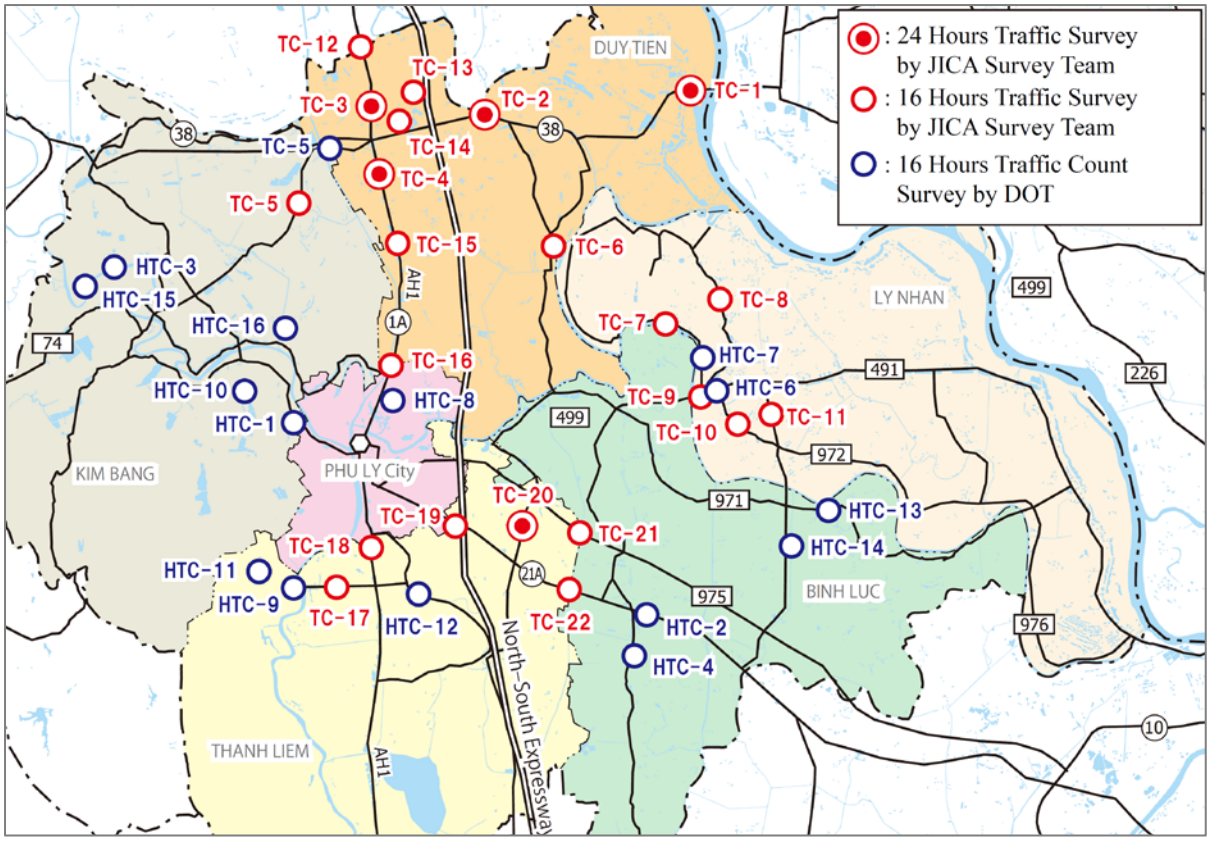
9.4 Current Traffic Volume on Main Roads in Ha Nam Province

The current traffic volume on main roads in Ha Nam Province had been surveyed in the previous study in year 2016. In Ha Nam Province, the Government did not conduct traffic count survey in year 2016. Thus, **Table 9.4-1** shows current traffic volume (based on the previous survey). Conversion rates from 16 hours to 24 hours to obtain daily traffic volume are taken average ratios by road classes; ratios of traffic volumes of 16 hours to ones of 24 hours. Traffic survey station is shown in **Figure 9.4-1**.

Table 9.4-1 Daily Traffic Volume at Survey Location

	Survey Location	Survey Hours	Traffic Volume (Veh/16h or Veh/day)	Conversion Rate (24hours/16hours,)	Daily Traffic Volume (Veh/day)	Heavy Traffic Volume Rate (%)
Surveyed by JICA Survey Team	TC-1	24	12,751	1.0	12,751	38.1%
	TC-2	24	23,249	1.0	23,024	20.4%
	TC-3	24	22,252	1.0	22,252	45.9%
	TC-4	24	25,926	1.0	25,926	40.1%
	TC-5	16	4,754	1.39[1)]	6,608	7.7%
	TC-6	16	6,236	1.39	8,668	11.4%
	TC-7	16	8,155	1.39	11,335	4.4%
	TC-8	16	4,380	1.39	6,088	12.1%
	TC-9	16	12,015	1.39	16,701	8.6%
	TC-10	16	3,928	1.39	5,460	15.6%
	TC-11	16	1,444	1.39	2,007	15.4%
	TC-12	16	20,904	1.12[2)]	23,412	51.8%
	TC-13	16	10,024	1.39	13,933	11.1%
	TC-14	16	13,487	1.39	18,747	22.9%
	TC-15	16	15,651	1.12	17,529	36.4%
	TC-16	16	16,124	1.12	18,059	37.5%
	TC-17	16	11,926	1.39	16,577	64.1%
	TC-18	16	26,646	1.12	29,844	25.0%
	TC-19	16	10,486	1.39	14,576	30.9%
	TC-20	24	6,734	1.00	6,734	10.3%
	TC-21	16	14,237	1.39	19,789	28.5%
	TC-22	16	10,883	1.39	15,127	28.1%
Data Provided by DOT (surveyed in year 2015)	HTC-1	16	10,225	1.39	14,214	10.5%
	HTC-2	16	16,916	1.12	18,946	6.8%
	HTC-3	16	3,319	1.39	4,614	6.9%
	HTC-4	16	3,495	1.39	4,859	4.3%
	HTC-5	16	4,017	1.12	4,500	6.6%
	HTC-6	16	11,917	1.39	16,566	3.7%
	HTC-7	16	4,211	1.39	5,854	1.4%
	HTC-8	16	3,049	1.39	4,239	2.3%
	HTC-9	16	34,376	1.39	47,783	10.8%
	HTC-10	16	6,050	1.39	8,410	9.2%
	HTC-11	16	21,557	1.39	29,965	9.5%
	HTC-12	16	1,019	1.39	1,417	1.2%
	HTC-13	16	211	1.39	294	2.8%
	HTC-14	16	803	1.39	1,117	2.9%
	HTC-15	16	1,582	1.39	2,199	3.3%
	HTC-16	16	1,453	1.39	2,020	3.1%
Remarks		*1): an average of ratios of traffic volume of 16 hours to ones of 24 hours surveyed at TC-20. *2): an average of ratios of traffic volume of 16 hours to ones of 24 hours surveyed at TC-4.				

Source: JICA Survey Team



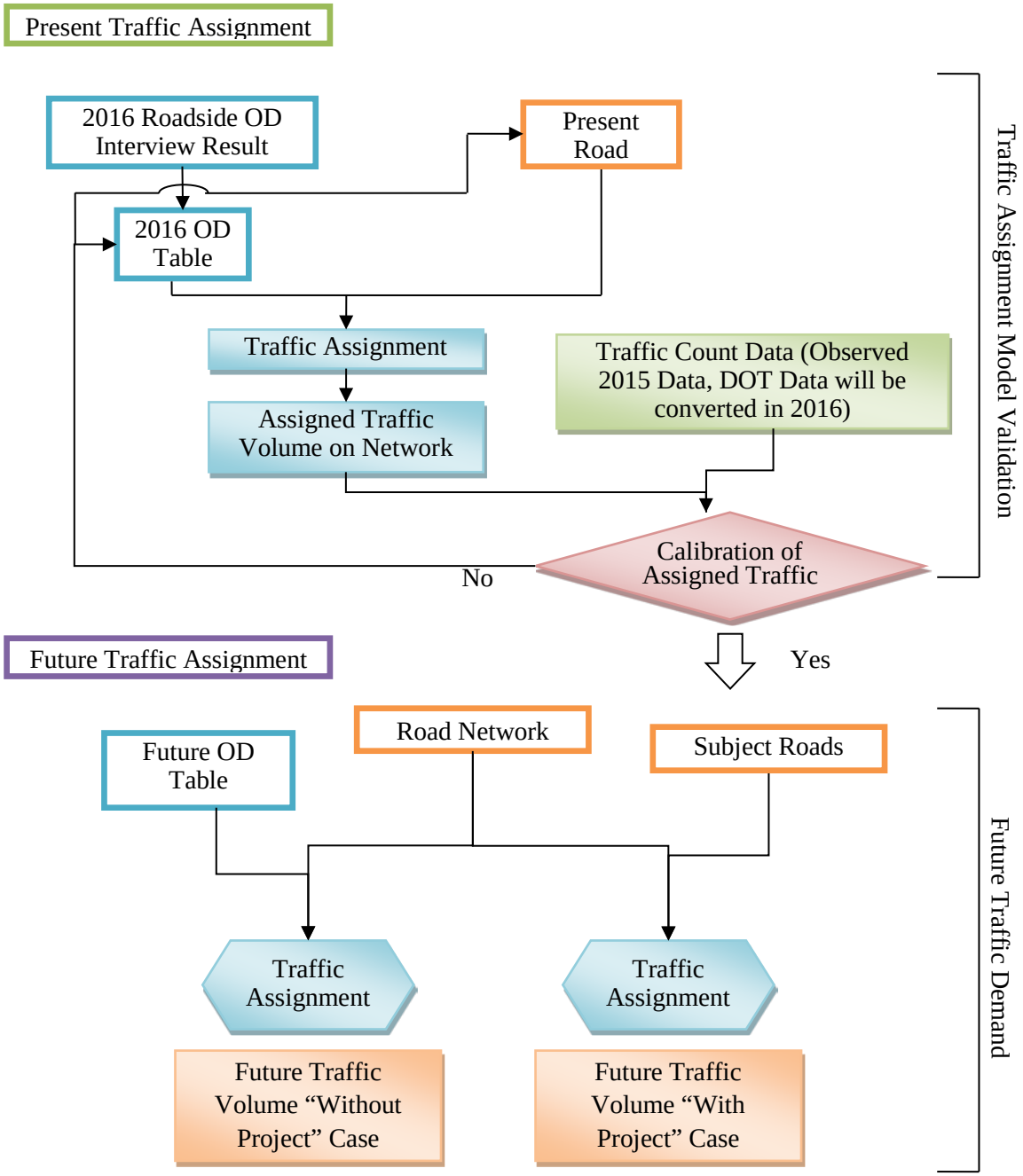
Source: JICA Survey Team and DOT

Figure 9.4-1 Traffic Count Survey Stations (Previous Survey and DOT)

9.5 Procedure of Traffic Demand Forecast

9.5.1 Flow of Traffic Demand Forecast

To estimate the traffic volumes on a subject road, traffic demand forecast has been conducted. **Figure 9.5-1** shows the traffic forecast procedure.



Source: JICA Survey Team

Figure 9.5-1 Procedure of Traffic Demand Forecast

9.5.2 Present Traffic Assignment

Based on analyzed roadside interview survey results in this project, the present OD table was prepared as year 2016. Traffic assignment was conducted using the present OD table and present road network, and then validation was conducted for the traffic count data (i.e., traffic survey result and year 2015 traffic volume carried out by DOT) and assigned traffic volume on each link.

9.5.3 Future Traffic Assignment

After validation of the present OD table, future traffic demand was forecasted. Future traffic assignment was conducted using future OD table and future road network (With LCB-1 to LCB-5 Case and Without-Project Case).

9.6 Traffic Zoning System

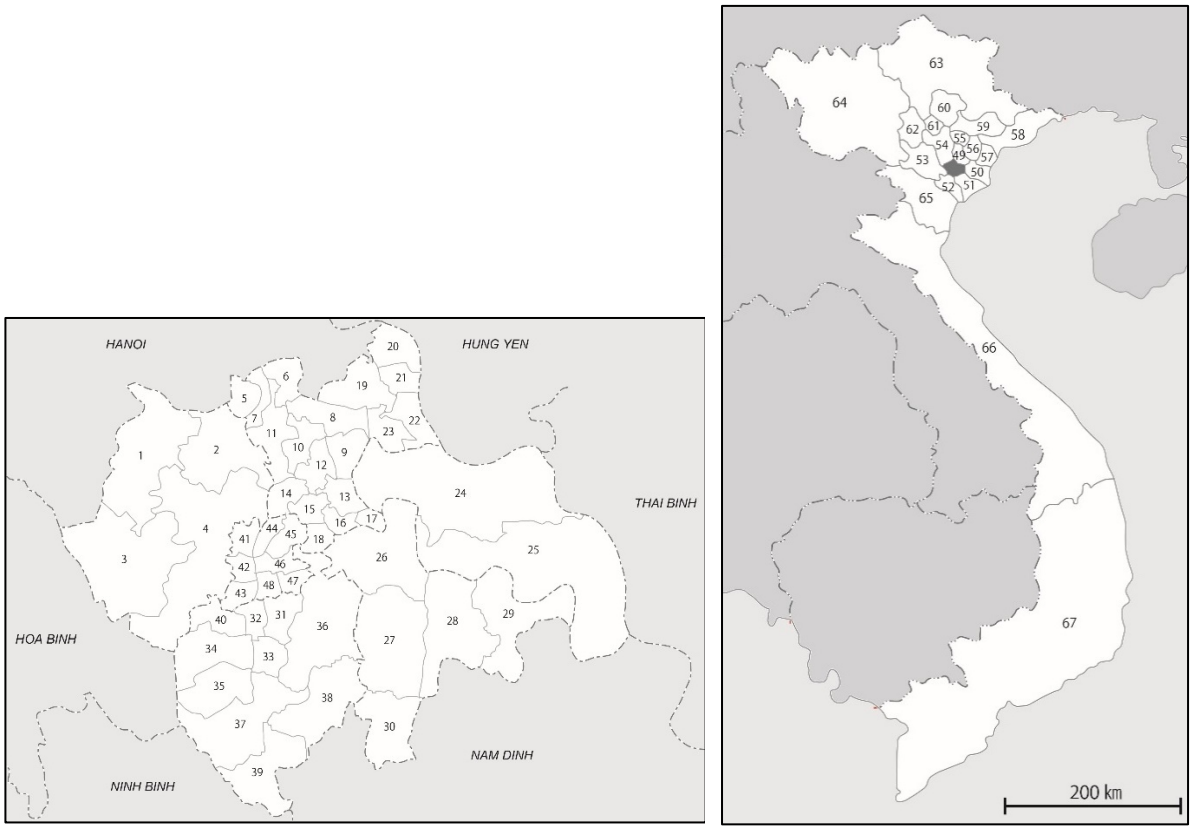
In this traffic assignment, the zoning system is comprised of Ha Nam Province, and other provinces (Hanoi, Hai Phong, etc). The total zone number is 67 zones as shown in **Table 9.6-1** and **Figure 9.6-1**.

Table 9.6-1 Traffic Zoning System

Zone Number[1)]	Big Zone[2)]	Town	District	Province
1	1	Nguyen Uy, Le Ho, Tuong Linh, Tan Son, Thuy Loi, Kha Phong	Kim Bang	Ha Nam
2		Dai Cuong, Nhat Tuu, Dong Hoa, Nhat Tan, Hoang Tay		
3		Ba Sao, Lien Son		
4		Van Xa, Ngoc Son, Kim Binh, Thi Son, Thanh Son		
5	2	Duy Hai	Duy Tien	
6		Bach Thuong		
7		Duy Minh		
8		Yan Bac		
9		Yen Nam		
10		Tien Noi		
11		Hoang Dong		
12		Tien Ngoai		
13		Doi Son		
14		Tien Tan		
15		Tien Hiep		
16		Chau Son		
17		Tien Phong		
18		Tien Hai		
19		Chau Giang		
20		Moc Bac		
21		Moc Nam		
22		Chuyen Ngoai		
23		Trac Van		
24	3	Hop Ly, Van Ly, Chinh Ly, Cong Ly, Nguyen Ly, Dao Ly, Chan Ly, Bac Ly, Nhan Dao, Dong Ly, Duc Ly	Ly Nhan	
25		Nhang Khang, Nhan Chinh, Nhan Nghia, Nhan Hung, Nhan Binh, Xuan Khe, Nhan My, Nhan Thinh, Phu Phuc, Tien Thang, Hoa Hau		
26	4	Dinh Xa, Trang An, Trinh Xa, Binh Nghia, Dong Du	Binh Luc	
27		Don Xa, An My, My Tho, La Son, An Do		
28		Hung Cong, Boi Cau, Trung Luong, An Noi		
29		Ngoc Lu, Bo De, An Ninh, Vu Ban		
30		Tieu Dong, An Lao		
31	5	Thanh Ha	Thanh Liem	
32		Thanh Tuyen		
33		Thanh Phong		
34		Thanh Thuy		
35		Thanh Tan		
36		Liem Tuyen, Liem Tiet, Liem Phong, Liem Thuan, Liem Can, Thanh Binh, Thuanh Luu		
37		Thanh Huong, Thanh Nghi		
38		Liem Tuc, Liem Son, Thanh Tam		
39		Thanh Nguyen, Thanh Hai		
40		Kien Khe		
41	6	Phu Van	Phu Ly	
42		P. Le Hong Phong		
43		Chau Son		
44		P. Quang Trung		
45		Lam Ha		
46		Liem Chinh		
47		Liem Chung		
48		Thanh Chau		
49	49	-	-	Hung Yen
50	50	-	-	Thai Binh
51	51	-	-	Nam Dinh
52	52	-	-	Ninh Binh
53	53	-	-	Hoa Binh
54	54	-	-	Ha Noi
55	55	-	-	Bac Ninh
56	56	-	-	Hai Duong
57	57	-	-	Hai Phong
58	58	-	-	Quang Ninh
59	59	-	-	Bac Giang
60	60	-	-	Thai Nguyen
61	61	-	-	Vinh Phuc
62	62	-	-	Phu Tho

Zone Number[1)]	Big Zone[2)]	Town	District	Province
63	63	-	-	Ha Giang, Cao Bang, Tuyen Quang, Bac Kan, Lang Son
64	64	-	-	Lai Chau, Lao Cai, Dien Bien, Son La, Yen Bai
65	65	-	-	Thanh Hoa
66	66	-	-	Nghe An, Ha Tinh, Quang Binh, Quang Tri, Thua Thien-Hue, Da Nang, Quang Nam, Kon Tum, Quang Ngai
67	67	-	-	Gia Lai, Binh Dinh, Phu Yen, Dak Lak, Khanh Hoa, Ninh Thuan, Dak Nong, Lam Dong, Binh Thuan, Dong Nai, Bink Phuoc, Tay Ninh, Binh Duong, Ho Chi Minh, Ba Ria-Vung Tau, Long An, Dong Thop, Tien Giang, Ben Tre, Tra Vinh, Vinh Long, Hau Giang, Can Tho, An Giang, Kien Giang, Ca Mau, Bac Lieu, Soc Trang
68	68	-	-	Dong Van Industrial Park
69	69	-	-	Hoa Mac Industrial Park
Remarks	1) Zone number is related with zoning map (**Figure 9.6-1**) 2) Big zone number is related with desired line (**Figure 9.9-1**)			

Source: JICA Survey Team



Ha Nam Province Vietnam

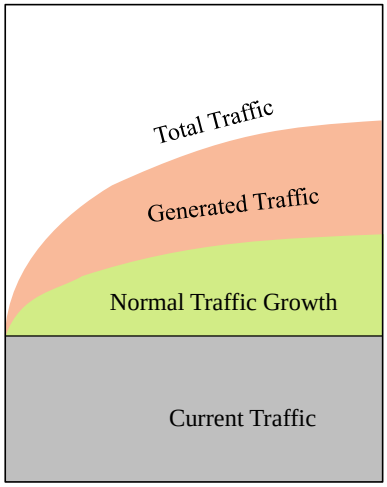
Source: JICA Survey Team

Figure 9.6-1 Zoning Map

9.7 Methods of Traffic Demand Forecast

9.7.1 Components of Total Traffic Growth

Components of total traffic growth are composed of current traffic, normal traffic growth (population growth and GDP growth) and generated traffic (development area) as shown in **Figure 9.7-1**. In this project, future attraction and generation volume shall be calculated utilizing these 3 components.



Factor	
Normal Traffic Growth	Population Growth
	GDP Growth
Generated Traffic	Dong Van III Phase1
	Dong Van III Phase2
	Dong Van III-B
	Dong Van I&II Extension
	Education Area
	Hospital Area

Figure 9.7-1 Scheme of Future Traffic Volume

9.7.2 Projection of Normal Traffic Growth

Normal traffic growth was estimated by the projection of population in Ha Nam Province and GDP in Vietnam. Growth rate of population by each department was estimated based on statistical data. **Table 9.7-1** shows the growth rate of population.

Vietnamese GDP is very high according to the high growth period rate. Growth rate of GDP was 5.83% for 2020 based on WB Statistics Data. From 2021, the JICA Survey Team assumed that Vietnamese GDP will stagnate or go down. Thus, the JICA Survey Team adopted the trend of Vietnamese GDP growth rate (1% down) lowering to 4.83% by 2030.

Table 9.7-1 Growth Rate of Population

City	2013	2014	2015	Growth Rate (2015-2013)
Phu Ly	137,530	138,502	139,768	0.81%
Duy Tien	116,148	117,010	117,760	0.69%
Kim Bang	118,294	118,681	119,299	0.42%
Thanh Liem	113,526	114,074	114,350	0.36%
Binh Luc	133,203	133,453	133,646	0.17%
Ly Nhan	177,279	177,661	177,864	0.16%

Source: Ha Nam Statistical Yearbook 2015

9.7.3 Projection of Traffic Growth to be generated by Subject Development Areas

Generation and attraction of traffic volumes are estimated with the formula shown below, which was developed based on experience in a similar development area in Japan.

The formula was established for three (3) specific areas: “Working Area”, “Commercial Area” and “Residence Area”.

1) Working Area

$$TVW = A \times \alpha 1 \times \alpha 2 / C \text{ (Conversion factor) (veh/day)} \qquad (9.7\text{-}1)$$

Where;

A: Basic unit of generation and attraction by category (4,500 persons)

α1: Modification rate of floor area (0.75 (based on factor of discount rate of floor area, floor area is at 0%))

α2: Modification rate of distance from station (0.7 (over 500 m)

C: 1.3 person/veh for Working Area

2) Commercial Area

$$TVC = 10,600 \times \alpha1 \times \alpha2 / C \text{ (veh/day)} \quad (9.7\text{-}2)$$

Where;

10,600 persons: Basic unit of local area

α1: Modification rate of floor area (0.8 (over 6 ha))

α2: Modification rate of distance from station (0.9 (over 500m))

C: 1.4 person/veh for Commercial Area

3) Residence Area

$$TVR = 700 / C \text{ (veh/day)} \quad (9.7\text{-}3)$$

Where;

700 persons: Basic unit of local area

C: 1.5 person/veh for Residential Area

9.8 Development Scenario of Subject Development Areas

9.8.1 Current Situation of Subject Development Areas

(1) Dong Van III Industrial Park (Phase-1)

- Dong Van III Phase 1: Land reclamation has been completed in Dong Van III Industrial Park (Phase-1). However, four Japanese companies have completed investment and starting construction.
- Dong Van III Phase 2: Implementation schedule is not clear in this stage. According to Dong Van III Phase 1 completion, Land reclamation will be started from 2021 based on discussion with Ha Nam Industrial Park Authority.
- Dong Van IIIB: Land reclamation and investment are in the planning stage. Implementation schedule is not clear in this area as well. According to interview with Ha Nam DPI, priority is lower than Dong Van III Phase 2.
- Dong Van I&II Extension: Land reclamation and investment are in the planning stage. Implementation schedule is not clear in this area as well.

(2) Hospital Development Area

Two big hospitals, Vietnam-Germany Hospital and Bach Mai Hospital, are being rapidly constructed. Accordingly, land readjustment for residence is being implemented around the two hospitals. Future population should be harmonized with the sewerage sector.

(3) Education Area

The overall plan of development is for 17 universities to be constructed. A university for police is under construction, and detail design of five universities have already been completed. Construction of three

universities are scheduled to be finished in 2025 and the remaining 2 universities in 2035. Future population should be harmonized with the sewerage sector.

9.8.2 Development Scenario of Subject Development Areas

Scenario of development area is shown in **Table 9.8-1** to estimate realistic demand in the development areas. Considering the existing condition (Implementation Schedule and Financing), the most relevant scenario was selected and evaluated by the JICA Survey Team. The conditions and scenario of operation rate estimation should be discussed with Dr. Hosono, who is in charge of investment promotion for industrial parks, particularly, the estimation of future operation rate at Dong Van Industrial Park. The discussion points should include the following:

- 100% of future operation rate in 2020 is over-estimation.
- Existing operation rate in Vietnam is 50% on average and the same rate in Ba Ria-Vung Tau Industrial Park.
- Long term effort is necessary to improve the operation rate.

Experiences of operation rate in Dong Van I and II are as below:

- Dong Van I was started in 2002, operation rate is 2% after 1 year, 35% after 5 years, 63% after 10 years.
- Dong Van II was started in 2007, operation rate is 17% after 1 year, 46% after 5 years, 82% after 9 years.
- Operation rates at Dong Van II show higher values due to the increased awareness and support from BTD Japan.

From the above, the JICA Survey Team has set four (4) scenarios as follows:

- Scenario-1: Operation Rate is 20.0% per year (100% per 5 years, max operation rate: 80%)
- Scenario-2: Operation Rate is 12.5% per year (100% per 8 years, max operation rate: 80%)
- Scenario-3: Operation Rate is 10.0% per year (100% per 10 years, max operation rate: 80%)
- Scenario-4: Operation Rate is 9.0% per year (100% per 11 years, max operation rate: 80%)

Table 9.8-1 shows the scenarios for Dong Van Industrial Park. The JICA Survey Team has recommended “Scenario-2”.

Table 9.8-1 Scenario of Dong Van Industrial Park

Development Area		Scenario	Scenario in Year 2021	Scenario in Year 2031	Evaluation
1	Dong Van III Phase 1	1-1	80% complete	-	-
		1-2	62.5% complete	80% complete	**Recommended**
		1-3	50% complete	80% complete	-
		1-4	45% complete	80% complete	
2	Dong Van III Phase 2	2-1	20% complete	80% complete	-
		2-2	12.5% complete	80% complete	**Recommended**
		2-3	10% complete	80% complete	-
		2-4	9% complete	80% complete	-
3	Dong Van IIIB	3-1	0% complete	80% complete	-
		3-2	0% complete	75% complete	**Recommended**
		3-3	0% complete	60% complete	-
		3-4	0% complete	54% complete	
4	Dong Van I&II Extension	4-1	0% complete	80% complete	-
		4-2	0% complete	62.5% complete	**Recommended**
		4-3	0% complete	50% complete	-
		4-4	0% complete	45% complete	

Source: Estimated by JICA Survey Team

Based on future traffic volume and scenario of development area, generated traffic was estimated as shown in the following tables.

Table 9.8-2 Generated Traffic in Development Area (2021)

Development Area	Generated Traffic (Veh/day)				
	Motorcycle	Car	Bus	Truck	Total
Dong Van III Phase1	69,004	15,261	2,193	20,911	107,368
Dong Van III Phase2	-	-	-	-	-
Dong Van III-B	-	-	-	-	-
Dong Van I&II Extension	-	-	-	-	-
Educational Area	2,218	490	70	672	3,451
Hospital Development Area	59,449	13,148	1,890	18,015	92,502

Source: JICA Survey Team

Table 9.8-3 Generated Traffic in Development Area (2031)

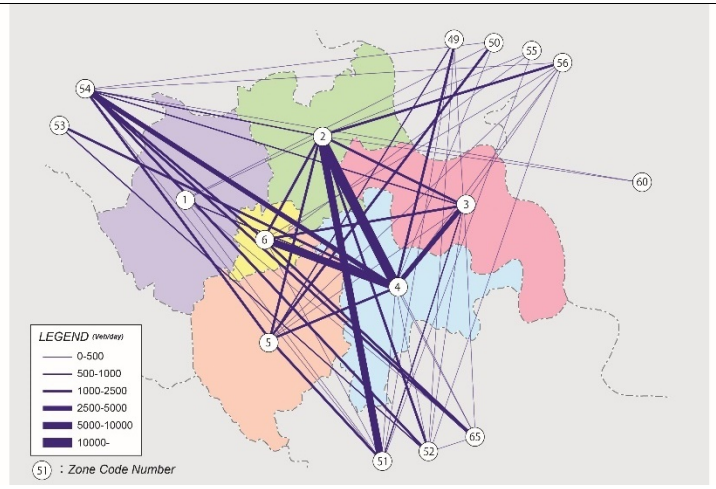
Development Area	Generated Traffic (Veh/day)				
	Motorcycle	Car	Bus	Truck	Total
Dong Van III Phase1	88,324	19,534	2,808	26,766	137,432
Dong Van III Phase2	203,773	45,067	6,478	61,751	317,068
Dong Van III-B	89,080	19,701	2,832	26,995	138,607
Dong Van I&II Extension	59,387	13,134	1,888	17,996	92,405
Educational Area	4,505	996	143	1,365	7,010
Hospital Development Area	89,472	19,788	2,844	27,113	139,218

Source: JICA Survey Team

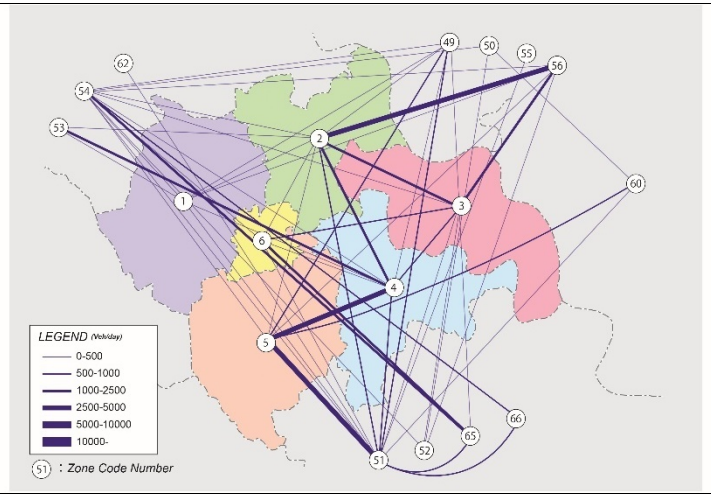
9.9 Present and Future OD Matrix

9.9.1 Features of Present OD Matrix

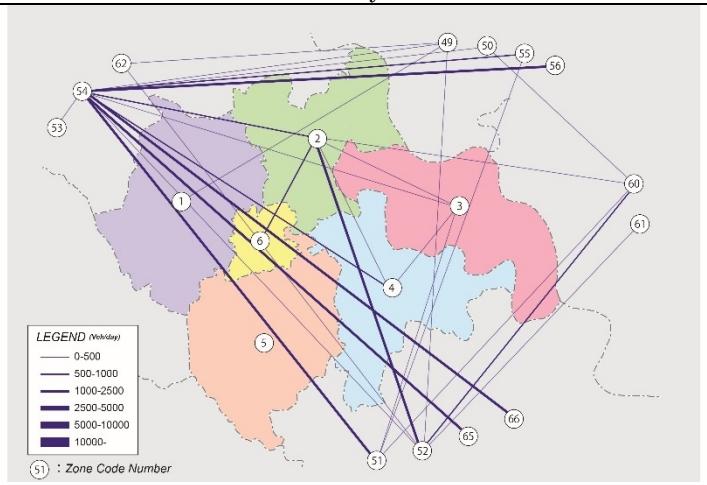
Desire lines for Motorcycle, Passenger Car, Bus and Truck are illustrated in **Figure 9.9-1**.



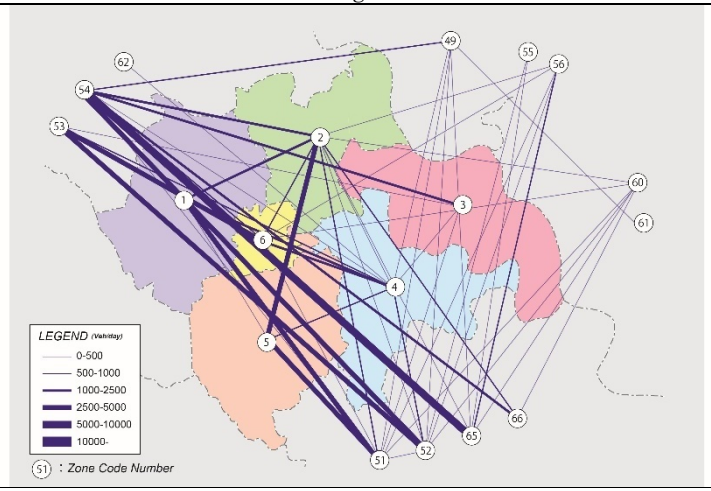
Motorcycle



Passenger Car



Bus



Truck

Source: JICA Survey Team
*Note: Zone Code Number is described at **Table 9.6-1**.*

Figure 9.9-1 Desire Lines

9.9.2 Modeling for Traffic Demand Forecast

(1) Tools for Modeling and Forecasting

During traffic demand forecasting, JICA STRADA system and EXCEL spreadsheet were employed. JICASTRADA is a geographic information system designed specifically for planning, managing, and analyzing of transportation systems. The software provides a set of tools for travel demand modeling as well as capabilities for geographic database management, presentation graphics and transportation models. JICASTRADA system is applied for the simulation of travel time and cost. For better precision, efficiency and minimization of trial errors, model calibrations and forecasts in trip generation, trip distribution and modal split steps are programmed using Excel spreadsheet, and the final step, traffic assignment stage is computed by JICASTRADA system.

(2) Trip Generation and Attraction Model

The objective of trip generation and attraction model is to forecast the number of trips by vehicle type that will depart and arrive in each traffic zone within the Ha Nam Area. The linear regression models were adopted.

$$Gi = ai * X1i + bi * X2i$$

$$Aj = aj * X1j + bj * X2j$$

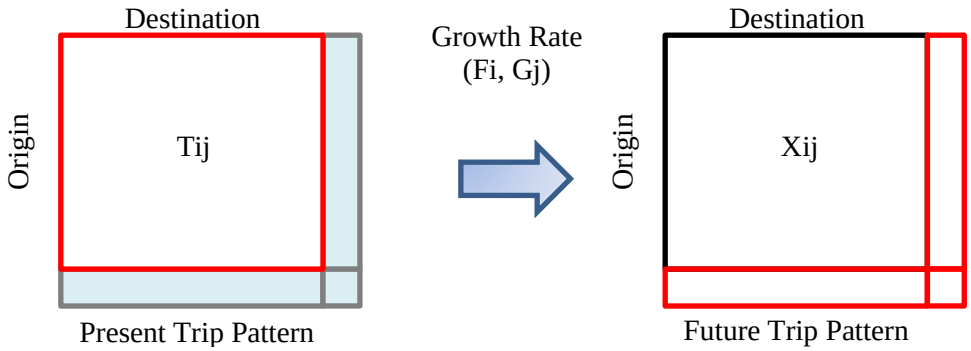
Where,

Gi – Trip Generation in zone i X1i, X2j – Attributes in zone i,j

Aj – Trip Attraction in zone j ai, aj, bi,bj – Coefficients

(3) Trip Distribution Model

Trip distribution assumed that future trip pattern was estimated by multiplying growth rate to present trip pattern in the method of "Present Pattern Method" as shown in **Figure 9.9-2**. The truck trips were estimated by using this method. In addition, motorcycle, car and bus trips were estimated by using this method and new trip pattern.



Source: JICA Survey Team

Figure 9.9-2 Present Pattern Method

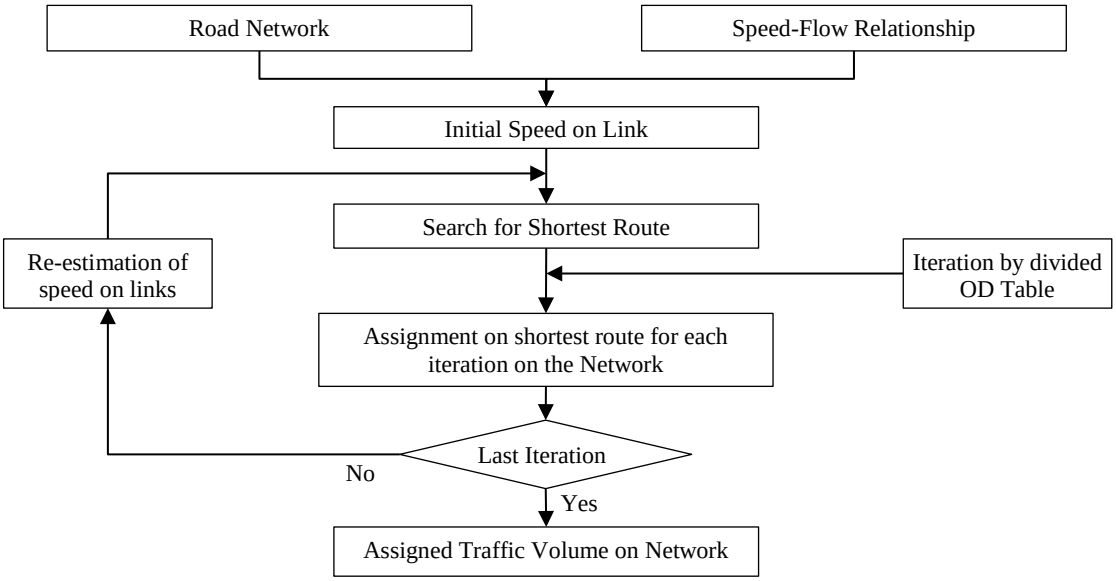
9.10 Traffic Assignment Method

9.10.1 Procedure for Traffic Assignment (Present and Future)

There are so many assignment techniques that can be used to estimate the traffic volume ranging from manual methods to complex iterative procedures by using computer programs. In this study, the capacity restraint assignment which is the most straightforward to use in network models was applied. This assignment technique is based on the speed-flow relationship. The flow chart of the applied methodology is presented in **Figure 9.10-1**.

In this assignment technique, the program determines the fastest routes between each origin and destination by evaluating the time utilized on each links by calculating the required travel time for each link according to its travel speed and road conditions, and then assigns the trips between the given origin and destination. As congestion increases until a certain level, alternative routes are introduced to handle the unassigned traffic. Zone-to-zone routing is built, which is the fastest path from each zone to another, and all trips are assigned to these optimum routes.

Since the link-travel time varies with the traffic volume of vehicles using that link, the OD tables are divided to apply an iteration procedure on five (5) stages, this can be explained as a degree of link congestion at each iteration, and depending on the current link loadings, the flows are divided between all the shortest routes generated and a new travel time is computed for the average assigned link flow at each pass. The iteration continues to re-estimate the speed on that links considering the assigned traffic on links, and to produce the alternative routes so that more accurate allocation can be achieved. The accumulated assigned traffic volume from each OD pair on the links composes the total assigned traffic volumes per direction for the network. JICA STRADA is used to estimate traffic volumes.

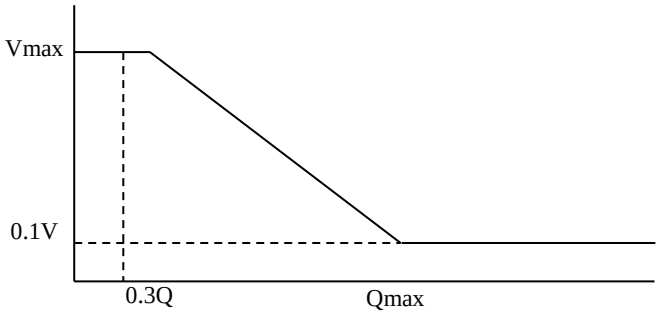


Source: JICA Survey Team

Figure 9.10-1 Traffic Assignment Procedure

9.10.2 Speed-Flow Relationship

The speed-flow relationship used in the traffic assignment procedure is shown in **Figure 9.10-2**. When the traffic volumes are over the maximum capacity 0.3*Qmax, it is assumed that vehicle speed drastically reduces. These speed-flow relationships are classified for the Ha Nam Province. The basic free flow and capacity is shown in **Table 9.10-1**.



Source: JICA Survey Team

Figure 9.10-2 Speed-Flow Relationship

Table 9.10-1 Free Speed and Capacity by Road Type

QV Type	Pavement	Road Class	Topography	Lane	Vmax	Qmax
1	Paved	Expressway	Plain	4	100	80,000
2				2	80	40,000
3		National Road	Plain	6	60	90,000
4				4	40	60,000
5				2	30	18,000
6		Provincial Road	Plain	8	60	96,000
7				6	50	72,000
8				4	40	48,000
9				2	30	14,400
10		Urban Road	Plain	4	40	36,000
11				2	30	12,000
12		District Road	Plain	4	40	34,000
13				2	30	10,000
14	Unpaved	Urban Road	Plain	2	20	6,000
15				1	20	3,000
16		District Road	Plain	2	20	5,000
17				1	20	2,500

Source: JICA Survey Team

9.10.3 Conversion Rates to Passenger Car Unit (PCU)

Table 9.10-2 shows the Passenger Car Unit (PCU) used in vehicle traffic conversion. This value is the same one used by the previous survey in Vietnam.

Table 9.10-2 Passenger Car Unit (PCU)

Vehicle Type	Passenger Car Unit (PCU)
Motor-cycle	0.3
Passenger Car	1.0
Bus	2.0
Truck	3.0

Source: TCVN 4054: 2005, Highway - Specifications for Design

9.10.4 Assignment Validation Method

The procedure of model validation entails two steps. First, the present OD matrix is assigned on an existing network. Second, the assigned traffic volume is compared with the result of the traffic count surveys at each corresponding location. This verification aims to check the accuracy of both the current OD matrix and an existing network model which represents the existing transport situation.

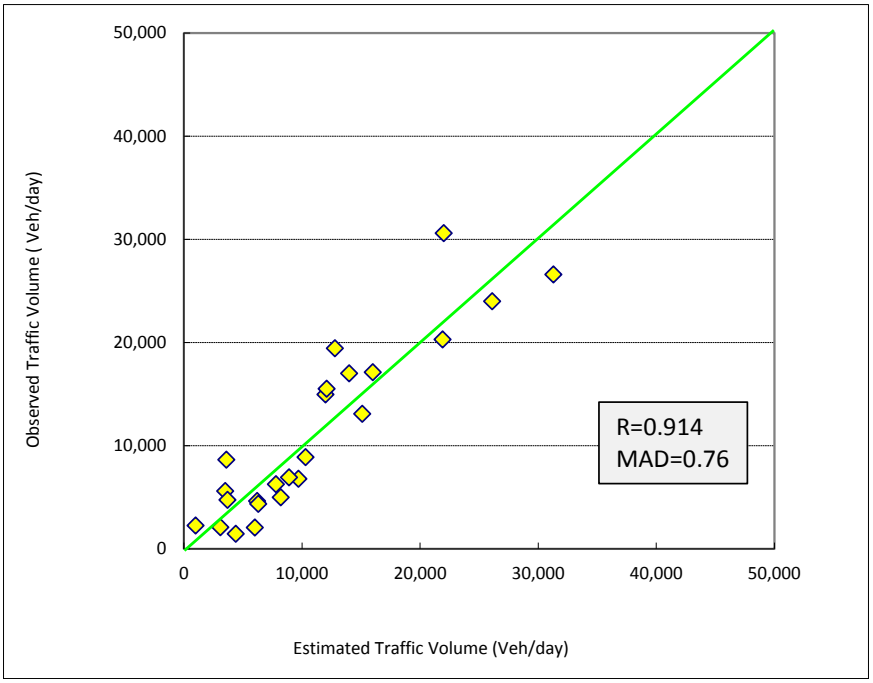
Table 9.10-3 presents the traffic volumes generated from traffic assignment volume and observed traffic volume (traffic count survey). **Figure 9.10-3** shows the result of comparison between the assigned traffic volume and observed traffic volume. This comparison between observed traffic count and assigned traffic flow at individual sites is done via the Correlation and the Mean Absolute Difference (MAD) Ratio. For daily traffic counts, the correlation is 0.914, the value of the MAD ratio is 0.76 which is considered to reflect a good calibration. By all indicators the assignment was accurately replicated by year 2016.

Table 9.10-3 Comparison of Observed (Survey Data) and Assigned Traffic Volume

No	Survey Station	Traffic Survey Volume (Veh/day)	Estimated Traffic Volume (Veh/day)	Rate (%)
1	TC-1	13,070	15,100	13%
2	TC-4	26,574	31,300	15%
3	TC-5	6,773	9,700	30%
4	TC-6	8,885	10,300	14%
5	TC-8	6,240	7,800	20%

No	Survey Station	Traffic Survey Volume (Veh/day)	Estimated Traffic Volume (Veh/day)	Rate (%)
6	TC-9	17,119	16,000	-7%
7	TC-10	5,597	3,500	-60%
8	TC-11	2,057	6,000	66%
9	TC-12	23,997	26,100	8%
10	TC-17	16,991	14,000	-21%
11	TC-18	30,590	22,000	-39%
12	TC-19	14,940	12,000	-25%
13	TC-20	6,902	8,900	22%
14	TC-21	20,284	21,900	7%
15	TC-22	15,505	12,100	-28%
16	HTC-2	19,420	12,800	-52%
17	HTC-3	4,729	3,700	-28%
18	HTC-4	4,980	8,200	39%
19	HTC-5	4,613	6,200	26%
20	HTC-8	4,345	6,300	31%
21	HTC-10	8,620	3,600	-139%
22	HTC-12	1,452	4,400	67%
23	HTC-15	2,254	1,000	-125%
24	HTC-16	2,071	3,100	33%
Total		**268,008**	**266,000**	**-1%**

Source: JICA Survey Team



Source: JICA Survey Team

Figure 9.10-3 Comparison of Observed (Survey Data) and Assigned Traffic Volumes

9.11 Results of Traffic Assignment (Present and Future)

Traffic assignment cases are as shown below:

1. Present Traffic Assignment (2016)
2. Future Traffic Assignment With Case and Without Case - Road Network for LCB-1 to 4 (2021)
3. Future Traffic Assignment With Case and Without Case - Road Network for LCB-1 to 4 (2031)

Results of future traffic volumes are shown in **Table 9.11-1** and **Table 9.11-2**; whereas, results of present and future traffic assignments are shown in **Figure 9.11-1** through **Figure 9.11-5**.

Table 9.11-1 Future Traffic Volume at Subject Roads (Veh/day)

Unit: Veh/day

Subject Road	Year	Motor cycle	Passenger Car	Bus	Truck	Total
Center Road (LCB-1)	2021	15,763	3,663	807	9,427	29,660
	2031	22,365	6,624	595	11,578	41,162
Expressway East Bypass Road (LCB-2)	2021	5,703	1,236	612	1,687	9,238
	2031	10,101	2,190	527	3,903	16,721
Feeder Road North (LCB-3)	2021	9,060	1,951	1,092	5,055	17,157
	2031	28,308	3,331	1,050	9,095	41,784
Feeder Road South (LCB-3)	2021	11,631	4,028	452	8,237	24,348
	2031	26,135	8,269	351	16,544	51,300
North-South Cross Road (LCB-4)	2021	5,528	1,368	37	4,037	10,970
	2031	8,287	3,143	290	8,614	20,333
East-West Cross Road (LCB-4)	2021	10,403	2,534	0	8,085	21,023
	2031	8,340	3,109	376	6,720	18,545

Source: JICA Survey Team

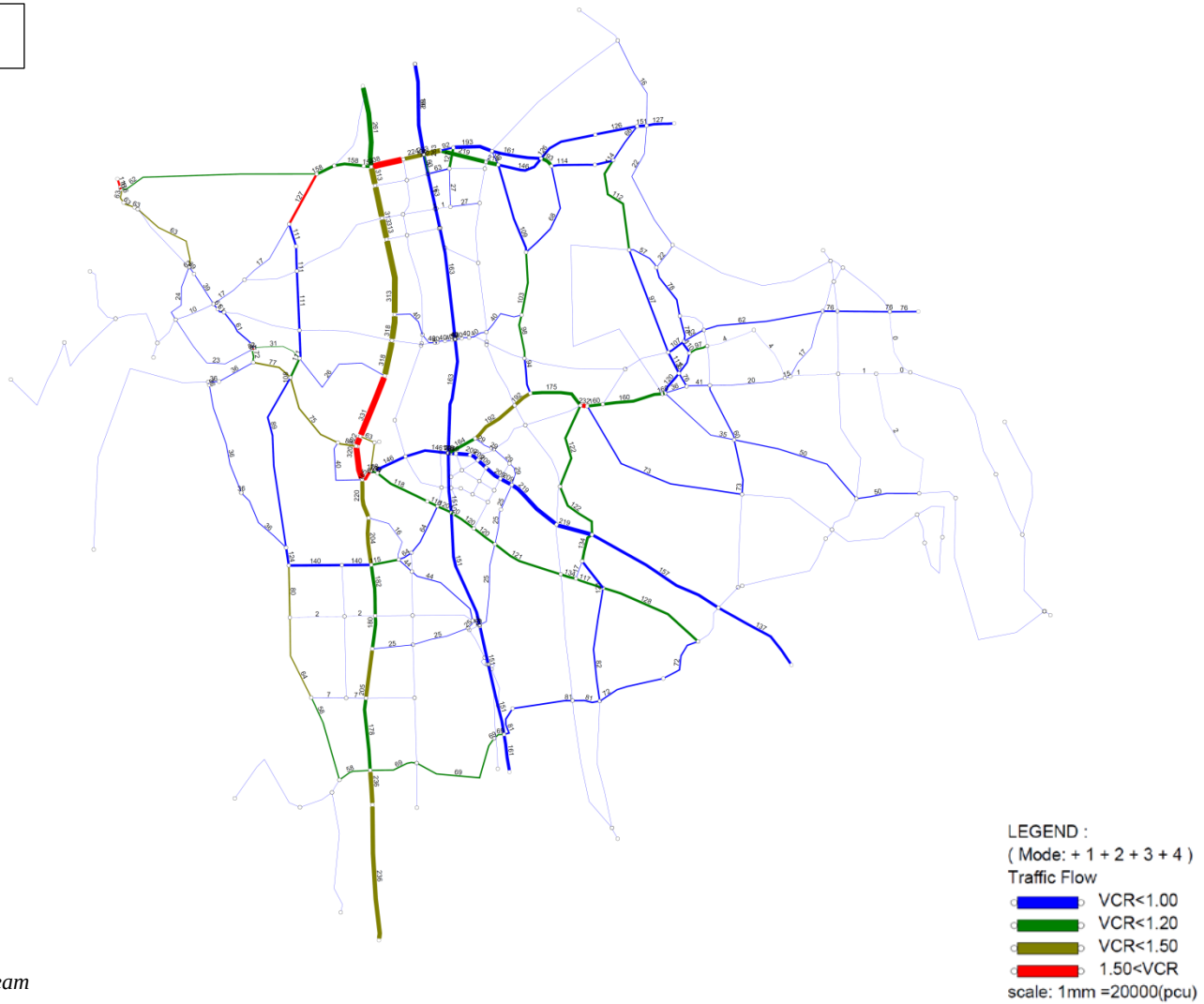
Table 9.11-2 Future Traffic Volume at Subject Roads (PCU/day)

Unit: PCU/day

Subject Road	Year	Motor cycle	Passenger Car	Bus	Truck	Total
Center Road (LCB-1)	2021	4,729	3,663	1,614	28,280	38,286
	2031	6,709	6,624	1,189	34,735	49,258
Expressway East Bypass Road (LCB-2)	2021	1,711	1,236	1,223	5,061	9,231
	2031	3,030	2,190	1,055	11,710	17,985
Feeder Road North (LCB-3)	2021	2,718	1,951	2,184	15,165	22,017
	2031	8,492	3,331	2,099	27,286	41,209
Feeder Road South (LCB-3)	2021	3,489	4,028	905	24,710	33,132
	2031	7,841	8,269	703	49,632	66,445
North-South Cross Road (LCB-4)	2021	1,658	1,368	74	12,111	15,212
	2031	2,486	3,143	580	25,841	32,050
East-West Cross Road (LCB-4)	2021	3,121	2,534	0	24,255	29,910
	2031	2,502	3,109	751	20,161	26,523

Source: JICA Survey Team

Existing Case (2016)

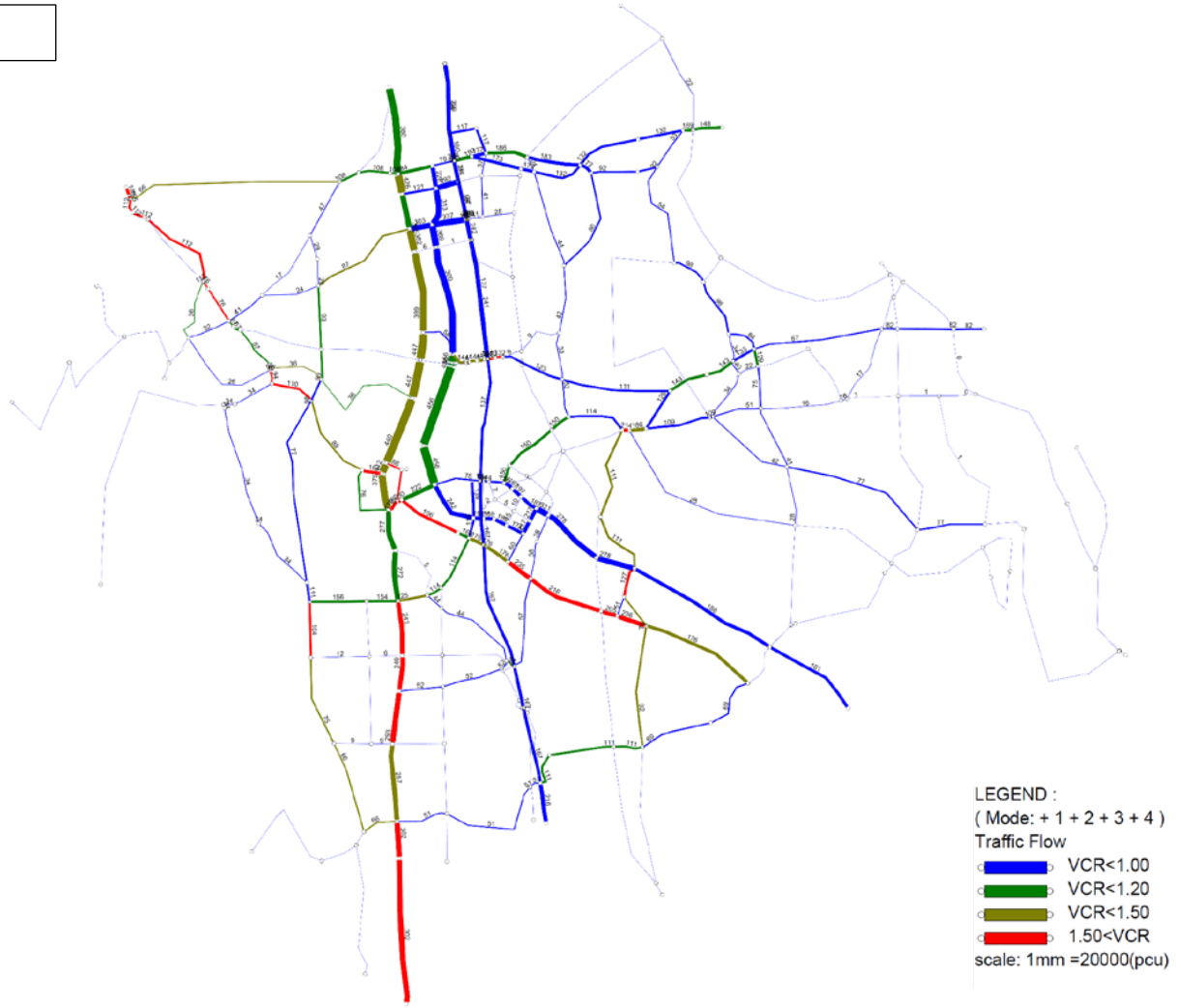


Unit: 100 Veh/day

Source: Estimated by JICA Survey Team

Figure 9.11-1 Existing Traffic Volume in Ha Nam Province (Year 2016)

With Case in 2021

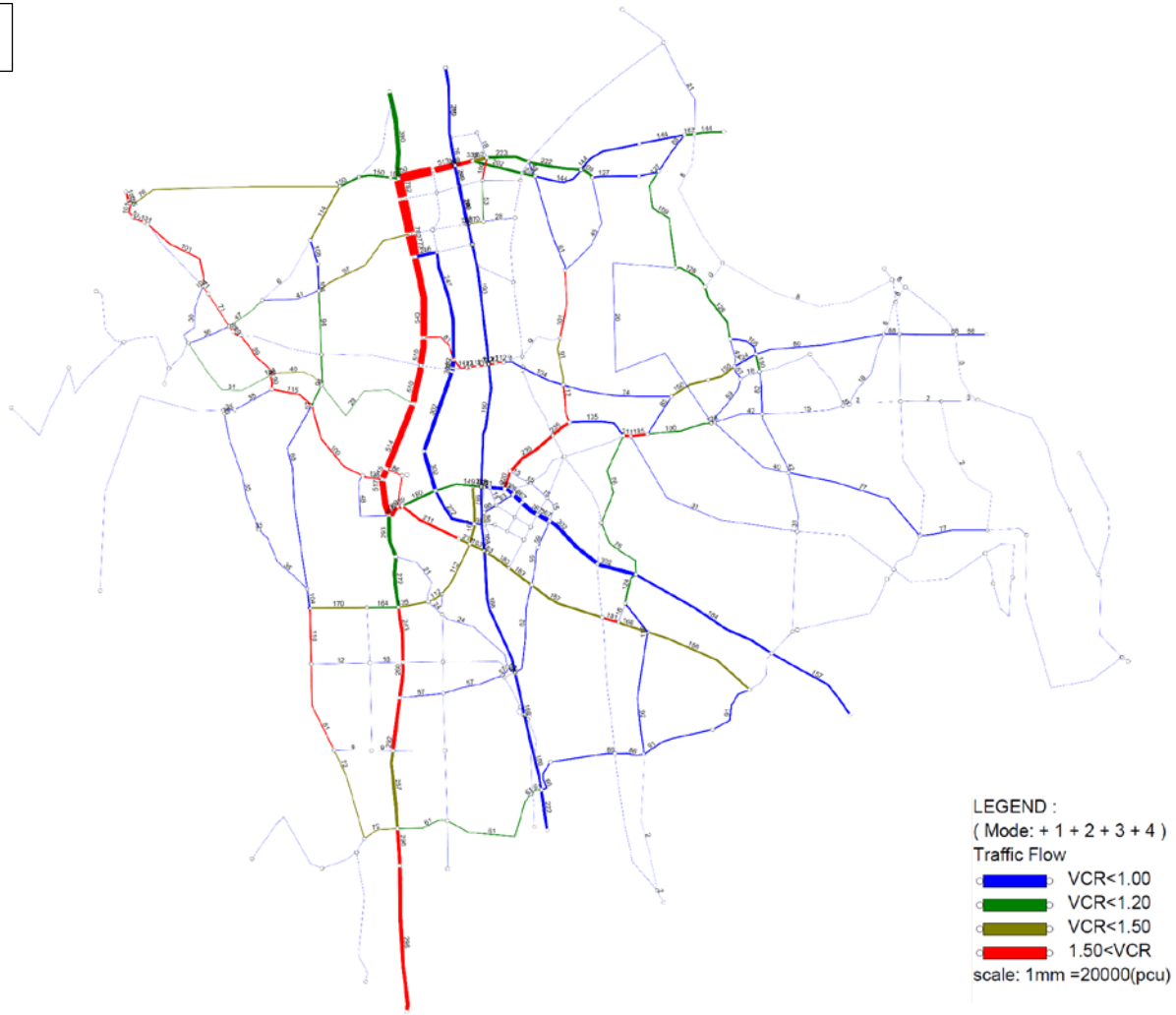


Unit: 100 Veh/day

Source: Estimated by JICA Survey Team

Figure 9.11-2 Future Traffic Volume in Ha Nam Province (With Case in 2021)

Without Case in 2021



Unit: 100 Veh/day

Source: Estimated by JICA Survey Team

Figure 9.11-3 Future Traffic Volume in Ha Nam Province (Without Case in 2021)

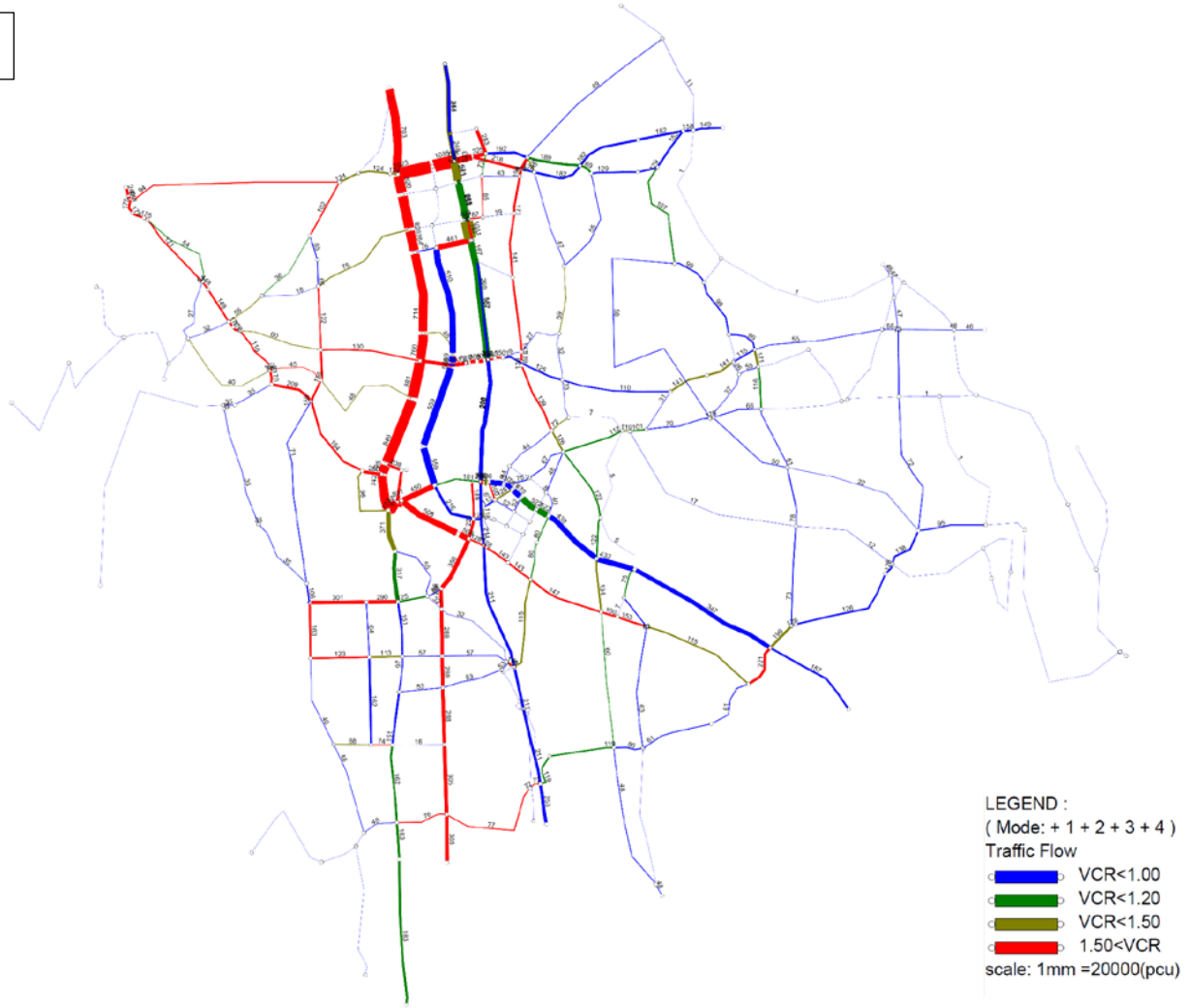
With Case in 2031

Unit: 100 Veh/day

Source: Estimated by JICA Survey Team

Figure 9.11-4 Future Traffic Volume in Ha Nam Province (With Case in 2031)

Without Case in 2031



Unit: 100 Veh/day

Source: Estimated by JICA Survey Team

Figure 9.11-5 Future Traffic Volume in Ha Nam Province (Without Case in 2031)

9.12 Justification of Number of Lanes of Subject Roads

The JICA Survey Team suggests the justification of number of lanes of subject road based on "Vietnamese Standard" and "Level of Service (AASHTO)". Basically, justification of number of lanes shall follow the own country standard. However, in this preparatory survey, the JICA Survey Team applied international standards for the justification of number of lanes by "Highway Capacity Manual, 2011".

9.12.1 Vietnamese Standard

The number of lanes on the cross section is determined by the road category given in **Table 9.12-1**, and must be checked by the formula:

$$n\ (lane) = \frac{N\ (rush-hour)}{Z.N\ (lth)} \qquad (9.12\text{-}1)$$

Where,

n (lane) = required number of lanes, rounded up as per Article 4.2.1;
N (rush-hour) = rush-hour design traffic capacity, which is determined as per Article 3.3.3;
N actual capacity = actual capacity of through traffic flow, which is determined, if there is no study and calculation, as follows:

- When there is median separator between the vehicles in opposite directions and side separator between motor vehicles and non-motorized ones, it is 1800 PCU/h/lane;
- When there is median separator between the vehicles in the opposite directions but no side separator for motor vehicles and non-motorized ones, it is 1500 PCU /h/lane;
- When there is no separator between the vehicles in the opposite directions and motor vehicles use the same lane with non-motorized ones, it is 1000 PCU /h/lane;

Z = volume-to-capacity ratio:
when Vtt ≥ 80km/h, Z = 0.55;
when Vtt = 60km/h, Z = 0.55 for the flat area and Z = 0.77 for the rolling-mountainous areas;
when Vtt ≤ 40km/h, Z = 0.85

Table 9.12-1 Number of Lanes calculated by Vietnamese Standard

Subject Roads	Year	Lanes	Remarks
Center Road (LCB-1)	2021	4	More than 4 lanes in this report
	2031	4	More than 4 lanes in this report
Expressway East Bypass Road (LCB-2)	2021	2	More than 2 lanes in this report
	2031	3	Necessity to be widening in the future
Feeder Road North (LCB-3)	2021	2	More than 2 lanes in this report
	2031	4	More than 4 lanes in this report
Feeder Road South (LCB-3)	2021	3	More than 3 lanes in this report
	2031	4	More than 4 lanes in this report
North-South Cross Road (LCB-4)	2021	2	More than 2 lanes in this report
	2031	3	More than 3 lanes in this report
East-West Cross Road (LCB-4)	2021	3	More than 3 lanes in this report
	2031	3	More than 3 lanes in this report

Source: TCVN 4054: 2005, Third Edition

9.12.2 Level of Service by AASHTO

The JICA Survey Team suggests the number of lanes for each road based on Level of Service (LOS). AASHOT suggest the target LOS for number of lanes as shown in **Table 9.12-2**.

LOS is recommended to be "C" or "D" by the JICA Survey Team according to AASHTO's criteria as shown in **Table 9.12-3**.

Table 9.12-2 Target LOS and Traffic Volume for Number of Lanes

Standards	2 Lanes	4 Lanes	6 Lanes
AASHTO USA	Level of Service: C or D		

Source: JICA Survey Team

Note: A Policy on Geometric Design of Highways and Streets, 2011 (AASHTO) suggests the appropriate level of service for each functional class of road

Table 9.12-3 Appropriate Level of Service for Specified Combinations of Area and Terrain Type

Functional Class	Rural: Level	Rural: Rolling	Rural: Mountainous	Urban and Suburban
Freeway	B	B	C	C or D
Arterial (Trunk)	B	B	C	C or D
Collector	C	C	D	D
Local	D	D	D	D

Source: A Policy on Geometric Design of Highways and Streets, 2011, AASHTO

Calculated LOS based on Highway Capacity Manual (HCM), 2011 and suggested number of lanes for each road is shown in **Table 9.12-4**.

Table 9.12-4 LOS and Number of Lanes

Subject Roads	Year	Terrain	2 Lanes	4 Lanes	6 Lanes
Center Road (LCB-1)	2021	Suburban	E	D	-
	2031	Suburban	E	D	-
Expressway East Bypass Road (LCB-2)	2021	Suburban	C	-	-
	2031	Suburban	D	-	-
Feeder Road North (LCB-3)	2021	Suburban	E	D	-
	2031	Suburban	E	D	-
Feeder Road South (LCB-3)	2021	Suburban	E	D	-
	2031	Suburban	E	D	-
North-South Cross Road (LCB-4)	2021	Suburban	D	D	C
	2031	Suburban	D	D	C
East-West Cross Road (LCB-4)	2021	Suburban	D	D	-
	2031	Suburban	D	D	-

Source: Calculated by JICA Survey Team

CHAPTER 10 ROAD DESIGN

10.1 Introduction

This Chapter presents road and bridge design based on design guidelines, topographic survey and geological survey. In the previous report, road and bridge design was without the above surveys; hence, the JICA Survey Team reviewed the roads designed and re-designed them in more detail in this report. Road components have been discussed by the JICA Survey Team with the Ha Nam Province People's Committee (HNPPC) and modified some road and bridge contents as shown in **Table 10.1-1**.

Table 10.1-1 Changing Point between Previous Survey and this Survey

	Data Collection Survey	Preparatory Survey (This Survey)
LCB-1	Total Length: 3.5km Width: 68.0m Number of Lanes: 4 lanes with center strip Sidewalk: 10.0m (both side)	Road design is almost same plan.
LCB-2	Total Length: **7.9km** Number of Lanes: **2 lanes and 4 lanes** Sidewalk: **2 lanes**	Total Length: **3.0km** (reduction of 1km south section) Number of Lane: **2 lanes** Sidewalk: **1 lane at Expressway side** (According to future expansion plan of LCB-2, outside of sidewalk will not be installed)
LCB-3	Total Length: 4.8km Number of Lanes: 4 lanes with center strip Flyover: 6 span I girder PC	Total Length: 4.8km Number of Lanes: 4 lanes with center strip Flyover: 9 span Super T girder PC
LCB-4	Total Length: 4.3m Number of Lanes: 4 lanes and 6 lanes with center strip Sidewalk: 2 lanes	Road design is almost same plan.
LCB-5	Total Length:6.0km Number of Lanes: 6 lanes with center strip Sidewalk: 3 lanes	Rejected
LCB-6	Total Rehabilitation Length: **24.0km** Improvement of overlay and repairing of sidewalk Replacement of pavement for the bridges Lighting System: **Sodium Lamp** for the bridges	Re-named "**LCB-5**" Total Rehabilitation Length: **3.9km** Improvement of overlay and repairing of sidewalk Replacement of pavement for the bridges Lighting System: **LED Lamp** for the bridges

Source: JICA Survey Team and Previous Survey

10.2 Design Policy

10.2.1 Design Guidelines

The design guidelines for road and bridge adopted the Vietnamese Standard as shown in below.

Road Design: TCVN 4054: 2005, Highway - Specifications for Design
TCXDVN 104: 2007, Urban Road Design Specification
ASSHTO Second Edition 1998 (for Structure Loading)
22 TCN 211–06, Pavement Design Standard

Bridge Design: 22 TCN 272-05, Bridge Design Specifications

10.2.2 Road Classifications

Table 10.2-1 shows road classifications in Vietnam applied for subject roads. In consideration of design speed of subject roads, the JICA Survey Team applied Grade IV Flat (60 km/h) as design level of road based on TCVN 4045 Vietnamese Standard.

Table 10.2-1 Road Classifications in Vietnam

Factors	Design Level of the Road					
	I	II	III	IV	V	VI
Design Speed (km/h)	120	100	80	**60**	40	30
Number of Lane (Lane)	6	4	2	2	2	1
Lane Width (m)	3.75	3.75	3.5	3.5	2.75	3.5
ROW width for motorized vehicle (m)	2x11.25	2x7.5	7.0	7.0	5.5	3.5
Width of center median (m)	3.0	1.5	0	0	0	0
Width of roadside (m)	3.5(3.0)	3.0(2.5)	2.5(2.0)	1.0(0.5)	1.0(0.5)	1.5
Width of Embankment (m)	32.5	22.5	12	9.0	7.5	6.5

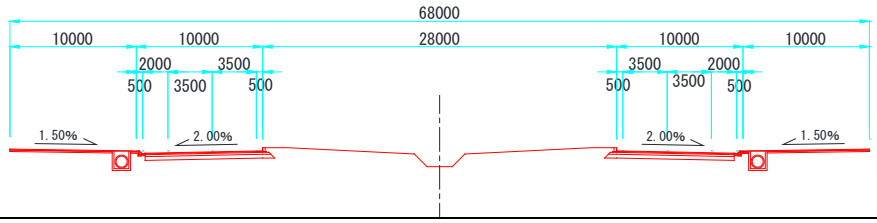
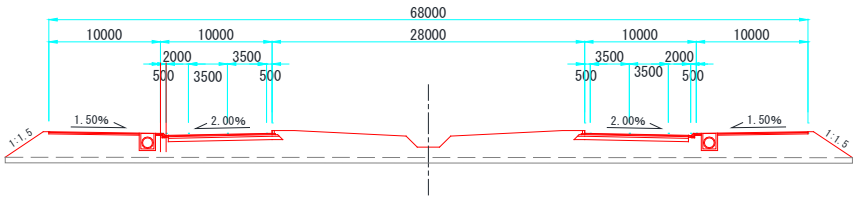
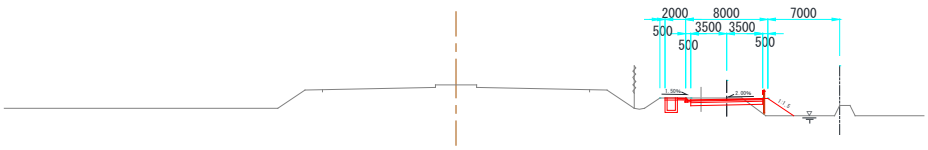
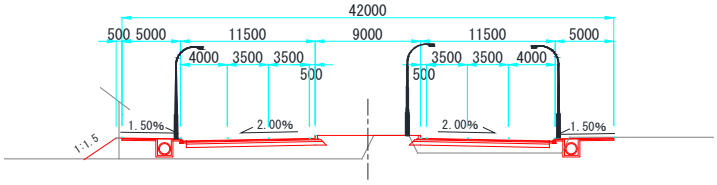
Source: TCVN 4054: 2005, Highway - Specifications for Design

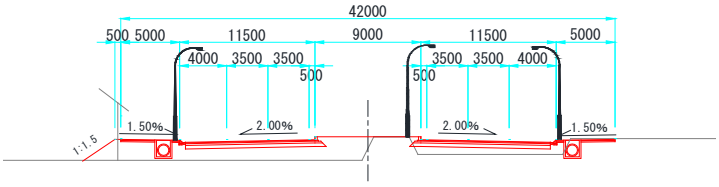
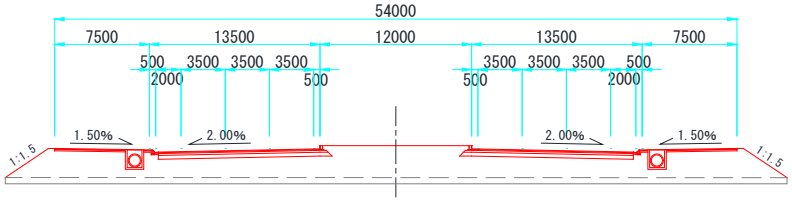
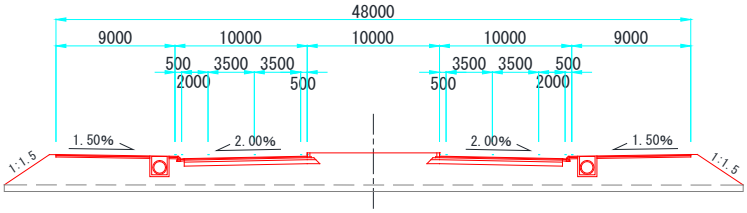
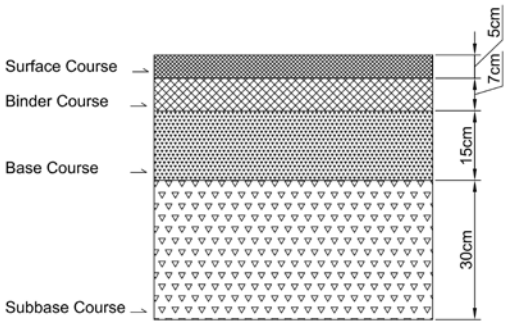
10.2.3 Typical Cross Sections

(1) Roads

Typical cross sections applied for LCB-1 to LCB-4 are shown in **Table 10.2-2**. As shown in the table, these typical cross sections are based on Ha Nam Province Master Plan and terrain condition by site survey.

Table 10.2-2 Typical Cross Sections for LCB-1 to LCB-4

LCB-1 Land Reclamation	
LCB-1 Non Land Reclamation	
LCB-2	
LCB-3 North	

LCB-3 South	
LCB-4 North-South	
LCB-4 East-West	
Pavement Structure	

Surface Course	5cm
Binder Course	7cm
Base Course	15cm
Subbase Cours	30cm
Pavement Structure	57cm

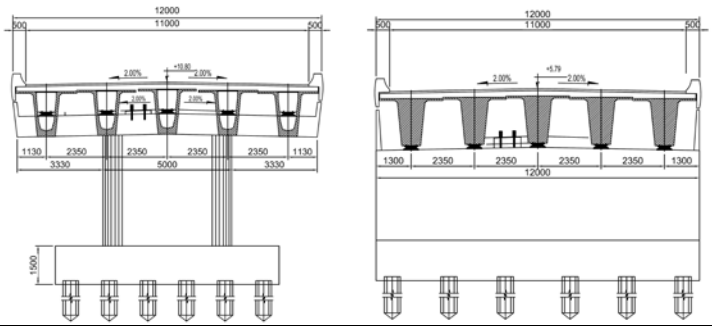
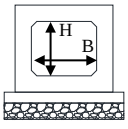
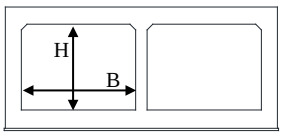
Note: Typical cross section of LCB-4 shows full installation in above table, demarcation of construction is shown in ***Chapter 6****.*

Source: JICA Survey Team

(2) Bridge and Cross Drainage (Culvert Box Type)

Table 10.2-3 shows the typical cross sections of bridges and box culverts.

Table 10.2-3 Typical Cross Sections of Bridges and Box Culverts

LCB3 Flyover		
Box Culvert		Size (B x H): 1.5 x 1.7m 2.0 x 2.0m 3.0 x 3.0m 4.0 x 3.0m
		Size (B x H): 10.0 x 8.0m x 2

Source: JICA Survey Team

10.2.4 Design Requirements for Bridge Design

Design requirements for bridge design are shown below. Bridge planning and structure design is shown in **Section 10.3**.

- Bridge design standard "22 TCN 272-05" should be complied in this project.
- Bridge will be passed on the existing expressway and frontage road located on both sides of expressway.
- Navigation clearance shall be over 4.75m for expressway operation.
- Bridge structure should be proper design by site situation.
- Number of lanes and road width shall be 2 lanes and 12m, respectively.

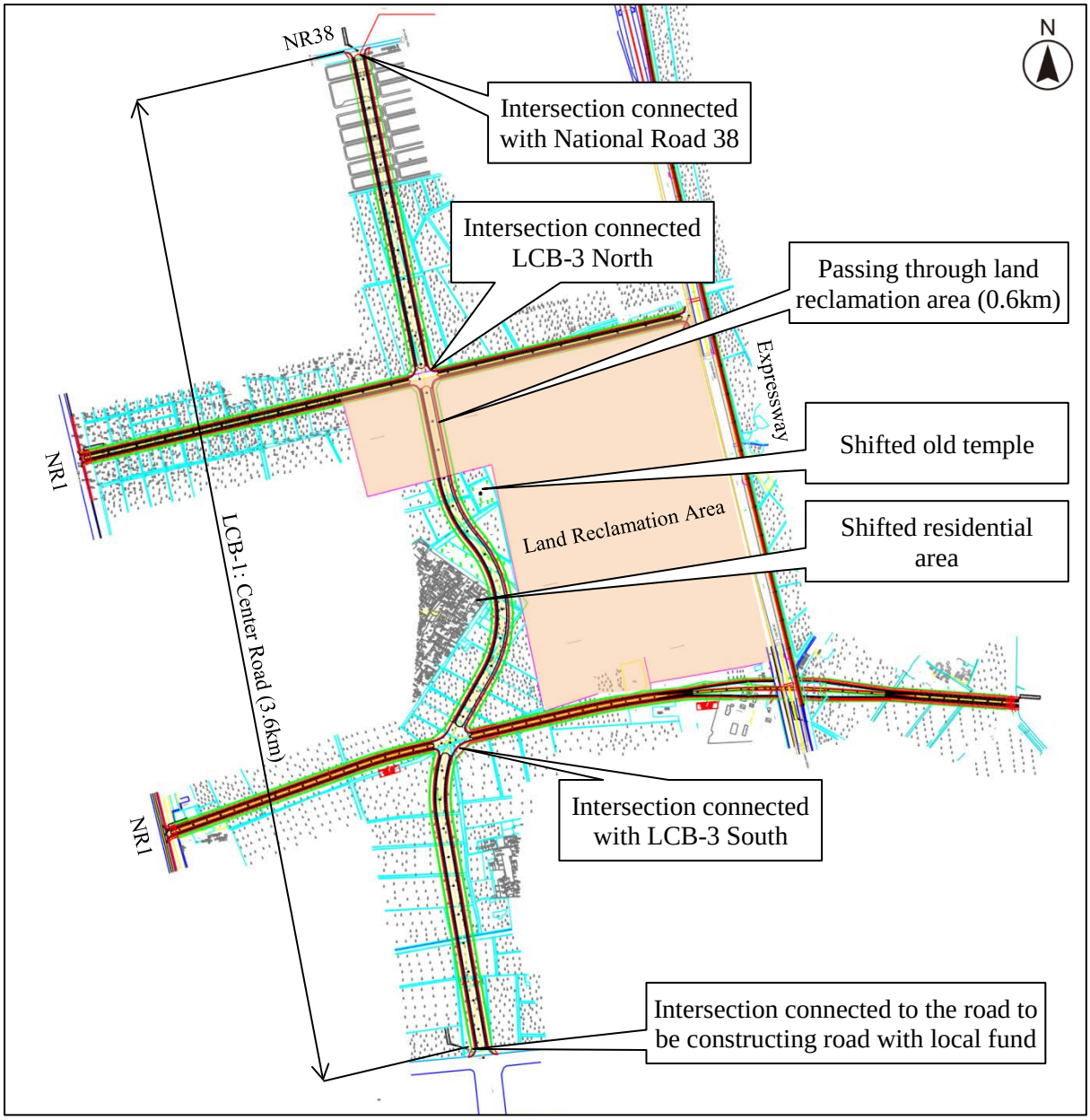
10.3 Road Design

Acceding to results of topographic survey data, the JICA Survey Team planned the alignment at next sections.

10.3.1 LCB 1

(1) Alignment with Road Width including Critical Points

Alignment with road width including critical points is shown in the following figure.



Source: JICA Survey Team

Figure 10.3-1 Alignment with Road Width including Critical Points (LCB-1)

(2) Intersections

Four (4) intersections will be installed at LCB-1 connected existing national road and LCB-3. Basically, intersection is assumed to be at-grade intersection.

(3) Drainage System

Drainage System for LCB-1 is summarized as follows:

- Rainwater drainage pipe will be installed under sidewalk.
- Water intake facilities will be installed at 30m interval.
- Rainwater will be drained into irrigation canals.

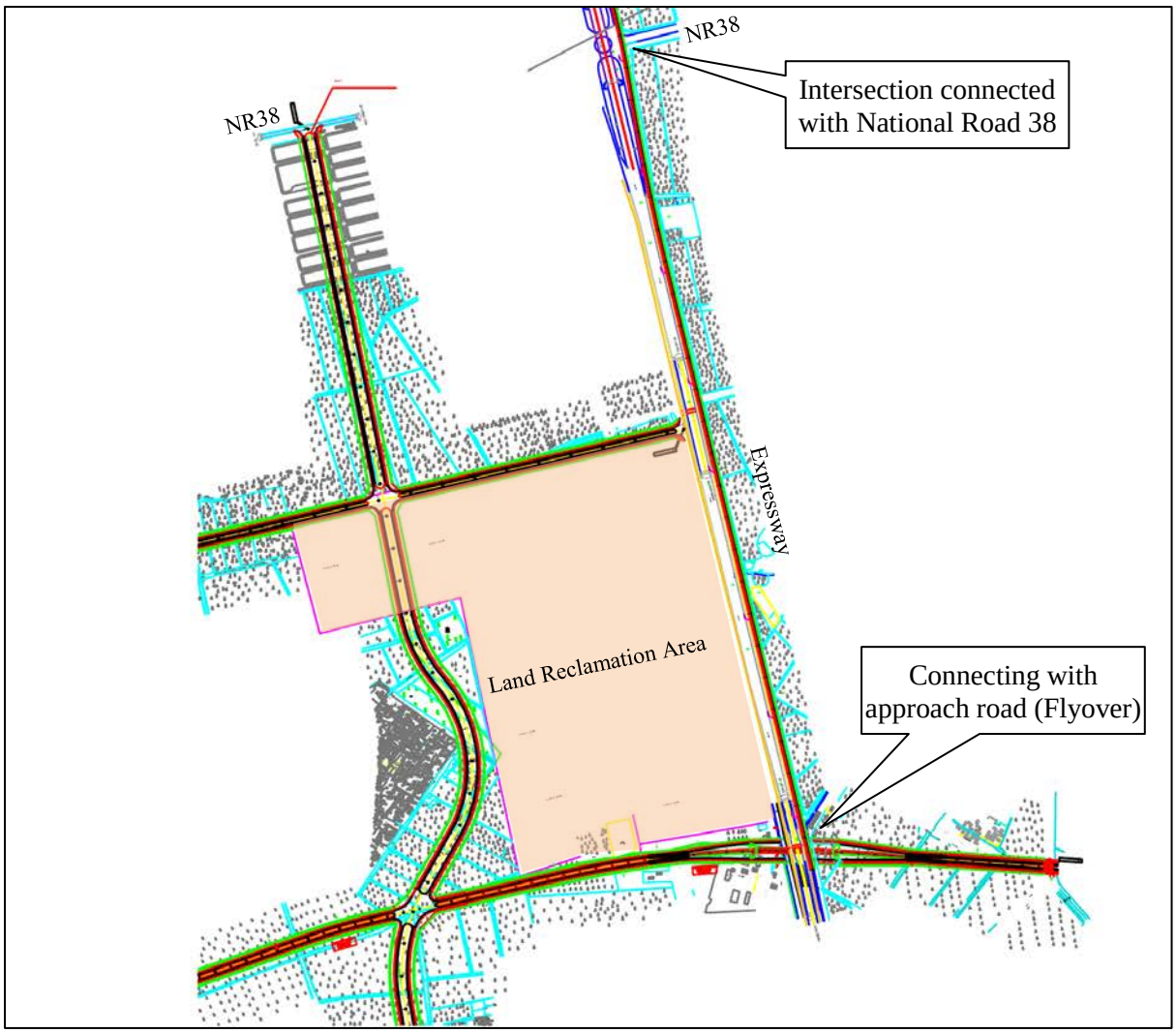
(4) Cross Drainage Design

Hume pipe (ϕ1000) will be installed at 30m interval for draining the rainwater at center median. Box culvert will be installed at irrigation canal section.

10.3.2 LCB 2

(1) Alignment with Road Width including Critical Points

Alignment with road width including critical points is shown in the following figures.



Source: JICA Survey Team

Figure 10.3-2 Alignment with Road Width including Critical Points (LCB-2)

(2) Intersections

Basically, intersection is assumed to be at-grade intersection.

(3) Drainage System

Drainage System for LCB-2 is summarized as follows:

- Rainwater drainage pipe will be installed under sidewalk.
- Water intake facilities will be installed at 30m interval.
- Rainwater will be drained to irrigation canal.

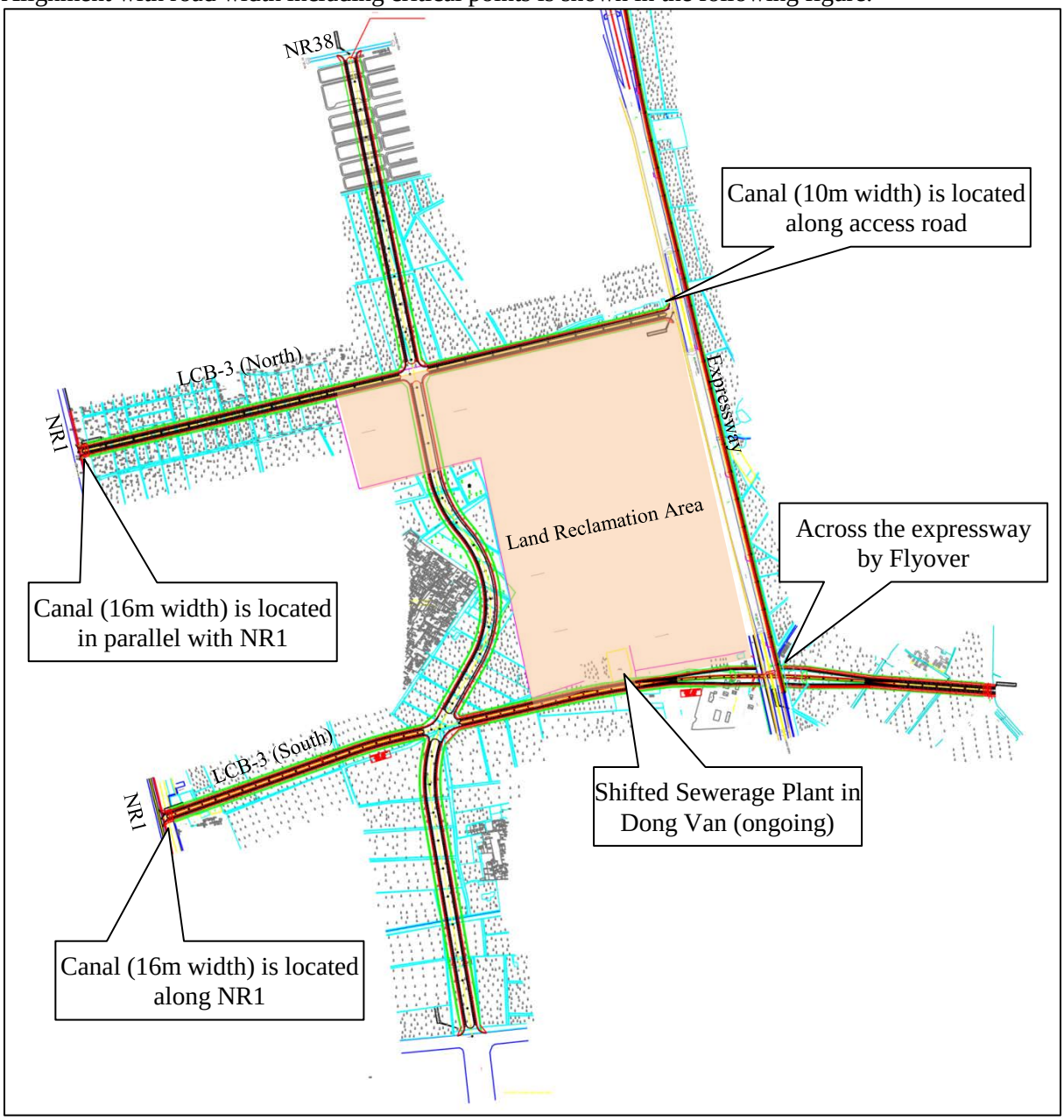
(4) Cross Drainage Design

Hume pipe (ϕ1000) will be installed at 30m interval for draining the rainwater at center median. Box culvert will be installed at irrigation canal section.

10.3.3 LCB 3

(1) Alignment with Road Width including Critical Points

Alignment with road width including critical points is shown in the following figure.



Source: JICA Survey Team

Figure 10.3-3 Alignment with Road Width including Critical Points (LCB-3)

(2) Intersections

Basically, intersection is assumed to be at-grade intersection.

(3) Drainage System

Drainage System for LCB-3 is summarized as follows:

- Rainwater drainage pipe will be installed under sidewalk.
- Water intake facilities will be installed 30m interval.
- Rainwater will be drained to irrigation canal.

(4) Cross Drainage Design

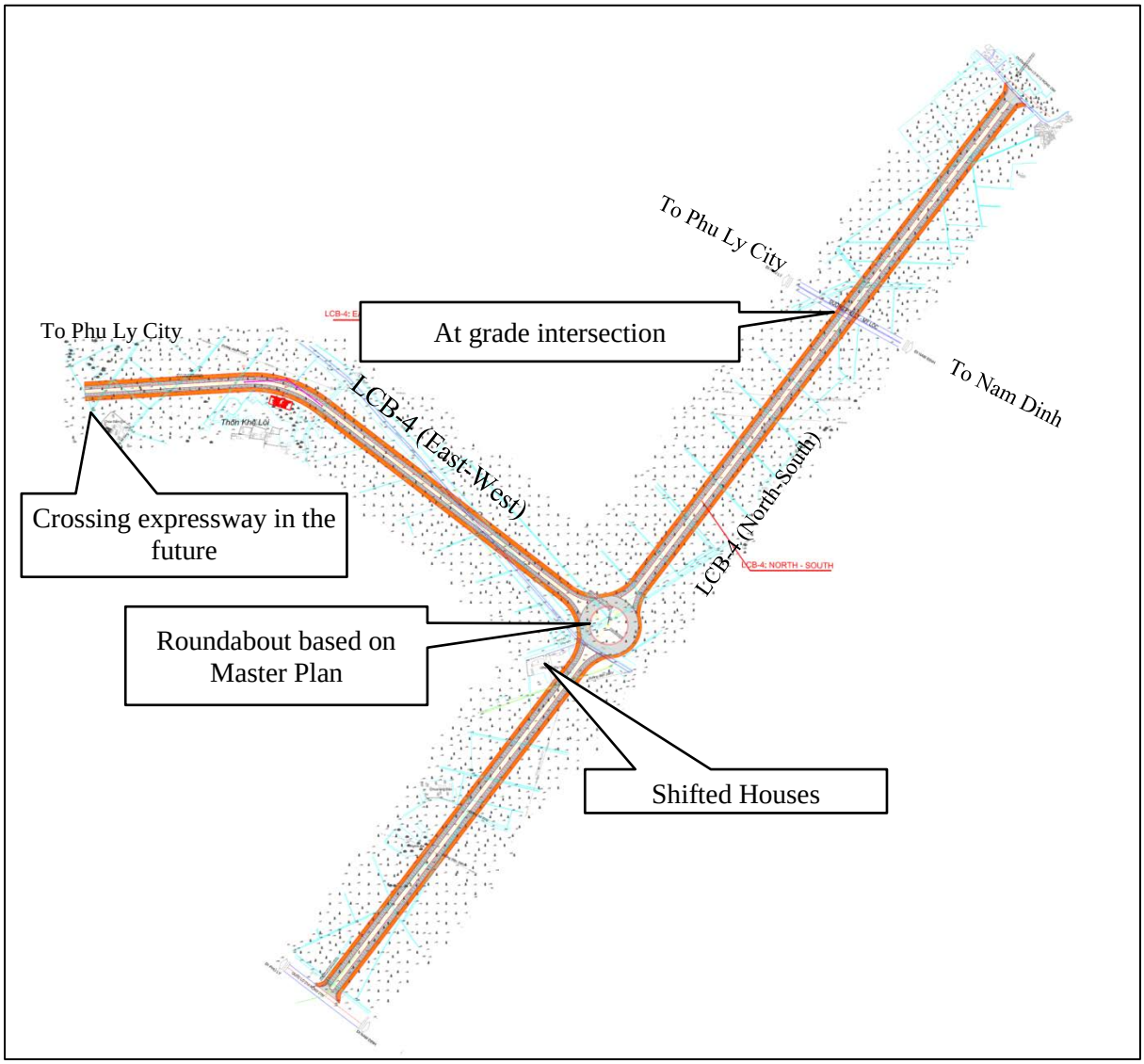
Hume pipe (ϕ1000) will be installed at 30m interval for draining the rainwater at center median. Box culvert will be installed at irrigation canal section.

Canal is located along national road and access road along expressway. Double Box Culvert 20m in width will be installed in these canals.

10.3.4 LCB 4

(1) Alignment with road width including Critical Points

Alignment with road width including critical points at LCB-4 is shown in the figure below.



Source: JICA Survey Team

Figure 10.3-4 Alignment with Road Width including Critical Points (LCB-4)

(2) Intersections

Roundabout intersection is connecting North-South Cross Road and East-West Cross Road based on the Master Plan in Ha Nam Province.

Other intersections will be constructed at-grade intersection.

(3) Drainage System

Drainage System for LCB-4 is summarized as follows:

- Rainwater drainage pipe will be installed under sidewalk.
- Water intake facilities will be installed at 30m interval.
- Rain water will be drained to irrigation canal.

(4) Cross Drainage Design

Hume pipe (ϕ1000) will be installed at 30m interval for draining the rainwater at center median. Box culvert will be installed at irrigation canal section.

(5) Installation of Sidewalk

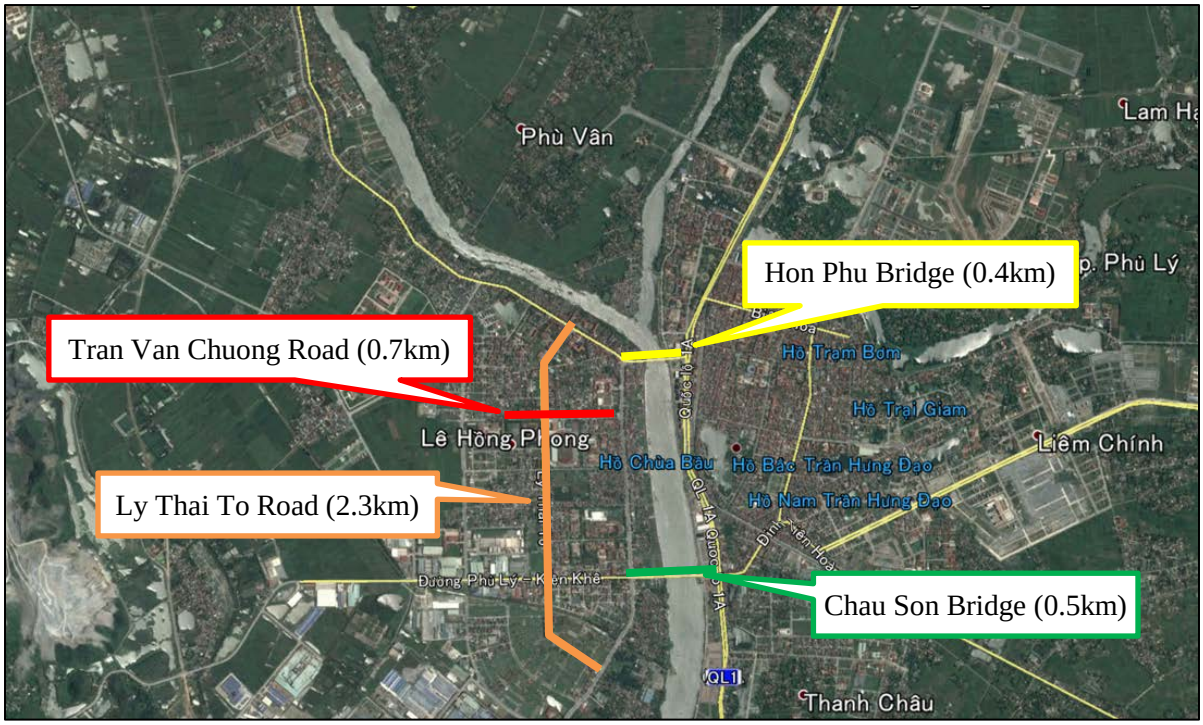
As shown in **Chapter 6**, main sewer of ICB-2 will be installed under the LCB-4 roads. demarcation of construction was applied in the **Chapter 6**. Technical engineering and safety issues for the implementation of construction stage should be discussed in the detailed design stage.

10.3.5 LCB5

(1) Subject Roads and Bridges

Figure 10.3-5 shows subject roads and bridges for LCB-5 rehabilitation. Site situations of subject roads and bridges are summarized as below.

Hon Phu Bridge:	Crossing the Dai River and connecting NR21 and NR1. Heavy traffic cannot pass this bridge based on height limit of facility (less than 2.0m).
Chau Son Bridge:	Crossing the Dai River and connecting NR1 and Chau Son Industrial Park. Thus, heavy traffic passes through this bridge and road surface is very bad.
Tran Van Chuong Road:	Main facilities (Stadium, public and private establishments, etc.) are located along this road. Traffic volume is not so high. However, there are big damages of pavement (pothole/rutting).
Ly Thai To Road:	Many houses are located along this road. Many motorcycles are using this road as community road. Condition of road surface and sidewalk is very bad. There is a dead-end at west side.



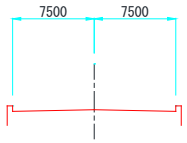
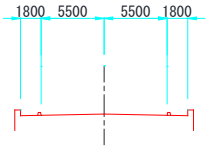
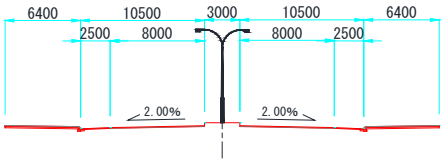
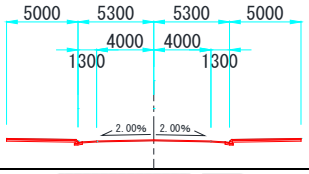
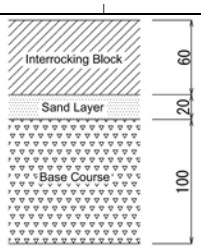
Source: JICA Survey Team

Figure 10.3-5 Subject Roads for LCB-5

(2) Typical Cross Section

Typical cross section of subject roads and bridges is shown in **Table 10.3-1**. These typical cross sections have been observed at each subject road and bridge by the JICA Survey Team.

Table 10.3-1 Typical Cross Section for LCB-5

LCB-5 (1) Chau Son Bridge	
LCB-5 (2) Hon Phu Bridge	
LCB-5 (3) Ly Thai To Road	
LCB-5 (4) Tran Van Chuong Road	
Inter-locking Structure	

Source: JICA Survey Team

(3) Scope of Work

Scope of work for roads and bridges are shown in **Table 10.3-2**. This table presents the items for improvement, details and remarks. The JICA Survey Team estimated unit cost of rehabilitation based on the table.

Table 10.3-2 Scope of Work for Road and Bridge Rehabilitation

Section	No.	Subject Roads and Bridges	Items for Improvement	Details
Bridge Section	LCB-5 (1)	Chau Son Bridge	1. Bridge surface pavement (to be resurfaced) 2. Lamps (to be replaced)	1. Length of bridge surface pavement: 0.5km 2. Number of poles: 28 poles (height= 6.0 m. diameter =0.2 m) 3. Number of lamps: 28 lamps
	LCB-5 (2)	Hon Phu Bridge	1. Bridge surface pavement (to be resurfaced) 2. Lamps (to be replaced)	1. Length of bridge surface pavement: 0.38km 2. Number of poles: 22 poles (height= 6.0 m. diameter =0.2 m) 3. Number of lamps: 22 lamps
Road Section	LCB-5 (3)	Ly Thai To Road	1. Overlay on existing pavement with AC pavement C12.5*8 with an average thickness of 7cm. 2. Resurfacing of sidewalks on both sides.	1. Width and length for overlay= 21m x 2,300m = 48,300 m^2 2. Width and length for resurfacing of sidewalks = 6.4m x 2,300m x 2 = 29,440m^2
	LCB-5 (4)	Tran Van Chuong Road	1. Overlay on existing pavement with AC pavement C12.5*8 with an average thickness of 7cm. 2. Resurfacing of sidewalks on both sides.	1. Width and length for overlay= 10.6m x 700m = 7,420 m^2 2. Width and length for resurfacing of sidewalks = 5m x 700m x 2 = 7,000m^2

Source: JICA Survey Team

10.4 Bridge Design

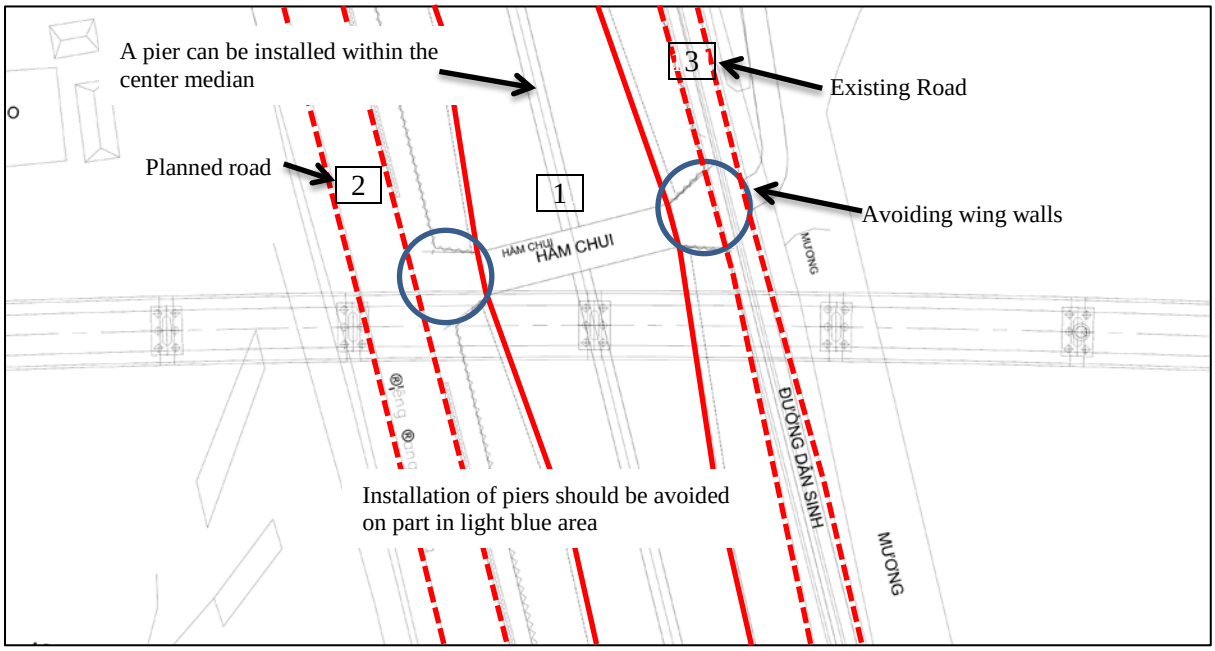
10.4.1 Bridge Length Crossing Over the Expressway

Bridge length is determined from the locations of abutment on both sides. Since construction cost of a bridge is usually dependent on the bridge length, determination of abutment locations is a critical issue in bridge planning in terms of minimizing construction cost.

(1) Control Points in Crossing the Expressway

Figure 10.4-1 shows control points in planning the locations of piers.

- Center median of the expressway (a pier can be installed).
- Box culvert for underpass of the expressway (piers should not touch wing walls on both sides).
- Existing two-lane road on the right side (east side) of the expressway (piers should avoid this road which is to be widened and improved under LCB-2).
- Planned road on the left side (west side) of the expressway (piers need not avoid this road at present which is to be planned again adjusting the pier in the future design stage).

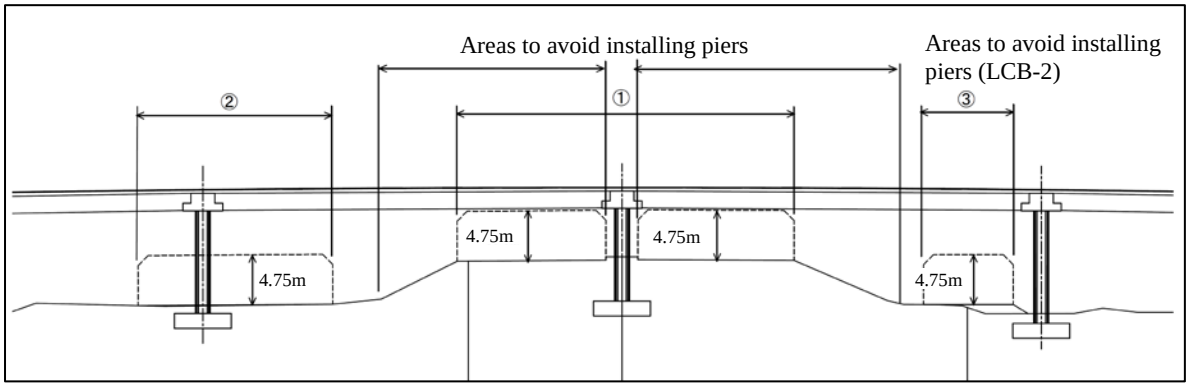


Source: JICA Survey Team

Figure 10.4-1 Control Points in Bridge Planning

(2) Vertical Clearance

Vertical clearance and areas to avoid installation of piers are shown in **Figure 10.4-2**.



Source: JICA Survey Team

Figure 10.4-2 Vertical Clearance and Areas to avoid Installation of Piers

(3) Location of Abutments

Figure 10.4-3 and **Figure 10.4-4** show locations of soil survey points conducted in this survey and soil conditions (boring logs) on both sides obtained:

- A1 Abutment (bore-hole No. Bh-f1): Soft cohesive soil layer exists down to 7.0m deep from the ground surface (N values are less than 5)
- A2 Abutment (bore-hole No. Bh-f2): Soft cohesive soil layer exists down to 6.5m deep from the ground surface (N values are less than 5)

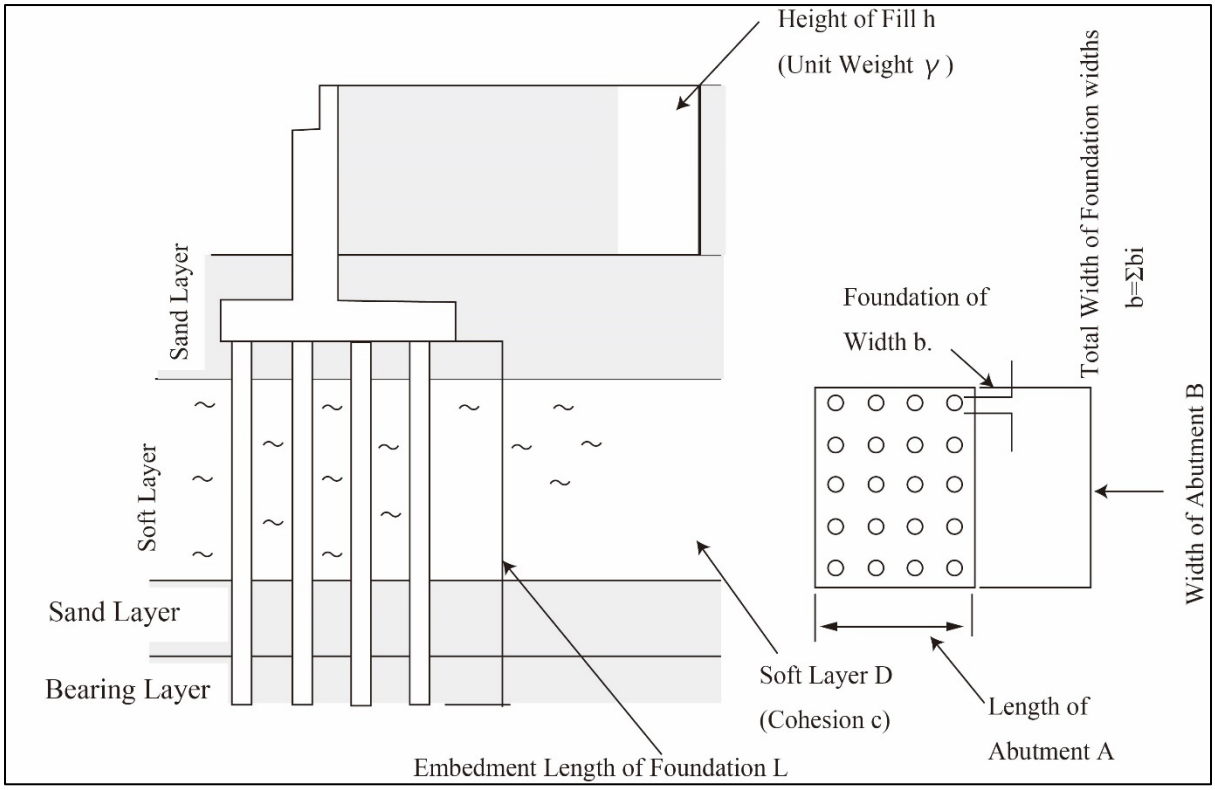
When constructing an abutment which is constantly subjected to eccentric load in soft ground, there is a possibility of lateral movement of its foundation. The lateral movement may sometimes break expansion joints and deform the abutment.

The locations of abutment are planned on places where lateral movement is estimated not to occur, which can be judged with the formula (10.3-1) stipulated in Specification for Highway Bridge prepared by Japan Road Association (JRA).

$$I = \mu 1 \times \mu 2 \times \mu 3 \frac{yh}{c} \gamma \qquad (10.3\text{-}1)$$

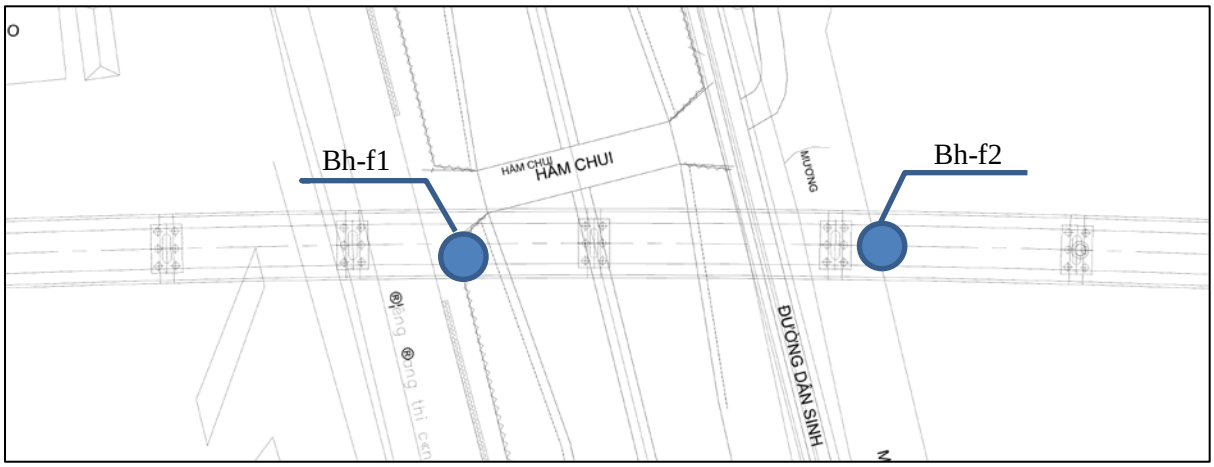
where, (please refer to **Figure 10.4-5**)

I: lateral movement-identifying index
μ1: corrective coefficient of soft ground thickness, $\mu 1 = D/L$
μ2: corrective coefficient of foundation body resistance width, $\mu 2 = b/B$
μ3: corrective coefficient of abutment length, μ3= D/A (≤3.0)
ɤ: unit weight of filling material (kN/m3)
h: height of backfill (m)
c: average value of cohesion in soft ground (kN/m2)
D: soft ground thickness (m)
a: abutment length (m)
B: abutment width (m)
b: total width of foundation bodies (m)
L: embedded depth of the foundation (m)



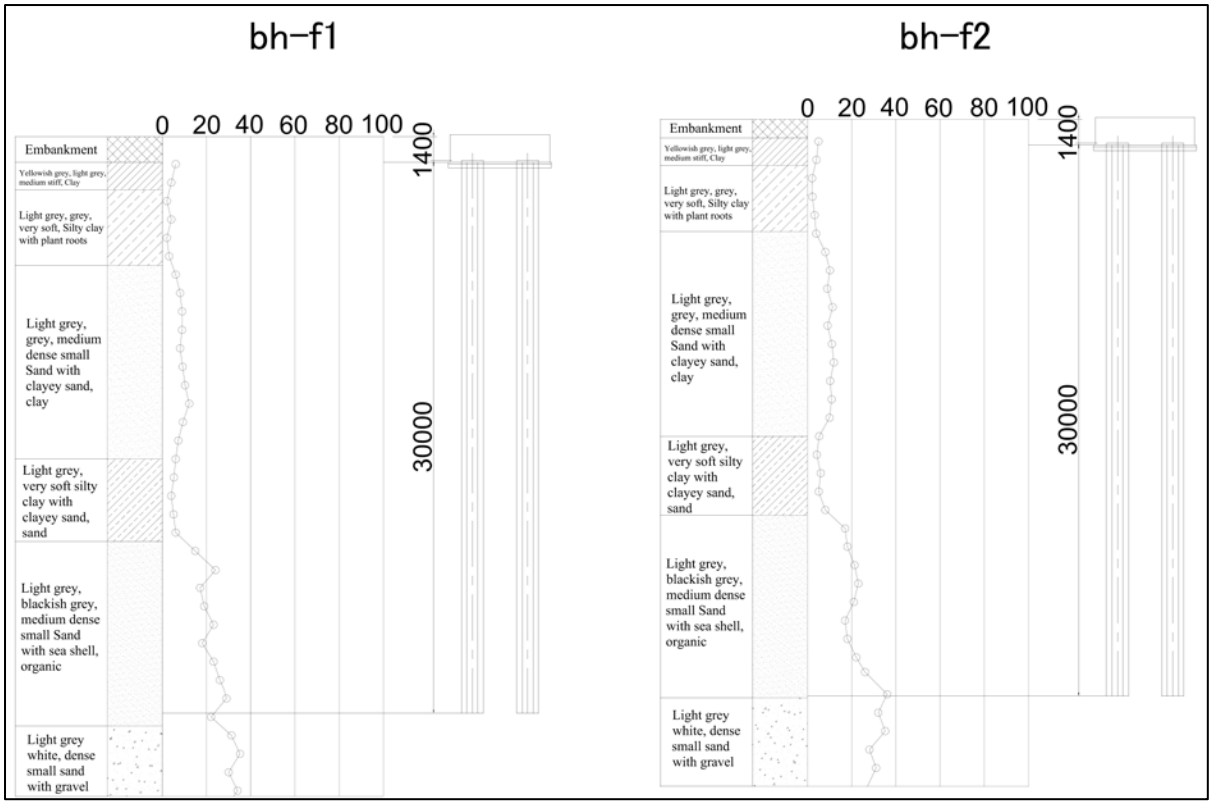
Source: Specifications for Highway Bridges, Japan Road Association, 2002

Figure 10.4-3 Foundation Subjected to Lateral Loads



Source: JICA Survey Team

Figure 10.4-4 Locations of Soil Survey



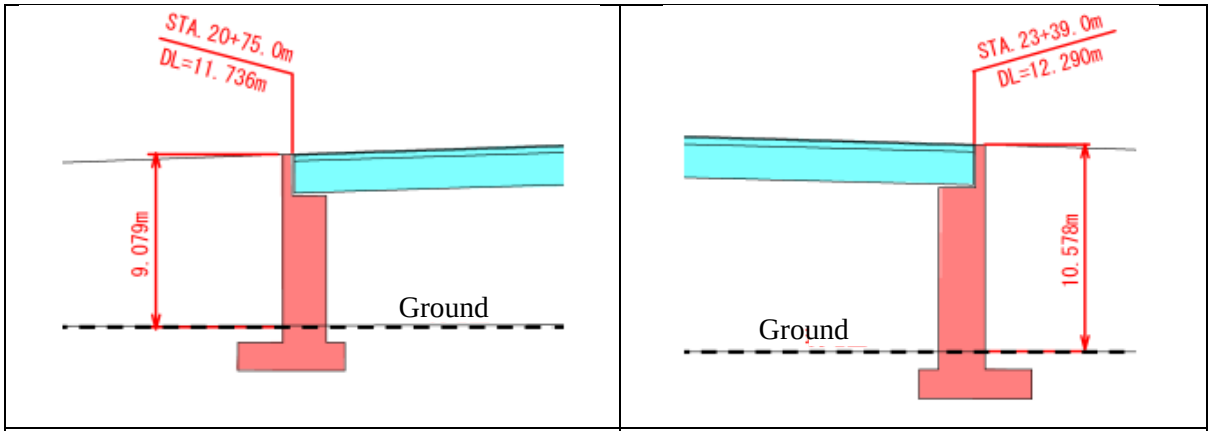
Source: JICA Survey Team

Figure 10.4-5 Boring Logs

Through the study above, the location of abutments on both sides are recommended as follows:

A1 Abutment: STA20+44.0m (Approximately 9.0m high) (**Figure 10.4-6**)

A2 Abutment: STA23+83.0m (Approximately10.0m high) (**Figure 10.4-6**)



Source: JICA Survey Team

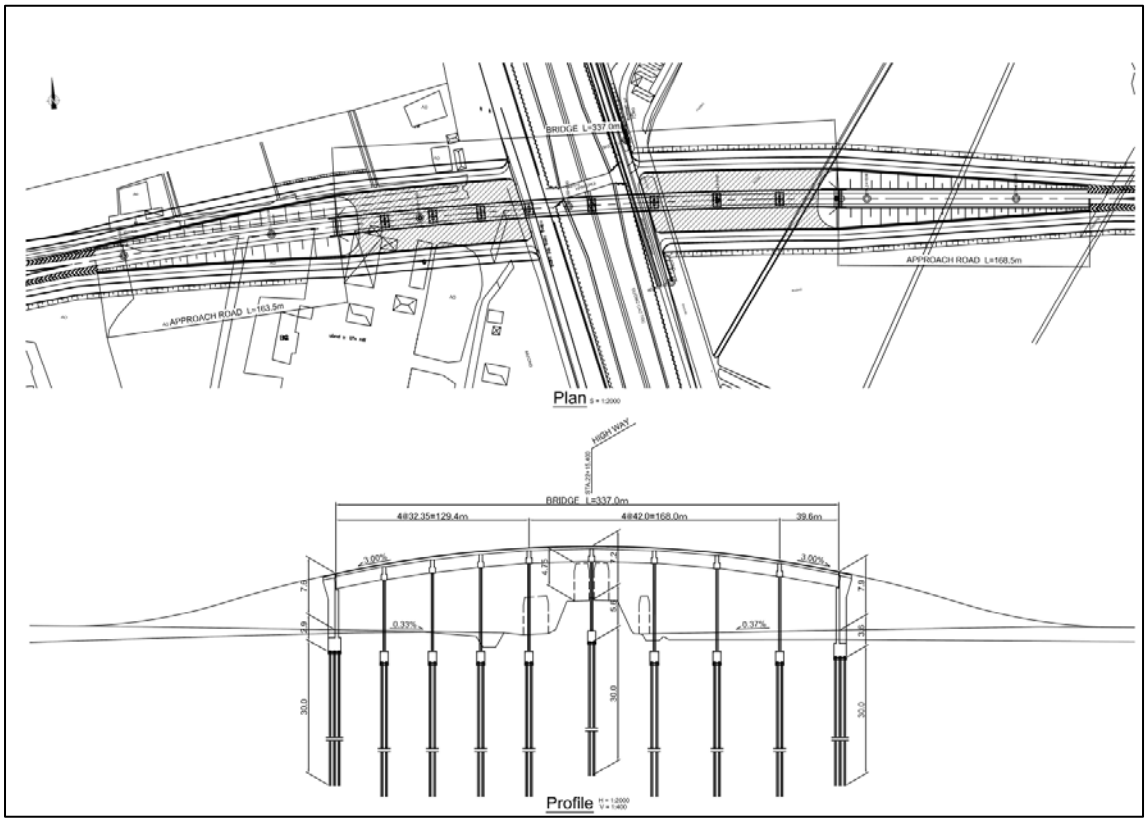
Figure 10.4-6 Location of Abutments on Both Sides

10.4.2 Superstructure

General view of flyover is shown in **Figure 10.4-7**. In the previous survey, the JICA Survey Team planned the superstructure like an I-girder PC bridge similar to the existing flyover across the expressway. However, the JICA Survey Team considered planning the superstructure as 9-span super T

PC bridges in this survey. Thus, the JICA Survey Team made a comparative study on bridge structures shown in **Table 10.4-1**.

As the result of comparison, the JICA Survey Team recommends the bridge structure as 9 span super T PC bridge. General map is shown in **Figure 10.4-8** and **Figure 10.4-9**.



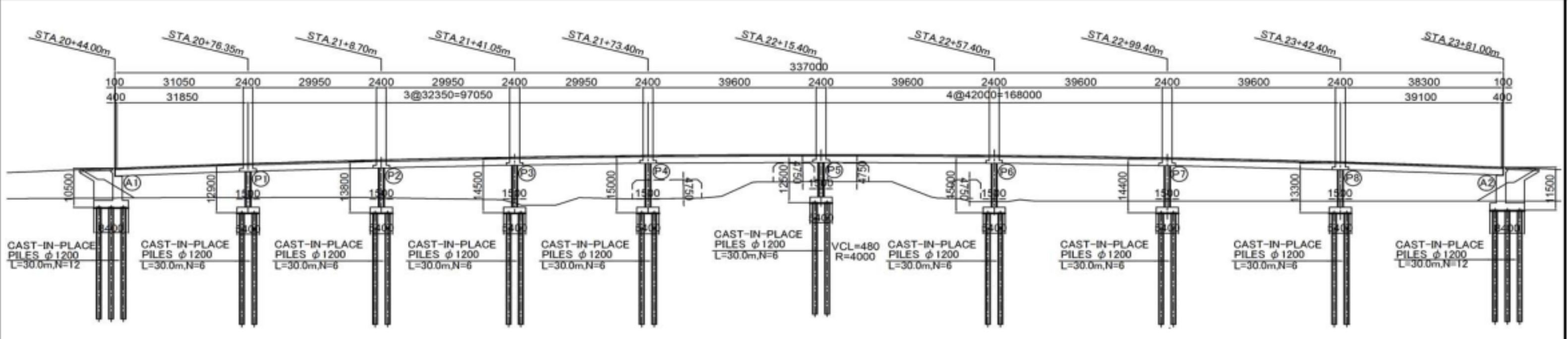
Source: JICA Survey Team

Figure 10.4-7 General View of Flyover

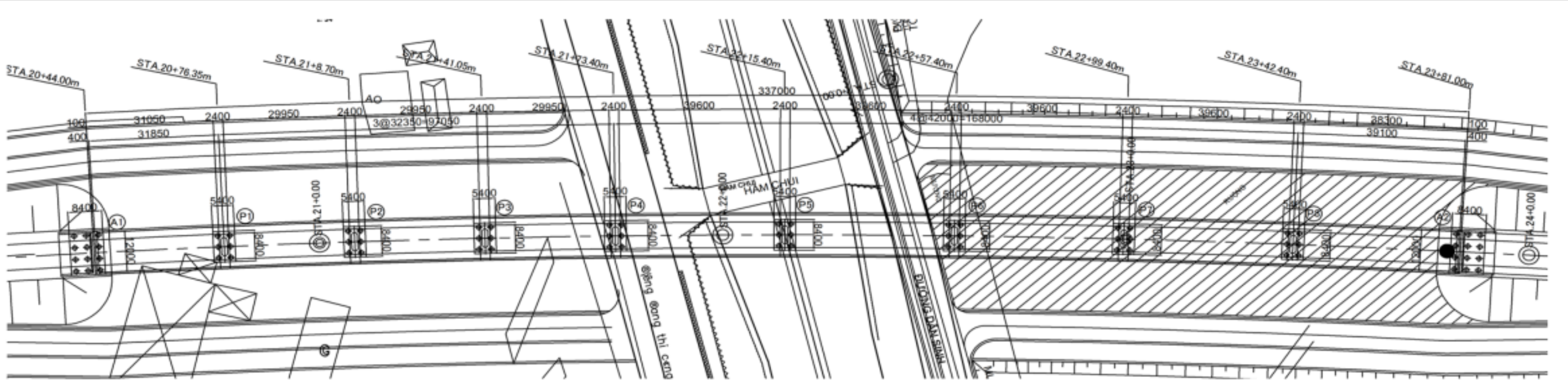
Table 10.4-1 Comparison between Super T PC Bridge and I Girder PC Bridge

Bridge Type : Super T Girder

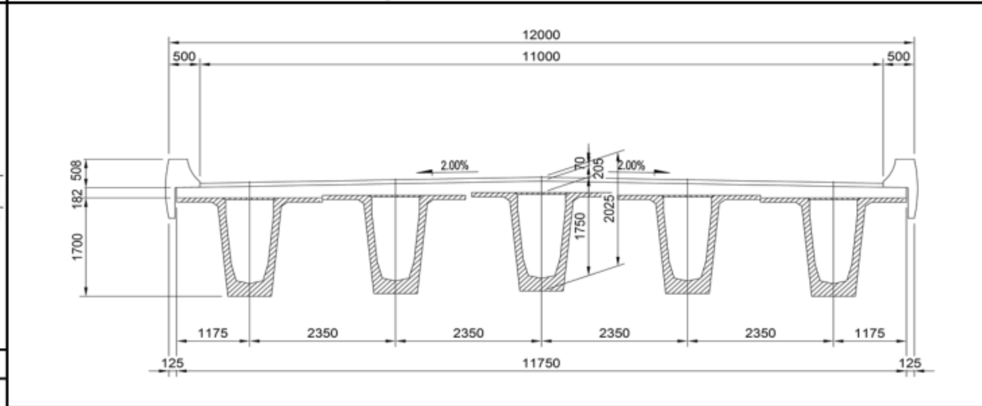
Elevation



Plan



Superstructure section

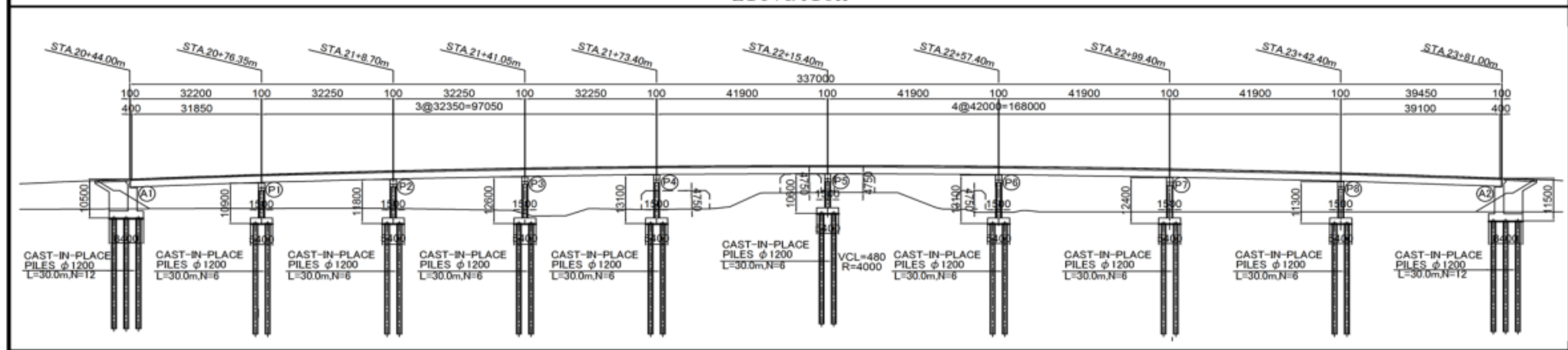


◆ Construction cost	A
◆ Construction characteristic	A
◆ Structural characteristic	A
◆ Maintenance characteristics	A
◆ Overall	A

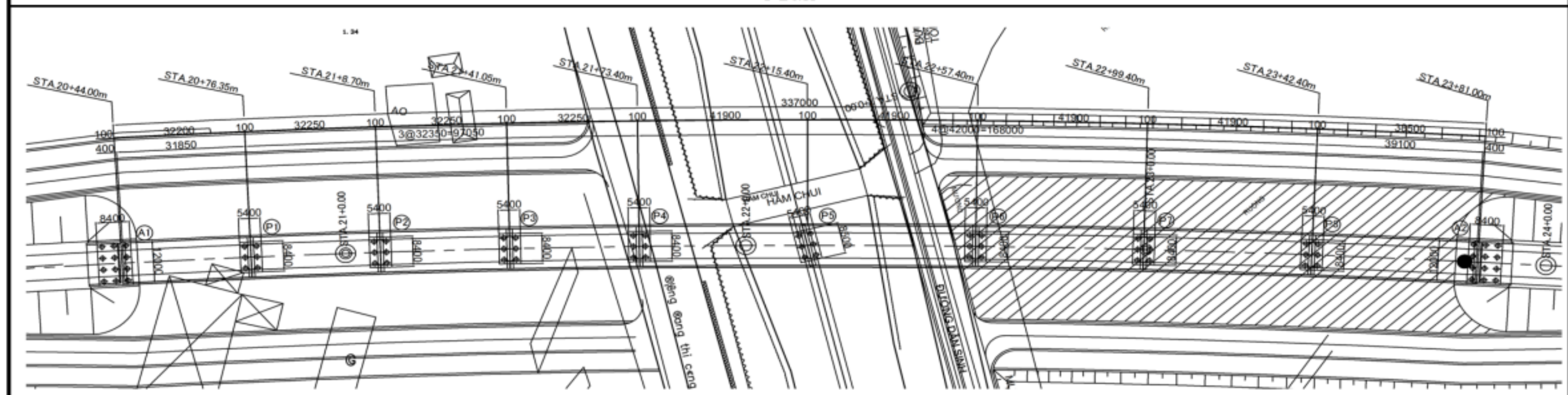
Recommend

Bridge Type : Post Tension I Girder

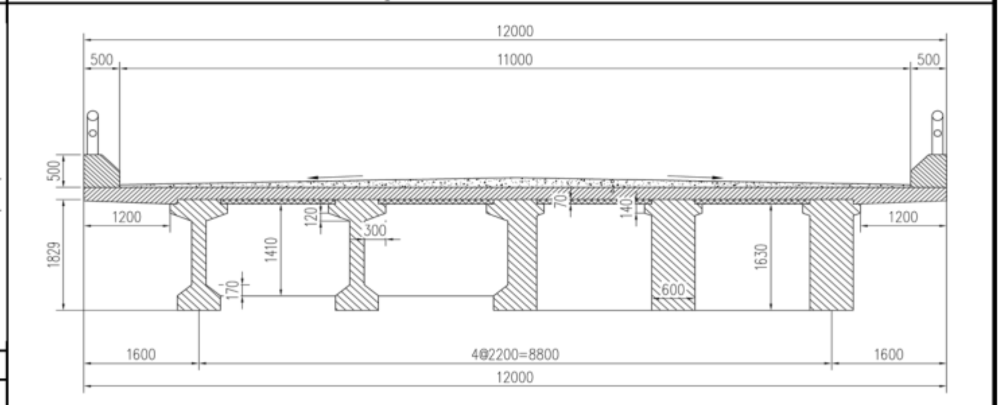
Elevation



Plan

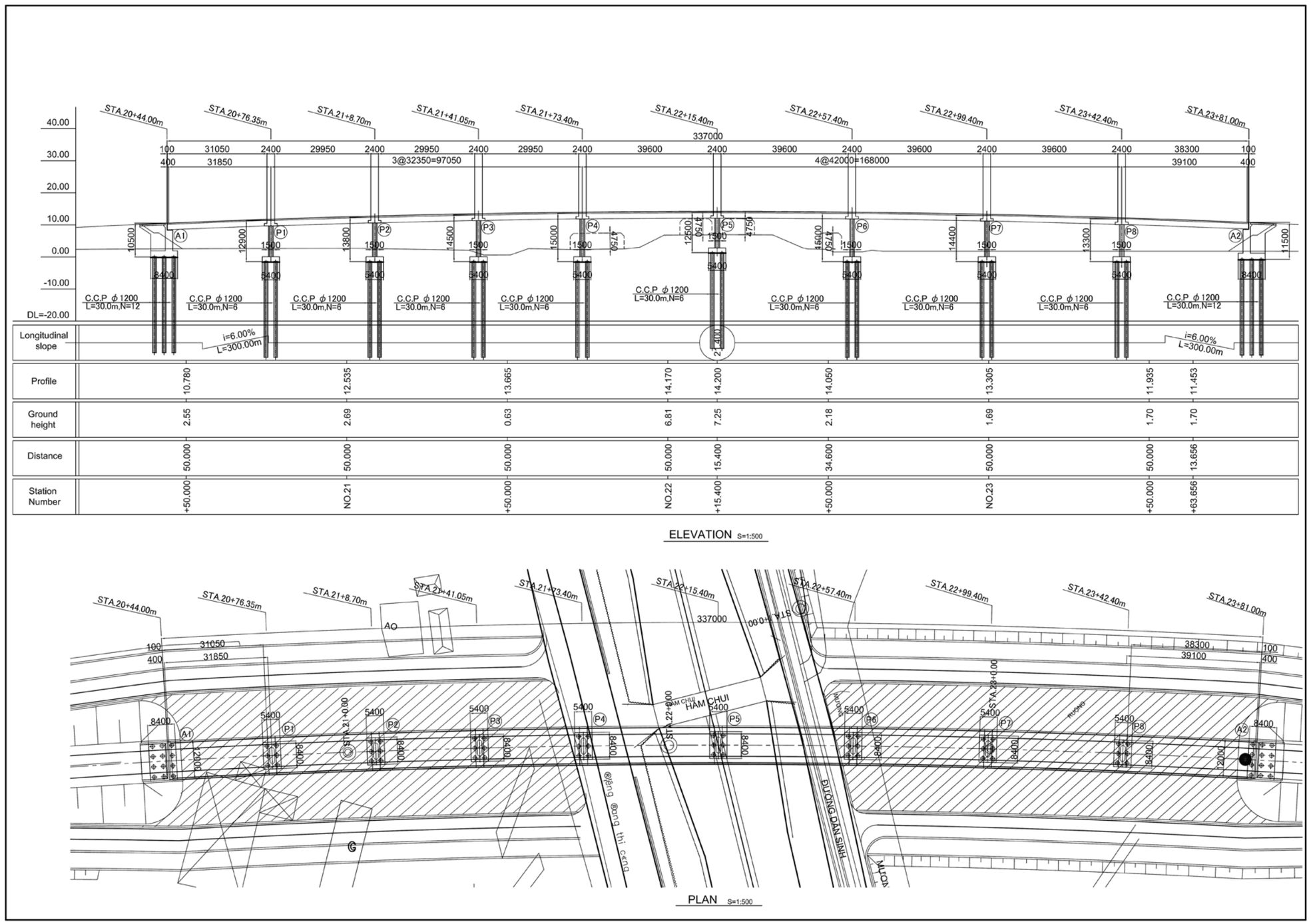


Superstructure section



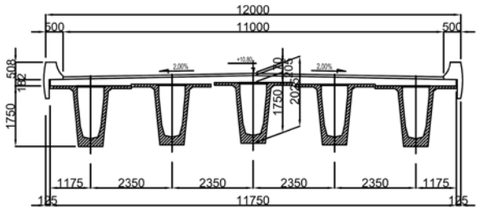
◆ Construction cost	B
◆ Construction characteristic	B
◆ Structural characteristic	A
◆ Maintenance characteristics	A
◆ Overall	B

Source: JICA Survey Team

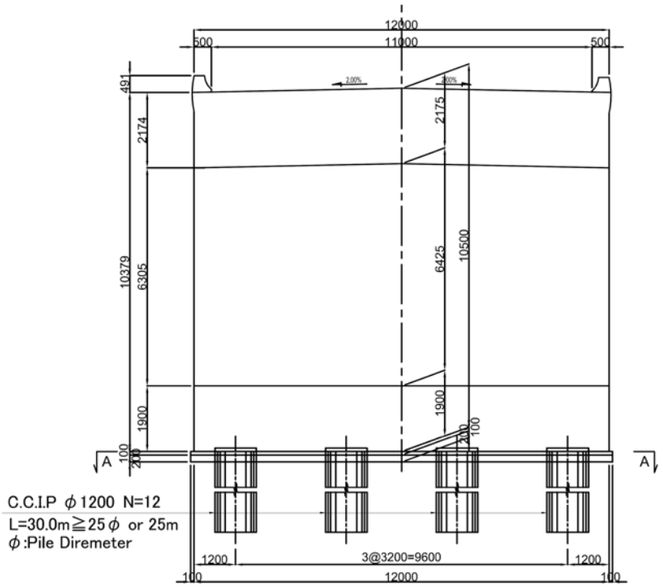


Source: JICA Survey Team

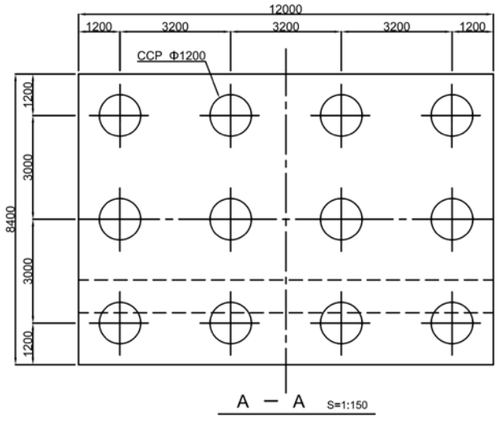
Figure 10.4-8 General Drawing of Super T PC Bridge (1)



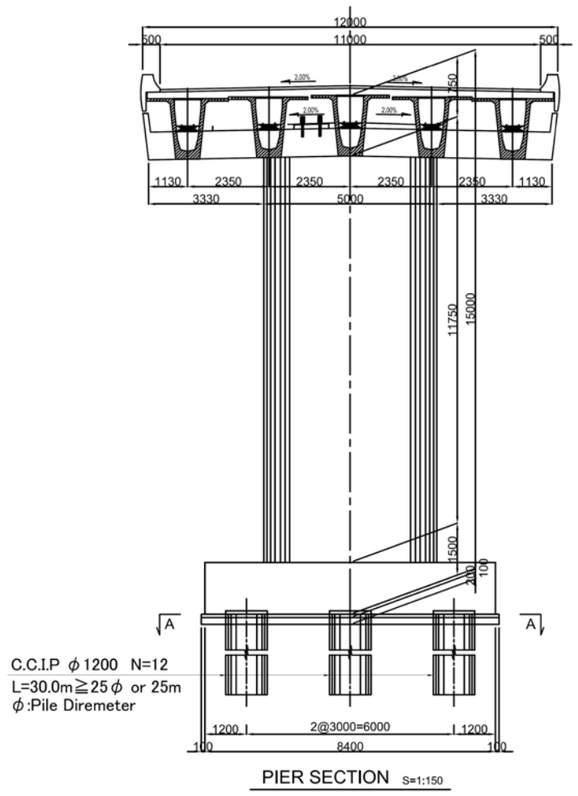
SUPERSTRUCTURE SECTION S=1:150



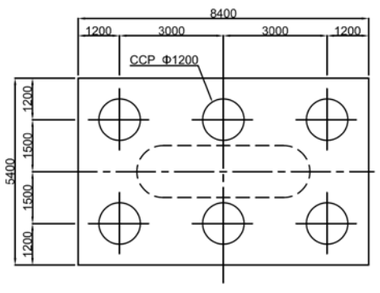
ABUTMENT SECTION S=1:150



A – A S=1:150



PIER SECTION S=1:150



A – A S=1:150

Source: JICA Survey Team

Figure 10.4-9 General Drawing of Super T PC Bridge (2)

CHAPTER 11 CONSTRUCTION PLANNING AND COST ESTIMATION

11.1 Quality Management Plan

The tasks to be carried out for quality management during the construction period are as follows;

- Concrete Works
- Reinforcing Bars and Formworks
- Earthwork
- Pavement Works

Based on the above, the quality control of main items for concrete works is presented, while the quality management of main items for pavement is presented in **Table 11.1-1** and **Table 11.1-2**.

Table 11.1-1 Quality Management Plan of Concrete Works

Item	Test Items	Test Method	Test Frequency
Concrete	Cement Property/Physical Test	AASHTO M85	Once before trial mix and once every 500m^3 batch of concrete; or once during production of cement (Mill sheet)
Aggregate	Property/Physical Test	AASHTO M6	Once before trial mix and once every 500m^3 batch of concrete; and every change of source/quarry location (check supplier data)
	Property/Physical Test	AASHTO M80	Once before trial mix and once every 500m^3 batch of concrete; and every change of source/quarry location (check supplier data)
	Sieve Analysis	AASHTO T27	Once a month
	Alkali-silica Reactive Test(Mortar Bar Method)	ASTM C1260	Once before trial mix and every change of source/quarry location (check supplier data)
	Mineral Composition Test	ASTM C295	Once before trial mix and every change of source/quarry location (check supplier data)
Water	Water Quality Test	AASHTO T26	Once before trial mix and when necessary
Admixture	Quality Test	ASTM C494	Once before trial mix and when necessary (Mill Sheet)
Concrete	Slump Test	AASHTO T119	Once every 75m^3 or per batch
	Air Content Test	AASHTO T121	Once every 75m^3 or per batch
	Compressive Strength Test	AASHTO T22	6 Samples per batch or 6 samples for every 75m^3 of concrete (3 samples each for 7-day strength and 28-day strength)
	Temperature	ASTM C1064	Once every 75m^3 or per batch

Source: JICA Survey Team

Table 11.1-2 Quality Management Plan for Earthwork and Pavement Work

Item	Test Items	Test Method	Test Frequency
Embankment	Density Test (Compaction)	AASHTO T191	Every 500m^2
Base course	Material Test (Sieve Analysis)	AASHTO T27	Once before placing and once every 1,500m^3 or change in source/quarry location.
	Material Test (CBR Test)	AASHTO T193	Once before placing and once every 1,500m^3 or change in source/quarry location.
	Dry Density Test (Compaction)	AASHTO T180	Once before placing and twice every 1,500m^3 or change in source/quarry location.
	Field Density Test (Compaction)	AASHTO T191	Every 500m^2

Item	Test Items	Test Method	Test Frequency
Asphalt paving	Material Test (Sieve Analysis)	AASHTO M43,M80	Once before placing and once every 1,500m3 or change in source/quarry location.
	Material testing (density and percentage of absorption).	AASHTO T84	
	Density-in-situ examination.	AASHTO T209	Every 200m
	Temperature survey		Every track
Modified asphalt paving	Marshall stability test	ASTM D 1559-89	Design stage: Five samples every mix, three pieces = 15 times Trial mix stage: : Three samples every mix, three pieces= 9 times Paving stage: Once before placing
	Dynamic Stability Test	Measurement of Plastic Deformation by Wheel Tracking Machine	At Trial Mix: Once per 1 mix At Construction: Once per paving asphalt of 1,000 ton
	Other tests	JIS	as may be necessary

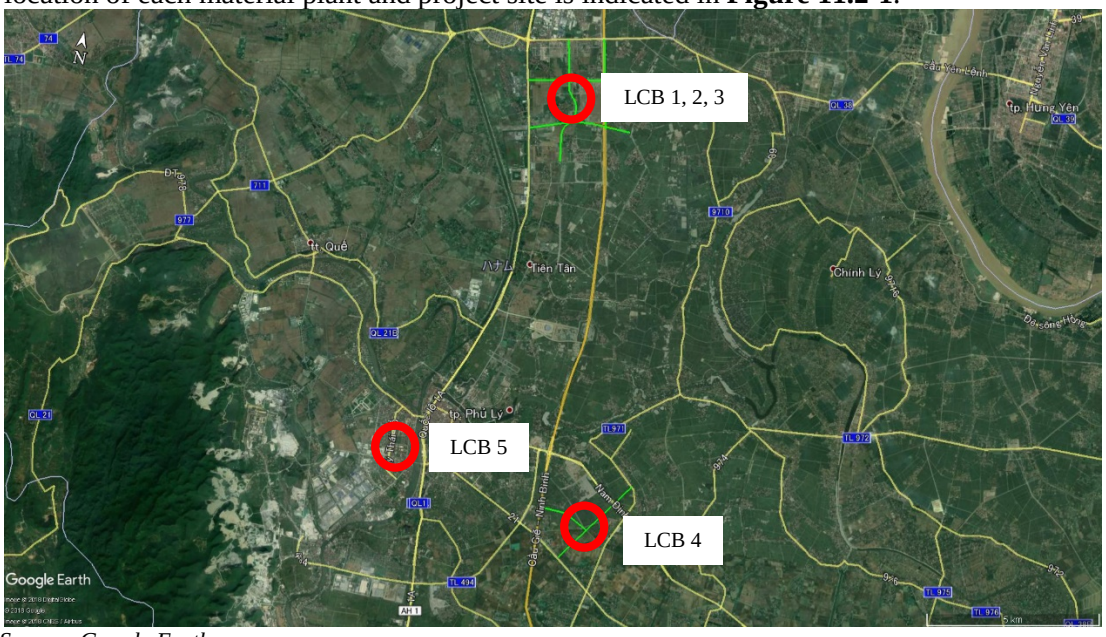
Source: JICA Survey Team

11.2 Procurement Plan of Construction Material

The contractor is able to procure all construction material for road sector in Vietnam. Main construction material such as mixed concrete, aggregate, soil, stone and asphalt are produced in Ha Nam Province. Other materials also can be procured around Hanoi city.

11.2.1 Location of Main Material Plants

The location of each material plant and project site is indicated in **Figure 11.2-1**.



Source: Google Earth

Figure 11.2-1 Location Map of Material Plant

(1) Mixed Concrete and Precast Concrete Plant

There are 2 mixed concrete plants in Phu Ly City. Mixed concrete of 120m^3/hour can be supplied to LCB 1, 2 and 3 by mixed concrete plant (2) where is located in 5 km from the project site. Another mixed concrete plant (1) is located in 10 km from LCB-4. The plant (1) can product mixed concrete of 720 m^3/hour and precast concrete material such as concrete pipe, foundation pile, pretension concrete products and precast box culvert. Photos of mixed concrete plants are shown in **Figure 11.2-2**.


Figure 11.2-2 Photos of Mixed Concrete Plant (1) and (2)

(2) Borrow Pit and Asphalt Plant

Borrow pit and asphalt plant are located in southwest of Phu Ly City. Distance to LCB 1, 2 and 3 is 17 km, to LCB 4 is 11 km. The supply capacity of the borrow pit is 4,000 m^3 per day. The borrow pit produces aggregate for concrete, base course material, embankment material and organic soil for median strip. The capacity of the asphalt plant is 1200 ton per hour. The photo of borrow pit and asphalt plant are shown in **Figure 11.2-3**.


Figure 11.2-3 Photo of Borrow Pit and Asphalt Plant

(3) Sand Pit

There are several sand pits beside a river in Phu Ly City. These sand pits have a sufficient capacity to supply sand to each project site.

(4) Disposal Site

Disposal site for construction waste materials is located next to mixed concrete plant (1). A charge for use of the disposal site is approximately 20,000-VND per 1m^3 of waste. However, the price of the charge is decided by negotiation between contractor and administrator of the disposal site.

11.3 Basic Condition of Cost Estimation

11.3.1 Base Year for Cost Estimation

The base year for cost estimation is September 2017.

11.3.2 Exchange Rate

Exchange rates are shown as follows.

- US$1 = ¥109.0
- US$1 = VND22,900
- VND1 = ¥0.00476

11.3.3 Currency for Cost Estimation

The cost component shall consist of foreign currency and local currency portions. Vietnam Don shall be used as the monetary unit for the local currency portions. But Japanese Yen shall be used as the monetary unit for foreign currency portions.

(1) Local Currency Portion

- All labor costs
- Costs of construction materials and equipment lease locally procured
- Value-Added tax (VAT)

(2) Foreign Currency Portion

- Cost of service procured form Japan and/or third counties.

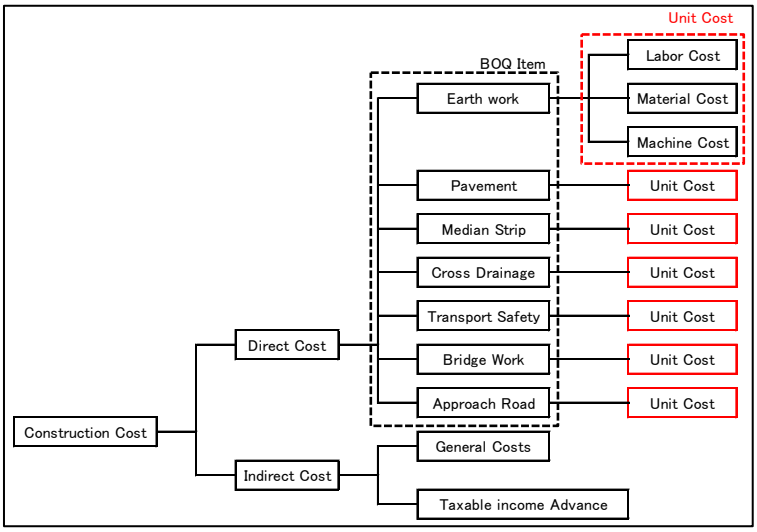
11.3.4 Reference Guidelines and Manuals

The cost estimation is referred to the following guidelines or manuals indicated below.

- Announcement No.9/2016/CBGVL-LS: DOC & DOF Ha Nam PPC, September 27th 2016 (Announcement for Construction Material Cost)
- Circular No.06/2016/TT-BXD: Ministry of Construction, March 1st 2016 (Circular for Guiding Formulation and Management of Costs of Investment In Work Construction)
- Circular No. 02/2015/TT-BLDTBXH: Ministry of Labor, Invalids and Social Affairs, 02nd February 2015 (Guiding the Employer's Compensation, Benefit and medical Expenses for Employees Suffered from Occupational Accidents and Diseases)
- Circular No. 05/2016/TT-BXD: Ministry of Construction, 10th March 2016 (Determination Labor Cost the Construction Cost Management 2016)

11.3.5 Methodology of Cost Estimation

Costs for construction work of road sector are estimated on unit price basis. The construction cost consists of direct cost and indirect costs. The direct cost consists of equipment, material and labor costs and indirect cost includes general costs and taxable income advance as following (**Figure 11.3-1**).



Source: JICA Survey Team

Figure 11.3-1 Composition of Construction Cost

Composition of the unit price as well as production rate is basically referred to the latest guidelines and manuals in each announcement or circular by Vietnamese Government. The composition of unit price

is as described below.

11.4 Direct Cost

11.4.1 Labor Cost

The labor rates are estimated by the Ministry of Construction based on the minimum labor rate. The labor wages used in the cost estimates exclude social insurance, medical insurance, union funds, and unemployed insurance. These insurance fees have been counted in the general costs.

11.4.2 Material Cost

In accordance with "Announcement for Construction Material Cost by Ha Nam PPC 27th September 2016", Material cost is the maximum cost including transportation fee and other cost to the construction site.

11.4.3 Machine Cost

Machine cost is calculated by "Price chart of machine day work and construction devices of Ha Nam province" that Ha Nam PPC published. This price chart is calculated based on equipment ownership cost.

11.5 Indirect Cost

11.5.1 General Costs

The rate applicable to general costs is shown in **Table 11.5-1**. The project using ODA capital applies the rate of civil works in the table. General costs range from 5.2 % to 6.5 % of the estimated direct cost. This includes insurance fee such as social insurance, medical insurance, union funds, and unemployed insurance.

Table 11.5-1 Rate for General Costs

Unit: %

No	Types of works	Gxd (no TAX) in approved general construction investment (billion dong)				
		≤15	≤100	≤500	≤1000	>1000
1	**Civil works**	**6.5**	**6.0**	**5.6**	**5.4**	**5.2**
	Particularly renovations/ restoration of cultural, historic relics	10.0	9.0	8.6	8.4	8.2
2	Industrial works	5.5	5.0	4.6	4.4	4.2
	Particularly construction works for tunnels, pits	6.5	6.3	6.0	5.8	5.7
3	Transport works	5.5	5.0	4.6	4.4	4.2
	Particularly underground traffic works	6.5	6.3	6.0	5.8	5.7
4	Agricultural and rural development works	5.5	5.0	4.6	4.4	4.2
5	Technical infrastructure works	5.0	5.0	4.1	3.9	3.7

Source: Circular no. 06/2016/TT-BXD: Guidance of defining and managing investment cost by Minister of Construction on 10th of March, 2016

11.5.2 Taxable Income Advance

The rate applicable to taxable income advance is shown in **Table 11.5-2**.

Table 11.5-2 Rate for Taxable Income

Unit: %

No	Types of works	Taxable income
1	**Civil works**	**5.5**
2	Industrial works	6.0
3	Transport works	6.0
4	Agricultural and rural development works	5.5
5	Technical infrastructure works	5.5
6	Installation technology equipment in construction works, line assemble, material/ components/ construction structure experimental testing	6.0

Source: Circular no. 06/2016/TT-BXD: Guidance of defining and managing investment cost by Minister of Construction on 10th of March, 2016

11.5.3 Construction Cost for Each Packages (LCB1 to LCB5)

Construction cost for 5 packages are shown as in **Table 11.5-3** to **Table 11.5-7**.

Table 11.5-3 Construction Cost of LCB1

No	Item	Cost	
		VND	JPY
I	Direct Cost	230,735,278,660	1,098,299,926
II	General Costs (I*5.9%)	13,613,381,441	64,799,696
III	Taxable Income Advance ((I+II)*5.5%)	13,439,176,306	63,970,479
	Construction Cost (I+II+III)	257,787,836,406	1,227,070,101

Source: JICA Survey Team

Table 11.5-4 Construction Cost of LCB2

No	Item	Cost	
		VND	JPY
I	Direct Cost	143,342,573,549	682,310,650
II	General Costs (I*6.0%)	8,600,554,413	40,938,639
III	Taxable Income Advance ((I+II)*5.5%)	8,356,872,038	39,778,711
	Construction Cost (I+II+III)	160,300,000,000	763,028,000

Source: JICA Survey Team

Table 11.5-5 Construction Cost of LCB3 (Incl. Bridge)

No	Item	Cost	
		VND	JPY
I	Direct Cost	443,957,164,714	2,113,236,104
II	General Costs (I*5.7%)	25,305,558,389	120,454,458
III	Taxable Income Advance ((I+II)*5.5%)	25,809,449,771	122,852,981
	Construction Cost (I+II+III)	495,072,172,873	2,356,543,543

Source: JICA Survey Team

Table 11.5-6 Construction Cost of LCB4

No	Item	Cost	
		VND	JPY
I	Direct Cost	261,465,875,063	1,244,577,565
II	General Costs (I*5.8%)	14,380,623,128	68,451,766
III	Taxable Income Advance ((I+II)*5.5%)	15,171,557,401	72,216,613
	Construction Cost (I+II+III)	291,018,055,592	1,385,245,945

Source: JICA Survey Team

Table 11.5-7 Construction Cost of LCB5

No	Item	Cost	
		VND	JPY
I	Direct Cost	18,389,864,193	87,535,754
II	General Costs (I*6.5%)	1,195,341,173	5,689,824
III	Taxable Income Advance ((I+II)*5.5%)	1,077,186,295	5,127,407
	Construction Cost (I+II+III)	20,662,391,661	98,352,984

Source: JICA Survey Team

Total construction cost for road sector is shown in the following table.

Table 11.5-8 Total Construction Cost for Road Sector

No	Item	Cost	
		VND	JPY
I	LCB1	257,787,836,406	1,227,070,101
II	LCB2	160,300,000,000	763,028,000
III	LCB3 (Incl. Bridge)	495,072,172,873	2,356,543,543
IV	LCB4	291,018,055,592	1,385,245,945
V	LCB5 (Rehabilitation)	20,662,391,661	98,352,984
	Total Construction Cost (I+II+III+IV+V)	1,224,840,456,532	5,830,240,573

Source: JICA Survey Team

11.6 Other Cost

11.6.1 Land Acquisition/ Resettlement Cost

Land acquisition cost for road sector is estimated as shown in **Table 11.6-1**.

Table 11.6-1 Land Acquisition Cost

No.	Item	Cost	
		VND	JPY
I	*LCB-1 to LCB-5*	80,460,637,000	382,992,632
II	*Independent monitoring = 1% (I)*	804,606,370	3,829,926
III	*Survey Cost = 1% (I)*	804,606,370	3,829,926
IV	*Management cost = 2% (I)*	1,609,212,740	7,659,853
VI	*Contingency (10% of I)*	8,046,063,700	38,299.263
	Total	91,725,126,180	436,611,601

Source: JICA Survey Team

11.6.2 Administration Cost

The rate of administration cost is 5.0%.

11.6.3 Consultancy Service Cost

Consultancy service cost is estimated for two stages, namely Detailed Design and Tender Assistant, and Construction Supervision.

(1) Detailed Engineering Cost

The Detailed Design requires six (6) months and the Tender Assistance requires five (5) months.

(2) Construction Supervision Cost

The Construction Supervision requires duration of construction period which is estimated for eighteen (18) months. The defect period follows twelve (12) months after the completion of the construction.

The summary of consultancy service cost is estimated as shown in **Table 11.6-2**.

Table 11.6-2 Consultancy Service Cost

Item	Foreign Currency (Mil. JPY)	Local Currency (Mil. VND)	TOTAL	
			Mil. VND	Mil. JPY
Total of Detailed Design, Tender Assistance and Construction Supervision	361	33,625	109,548	521

Source: JICA Survey Team

11.6.4 Price Escalation Cost

The rate of price escalation is 1.83% for foreign currency portion and 2.86% p.a. for local currency portion.

11.6.5 Physical Contingency Cost

The rate of physical contingency cost is 5.0%.

11.7 Summary of Project Cost

The project cost of road sector is estimated as shown in **Table 11.7-1**.

Table 11.7-1 Summary of Project Cost of Road Sector

Consultancy Item	Foreign Currency (Mil. JPY)	Local Currency (Mil. VND)	TOTAL	
			Mil. VND	Mil. JPY
1. Construction Cost	0	1,224,840	1,224,840	5,830
2. Land Acquisition Cost	0	97,230	97,230	463
3. Price Escalation	0	87,189	87,189	415
4. Physical Contingency	0	65,550	65,550	312
5. Consultancy Service	391	37,021	119,128	567
6. Administration Cost	0	79,645	79,645	379
7. VAT	0	137,655	137,655	655
8. Tax on Consulting Services	0	17,869	17,869	85
9. Import Tax	0	0	0	0
10. Interest during Construction	50	0	10,589	50
11. Front end Fee	14	0	2,991	14
GRAND TOTAL	455	1,747,000	1,842,687	8,771

Source: JICA Survey Team

CHAPTER 12 IMPLEMENTATION STRUCTURE

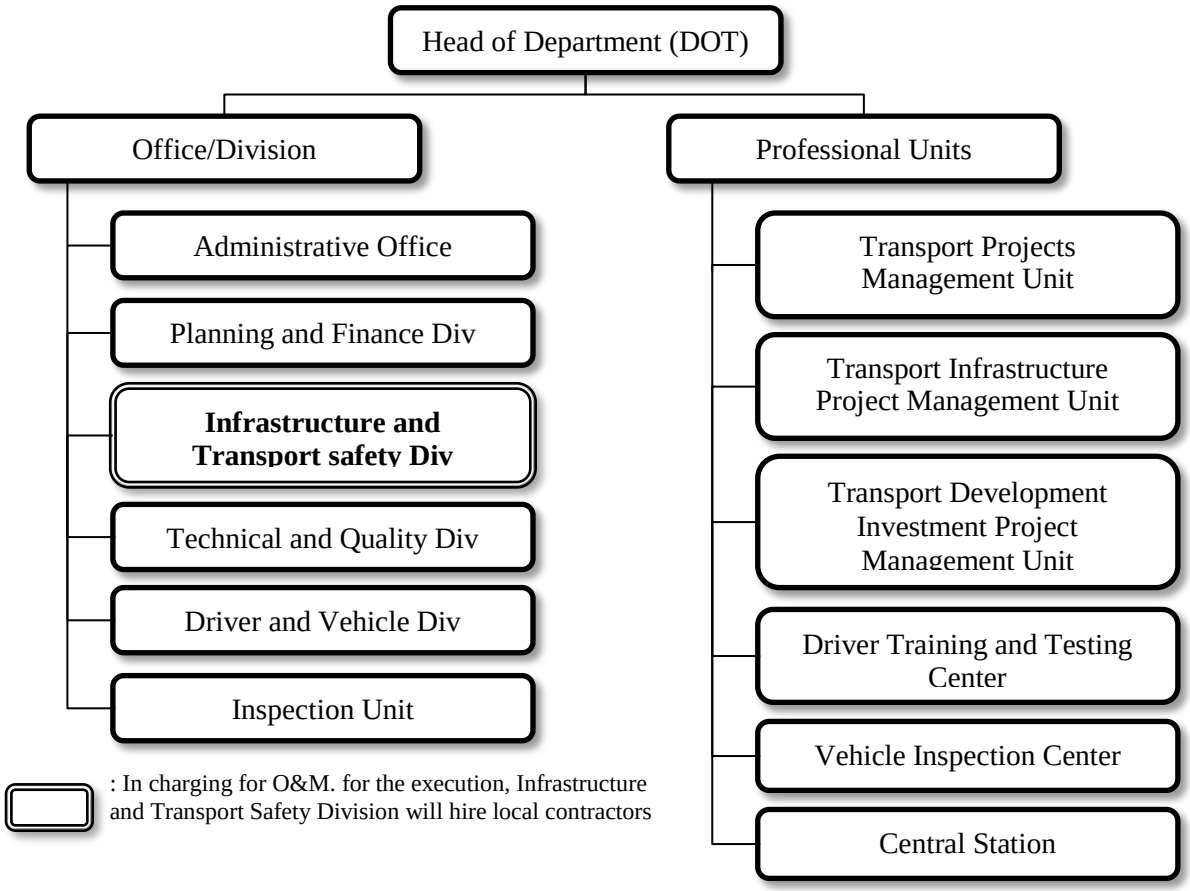
12.1 Organization Structure

The Department of Transport (DOT) of Ha Nam Province implements the O&M for national and provincial roads. Implementation structure of DOT is shown in **Figure 12.1-1**. The budget of operation and maintenance for national roads is allocated from a transport O&M fund under MOT, collected from revenue from toll roads, vehicle registration fees, and vehicle inspection fees. The budget for provincial roads is from the provincial budget and an additional budget allocated from the transport O&M fund. Ha Nam Province collects vehicle registration fees and vehicle inspection fees, and then the transport O&M fund allocates 60% of these fees to DOT as additional budget. The budget for national roads is approved by a central government based on the development plan of DOT. The budget of provincial roads is inspected and evaluated by the Ministry of Finance (MOF) based on the development plan of DOF and then approved by the Provincial People's Committee. In case of large repairs, the budget is periodically allocated from fund under the central government, and a detailed development plan is necessary to be approved. **Table 12.1-1** shows O&M unit cost by DOT. This unit cost is yearly O&M cost per 1km and breakdown is equipment cost, labor cost and TAX by interview to DOT. O&M cost of subject roads calculated as O&M cost times subject road length.

Table 12.1-1 O&M Unit Cost by DOT

Road Type	O&M Unit Cost (Million VND/km/Year)
National Road	25.0
Provincial Road	22.4

Source: DOT



Source: Department of Transport

Figure 12.1-1 Implementation Structure of O&M of DOT

CHAPTER 13 IMPLEMENTATION SCHEDULE

13.1 Overall Project Implementation Schedule

The proposed overall project implementation schedule of road sector is shown in **Table 13.1-1** Contents and schedule of the overall project implementation are shown below;

- Signing of loan agreement will be conducted from June 2019
- Selection of consultant for detailed design will be conducted after pledged for the duration of eleven (11) months from May 2019
- Selected consultant will carry out the detailed design of road sector during six (6) months from April 2020
- The consultant should assist in the tender document preparation from September 2020
- Construction supervision will be conducted for thirty (19) months from February 2021 including defects liability
- Details of consultancy service are in the **Appendix**
- Land acquisition will be conducted by the local government from May 2019 until construction period
- Construction will be conducted from February 2021 for eighteen (18) months, after that defects liability will be observed for twelve (12) months

Table 13.1-1 Overall Implementation Schedule

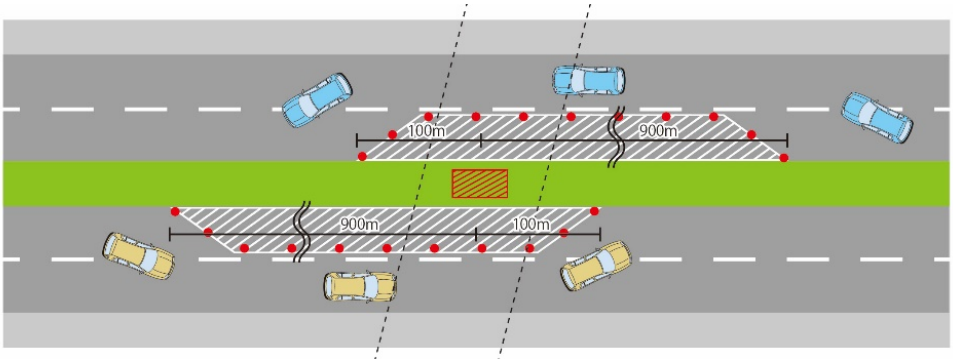
Item	Period	2017	2018	2019	2020	2021	2022
		9 10 11 12		1 2 3 4 5 6 7 8 9 10 11 12	1 2 3 4 5 6 7 8 9 10 11 12	1 2 3 4 5 6 7 8 9 10 11 12	1 2 3 4 5 6 7 8 9 10 11 12
Road Sector							
Pledge		●					
Signing of Loan Agreement				●			
Consulting Service							
Selection of Consulting Firm (D/D, T/A and C/S)	**11**			1 1 1 1 1 1 1 1 1 1 1			
Detailed Design (D/D)	**6**				1 1 1 1 1 1		
Tender Assistance (T/A)	**5**				1 1 1 1 1		
Construction Supervision	**18**					1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	
Land Acquisition	**12**			1 1 1 1 1 1 1 1 1 1 1			

Source: JICA Survey Team

13.2 Detail of Construction Planning

The schedule of construction for road sector planed as shown in **Table 13.2-2**. Contents and schedule of the construction for road sector are shown below.

- Construction of road sector will be divided into 5 packages as local competitive bidding
- Construction period is calculated by unit which refers to the volume of work. Unit which refers to the volume of work is shown in **Table 13.2-1**
- The survey adopts extra-banking as countermeasures for ground subsidence during two (2) months after embankment
- Installing work of pear on median strip of existing express way goes in advance of the other bridge work (*1 in **Table 13.2-2**) and the work will be conducted during night-time (from 8 p.m. to 5 a.m., 9 hours) because it is necessary to regulate the lane of the express way
- The method of the lane closure is shown in **Figure 13.2-1**.



Source: JICA Survey Team

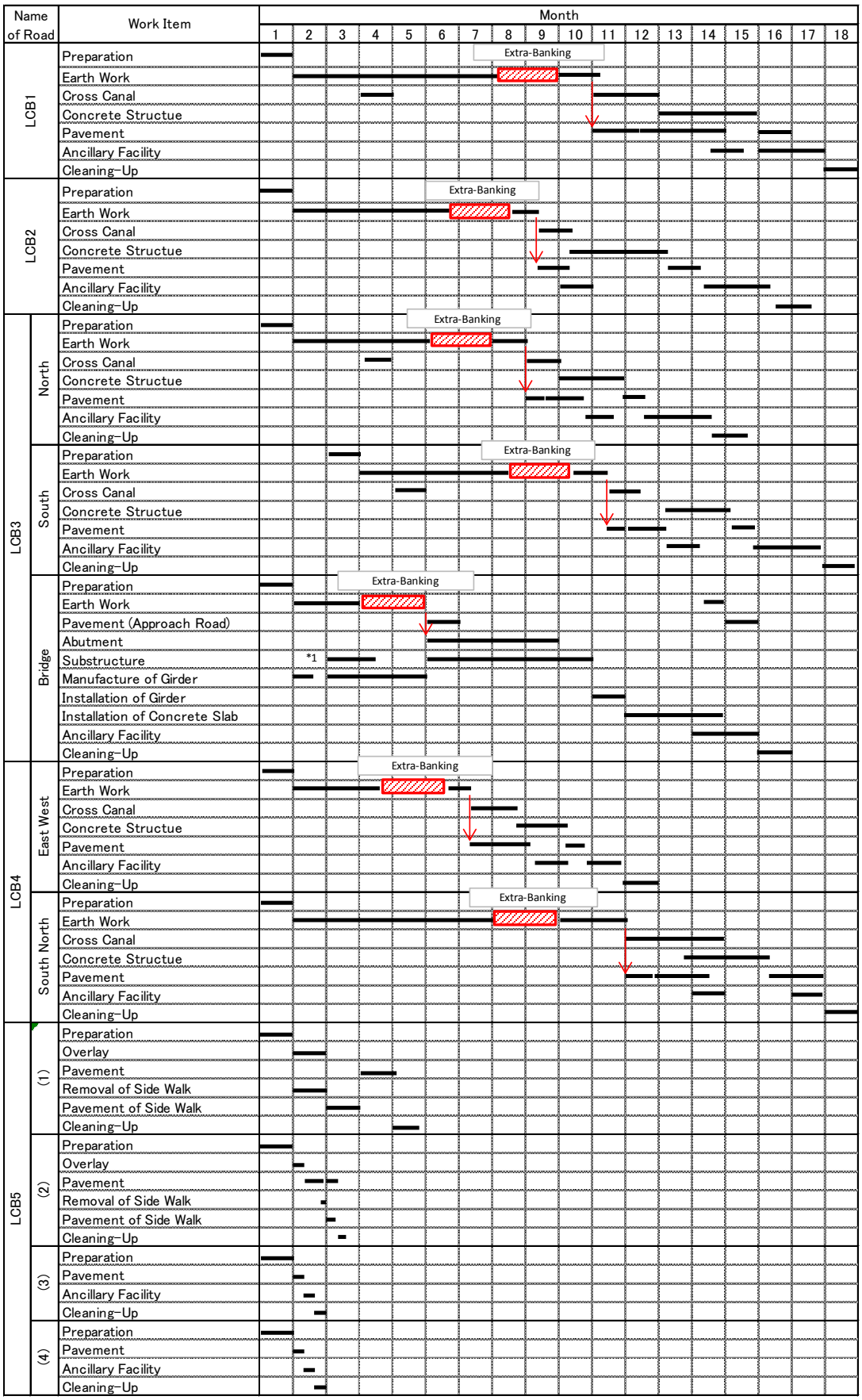
Figure 13.2-1 Method of Lane Closure

Table 13.2-1 Daily Quantity of Work

Work Item	Daily Quantity of Work	Remark
1. Earth Work		
1-1. Excavation (by machine)	300 m^3	Backhoe 1.4m^3
1-2. Backfill (by machine)	350 m^3	Bulldozer 21t
1-3. Embankment (by machine)	770 m^3	Bulldozer 21t
2. Side Ditch Treatment		
2-1. L gutter	11 m	
2-2. U Ditch with Cover (1000*1000)	18 m	
3. Pavement		
3-1. Subbase Course	1,110 m^2	
3-2. Base Course	555 m^2	
3-3. Binder Course	2,300 m^2	
3-4. Wearing Course	2,300 m^2	
4. Bridge		
4-1. Girder Manufacturing	60 days	Lump Sum
4-2. Installation of Girder	5 pc	
5. Road Rehabilitation		
5-1. Overlay	1,800m^2	

Source: JICA Survey Team

Table 13.2-2 Construction Schedule for Road Sector



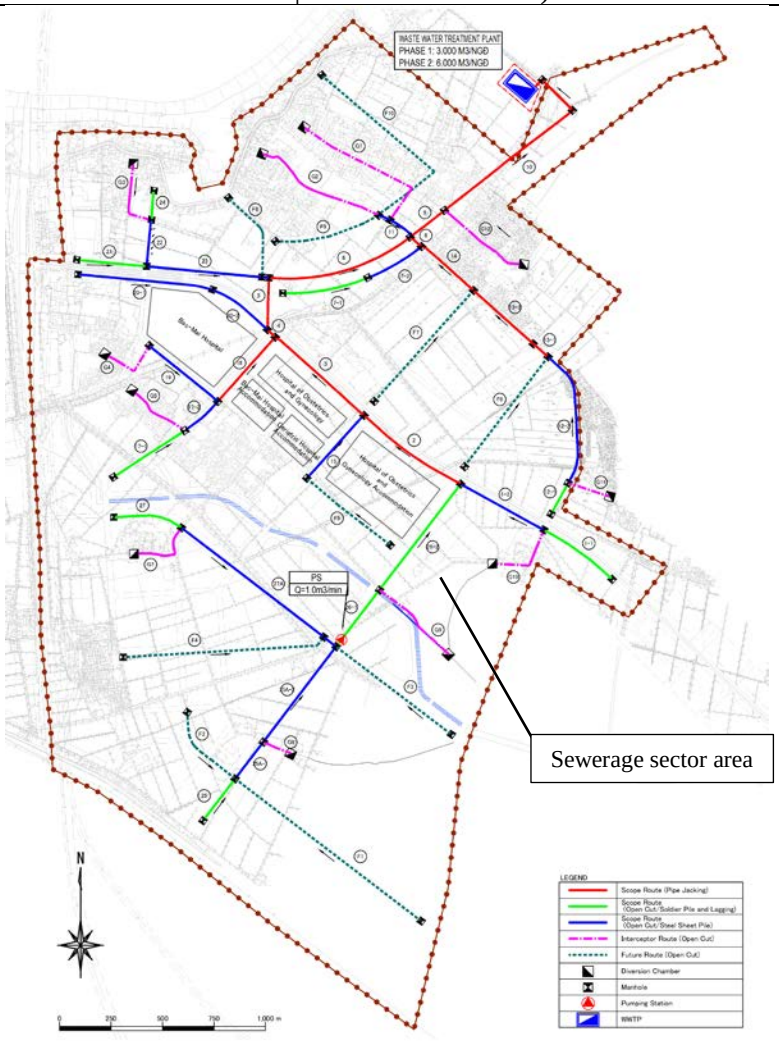
Source: JICA Survey Team

CHAPTER 14 ENVIRONMENTAL AND SOCIAL CONSIDERATIONS

14.1 Overviews of Project Components

The Project is focused on two main components: the sewerage sector and the road sector.

14.1.1 Sewerage Sector

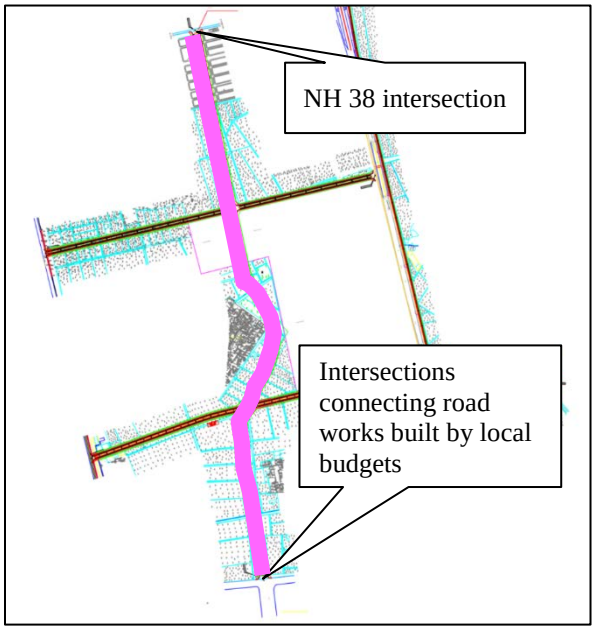
Location	Phu Ly city in HA NAM PROVINCE
Facility Outline	**Design Treatment Capacity;** 3,000 m^3/day (Maximum Daily Wastewater Flow) **Main drainage pipe;** L= about 19.3 km (φ300 mm L = 15.5 km, φ400 mm L = 2.6 km, φ500 mm L = 1.2 km)
Summary Plan	
Project Area	Hospital area. Treatment Facility 23,000m^2, Main Sewer 25,600m^2 Total area:48,600m^2

14.1.2 Road Sector

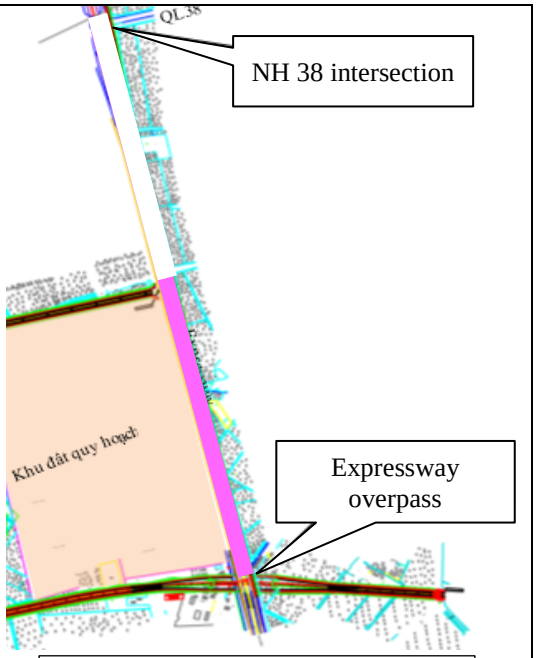
Facility Outline

Project name	Road Classification	Design Speed	Length, Lane width and Number of Lane	Structure
Center road (LCB-01)	Grade IV Plain (Vietnam Standard)	60km/h	Length: 3.5km Width: 68m 4 lanes	
Expressway East Bypass Road (LCB-02)	Grade IV Plain (Vietnam Standard)	60km/h	Length:3.0 km Width: 10.5 m 2 Lanes	
Feeder Road North and South(LCB-03)	Grade IV Plain (Vietnam Standard)	60km/h	(Feeder Road North) Length:2.0 km, Width: 42 m 4 Lanes (Feeder Road South) Length:2.8 km, Width: 42 m 4 Lanes	Flyover across the Expressway (Length:337m, Width:12m, 2 Lanes, Bridge length:440m)
North-South and East- West Cross Road(LCB-04)	Grade IV Plain (Vietnam Standard)	60km/h	(North-South Cross Road) Length:2.9 km, Width: 54 m 6 Lanes (East-West Cross road) Length:1.4 km, Width: 48 m 4 Lanes	
Phu Ly City Rehabilitation Road (LCB-05)	-	60km/h	(Chau Son Bridge) Improvement of bridge surface pavement (L = 0.5km), Replacement of ramp (28 nos) (Hong Phu Bridge) Improvement of bridge surface pavement (L=0.38km), replacement of ramp (22 nos) (Tran Van Chuong road) Overlay on existing pavement with AC pavement C12.5*8 with an average thickness of 7cm (48,300 m2), Resurfacing of sidewalks on both sides (29,440 m2) (Ly Thai To road) Overlay on existing pavement with AC pavement C12.5*8 with an average thickness of 7cm (7,420 m2), Resurfacing of sidewalks on both sides (7,000 m2)	

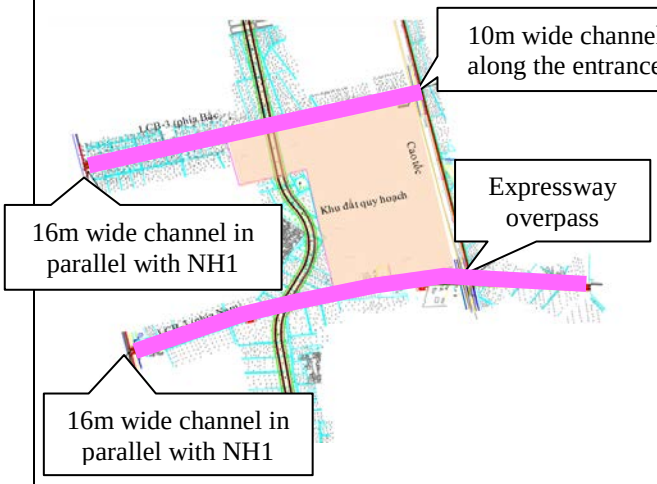
Summary Plan



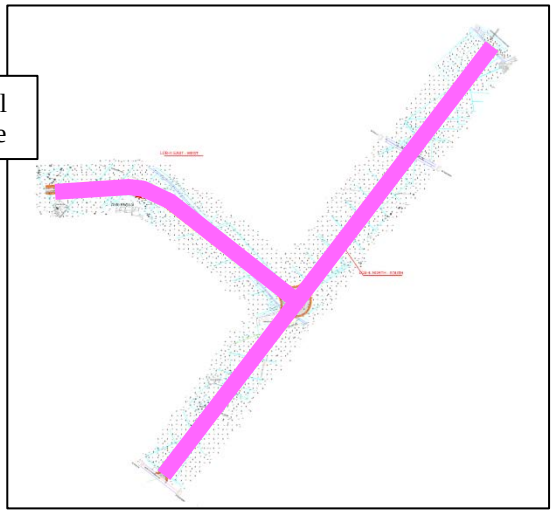
Center road (LCB-01)



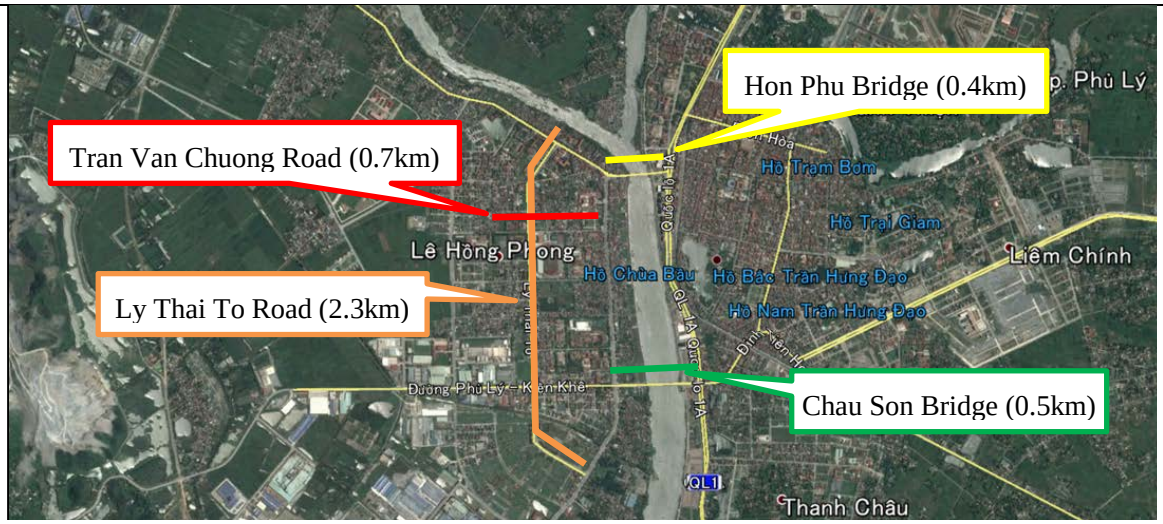
Expressway East Bypass Road (LCB-02)



Feeder Road North and South (LCB-03)



North-South and East- West Cross Road(L CB-04)

	 Phu Ly City Road Rehabilitation (LCB-05)
Project area	LCB-1: 202,349 m^2, LCB-2: 19,980 m^2, LCB-3: 173,870 m^2, LCB-4: 226,593 m^2, LCB-5: No clearance area Total area: 622,792m^2

14.1.3 Environmental Category of this Project

This Project is categorized as "Category B" based on the JICA Environmental and Social Guidelines, 2010 for the following reasons:

The project is not considered to be a large-scale road and sewage sector, is not located in a sensitive area, nor has sensitive characteristics under the JICA guidelines for environmental and social considerations (April 2010), it is not likely to have a significant adverse impact on the environment.

14.2 Current Environmental and Social Situations relevant to the Project

14.2.1 Environmental Situations

(1) Geography

Phu Ly City is the political, economic, and cultural center of Ha Nam Province, located in the center of the province, between the confluence of Day, Nhue, and Chau rivers. Its geographical coordinates are 20°30' - 20°35' north latitude and $105^0$54 - $105^0$58 East longitude.

(2) Geology

Phu Ly city is located in the plain along rivers; the terrain is divided by the rivers and low areas. The general slope of the city's terrain is from West to East. The topographic features of the city are as follows:

- The topography of the old city area in the east of Day River and new urban areas in the west of Day River is raised, reaching the elevation of 3.0 m - 6.8 m;
- The topography of Phu Van region in the north of Day River and Chau River is also raised, reaching the elevation of 3.0 m - 4.5 m.
- The area of rice fields and vegetable fields has an elevation of 1.8 m - 2.2 m.
- Low areas of ponds/marsh have an elevation from - 0.8 to + 0.4 m. The low areas are north of Chau River and east of Day River where the interconnected ponds, lakes and low fields are frequently flooded.

(3) Soil

Physical and chemical factors: According to the report on Environmental Status Ha Nam 2015, the type of soil in Ha Nam is less acidic, the soil fertility is different from the lands. In the farm land near

industrial zones, there is no sign of acidification in industrial clusters- different villages, the pH values are in the range of limit values. According to the result of the physical and chemical indicators of land at the rice field in Phu Ly city, the concentrations of heavy metals in soil such as Pb, Cu, Cd, Zn in the region are in the permitted limits by QCVN 03:2008 BTNMT.

(4) Climate

1) Temperature

The average air temperature is 23.1°C. The highest monthly average temperature is 32.1°C (in July). The highest absolute temperature is 41.5°C. The lowest monthly average temperature is 14.2°C (in January). The lowest absolute temperature is 4.5°C. The hottest months are June, July, and August. The coldest months are January, February, and December.

2) Humidity

The monthly average humidity is 85.1%, and the average absolute lowest humidity of many years is 17 - 41%. The period with the highest humidity is from February to April (87.6% on average).

3) Rainfall

The average rainfall in many years is 1,697 mm. The rainy season lasts from May to October, with total rainfall of the entire season being 1,442 mm, accounting for 85% of the total annual average rainfall. The average rainfall of the 4 continuous months with the highest rainfall (from June to September) is 1,085 mm, accounting for 64% of the annual average rainfall. The dry season is from November to April, with total average rainfall being 255 mm, only accounting for 15% of the total annual average rainfall.

4) Wind Speed

The average wind speed of many years is 3.0m/s. The highest wind speed is typically due to storm conditions, or northeast monsoon, being 36 m/s as observed.

(5) Hydrology

1) River and Canal

The annual volume of average rainfall in Ha Nam province is about 1.602 billion m^3. Annual surface water run-off from the Red, Day and Nhue rivers into the territory is about 14.050 billion m3. Groundwater flows through the territory is always supplemented by those from other regions. Ground water in Ha Nam exists in many layers and is of good quality, sufficient to meet the demand for socio-economic development.

The information of Chau Giang River which is the drainage point of the sewage treatment facility is as follows;

Chau Giang River: Chau Giang River flows through Phu Ly City, in meandering shape and complicated flow. The mainstream follows the left bank from nearby Me Prison to the end of Bien Hoa Road. At the upstream section of Phu Ly Bridge on NR 1A, the mainstream follows the right bank, with uneven riverbed width (100-180 m) and riverbed elevation from -2 m to -4 m. Especially, there is a deep depression (-7 m), across Luong Khanh Thien Primary School.

The hydrological regime of Chau Giang River (in Phu Ly City) is subject to the influence of upstream flood within the Red River system. The average water level of many years for the dry season is +1.2 m (water level respective to 95% frequency being +0.28 m). The average water level of many years for the rainy season is +2.18 m. Design flows creates the source in the dry season and irrigates alluvial soil in the rainy season) are Qdry =36 m^3/s and Qrainy =69.61 m^3/s.

2) Rainwater Drainage

Rainwater drainage depends on agriculture irrigation.

Planning area is under the basin drainage of Chau Giang River. Rainwater is collected in the channel network leading to Lac Trang lake through Lac Trang pumping station (capacity of 29,000m^3/h) and a part of it during Phuoc pumping station (with capacity of 80,000m^3/h) to Chau Giang river.

(6) Natural Environment

1) Protection Area

There are no protection areas in and near the Project area designated by Vietnamese law as a nature reserve (national park, protected areas, Ramsar Wetlands, etc.) or cultural heritage sites.

2) Natural Situation in Ha Nam Province

a) Flora

According to Vietnam National University-level key scientific research subject general report QGTĐ 0603, Ha Nam Province has 51 high-rank plant species of different ecological ranges categorized into the following groups: i) Underwater plant group: pondweed, arrow-leaf species; ii) Water surface plant group: water hyacinth, water cabbage, watermoss, giant salvinia, spinach, coriander; iii) flood-tolerant plant group: consisting the most special plant biomes in terms of both ecological and landscape roles for the area.

b) Fauna

According to preliminary statistics, this area has up to 40 mammal species, 113 bird species, 14 reptile and amphibian species. The forest fauna includes some animal species such as mammal (civet, bat, squirrel, mouse, etc.), reptile (snake, lizard, chameleon, etc.), bird (flower-pecker, starling), etc. At present, found organisms of wild species such as civet or chameleon are of very few numbers.

3) Ecosystem in Project Area

In the project area, there are no endemic species or creatures listed in the Red Book which require protection according to the existing literature. It is expected that the project area has no natural vegetation and no rare or typical fauna and flora, because the project area has been developed agricultural land.

14.2.2 Baseline Survey

(1) Survey Summary

Survey summary is shown in **Table 14.2-1**.

Table 14.2-1 Survey Summary

Item	Survey summary	Number of investigations
Air Quality	Investigation at 4 locations. Each location was monitored at 12 different times a day. The monitoring time was 2 hour/sample within 24 hours.	1 time
Noise and Vibration	Investigation at 4 locations. Each location was monitored at 12 different times a day. The monitoring time was 2 hour/sample within 24 hours.	1 time
Water Quality (Surface water)	Sampling, and analyzing have been undertaken for 01 surface water sample in the discharge areas near WWTP.	1 time

Source: JICA Survey Team

(2) Survey Method

Survey method is shown in **Table 14.2-2**.

Table 14.2-2 Survey Method

No.	Indicator	Frequency	Analysis method
Air Quality			
1	Temperature	2 hour/sample within 24 hours	*QCVN 46:2012/BTNMT*
2	Relative humidity		
3	Wind speed		*ITA-HT-04*
4	Smell		*Organoleptic rating*
5	CO		*ITA-PPTN-WI32*
6	SO_2		*TCVN 5971:1995*
7	NO_2		*TCVN 6137:2009*
8	TSP		*TCVN 5067:1995*
9	$PM_{2.5}$		*TCVN 5067:1995*
10	CxHy		*TCVN 10370-2:2014*
11	Pb		*TCVN 6152 : 1996*
Noise			
1	LAeq	2 hour/sample within 24 hours	*TCVN 7878-2:2010*
Vibration			
1	Vibration	2 hour/sample within 24 hours	*TCVN 6193:2001*
Water Quality（Surface Water）			
1	pH	One sample/location	*TCVN 6492:2011*
2	BOD_5 (20ºC)		*TCVN 6001-1:2008*
3	Temperature		*SMEWW 2550B:2012*
4	Dissolved oxygen (DO)		*TCVN 7325:2004*
5	Electrical Conductivity(EC)		*SMEWW 2510B:2012*
6	Color		*TCVN 6185:2008*
7	Total Suspended Solids (TSS)		*TCVN 6625:2000*
8	Chemical Oxygen Demand (COD)		*SMEWW 5220B:2012*
9	Chlorine (Cl^-)		*TCVN 6194:1996*
10	Nitrite (NO_2^-)		*TCVN 6178:1996*
11	Nitrate (NO_3^-)		*TCVN 6180:1996*
12	Iron (Fe)		*TCVN 6177:1996*
13	Pb		*TCVN 6193:1996*
14	Zn		*TCVN 6193:1996*
15	As		*TCVN 6626:2000*
16	Total N		*TCVN 6638:2000*
17	Total P		*TCVN 6202:2008*
18	Detergent /surfactant		*TCVN 6336:1998*
19	Levels of oil and grease		*TCVN 7875:2008*
20	Coliform		*TCVN 6187-2:1996*

Source: JICA Survey Team

(3) Survey Location

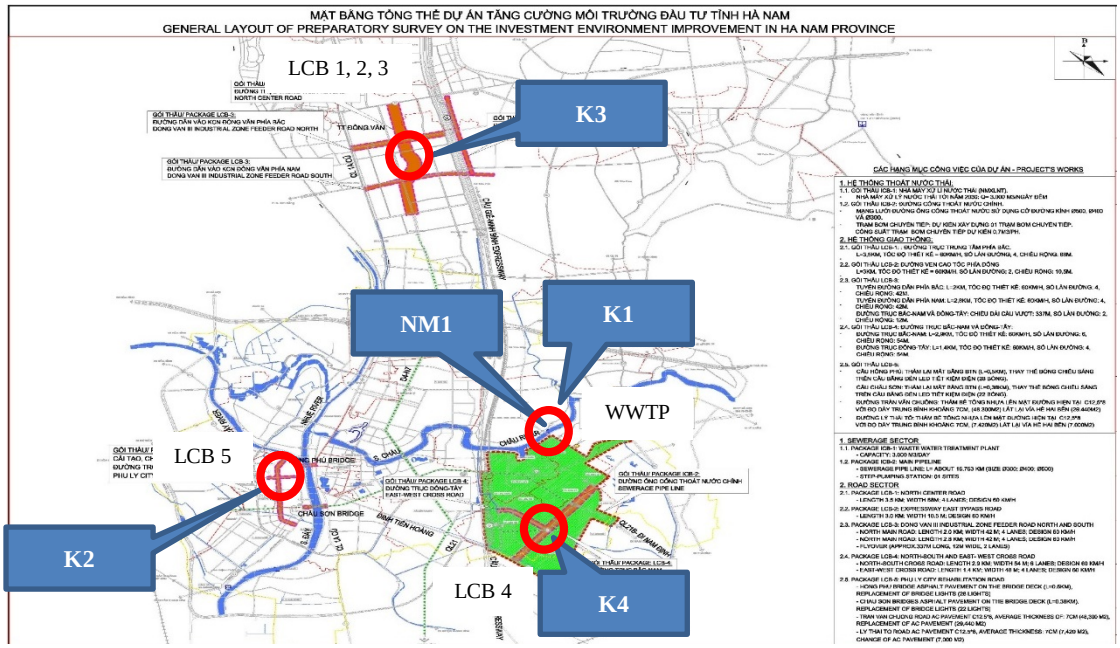
Survey location is shown in **Table 14.2-3** and **Figure 14.2-1**.

Table 14.2-3 Survey Location

No.	Symbol No.	Location Name	Coordinate	Date of implementation
Air quality, Noise and Vibration				
1	*K1*	*Dinh Xa commune - Phu Ly City – Ha Nam Province*	*20.545280ºN. 105.964763ºE*	August/2018
2	*K2*	*Phu Ly city center (near Hong Phu bridge) – Ha Nam Province* Near LCB-5	*20.541977ºN. 105.912244ºE*	November /2016
3	*K3*	*LCB3 (the beginning of LCB3, near highway) – Tien Noi commune – Duy Tien District – Ha Nam Province*	*20.636461ºN, 105.940687ºE*	November /2016
4	*K4*	*Middle of LCB4 – Liem Tiet commune – Phu Ly City – Ha Nam Province*	*20.529812ºN, 105.967422ºE*	November/2016
Water Quality (Surface Water)				

No.	Symbol No.	Location Name	Coordinate	Date of implementation
1	NM1	*Chau Giang River (near WWTP) Dinh Xa commune - Phu Ly City – Ha Nam Province* (Draining point of sewage treatment facility)	*20.548053°N, 105.960775°E*	August/2018

Source: JICA Survey Team



Source: JICA Survey Team

Figure 14.2-1 Location Map of Baseline Survey

(4) Results

1) Air Quality

Result of air quality tests are shown in **Table 14.2-4**.

The analysis results showed that at all the surveyed locations the ambient air quality is still good, the parameters of CO, SO_2, NO_2, TSP, PM2.5, CxHy and Pb are lower compared to the national standards indicated in QCVN 05:2013/BTNMT and QCVN 06:2009/BTNMT.

Table 14.2-4 Results of Air Quality Test

No.	Indicator	Unit	K1	K2	K3	K4	QCVN 05, 06:2013/BTNMT
1	Temperature	°C	27.0	27.5	24.4	24.2	-
2	Relative humidity	%	76.0	77.6	64.8	64.6	-
3	Wind speed	m/s	0.5	0.5	0.2	0.2	-
4	Smell	-	No smell	No smell	No smell	No smell	-
5	CO	µg/m^3	4,465.6	8,374.5	4,875.0	4,896.7	**30,000**
6	SO_2	µg/m^3	82.3	107.2	102.3	103.4	**125**
7	NO_2	µg/m^3	55.9	77.9	71.5	70.3	**100**
8	TSP	µg/m^3	97.0	133.4	189.1	190.7	**200**
9	$PM_{2.5}$	µg/m^3	15.3	41.6	0.9	0.9	**50**
10	CxHy	µg/m^3	808.7	1,312.8	468.2	467.8	**1,500(*)**
11	Pb	µg/m^3	0.0	0.3	0.0	0.0	**1.5**

Note:

- Compared Standard:

+ QCVN 05:2013/BTNMT: National technical regulations on ambient air quality (average 24 hours)
+ (*)QCVN 06:2009/BTNMT: National technical regulations for hazardous substances in the ambient air.
+ **(-):**No regulations.

Source: JICA Survey Team

2) Noise

Results of noise tests are shown in **Table 14.2-5**.

Compared to the noise standard of QCVN 26:2010/BTNMT for common areas from 6pm to 21pm which is 70dBA, K3 and K4 sampling locations have the noise levels higher than the allowable limit.

Compared to the noise standard of QCVN 26:2010/BTNMT for common areas from 21pm to 6pm which is 55dBA, K2, K3 and K4 sampling locations have the noise levels higher than the allowable limit.

The reasons for exceeding the allowable limit are assumed to be as follows;

K2: Located near the center of Phu ly city, traffic volume is high not only during day time but also at night time.

K3: Located near the Expressway, impact from the Expressway can be considered.

K4: Located on the trunk road, many large-sized vehicles such as trucks are running.

Table 14.2-5 Results of Noise Tests

Indicator	Unit	time	K1	K2	K3	K4	QCVN 26: 2010/BTNTMT
Laeq	dBA	*6～21*	55.4	68.6	72.2	72.2	**70**
		21～6	52.6	60.5	56.2	56.1	**55**

Note:

- Compared Standard:

+ QCVN 26: 2010/BTNTMT: National technical regulations on noise.

Source: JICA Survey Team

3) Vibration

Results of vibration tests are shown in Table 14.2-6.

Compared to the vibration standard of QCVN 27:2010/BTNMT for common area from 6pm to 21pm which is 75dBA, all the sampling locations have the vibration levels lower than the allowable limit.

Table 14.2-6 Results of Vibration Tests

Indicator	Unit	Time	K1	K2	K3	K4	QCVN 27: 2010/BTNTMT
Vibration	dB	6～21	42.5	71.9	70.1	69.8	**75**
		21～6	43.1	55.0	64.6	67.4	**Background level**

Note:

- Compared Standard:

+QCVN 27: 2010/BTNTMT: National technical regulations on vibration. (Applicable to Table 1 - The maximum value allowed for the vibration for construction activities in common area)

Background level: the vibration measured in the absence of construction in the area.

Source: JICA Survey Team

4) Water Quality (Surface Water)

Results of water quality tests are shown in **Table 14.2-7**.

Compared to QCVN 08-MT:2015/ BTNMT: national technical regulation on surface water quality, B1 level (national technical regulation on surface water quality for waterway transportation and other purposes with low water quality requirements), BOD, DO, TSS, Fe, As, Levels of oil and grease and Coliform are not set to meet the regulation. The influence of agricultural drainage and domestic wastewater was considered as a factor of nonconformity to the regulation.

Table 14.2-7 Results of Water Quality Tests

No.	Indicator	Unit	Result	QCVN 08-MT:2015 /BTNMT(Column B1)
			NM1	
1	pH	-	7.01	**5.5-9**
2	BOD_5 (20°C) (*)	mg/l	7.22	**15**
3	Temperature	^0C	26.8	**-**
4	Dissolved oxygen (DO)	mg/l	5.3	**≥4**
5	Electrical Conductivity(EC)	mS/cm	114	**-**
6	Color	Pt-Co	14.16	**-**
7	Total Suspended Solids (TSS)	mg/l	35.2	**50**
8	Chemical Oxygen Demand (COD)	mg/l	11.8	**30**
9	Cl^-	mg/l	174.11	**350**
10	NO_2^-	mg/l	0.028	**0.05**
11	NO_3^-	mg/l	4.32	**10**
12	Fe	mg/l	1.01	**1.5**
13	Pb (*)	mg/l	0.012	**0.05**
14	Zn (*)	mg/l	0.28	**1.5**
15	As (*)	mg/l	0.026	**0.05**
16	Total N (*)	mg/l	4.15	**-**
17	Total P (*)	mg/l	1.15	**-**
18	Detergent /surfactant (*)	mg/l	0.15	**0.4**
19	Levels of oil and grease (*).	mg/l	0.56	**1**
20	Coliform (*)	MPN/100 ml	5,342	**7,500**

Note:

- Compared Standard:

+ QCVN 08-MT:2015/BTNMT (B1): National technical regulations on surface water quality in service for the purpose of irrigation or other uses require the same water quality or the intended use as type B2.

+ **(*):** These indicators are certified by subcontractors.

+ **(-):** No regulations

Source: JICA Survey Team

14.2.3 Socio-Economic Overall Situations

Ha Nam Province is located in the southwest of Red River Delta, in the northern key economic zone, is the gateway to Hanoi capital with the natural land area of 84,952 hectares. Phu Ly town is the economic, political and cultural center of the province and 58 km far from Hanoi. Ha Nam has a favorable transportation network, located on the North-South railway axis and National Highway 1ª, an important traffic artery of the country, which creates favorable conditions for economic exchanges and cooperation with the provinces, cities and economic centers of the country.

Ha Nam Province has climatic and hydrological conditions favorable for developing a diversified ecological agriculture, with a variety of tropical, subtropical and temperate flora. Summer has much sunshine and heavy rainfall, high temperatures and humidity, which is suitable for all kinds of tropical plants and animals, all kinds of high-value winter crops and export goods such as tomatoes, cucumbers, etc. Weather conditions are favorable for the development of industries, trade, tourism and services as well as for social and cultural activities and daily life of the population.

Ha Nam Province comprises 6 districts and municipality-level administrative units, including Phu Ly city (the provincial capital), Duy Tien, Kim Bang, Ly Nhan, Thanh Liem district and Binh Luc districts. Some information about the area and the population situation of Ha Nam Province are summarized in **Table 14.2-8**.

Table 14.2-8 Population and Area by each District/City in Ha Nam Province

No.	Administrative units	Area (ha)	Population (people)	Remark
1	Ha Nam province	84,952	802,687	Up to 2015
2	Duy Tien district	12,100.35	117,760	
3	Phu Ly city	8,787.30	139,768	
4	Kim Bang district	187	119,299	
5	Ly Nhan district	167.7	177,864	
6	Thanh Liem district	178.1	114,350	
7	Binh Luc district	155.5	133,646	

Source: Statistical Yearbook of Ha Nam, year 2014

The Investment Environment Improvement Project in Ha Nam province will be implemented in 21 communes and wards of 4 districts and city, including 5 communes of Duy Tien, 14 communes/wards of Phu Ly city, one commune of Binh Luc and one commune of Thanh Liem District.

14.3 Legal and Institutional Framework in Vietnam relevant to Environmental and Social Considerations

(1) Legal and Institutional Framework in Vietnam relevant to Environmental and Social Considerations

1) Legal Framework on Environmental and Social Considerations

Overview of legal framework on environmental and social consideration in Vietnam is shown in **Table 14.3-1**

Table 14.3-1 Overview of Legal Framework on Environmental and Social Considerations

Item	Overview
Relevant laws and standards for social and environmental considerations	2014 Law on Environmental Protection (55/2014/QH13) Implementation and Guidelines for Law on Environmental Protection (Decree 19/2015/ND-CP)
Environmental Impact Assessment (EIA)	2014 Law on Environmental Protection(55/2014/QH13) Implementation and Guidelines for Law on Environmental Protection (Decree 19/2015/ND-CP) Ministry of Natural Resources and Environment (MONRE) Circular No. 27/2015/TT-BTNMT
Disclosure of information	While the MONRE circular requires EIAs to be made public, details on methods for public disclosure are not clearly specified.
Environmental Regulation	QCVN 05:2013/ BTNMT - National technical regulations on ambient air quality; QCVN 08-MT:2015/BTNMT - National technical regulations on surface water quality; QCVN 09-MT:2015/BTNMT - National technical regulations on groundwater quality; QCVN 14:2008/BTNMT - National technical regulations on domestic wastewater. QCVN 39/2011/BTNMT National technical regulations on irrigation water quality; QCVN 26:2010/BTNMT - National technical regulations on noise; QCVN 27:2010/BTNMT - National technical regulations on vibration; QCVN 07: 2009/BTNMT- National technical regulations on hazardous waste threshold; QCVN 03-MT: 2015/BTNMT- National technical regulations on allowable limits of some heavy metals in soil; QCVN 15: 2008/BTNMT- National technical regulations on plant protection chemical residues in soil; QCVN 43:2012/BTNMT - National technical regulations on amount of sediments.
Laws related to Land Acquisition	Land recovery is defined in writing as follows: - Constitution of the Socialist Republic of Vietnam adopted on November 28, 2013. - Land Law No. 45/2013/QH13 dated November 29, 2013 of the National Assembly on Land (effective on July 1, 2014). - Decree No. 43/2014/ND-CP dated May 15, 2014 of the GoV on detailing a number of articles of the Land Law. - Decree No. 44/2014/ND-CP dated May 15, 2014 of the GoV on land prices. - Decree No. 47/2014/ND-CP dated May 15, 2014 of the GoV on compensation, assistance and resettlement upon land acquisition by the State. - Circular No.36/2014TT-BTNMT of the MONRE dated 30 June 2014 detailing the methods for land pricing, adjustment to land price brackets and land price lists, specific land pricing and provision of consultancy on land - Circular No.37/2014/TT-BTNMT the MONRE dated June 30, 2014 on compensation, assistance and resettlement upon land acquisition by the State; - Circular No.76/2014/TT-BTC dated 16th June 2014 of the MOF providing guidance on the implementation of some articles of Decree 45/2014/ND-CP, promulgating regulations on the collection of land use fee; - Decree No. 01/2017/ND-CP dated January 06, 2017 on amendment and supplement of a number of Articles of the Decree detailing regulations on implementation of the Land Law
Resettlement	Resettlement is defined by legislation for land recovery.

Source: JICA Survey Team

The A-RAP in the preparatory study phase could be regarded as the "Policy Framework for Compensation Support and Resettlement", which is regulated on the Decree No. 47/2014/ND-CP dated May 15, 2014 in Vietnam.

The Compensation for the PAPs will be done based on the Land Law. The level of the compensation, which is the same as the JICA Environmental and Social Guidelines, 2010, are described in this A-RAP.

According to The Law on Land No. 45/2013/QH13, Article 87, paragraph 2. Compensation, assistance, resettlement for special cases regulate: "For projects using loans from international organizations, foreign which Vietnam State has committed to a policy framework for compensation, assistance and resettlement it will comply with that policy framework".

2) Legal Framework in Ha Nam Province for Land Acquisition and Resettlement

In addition to the national legislation, the Provincial People's Committees have also issued regulations on land acquisition and resettlement since they are given responsibility for planning and implementation in the province. For Ha Nam Province, the related regulations are as follows:

- Decision No. 38/2014/QD-UBND dated September 12, 2014 on "Compensation, Support and Resettlement when Land is Recovered in Ha Nam Province"
- Decision No.39/2014/QD-UBND dated September 12, 2014 issuing regulations on quota for allocation, recognition of residential land; the minimum area to be split or consolidated of land in Ha Nam province.
- Decision No.41/2014/QD-UBND issuing on the management of resettlement land.
- Decision No.42/2014/QD-UBND dated September 30, 2014 on "Compensation rate for houses, structures and relocation of graves when the State recovers land in Ha Nam province"
- Decision No. 49/2014/QD-UBND dated September 30, 2014 on "Compensation rate for crops and livestock when the State recovers land"
- Decision No. 50/2014/QD-UBND dated December 19, 2014 on "Decisions Regarding Land Value in Ha Nam Province"
- Decree No. 06/2016/QD-UBND dated 14th April 2016 issue on supplementing some contents of compensation, assistance and resettlement when the State acquires land in Ha Nam province, attached with Decision No. 38/2014/ QD-UBND dated 12nd September 2014 of the provincial People's Committee.
- Decree No. 32/2015 QD-UBND dated 24th December 2015 promulgating the compensation rate for house, structures and removal graves upon land acquisition by the State in Ha Nam province in 2016.

(2) Institutional Framework of the Land Acquisition and Resettlement in Ha Nam Province

According to Article 23 of the Land Law 2013, responsibilities for the management of lands are assigned as followings:

- The Government shall perform the unified state management over land nationwide,
- The Ministry of Natural Resources and Environment (MONRE) shall take responsibility before the Government for the unified state management over land,
- Related ministries and ministerial-level agencies shall, within the scope of their respective tasks and powers, assist the Government in performing the state management over land, and
- People's Committees at all levels shall perform the state management over land in their localities according to their competence prescribed in this Law.

According to Article 66 of the Land Law 2013, the competence to acquire land is assigned as follows:

Clause 1 Provincial People's Committee	a) Recovery of land from organizations, religious establishments, overseas Vietnamese, foreign organizations with diplomatic functions, and foreign-invested enterprises, excluding the case prescribed at Point b, Clause 2 below; b) Recovery of agricultural land which is part of the public land funds of communes, wards or townships.

Clause 2 District-level People's Committees	a) Recovery of land from households, individuals and communities; b) Recovery of land from overseas Vietnamese who is allowed to own houses in Vietnam.
Provincial People's Committee; or authorized district-level People's Committees	In case both subjects prescribed in Clauses 1 and 2 of this Article exist in one recovered area.

(3) Roles of Relevant Environmental and Social Agencies

Summary of relevant environmental and social regulating authorities and other relevant agencies is given in **Table 14.3-2.**

Table 14.3-2 Overview of Relevant Environmental and Social Regulating Authorities and Other Relevant Agencies

Environmental and Social Regulating Authorities
Under the Law on Environmental Protection, MONRE is granted administrative functions for environmental protection. Under MONRE, the Vietnam Environmental Agency (VEA) formulates environmental regulations, strategies, plans, national objectives, programs and projects and oversees EIA evaluations. In addition, VEA also handles general environmental protections, including environmental pollution measures, promotion of environmental protections and waste management.
EIA Approving Agencies
Under the Law on Environmental Protection and Decree 19/2015/ND-CP (Issued Feb. 14, 2015), either MONRE or the provincial DONREs are responsible for evaluating and approving EIA reports, depending on project type and scale. In this project case, MONRE is the EIA approving agency based on Appendix III of Decree 18/2015/ND-CP of the prime minister.
Other Agencies
Under Decree 43/2014/ND-CP, the provincial DONREs handle compensation work for the project. Note here that there are no donor agencies, NGOs or other groups assisting in environmental protections for the Ha Nam Province.

Source: JICA Survey Team

(4) Gap Analyses with JICA Environmental and Social Considerations Guidelines

Differences among the JICA Environmental and Social Considerations Guidelines, World Bank Safeguard Policies and Vietnamese legislation relevant to the EIA are shown in **Table 14.3-3**.

Table 14.3-3 Comparison between JICA Environmental Guidelines/World Bank Safeguard Policies to relevant Vietnamese EIA Laws

	JICA Environmental Guidelines & World Bank Safeguard Policies	Relevant EIA Laws of Vietnam	Major Differences	Measures to Close Gap
Applicable laws and standards	JICA confirms that projects comply with the laws or standards related to the environment and local communities in the central and local governments of host countries; it also confirms that projects conform to those governments' policies and plans on the environment and local communities.	An existing environmental assessment system regulated by the Ministry of Natural Resources and Environment (MONRE). (Decree NO.19/2015/ND-CP)	(Nothing in particular)	—
	JICA confirms that projects do not deviate significantly from the World Bank's Safeguard Policies, and refers as a benchmark to the standards of international financial organizations; to internationally recognized	An existing environmental assessment system regulated by the Ministry of Natural Resources and Environment (MONRE). (Decree NO.19/2015/ND-CP)	There is not big deviation on regarding sustainable development. According to the law of Vietnam, provision of information disclosure and residents participation is regulated. However, details on how to	EIA and Monitoring results will be disclosed to local stakeholders in project owner's responsibility.

	JICA Environmental Guidelines & World Bank Safeguard Policies	Relevant EIA Laws of Vietnam	Major Differences	Measures to Close Gap
	standards, or international standards, treaties, and declarations, etc.; and to the good practices etc. of developed nations including Japan, when appropriate.		disclose and how resident will participate are not determined.	Consult with local stakeholders will be held extensively and multiple times in project owner's responsibility.
Language of EIA Reports	EIA reports (which may be referred to differently in different systems) must be written in the official language or in a language widely used in the country in which the project is to be implemented. When explaining projects to local residents, written materials must be provided in a language and form understandable to them.	Written in either Vietnamese or English. (Circular No.27/2015/TT-BTNMT)	(Nothing in particular)	—
Disclosure of Information on Environmental and Social Considerations	In principle, project proponents etc. disclose information about the environmental and social considerations of their projects. JICA assists project proponents etc. by implementing cooperation projects as needed. Encourage project proponents etc. to disclose and present information about environmental and social considerations to local stakeholders.	When preparing the EIA Report, the opinions of the administrative communes/districts or the municipal PC must be heard, and those opinions must be included in the EIA Report. (Law on Environment Protection) The EIA report is mandated to be announced at a public hearing (Decree No. 19/2015/ND-CP). However, details on how to receive comments during the open period are not determined.	Vietnamese legislation has yet to reach to a decision regarding detailed issues about the disclosure of EIA Reports.	EIA report will be disclosed to local stakeholders in project owner's responsibility.
Availability/ Reproduction	EIA reports are required to be made available to the local residents of the country in which the project is to be implemented. The EIA reports are required to be available at all times for	The EIA report will be disclosed at the relevant commune PC headquarters. (Circular No.27/2015/TT-BTNMT)	Ditto	EIA report will be disclosed and the acquisition of the copy will be accepted in project

	JICA Environmental Guidelines & World Bank Safeguard Policies	Relevant EIA Laws of Vietnam	Major Differences	Measures to Close Gap
	perusal by project stakeholders such as local residents and reproduction must be permitted.			owner's responsibility.
Consulting with local Stakeholders	In principle, project proponents etc. consult with local stakeholders through means that induce broad public participation to a reasonable extent, in order to take into consideration of the environmental and social factors in a way that is most suitable to local situations, and in order to reach an appropriate consensus. JICA assists project proponents etc., by implementing cooperation projects as needed.	Residents may participate in the scoping stage and appraisal stages of the EIA Report. Discussions with stakeholders are to be held for national projects under Category A during the scoping stage, and residents as well as stakeholders must be consulted. A public hearing must also be held during the appraisal stage of the EIA report. (Circular No.27/2015/TT-BTNMT)	Procedures of the consulting local Stakeholders are currently not determined.	Consult with local stakeholders will be held extensively and multiple times in project owner's responsibility.
Disclosing Monitoring Results	Project proponents, etc., should make efforts to make the results of the monitoring process available to local project stakeholders.	Monitoring results shall be summarized in a white paper and archived within the country. (Three levels: provincial, local, and state) (Circular No.27/2015/TT-BTNMT)	Procedures of disclosing monitoring results are currently not determined.	Monitoring result will be disclosed to local Stakeholders in project owner's responsibility.

Source: Updated by the Study Team based on the Profile of Vietnam Environmental and Social Considerations (JICA, Sep.2011)

Differences among the JICA Environmental and Social Considerations Guidelines, World Bank Safeguard Policies and Vietnamese legislation relevant to resettlement and land acquisitions are shown in **Table 14.3-4**.

Table 14.3-4 Policy Gaps between JICA Guidelines and Vietnamese Country System on Land Acquisition and Resettlement

No.	JICA Guidelines for Environmental and Social Considerations with World Bank's Safeguard Policy	Vietnamese Law & Regulations	Countermeasures for Filling Gaps
1	Involuntary resettlement and loss of means of livelihood are to be avoided when feasible by exploring all viable alternatives.	N/A	Based on the JICA Environmental Guidelines, land acquisition and resettlement shall be avoided and/or minimized during the process to decide locations of the

No.	JICA Guidelines for Environmental and Social Considerations with World Bank's Safeguard Policy	Vietnamese Law & Regulations	Countermeasures for Filling Gaps
2	When population displacement is unavoidable, effective measures to minimize impact and to compensate for losses should be taken.	N/A	sewerage and road facilities, to plan their structures, and to discuss about any issues related to resettlement/land acquisitions. Also, A-RAP describe compensation policies/measures and each level based on the JICA Environmental Guidelines.
3	People who must be resettled involuntarily and people whose means of livelihood will be hindered or lost must be sufficiently compensated and supported, so that they can improve or at least restore their standard of living, income opportunities and production levels to pre-project levels.	Clause 2 of Article 85 of the Land Law stipulates that "in the concentrated resettlement areas, infrastructure must be developed synchronously, ensuring construction standards and regulations and conformity with the conditions, customs and practices of each region and area".	A-RAP secures "improve or at least restore their standard of living, income opportunities and production levels to pre-project levels" by using appropriate entitlement matrix.
4	Compensation must be based on the full replacement cost as much as possible.	[Land] Clause 2 of Article 74 of the Former Land Law states that "the compensation must be made for the land area which is actually used and does not exceed the agricultural land allocation quota prescribed in Article 129 (e.g. Not exceeding 2 hectares for each type of land). [Structures] Clause 1 and Clause 3 of Article 89 of the Land Law specifies that "the compensation amount is equivalent to the value of new construction facilities with equivalent technical standards prescribed by specialized law". However, the case of Clause 2, PAPs except the cases illustrated in Clause 1 does not mention clearly "compensation by replacement cost". The New Land Law (No.45/2013/QH13) actually regulates that the compensation costs shall be applied to the replacement costs, which are reflected on the market cost.	This Project is located within Ha Nam Province. The Ha Nam Province has a recent detailed compensation rates list, which are regulated by Decision No.49/2014/QD-UBND, and are nearly equal of the replacement costs. Therefore, the compensation costs could be applied to the recent detailed compensation rates list as nearly equal of the replacement costs. There is no resident, who has more than 2 hectares for each type of land within the project area.
5	Compensation and other kinds of assistance must be provided prior to displacement.	Clause 1 of Article 93 of the Land Law stipulates that "Within 30 days after the decision on the land recovery by a competent state agency takes effect, agencies and organizations in charge of compensation shall pay compensation and support to people whose land is recovered."	Not required.

No.	JICA Guidelines for Environmental and Social Considerations with World Bank's Safeguard Policy	Vietnamese Law & Regulations	Countermeasures for Filling Gaps
6	For projects that entail large-scale involuntary resettlement, resettlement action plans must be prepared and made available to the public.	Article 67 of the Land Law states that: "(... on land recovery for national defense or security purpose; or for socio-economic development in the national or public interest), competent state agencies shall notify the land users about the land recovery before undertaking the surveys on affected land/properties... and making of plans for compensation, support and resettlement." However, the Public Investment Law stipulates that: "... before issuing the notification on land acquisition, the project investment policy (including Pre-F/S) should be approved." There is no system to prepare resettlement action plan at the time of pre-feasibility study or environmental review by development partners.	It is anticipated that large-scale involuntary resettlement is not caused by the Project. Therefore, in the Project, the preparation of full-scale RAP is not required. However, there was a possibility that this Project may cause small-scale (less than 200 persons) involuntary resettlement or land acquisitions. Therefore, the JICA Preparatory Survey Team had provided supports to the Vietnam counterpart agencies in this A-RAP with sufficient adherence to the JICA Environmental Guidelines.
7	In preparing a resettlement action plan, consultations must be held with the affected people and their communities based on sufficient information made available to them in advance.	Article 69 of the Land Law specifies public consultation at planning and implementation stage as followings: "The organization in charge of compensation and ground clearance shall make the plan for compensation, support and resettlement and coordinate with the commune-level People's Committee in the locality to conduct consultations on the plans for compensation, support and resettlement in the forms of meetings with land users living in the recovered area, posting up the plan for compensation, support and resettlement at offices of the commune-level People's Committee and at common public places of the residential areas of which land is recovered. The consultation results must be recorded in minutes which are certified by representatives of the commune-level People's Committee and Vietnam Fatherland Front, and users of recovered land."	Even if the project needs not RAP, but A-RAP, any consultation meetings (stakeholder meetings) must be held. This Project will hold stakeholder meetings at Planning and Implementation Stage, which are regulated on Article 69 of the Land Law.
8	When consultations are held, explanations must be given in a form, manner, and language that are understandable to the affected people		Based on the JICA Environmental Guidelines, consultations have to be implemented in understandable language
9	Appropriate participation of affected people must be promoted in planning, implementation, and monitoring of resettlement action plans.		Based on the JICA Environmental Guidelines, in case of the Category A projects, stakeholder meetings are organized at least two times, at the time of the draft scoping and at the time of draft reporting, supplemented by focus group meetings as parts of public participation in planning stage. In addition to above-mentioned meetings, the A-RAP proposed promotion of public participation in monitoring stage as well as implementation stage.
10	Appropriate and accessible grievance mechanisms must be established for the affected people and their communities.	Article 204 (Chapter 13) of the Land Law stipulates that: "Land users and people who have land use-related rights and obligations are entitled to lodge complaints about, or file lawsuits against, administrative decisions or	During the Preparatory Survey, a Grievance Redress Mechanism was prepared, based on the JICA Environmental Guidelines, and was included in the A- RAP. In general, the Commune PCs or

No.	JICA Guidelines for Environmental and Social Considerations with World Bank's Safeguard Policy	Vietnamese Law & Regulations	Countermeasures for Filling Gaps
		administrative acts in land management."	the District PCs take role as the first places for people to address complaints of file lawsuits. If the complaints/lawsuits cannot be settled at these levels, people can address it at the higher administrative levels.
11	Affected people are to be identified and recorded as early as possible in order to establish their eligibility through an initial baseline survey (including population census that serves as an eligibility cut-off date, asset inventory, and socioeconomic survey), preferably at the project identification stage, to prevent a subsequent influx of encroachers of others who wish to take advantage of such benefits.	After project approval by the Government followed by the decision on land acquisition by the People's Committee, a detailed measurement survey (DMS) is implemented.	Based on the JICA Environmental Guidelines, the Cut-off-Date is declared when the Census Survey is commenced before project approval. Therefore, a Census Survey is conducted in this Preparatory Survey Phase. Also, after project approval and the DMS conducting at the detailed design phase, the information on affected households and properties will be updated and finalized.
12	Eligibility of benefits includes, the PAPs who have formal legal rights to land (including customary and traditional land rights recognized under law), the PAPs who do not have formal legal rights to land at the time of census but have a claim to such land or assets and the PAPs who have no recognizable legal right to the land they are occupying.	Article 82 of the Land Law stipulates that illegal land use can be recovered by the State without compensation. Clause 2 of Article 92 of the Land Law stipulates that illegal land attached assets can be acquired without compensation. Under Clause 2 of Article 77 of the Land Law, the Government does not compensate land users who violate land legislation, elaborated in Article 64 of the Land Law, and owners of illegally established land attached assets, and unregistered land users of agricultural land after 1 July 2004. Article 88 and 92 of the Land Law does not allow compensation for non-legitimate owner of the land attached assets. Article 94 and 157 of the Land Law covers compensation for the damage caused by limited land use and damage on land attached assets in case of restrictions due to establishment of safety corridors, but only for legally recognized land users.	Based on the JICA Environmental Guidelines, both formal and informal settlers are eligible for compensations. However, it was not found any informal settlers within the affected areas. Also, as the Cut- off- Date based on the JICA Environmental Guidelines, was declared, only formal PAPs are eligible for compensations in this project.
13	Preference should be given to land-based resettlement strategies for displaced persons whose livelihoods are land-based.	Article 74 of the Land Law mentions the "land for land" compensation in principle. In the case of relocation site preparation, Article 85 of the Land Law describes the introduction of necessary infrastructure and considerations on harmonization with	As priority, compensation "land for land" at location acceptable to DPs, or, if requested or there is no reserved land to compensate "land for land", cash compensation shall be provided.

No.	JICA Guidelines for Environmental and Social Considerations with World Bank's Safeguard Policy	Vietnamese Law & Regulations	Countermeasures for Filling Gaps
		surrounding communes.	
14	Provide support for the transition period (between displacement and livelihood restoration).	Article 84 of the Land Law covers some kinds of assistance for business disturbance and income restoration. However, unregistered owners of commercial structures/businesses for the cost of re-establishing their business activities, net income loss during the transition period, and cost of transferring and re-installing plant, machinery, etc., are not eligible for compensation.	The A-RAP covers the non-registered cases and compensation for temporary business disturbance, income restoration at the early stage, or any other allowance are considered.
15	Particular attention must be paid to the needs of the vulnerable groups among those displaced, especially those below the poverty line, landless, elderly, women and children, ethnic minorities etc.	There is no clear description of special considerations for socially vulnerable groups except Article 27 of the Land Law regarding land use fee and land allocation.	Based on needs assessment through stakeholder meetings, socio-economic surveys, focus group meetings etc., special considerations for vulnerable groups, such as households headed/with woman, handicapped, elderly, poor, and etc., are discussed and reflected in the A-RAP.
16	Internal and external monitoring system must be established and implemented properly	Article 13 of the Land Law covers general monitoring and evaluation, but not particularly resettlement.	Based on the JICA Environmental Guidelines, a monitoring framework composed by internal monitoring, external monitoring, and evaluation is established in the A-RAP.

Source: JICA Survey Team

The following table shows the JICA Policies on Involuntary Resettlement.

JICA Policies on Involuntary Resettlement

The key principle of JICA policies on involuntary resettlement is summarized below.

I. Involuntary resettlement and loss of means of livelihood are to be avoided when feasible by exploring all viable alternatives.
II. When, population displacement is unavoidable, effective measures to minimize the impact and to compensate for losses should be taken.
III. People who must be resettled involuntarily and people whose means of livelihood will be hindered or lost must be sufficiently compensated and supported, so that they can improve or at least restore their standard of living, income opportunities and production levels to pre-project levels.
IV. Compensation must be based on the full replacement cost[1] as much as possible.
V. Compensation and other kinds of assistance must be provided prior to displacement.
VI. For projects that entail large-scale involuntary resettlement, resettlement action plans must be prepared and made available to the public. It is desirable that the resettlement action plan include elements laid out in the World Bank Safeguard Policy, OP 4.12, Annex A.
VII. In preparing a resettlement action plan, consultations must be held with the affected people and their communities based on sufficient information made available to them in advance. When consultations are held, explanations must be given in a form, manner, and language that are understandable to the affected people.
VIII. Appropriate participation of affected people must be promoted in planning, implementation, and monitoring of resettlement action plans.
IX. Appropriate and accessible grievance mechanisms must be established for the affected people and their communities.

Above principles are complemented by World Bank OP 4.12, since it is stated in the JICA Guideline that "JICA confirms that projects do not deviate significantly from the World Bank's Safeguard Policies". Additional key principle based on World Bank OP 4.12 is as follows.

X. Affected people are to be identified and recorded as early as possible in order to establish their eligibility through an initial baseline survey (including population census that serves as an eligibility cut-off date, asset inventory, and socioeconomic survey), preferably at the project identification stage, to prevent a subsequent influx of encroachers of others who wish to take advance of such benefits.
XI. Eligibility of Benefits include, the PAPs who have formal legal rights to land (including customary and traditional land rights recognized under law), the PAPs who do not have formal legal rights to land at the time of census but have a claim to such land or assets and the PAPs who have no recognizable legal right to the land they are occupying.
XII. Preference should be given to land-based resettlement strategies for displaced persons whose livelihoods are land-based.
XIII. Provide support for the transition period (between displacement and livelihood restoration.
XIV. Particular attention must be paid to the needs of the vulnerable groups among those displaced, especially those below the poverty line, landless, elderly, women and children, ethnic minorities etc.
XV. For projects that entail land acquisition or involuntary resettlement of fewer than 200 people, abbreviated resettlement plan is to be prepared. In addition to the above core principles on the JICA policy, it also laid emphasis on a detailed resettlement policy inclusive of all the above points; project specific resettlement plan; institutional framework for implementation; monitoring and evaluation mechanism; time schedule for implementation; and, detailed Financial Plan etc.

Source: JICA Survey Team

14.4 Alternative Analysis and Scoping

14.4.1 Alternative Analysis

The summary of verification of the alternatives for each component is shown in **Table 14.4-1**.

[1]Description of "replacement cost" is as follows.

Land	Agricultural Land	The pre-project or pre-displacement, whichever is higher, market value of land of equal productive potential or use located in the vicinity of the affected land, plus the cost of preparing the land to levels similar to those of the affected land, plus the cost of any registration and transfer taxes.
	Land in Urban Areas	The pre-displacement market value of land of equal size and use, with similar or improved public infrastructure facilities and services and located in the vicinity of the affected land, plus the cost of any registration and transfer taxes.
Structure	Houses and Other Structures	The market cost of the materials to build a replacement structure with an area and quality similar or better than those of the affected structure, or to repair a partially affected structure, plus the cost of transporting building materials to the construction site, plus the cost of any labor and contractors' fees, plus the cost of any registration and transfer taxes.

Table 14.4-1 Verification of the Alternative Plan

Project	Summary of Verification of the Alternative Plan	Environmental Aspect	Social Aspect	Economy Aspect
Sewerage Sector	[Optimum Plan] ・A plan without resettlement is considered. *Comparative evaluation on wastewater treatment method was conducted and the Pre-treated Trickling Filter (PTF) process has been adopted. (See Chapter 4.2 for details)	- The construction area without protected area or natural forest is selected. - Improvement of water quality in public waters is expected.	- The construction area with few neighboring residents is selected. - Public Health will improve due to establishment of sewerage systems.	- Economic benefits are expected by improving the quality of life.
	・Not implementing development is considered.	- Water quality pollution in public waters is expected to deteriorate due to population increase.	- Public health will worsen due to degradation of sanitation accompanying population increase.	- Economic loss is expected with the degradation of quality of life.
Road sector	・Initial plan (A plan formed before the investigation.)	- The construction area without protected area or natural forest is selected. - The impacts of noise, vibration, and dust due to increase in transportation vehicles is expected around the project site.	- Impacts on 6 households of residents is expected with the project. - Improvement of accessibility of neighboring residents is expected.	- Regional Economic Development could be expected due to improvement of transportation networks
	[Optimum Plan] (A plan formed after the investigation.) ・Adjustment of initial design (examination of another route) to minimize land acquisition and resettlement	- The construction area without protected area or natural forest is selected. - The impacts of noise, vibration, and dust due to increase in transportation vehicles is expected around the project site.	- Due to the adjustment of initial design (examination of another route), involuntary resettlement will not occur. - Improvement of accessibility of neighboring residents is expected.	- Regional Economic Development could be expected due to improvement of transportation networks
	・Not implementing development is considered.	- No impact is expected.	- Congestion and accessibility deterioration is expected due to the development of the surrounding area.	- Economic loss is expected with congestion and accessibility deterioration.

Source: JICA Survey Team

14.4.2 Scoping

In addition to direct and immediate environmental impacts of the project, the scope of environmental

impact investigated in this study also included derivative and secondary impacts, cumulative impacts, and inseparable project impacts to the extent thought reasonable over the entire project life cycle.

Table 14.4-2 Scoping Matrix of the Sewerage Sector

Class	JICA Guidelines		Evaluation		Reasons for Assessment
	No.	Impacts	Before / During Construction	During Operation	
Anti-pollution Measures	1	Air pollution	B-	D	During construction: Air quality is expected to worsen at the work site and in the surrounding area due to airborne pollutants and dust from construction work. During operation: With the operation of the sewage treatment facility, no influence of air pollutants and dust to the surrounding area is not expected.
	2	Water pollution	B-	B±	During construction: Surface water could be contaminated by domestic wastewater from construction workers, wastewater from construction machinery, drainage from vehicle cleaning, sediment and oil runoff during rainfall in the construction site. During operation: When completed, the sewerage system will make a positive impact on water quality in the project area. If sewage is not properly treated, the influence of water pollution at the discharge destination is expected.
	3	Waste	B-	B-	During construction: Construction waste, domestic waste from workers and hazardous waste are expected. During operation: Waste caused by the sewage treatment is expected.
	4	Soil pollution	B-	B-	During construction: There could be soil pollution from workers' domestic wastewater, wastewater runoff containing oil from construction machinery or vehicles, and waste. During operation: If hazardous waste is not properly treated, the influence of soil pollution is expected.
	5	Noise and vibration	B-	D	During construction: Noise and vibration is expected from work vehicles and construction machinery. During operation: With the operation of the sewage treatment facility, no influence of noise and vibration to the surrounding area is expected.
	6	Ground subsidence	B-	D	During construction: Construction with boring or pile work not meeting technical standards could impact the ground stratum. During operation: No impact is expected, because there is no intake of groundwater.
	7	Offensive odors	D	B-	During construction: Construction work to generate offensive odors is not expected. During operation: The occurrence of offensive odor is expected in the course of sewage treatment.
	8	Sediment	D	B+	During construction: Construction work to impact on sediment is not expected, because there is no plan to modify the river. During operation: When completed, the sewerage system will make a positive impact on sediment due to removal of the sludge.
Natural Environment	9	Protected areas	D	D	During construction/operation: The Project Site has no protected areas, historic or cultural heritage sites, tourist areas, resort areas, or natural forests.
	10	Ecosystem	D	B+	During construction: The Project Site has no protected areas or natural forests. The surrounding area is developed into farmland or urban site, so that, negative impact on ecosystem is not expected. During operation: When completed, the sewerage system will make a positive impact on natural environment (ecosystem) due

Class	JICA Guidelines		Evaluation		Reasons for Assessment
	No.	Impacts	Before / During Construction	During Operation	
					to improvement of water quality in public waters.
	11	Hydrology	D	D	During construction: Negative impact is not expected on hydrology, because intake from river or modification of river is not planned by the project. During operation: The amount of water at drainage destination will be increased. But, because the amount of waste water from sewage treatment facility maximum 3,000m^3/day) is significantly less than the amount of water flow of *Chau Giang river* (minimum in dry season 3,110,400 m^3/day), negative impact is not expected on hydrology.
	12	Topography and geology	D	D	During construction/ operation: No impact is expected on the topography and geology, because there is no important topography and geology on the site.
Social Environment	13	Resettlement and land acquisition	B-	D	Before and during construction: No resettlement will occur by the proposed sewerage facilities due to the locations. However, some land acquisitions will be needed. During operation, no impacts on the resettlement/land acquisitions is expected due to the characteristics (no expansion of the land acquisition, etc.) of the project operations.
	14	Poverty	B-	D	During construction: Minimal adverse impact is expected, because the few poor peoples (total 11 households) , regulated under “Decision No. 59/2015/QD-TTg, promulgating multidimensional poverty levels applicable during 2016-2020” in Vietnam, and live in the project sites. They will lose their livelihood means due to the land acquisitions. During operation, No further impacts on poor people are expected due to characteristics of the operations.
	15	Ethnic minorities and indigenous peoples	D	D	During construction/operation: No impact is expected, because no specific minority groups is confirmed in the project sites.
	16	Local economy, such as employment, livelihood, etc.	B+	B+	During construction/operation: The growth of local economy is expected due to increase in the job opportunities during the construction/operation works.
	17	Land use and utilization of local resources	D	D	During construction/operation: Land use will change from some agriculture fields to the wastewater treatment plant, but the scale is not large and limited. Therefore, no impacts are expected.
	18	Water usage	D	B+	During construction: No impact is expected due to characteristics (few water consumption) of the construction. During operation: Favorable impacts on agricultural activities are expected, in case of re-use of treated water for the agriculture.
	19	Existing social infrastructures and services	D	B+	During construction: No impact is expected due to not large-scale and limited of the construction. During operation: Sewage treatment system will make favorable impacts on the infrastructure and social services.
	20	Social institutions such as social infrastructure and local decision-making institutions	D	D	During construction/operation: No impact is expected on social capital, local decision-making bodies or other social institutions due to characteristics (not large-scale and limited areas of the project).

Class	JICA Guidelines		Evaluation		Reasons for Assessment
	No.	Impacts	Before / During Construction	During Operation	
	21	Misdistribution of benefits and damages	D	B-	During construction: No impact is expected due to not large - scale and limited of the construction work. During operation: There is a possibility that the sewerage system will generate adverse impacts on misdistribution of benefits within the site due to the limited coverage of the sewer system.
	22	Local conflicts of interest	D	B-	During construction: No impact is expected due to not large - scale and limited of the construction work. During operation: There is a possibility that the sewerage system will generate local conflicts due to the limited coverage of the sewer system.
	23	Cultural heritage	D	D	During construction/operation: No impact is expected on cultural heritage because there is no protected cultural heritage in the project site.
	24	Landscape	D	D	During construction/operation: No impacts on cultural heritage is expected. The project site does not include any scenic sites such as dense forests or coastal sites.
	25	Gender	D	D	During construction/operation: No gender issues are expected due to the characteristics (no specific gender issues and the vulnerabilities) of the project areas.
	26	Children rights	D	D	During construction/operation: No impact on children's rights is expected due to characteristics (no children's labor/operation demands) of the construction/project.
	27	Infectious diseases such as HIV/AIDS	D	B+	During construction: No impact by infectious diseases is expected because there is no large-scale influx of outsiders by the construction works. During operation: The sewerage system may cause a favorable impact against infectious diseases.
	28	Working environment (including occupational safety)	B-	B-	During construction: Workers' safety may be degraded due to possible inappropriate construction works. During operation: Workers' safety may be degraded due to possible inappropriate operation works.
Others	29	Accidents	B-	B-	During construction: Traffic accidents at the construction site, fire, falling or electrocution may increase due to the increase of the traffic volume by the construction vehicles and inappropriate construction works. During operation: There is a possibility that the risk of the accidents (wastewater spills, etc.) may increase due to the project operations.
	30	Trans-boundary impacts and climate change	D	D	During construction/operation: The project is not expected to have any specific trans-boundary impacts or climate change impacts due to not large scale and limited areas of the project.

A+/-: Significant positive/negative impact is expected.
B+/-: Positive/negative impact is expected to some extent.
C+/-: Extent of positive/negative impact is unknown. (A further examination is needed, and the impact could be clarified as the study progresses)
D: No impact is expected.
Source: JICA Survey Team

Table 14.4-3 Scoping Matrix of the Road Sector

Class	JICA Guidelines		Evaluation		Reasons for Assessment
	No.	Impacts	Before/ During construction	During operation	
Anti-pollution Measures	1	Air pollution	B-	B-	During construction: Air quality is expected to worsen at the work site and in the surrounding area due to airborne pollutants and dust from road construction work and transport vehicles. During operation: Impacts from air pollution are expected in connection with increased traffic.
	2	Water pollution	D	D	During construction: Surface water could be contaminated by domestic wastewater from construction workers, wastewater from construction machinery, drainage from vehicle cleaning, sediment and oil run-off during rainfall in the construction site. However, since there are no rivers and canals to be conserved around the project area, the influence of water pollution is not expected. During operation: Generation of water pollution due to running of the vehicle is not expected.
	3	Waste	B-	D	During construction: Construction waste and general waste from workers is expected. During operation: Generation of waste due to running vehicles is not expected.
	4	Soil pollution	B-	D	During construction: There could be soil pollution from workers' domestic wastewater, wastewater runoff containing oil from construction machinery or vehicles, and waste. During operation: Generation of soil pollution due to running of the vehicle is not expected.
	5	Noise and vibration	B-	B-	During construction: Noise and vibration is expected from road construction work and transport vehicle. During operation: Noise and vibration is expected in connection with increased traffic.
	6	Ground subsidence	D	D	During construction/ operation: No impact is expected, because there is no intake of groundwater nor construction of underground structures such as tunnels.
	7	Offensive odors	D	D	During construction: Construction work to generate offensive odors is not expected. During operation: Offensive odors due to running of vehicle is not expected.
	8	Sediment	D	D	During construction: Construction work to impact on sediment is not expected since there are no rivers and canals to be conserved around the project area. During operation: No impact is expected, because there is no outflow of dirt from the road into the river or canal.
Natural Environment	9	Protected areas	D	D	During construction/operation: The Project Site has no protected area, historic or cultural heritage site, tourist area, resort area, or natural forest.
	10	Ecosystem	D	D	During construction/operation: The Project Site has no protected area or natural forest. The surrounding area is developed into farmland or urban area, so that, construction or operation work is not expected to impact on ecosystem.
	11	Hydrology	D	D	During construction/operation: No impact is expected on Hydrology, because there is no modification of river.
	12	Topography and geology	D	D	During construction/ operation: No impact is expected on the topography and geology, because there is no important topography and geology on the site.

Class	JICA Guidelines		Evaluation		Reasons for Assessment
	No.	Impacts	Before/ During construction	During operation	
Social Environment	13	Resettlement and land acquisition	B-	D	Before and during construction: Resettlement will not be caused by the proposed road facilities due to the locations. However, some land acquisitions will be needed. During the operation, no impacts on the resettlement/land acquisitions is expected due to the characteristics (no expansion of the land acquisition, etc.) of the project operations.
	14	Poverty	B-	D	During construction: Some adverse impact is expected. Some poor people (total 11 households) who are regulated "Decision No. 59/2015/QD-TTg, promulgating multidimensional poverty levels applicable during 2016-2020" in Vietnam, and live in the project sites. They will lose their livelihood means due to the land acquisitions. During operation, No further impacts on poor people are expected due to characteristics of the operations.
	15	Ethnic minorities and indigenous peoples	D	D	During construction/operation: No impact is expected. No specific minority group is confirmed in the project sites.
	16	Local economies, such as employment, livelihood, etc.	B+	B+	During construction: The growth of local economy is expected due to the construction works. During operation: The growth of local economy is expected due to development of transportation networks.
	17	Land use and utilization of local resources	D	D	During construction/operation: Land use will change from agriculture or urban area to the road facilities, however, this change is limited and not large-scale. Therefore, no actual impact is expected.
	18	Water usage	D	D	During construction/operation: No specific impact is expected due to the characteristics (few water consumptions during the constructions and the operations) of the project.
	19	Existing social infrastructures and services	D	B+	During construction: the construction works of some roads may cause inconvenient social services, but the scale and the possible impacts will be small or slight. During operation: Development of transportation networks will make favorable impacts on infrastructure/social services.
	20	Social institutions such as social infrastructure and local decision-making institutions	D	D	During construction/operation: Adverse impact on social capital, local decision-making bodies or other social institutions is not expected due to characteristics (not large-scale and the limitations) of the project.
	21	Misdistribution of benefits and damages	B-	B-	During construction: There is a possibility that residents subject to compensation will benefit from land acquisition, while other residents will be affected temporarily by noise, air pollution, and other nuisances by the construction. During operation: There is a possibility that the improvement of the limited local transportation network improvement will cause to misdistribution of benefits and damages
	22	Local conflicts of interest	B-	B-	During construction: There is a possibility that residents subject to compensation will benefit from land acquisition, while other residents will be affected by noise, air pollution, and other nuisances by the project construction. During operation: There is a possibility that the improvement of the limited local road network system will cause local conflicts of interest.
	23	Cultural heritage	D	D	During construction/operation: No impact on cultural heritage is expected because there is no protected cultural heritages in the

Class	JICA Guidelines		Evaluation		Reasons for Assessment
	No.	Impacts	Before/ During construction	During operation	
					project site.
	24	Landscape	D	D	During construction/operation: No impact on cultural heritage is expected. The project site does not include any scenic sites such as dense forests or coastal sites.
	25	Gender	D	D	During construction/operation: No impact on gender issues is expected due to the characteristics (no specific gender issues and the vulnerabilities) of the project areas.
	26	Children rights	D	D	During construction/operation: No impact on children's rights is expected due to the characteristics (no children's labor/operation demands) of the construction/project.
	27	Infectious diseases such as HIV/AIDS	D	D	During construction/operation: No impact by infectious diseases is expected due to not large-scale of the influx from the outsiders by the construction/operation works.
	28	Working environment (including occupational safety)	B-	B-	During construction: Workers' safety may be degraded due to possible inappropriate construction works. During operation: Workers' safety may be degraded due to possible inappropriate operation works.
- Other	29	Accidents	B-	B-	During construction: Traffic accidents at the construction site, fire, falling or electrocution may increase due to increase of the traffic volume by the construction vehicles and inappropriate construction works. During operation: There is a possibility that the risk of the traffic accidents will increase due to the project operations.
	30	Trans-boundary impacts and climate change	D	D	During construction/operation: The project is not expected to have any specific trans-boundary impacts or climate change impacts due to its scale and location of the project.

A+/-: Significant positive/negative impact is expected.
B+/-: Positive/negative impact is expected to some extent.
C+/-: Extent of positive/negative impact is unknown. (A further examination is needed, and the impact could be clarified as the study progresses)
D: No impact is expected.
Source: JICA Survey Team

14.4.3 TOR of Items for Environmental and Social Considerations

The Terms of Reference (TOR) for the environmental and social consideration items which were evaluated as A^-, B^- or C in the scoping results of the sewerage and the road sectors have been discussed. The results of discussions are shown in **Table 14.4-4**.

Table 14.4-4 TOR for Environmental and Social Consideration Items

Class	Required Environmental and Social Item		Impact Assessment		Survey items	Survey Method
	No.	Impacts	Before/ During construction	During operation		
Anti-pollution Measures	1	Air pollution	B-	B-	Air quality situation Air quality standards Impacts on air quality by construction and operation activities	- Field Survey - Existing documents reviews - Confirmation (Hearing) of construction contents/methods, and construction vehicles - Similar case studies

Class	Required Environmental and Social Item		Impact Assessment		Survey items	Survey Method
	No.	Impacts	Before/ During construction	During operation		
	2	Water pollution	B-	B-	Water quality situation Surface water quality standards Impacts on water quality by construction and operation activities	- Field Survey - Existing documents reviews - Confirmation (Hearing) of construction contents/methods, - Similar case studies
	3	Waste	B-	B-	Amount of generated waste Wastes disposal methods	- Existing documents reviews - Hearing survey with relevant persons. - Similar case studies
	4	Soil pollution	B-	B-	Wastes disposal methods	- Existing documents reviews - Confirmation (Hearing) of construction contents/methods, and construction vehicles - Similar case studies
	5	Noise and vibration	B-	B-	Noise and vibration situation Noise and vibration permission levels	- Field survey - Confirmation (Hearing) of construction contents/methods - Similar case studies
	6	Ground subsidence	B-	D	Present ground situation Impacts on ground subsidence by construction activities	- Field Survey - Confirmation (Hearing) of construction contents/methods, and construction vehicles - Similar case studies
	7	Offensive odors	D	B-	Generation of offensive odors accompanying the operation of the sewage treatment facility	- Existing documents reviews - Similar case studies
Social Environment	13	Resettlement and land acquisition	B-	D	- Socio-economic situations of the Project Affected Persons (PAPs) - Property loss situations by the project - Land acquisition sites and areas	- Socio-economic and Inventory of loss Survey to the PAPs - Questionnaire Survey of the PAPs - Stakeholder Meetings - Field survey
	14	Poverty	B-	D	- Economic situations of the PAPs	-Socio-economic and Inventory of loss Survey of the PAPs -Questionnaire Survey of the PAPs - Existing documents reviews
	21	Misdistribution of benefits and damages	D (Sewerage) B- (Road)	B-	-Living conditions of each PAP	- Field survey - Hearing survey on the PAPs
	22	Local conflicts of interest	D (Sewerage) B- (Road)	B-	- Possible causes of conflicts for sewerage treatment/ water and convenience of the local road networks	- Existing documents reviews - Stakeholder Meetings - Hearings to relevant persons
	28	Working environment (including occupational	B-	B-	-Present working environment situations -Construction methods -Operation methods	- Existing documents reviews - Hearings to relevant persons

Class	Required Environmental and Social Item		Impact Assessment		Survey items	Survey Method
	No.	Impacts	Before/ During construction	During operation		
		safety)				
Others	29	Accidents	B-	B-	- Number of accidents -Causes of the accidents	- Existing documents reviews - Hearings to relevant persons

Impact assessment classification is below;

A+/-: Significant positive/negative impact is expected.

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

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

D: No impact is expected.

Source: JICA Survey Team

14.5 Environmental and Social Survey Results and Impacts Evaluation

14.5.1 Environmental and Social Survey Results

Environmental and social survey results for the selected items of the Sewerage Sector are summarized in **Table 14.5-1**.

Table 14.5-1 Environmental and Social Survey Results of Sewerage Sector

Impact Items	Survey Results (including quantitative predictions)
Air Pollution	Result of baseline survey, all items of air quality at the vicinity of the sewage treatment facility (K1) satisfy the environmental standards of Vietnamese（QCVN 05:2013/BTNMT）. During construction, dust and exhaust gases will be dispersed from the processes of ground leveling, excavation, backfilling, and stockpiling and transportation of materials. Dust: The loads of dust generated in the process of transporting excavated earth are forecast as being not substantial and would be distributed evenly along transportation routes, between 0.042 and 0.54mg/m^3. According to calculations, the dust concentration would not exceed the national standards on ambient air quality (QCVN 05: 2013/BTNMT) outside 60m of distance. Exhaust gases: The CO contents in the areas are between 0.09-1.24 mg/m^3. The SO_2 contents are between 0.05-0.62 mg/m^3; and HC contents between 0.08-0.62 mg/m^3. Outside 40m of the construction sites, the results of analysis of exhaust gases compared to the national ambient air quality standards (QCVN 05: 2013/BTNMT) show that they are still within the permissible limits.
Water pollution	Result of baseline survey, all items of water quality at the drainage destination of the sewage treatment facility (NM1:*Chau Giang river*) satisfy the National technical regulation on surface water quality（QCVN 08-MT:2015/BTNMT(Column B1)）. During construction, impact of domestic wastewater from construction workers, wastewater from construction machinery, drainage from vehicle cleaning, sediment and oil runoff during rainfall in the construction site add to the drainage destination of the sewage treatment facility. The total volume of domestic wastewater generated from construction processes will be about 20m^3/day at all the construction sites. It is assessed that there will be small amount of generated domestic wastewater. Runoff flowing through the construction area, the content of suspended solids often exceeds the permissible limits set out in national industrial wastewater standards (QCVN 40:2011/BTNMT)- Column B, while the content of mineral grease and oil, if not properly isolated, is likely to exceed the permissible discharge limit. During operation, improvement of water quality of rivers etc. which are the drainage point of sewage at present is expected due to maintenance of sewage treatment network in the *Phu Ly city and* north development area in HA NAM PROVINCE. The collection and treatment of wastewater in the area will help reduce a large amount of pollutants. With a capacity of 3,000 m3/day and the treated effluent water meeting the Column A of the national standard on industrial waste water (QCVN 40: 2011/BTNMT), the specific amounts of pollutants reduced would be as follows: BOD_5: 0.09tons/day, TSS: 0.15 tons/day, NH_4^+-N: 0.015 tons/day, PO_4^{3-}: 0.018 tons/day. It can be seen 3,000 m3 of treated water/day is discharged into Chau Giang river, there will be a slight

Impact Items	Survey Results (including quantitative predictions)
	increase in the values of water indicators such as NH_4^+, PO_4^{3-}. However, this increased value is only about 0.08mg/l even at lowest river levels, and the water quality is still within permitted limits of the national standard of column B2 for water quality for waterway traffic and other purposes. Other indicators such as BOD_5 and SS would tend to decrease, improving river water quality.
Waste	During construction, construction waste, domestic waste from workers and hazardous waste is expected. The total volume of soil to be transported out of construction is expected to be 25,380 m^3. The total amount of construction wastes generated during construction will be 55 m^3. The total volume of domestic waste from workers assumed as 175 people is expected to be 87.5kg/day. The total volume of hazardous waste such as waste grease and oil is 114 liters of oil/month. In addition, the subproject would also generate an estimated amount of 50 kg of oily rags and containers per month. During operation, creation of sludge and Hazardous waste from sewage treatment process is expected. The generation of sludge is expected to be 2.8 m^3/day until 2030 and 5.6m^3/day in the future plan of up to 2035. As domestic wastewater normally does not contain hazardous substances, the treatment technology is biotechnology without the use of chemicals. Therefore, the sludge can be regarded as normal waste and can be used as fertilizer. Hazardous waste generated from the operation of the sewage treatment facility is composed mostly of chemical packaging materials used in wastewater treatment, waste grease and oil, oily rags (about 100kg/year) from maintenance tasks, and broken fluorescent lamps (about 50kg/year), and Chemical packaging materials (about 20kg/year) to be discarded. Such waste is a threat to the soil and water environment if dumped into the surrounding area. However, such types of waste can be completely controlled during operation so as to mitigate possible impacts.
Soil Pollution	During construction, if hazardous waste such as waste grease and oil, oil rags and containers is not properly treated, the influence of soil pollution is expected. During operation, if hazardous waste such as chemical packaging materials, waste grease and oil, oily rags etc. is not properly treated, the influence of soil pollution is expected.
Noise and vibration	Result of baseline survey, noise level at the vicinity of the sewage treatment facility (K1) satisfy the permitted level of noise (QCVN 026:2010/BTNMT). Vibration level at the vicinity of the sewage treatment facility (K1) satisfy the permitted level of vibration (QCVN27：2010/BTNMT). During construction, impact of operation of construction machines and running of construction vehicles add to current atmospheric environment. During construction, the results of separate noise level assessment of individual construction and transport vehicles as well as resonant noise level are estimated, at the distance of 20 meters from the sources of noise, the noise levels from construction and transport vehicles are all within the allowable limits of QCVN 26:2010/BTNMT. The results of vibration level assessment of pile drivers, rammers, bulldozers, and heavy trucks, the safe distance for bearing strong impacts from vibration is about 10 meters from the generating source.
Ground subsidence	As a result of the ground survey, ground of project area is stable. During construction, drilling and piling work are carried out based on Vietnamese standards. Therefore, ground subsidence by the project is not expected.
Offensive odors	During operation, the occurrence of offensive odor in the process of sewage treatment is expected. Odors from the wastewater treatment process are generated mainly from the treatment units where anaerobic decomposition takes place. In normal operation conditions with a closed treatment technology and a separated buffer zone 30m away in accordance with QCVN 07:2010/BXD standards, offensive odors are not likely to exist. The control of offensive odors and aerosols generated from the sewage treatment facility can be effectively performed with odor collection and treatment devices.
Resettlement and land acquisition	Before and during construction, no resettlement occurs, but a total of 13,000 m^2 of the present land is necessary for the construction of the proposed sewerage facilities. The land acquisition will be a total of 9,350 m^2, where there are private owned lands, according to the Inventory of Loss Survey. However, each reasonable compensation measure based on the replacement costs or others are proposed on the A-RAP, to each entitled PAP. During operation, the proposed sewerage component will not cause resettlement and land acquisition, according to the operation activities.
Poverty	During construction, the limited Poor Peoples (total 11 households of the family members) in the project sites may lose present livelihood means by the project construction. On the other hand, the reasonable

Impact Items	Survey Results (including quantitative predictions)
	compensation measures including livelihood restoration programs are proposed on the A-RAP. During operation, no impacts are expected due to characteristics of the operations.
Misdistribution of benefits and damages	During construction, before conducting this survey, a risk of any misdistribution of benefits and damages are expected for the sewerage components constructions. However, the local peoples did not mention the risks during all the stakeholders meetings. Therefore, the sewerage components will not cause any misdistribution of benefits and damages due to the characteristics of the construction works. During operation, before conducting this survey, a risk of any misdistribution of benefits and damages are expected in the operation phase as well. However, the local peoples did not mention the risks during all the stakeholders meetings. Therefore, the constructed sewer system will not cause any misdistribution of benefits and damages in the project site. On the other hand, almost all people are expecting to the smooth and fast project implementation.
Local conflicts of interest	During construction, the sewerage component will not cause any local conflicts of interest due to the characteristics of the construction works. During operation, the constructed sewer system will not cause any local conflicts of interest, according to the stakeholders meetings and the hearings to the local persons. Almost all people are expecting to the smooth and fast project implementation.
Working environment	During construction, there is a possibility that no clear regulated working rules for the construction works may force unsanitary working environment to the laborers, based on the review of the working methods for the sewerage facilities. During operation, there is a possibility that no clear regulated operation rules may force unsanitary operation environment to the operators, based on the review of the operation methods for the sewerage facilities.
Accidents	During construction, there is a possibility that no clear safety working rules for the construction works may cause increase in the traffic accidents, fire, falling or electrocution in the sites, according to the hearings to local people. During operation, there is a possibility that no clear regulated operation rules may cause water pollution accidents in the sites, according to relevant hearings to the local peoples.

Source: JICA Survey Team

Environmental and Social Survey Results for the selected items for Road Sector are summarized in **Table 14.5-2**.

Table 14.5-2 Environmental and Social Survey Results of Road Sector

Impact Item	Survey Results (including quantitative predictions)
Air Pollution	Result of baseline survey, all items of air quality around the planned route (K2, K3, K4) satisfy the Environmental standards of Vietnamese（QCVN 05:2013/BTNMT）. During construction, dust and exhaust gases will be dispersed from the processes of ground leveling, excavation, backfilling, and stockpiling and transportation of materials. According to the standards established by the World Health Organization (WHO) (*Assessment of Sources of Air, Water and Land Pollution –Part 1: Rapid Inventory Techniques in Environmental Pollution, WHO, 1993)*, the concentration of pollutants created by transportation operations can be calculated as follows: *For Center road (LCB-01):* Dust concentrations vary between 0.25-0.37 mg/m^3 (compared with permissible standard limits of 0.3mg/m^3); CO contents between 0.28-0.85 mg/m^3 (compared with 30 mg/m^3); SO_2 contents between 0.22-0.35 mg/m^3 (compared with 0.35 mg/m^3); and HC contents between 0.3-0.45 mg/m^3 (compared with 5 mg/m^3). *For Expressway East Bypass Road (LCB-02):* Dust concentrations vary between 0.24-0.54mg/m^3; CO contents between 0.56-1.24 mg/m^3; SO_2 contents between 0.28-0.62mg/m^3; and HC contents between 0.46-0.62mg/m^3. *For Feeder Road North and South(LCB-03):* Dust concentrations vary between 0.042-0.092mg/m^3; CO contents between 0.09-0.21mg/m^3; SO_2 contents between 0.05-0.17mg/m^3; and HC contents between 0.08-0.28mg/m^3. *For North-South and East- West Cross Road(LCB-04):* Dust concentrations vary between 0.1-0.35 mg/m^3; CO contents between 0.23-0.82 mg/m^3 (compared with 30 mg/m^3); SO_2 contents between 0.12-0.25 mg/m^3; and HC contents between 0.19-0.41 mg/m^3. *For Phu Ly City Rehabilitation Road (LCB-05):* Dust concentrations vary between 0.24-0.54mg/m^3;

Impact Item	Survey Results (including quantitative predictions)
	CO contents between 0.56-1.24 mg/m^3; SO_2 contents between 0.28-0.62mg/m^3; and HC contents between 0.46-0.62mg/m^3. During operation, impact of exhaust gas, pollutants from increased traveling vehicle add to current atmospheric environment.
Waste	During construction, construction waste and general waste from workers is expected. The total volume of soil to be transported out of construction is expected to be 440,940 m^3. The total amount of construction wastes generated during construction will be 75 m^3. The total volume of domestic waste from workers assumed as 240 people is expected to be 120 kg/day. The total volume of hazardous waste such as waste grease and oil is 114 liters of oil/month. In addition, the subproject would also generate an estimated amount of 50 kg of oily rags and containers per month.
Soil Pollution	During construction, if hazardous waste such as waste grease and oil, oil rags and containers is not properly treated, the influence of soil pollution is expected.
Noise and vibration	Result of baseline survey, noise level around the planned route (K2, K3, K4), two points (K3, K4) in the daytime and three points (K2, K3, K4) in the night are higher than the permitted level of noise (QCVN 26:2010/BTNMT). Vibration level around the planned route (K2, K3, K4) in the daytime satisfy the permitted level of vibration (QCVN27 : 2010/BTNMT). During construction, impact of noise and vibration from operation of construction machines and running of construction vehicles, transport of dirt add to current atmospheric environment. During operation, impact of noise and vibration from increased traveling vehicle add to current atmospheric environment.
Resettlement and land acquisition	Before and during construction, no resettlement of households occurs, but a total of 622,792 m^2 of the present land is necessary for the construction of the proposed road facilities. The land acquisition will be generated for a total of 404,393 m^2, where there is private owned land, according to the Inventory of Loss Survey. However, each reasonable compensation measure based on the replacement costs or others are proposed on the A-RAP, to each entitled PAP. During operation, the proposed road component will not cause resettlement and land acquisition, according to the project activities.
Poverty	During construction, the limited Poor Peoples (11 households of the family members) in the project sites may lose present livelihood means by the project construction. On the other hand, the reasonable compensation measures including livelihood restoration programs are proposed on the A-RAP. During operation, no impact is expected due to characteristics of the operations.
Misdistribution of benefits and damages	During the construction, before conducting this survey, a risk of any misdistribution of benefits and damages are expected for the road components construction. However, the local peoples did not mention the risks during all the stakeholders meetings. Therefore, the road components constructions will not cause any misdistribution of benefits and damages. During operation, before conducting this survey, a risk of any misdistribution of benefits and damages are expected in the operation phase as well. However, the local peoples did not mention the risks during all the stakeholders meetings. Therefore, the road network development/rehabilitation will not cause any misdistribution of benefits and damages, according to the hearings to local peoples at several project sites. On the other hand, almost all people are expecting to the smooth and fast project implementation.
Local conflicts of interest	During the construction, the road component will not cause any local conflicts of interest, according to the hearings to local peoples at the road development/rehabilitation sites. During operation, the road network development/rehabilitation will not cause any local conflicts of interest, according to the hearings to local peoples at several project sites due to improve local transportation networks.
Working environment	During construction, there is a possibility that no clear regulated working rules for the construction works may force unsafety working environment to the labors, based on the review of the working methods for the road facilities. During operation, no clear regulated operation rules may force unsafety operation environment to the operators, based on the review of the operation methods for the road facilities.
Accidents	During construction, there is a possibility that no clear safety working rules for the construction works or no disseminated traffic safety rules to the laborers may cause increase in the traffic accidents, fire,

Impact Item	Survey Results (including quantitative predictions)
	falling or electrocution in the sites, according to the stakeholders meetings and the hearings to the local persons. During operation, insufficient traffic safety operation rules or no disseminated traffic safety rules to the local peoples may increase in the traffic accidents in the sites, according to the stakeholders meetings and the hearings to the local peoples.

Source: JICA Survey Team

14.5.2 Impacts Evaluation

Impacts evaluation based on "**Subsection 14.5.1**, Environmental and Social Survey Results" is shown in **Table 14.5-3** and **Table 14.5-4.**

Table 14.5-3 Impacts Evaluation of Sewerage Sector

Category	No.	Impacts	Impact assessment at scoping		Impact assessment based on survey results		Reasons for assessment
			Before/ during construction	During operation	Before/ during construction	During operation	
Anti-pollution Measures	1	Air pollution	B-	D	B-	D	During construction: Dust and exhaust gases will be dispersed from the processes of ground leveling, excavation, backfilling, and stockpiling and transportation of materials. During operation: By the operation of the sewage treatment facility, no influence of air pollutants and dust to the surrounding area is expected.
	2	Water pollution	B-	B±	B-	B±	During construction: It is assessed that there will be small amount of generated domestic wastewater. In the runoff flowing through the construction area, the content of suspended solids often exceeds the permissible limits set out in national industrial wastewater standards (QCVN 40:2011/BTNMT)-Column A, while the content of mineral grease and oil, if not properly isolated, is likely to exceed the permissible discharge limit. During operation: When completed, the sewerage system will make a positive impact on water quality in the project area, but negative impact of water pollution is expected at drainage destination, if sewage is not properly treated.
	3	Waste	B-	B-	B-	B-	During construction: Construction waste, domestic waste from workers and hazardous waste is expected. During operation: Creation of sludge and hazardous waste from sewage treatment process is expected. The sludge can be regarded as normal waste and can be used as fertilizer.
	4	Soil pollution	B-	B-	B-	B-	During construction: If hazardous waste such as waste grease and oil, oil rags and containers is not properly treated, the influence of soil pollution is expected. During operation: If hazardous waste such as chemical packaging materials, waste grease and oil, oily rags, etc,. is not properly treated, the influence of soil pollution is expected.
	5	Noise and vibration	B-	D	B-	D	During construction: Noise and vibration is expected from work vehicles and construction machinery. During operation: By the operation of the sewage treatment facility, the influence of noise and vibration to the surrounding area is not expected.

Category	No.	Impacts	Impact assessment at scoping		Impact assessment based on survey results		Reasons for assessment
			Before/ during construction	During operation	Before/ during construction	During operation	
	6	Ground subsidence	B-	D	D	D	During construction: Drilling and piling work are carried out based on Vietnamese standards. As a result of the ground survey, ground of project area is stable. Therefore, ground subsidence by the project is not expected. During operation: No impact is expected, because there is no intake of groundwater.
	7	Offensive odors	D	B-	D	B-	During construction: Construction work to generate offensive odors is not expected. During operation: The occurrence of offensive odor in the process of sewage treatment is expected. Odors from the wastewater treatment process are generated mainly from the treatment units where anaerobic decomposition takes place. In normal operation conditions with a closed treatment technology and a separated buffer zone 30m away in accordance with QCVN 07:2010/BXD standards, offensive odors are not likely to exist.
Social environment	8	Resettlement and land acquisition	B-	D	B-	D	Before and during construction: Since the project sites of the sewerage component are mainly paddy fields, no resettlement will occur, but some land acquisitions will be generated.
	9	Poverty	B-	D	B-	D	During construction: The poor peoples may lose each livelihood means such as agriculture fields.
	10	Misdistribution of benefits and damages	D	B-	D	D	During construction/operation: The sewer system will not cause misdistribution of benefits and damages, according to the hearings to the local peoples.
	11	Local conflicts of interest	D	B-	D	D	During construction/operation: The sewer system will not cause local conflicts of interest, according to the hearings to the local peoples.
	12	Work environment (including occupational safety)	B-	B-	B-	B-	During construction: Workers' health could be impacted by the construction works. During operation: Inadequate working environment are passively expected to impact on the laborers.
Other	13	Accidents	B-	B-	B-	B-	During construction: Work accidents, such as traffic accidents on the construction site, fire, falling or electrocution, are possible. During operation: Inadequate working environment are passively expected to impact on the laborers.

Impact assessment classification is below;
A+/-: Significant positive/negative impact is expected.,
B+/-: Positive/negative impact is expected to some extent.
C+/-: Extent of positive/negative impact is unknown. (A further examination is needed, and the impact could be clarified as the study progresses),
D: No impact is expected.
Source: JICA Survey Team

Table 14.5-4 Impacts Evaluation of Road Sector

Category	No.	Impacts	Impact assessment at scoping		Impact assessment based on survey results		Reasons for assessment
			Before/ during construction	During operation	Before/ during construction	During operation	
Anti-pollution Measures	1	Air pollution	B-	B-	B-	B-	During construction: Dust and exhaust gases will be dispersed from the processes of ground leveling, excavation, backfilling, and stockpiling and transportation of materials. During operation: Impacts from air pollution are expected in connection with increased traffic.
	2	Waste	B-	D	B-	D	During construction: Construction waste, domestic waste from workers and hazardous waste is expected. During operation: Generation of waste due to running vehicles is not expected.
	3	Soil pollution	B-	D	B-	D	During construction: If hazardous waste such as waste grease and oil, oil rags and containers is not properly treated, the influence of soil pollution is expected. During operation: Generation of waste due to running vehicles is not expected.
	4	Noise and vibration	B-	B-	B-	B-	During construction: Noise and vibration is expected from road construction work and transport vehicle. During operation: Noise and vibration is expected in connection with increased traffic.
Social environment	5	Resettlement and land acquisition	B-	D	B-	D	Before and during construction: Since the project sites of the road component are mainly paddy fields, no resettlement will occur, but some land acquisitions will be generated.
	6	Poverty	B-	D	B-	D	During construction: The poor peoples may lose each livelihood means such as agriculture fields.
	7	Misdistribution of benefits and damages	D	B-	D	D	During construction/operation: The road network system will not cause misdistribution of benefits and damages, according to the hearings to the local peoples.
	8	Local conflicts of interest	D	B-	D	D	During construction/operation: The road network system will not cause local conflicts of interest, according to the hearings to the local peoples.
	9	Work environment (including occupational safety)	B-	B-	B-	B-	During construction: Workers' health could be impacted by the construction works. During operation: Inadequate working environment are passively expected to impact on the laborers.
Other	10	Accidents	B-	B-	B-	B-	During construction: Work accidents, such as traffic accidents on the construction site, fire, falling or electrocution, are possible. During operation: Inadequate working environment are passively expected to impact on the laborers.

Impact assessment classification is below;
A+/-: Significant positive/negative impact is expected., B+/-: Positive/negative impact is expected to some extent.
C+/-: Extent of positive/negative impact is unknown. (A further examination is needed, and the impact could be clarified as the study progresses)
D: No impact is expected.

Source: JICA Survey Team

14.6 Mitigation Measures and Environmental Management/Monitoring Plans

14.6.1 Mitigation Measures

The proposed mitigation measures for possible adverse impacts are shown in **Table 14.6-1** and **Table 14.6-2.**

Table 14.6-1 Mitigation Measures of Sewerage Sector

Impacts	Mitigation measures	implementation period	Responsible party	Supervisor
Air pollution	・Carry out watering for dust control at least 3 times a day: in the morning, at noon, and in the afternoon during dry weather with temperatures of over 25oC, or in windy weather. Avoid overwatering since this may make the surrounding muddy.	During construction	Contractor	-Ha Nam province
	・Vehicles in Vietnam must undergo a regular emissions check and obtain certification: “Certificate of conformity from inspection of quality, technical safety and environmental protection” following Decision No. 35/2005/QD-BGTVT		Contractor	-Ha Nam province
	・Wash trucks to get rid of mud and sand before leaving the construction site to keep dust from spreading in the surrounding area.		Contractor	-Ha Nam province
	・Do not put vehicles and machines to run idle for more than 5 minutes.		Contractor	-Ha Nam province
	・Not use old vehicles for construction, to not overload vehicles, and to cover the material being transported.		Contractor	-Ha Nam province
Water pollution	Construction wastewater and rainwater runoff ・Develop rainwater drainage channels and a settling basin.	During construction	Contractor	-Ha Nam province
	・Prevent oil leakage by performing the maintenance of the construction equipment.		Contractor	-Ha Nam province
	Domestic wastewater ・Provide toilets based on Ministry of Health regulations.		Contractor	-Ha Nam province
	・Prohibit defecation outside.		Contractor	-Ha Nam province
	Drainage ・Drain that meet the effluent standard of Vietnam	During operation	Implementation Body	-Ha Nam province
	・Analyze the water quality on a regular basis.		Implementation Body	-Ha Nam province
Waste	・Sort waste into construction waste, hazardous waste, and general waste.	During construction	Contractor	-Ha Nam province

Impacts	Mitigation measures	implementation period	Responsible party	Supervisor
	・Contract local waste collection and recycling companies for waste collection (incl. Hazardous waste) based on relevant laws.		Contractor	-Ha Nam province
	・No burning, on-site burying or dumping of solid waste shall occur. Waste oil ・Avoid repairing trucks and machines at the construction site.		Contractor Contractor	-Ha Nam province -Ha Nam province
	・Provide oil recovery tank.		Contractor	-Ha Nam province
	・Collect and temporarily store used oil and grease separately in specialized containers and place in safe and fire-free areas with impermeable floors roofs, at a safe distance from fire sources.		Contractor	-Ha Nam province
	Hazardous waste ・Manage all hazardous waste based on directive 12/2011 BNTN&MT.	During operation	Implementation Body	-Ha Nam province
	Sludge ・Sludge shall be periodically monitored to identify any possible hazard.		Implementation Body	-Ha Nam province
Soil pollution	・Carefully manage waste (See “Waste”)	During construction	Contractor	-Ha Nam province
	・Carefully manage waste (See “Waste”)	During operation	Implementation Body	-Ha Nam province
Noise and vibrations	・Restrict speed of vehicles.	During construction	Contractor	-Ha Nam province
	・Restrict the use of unnecessary horn.		Contractor	-Ha Nam province
	・Do not put vehicles and machines to run idle in more than 5 minutes.		Contractor	-Ha Nam province
	・Avoid construction operations generating great vibration and loud noise within the time between 6pm and 7am when construction takes place near residential areas.		Contractor	-Ha Nam province
	・Night construction must be informed to the community at least 2 days in advance.		Contractor	-Ha Nam province
Offensive odors	・Odor and air emission problems during the operation shall be controlled with control measures integrated in the design of the WWTP	During operation	Implementation Body	-Ha Nam province
	・Domestic waste and sludge generated during the operation of the plant shall be safely stored in a closed area before being transported away to serve the planting of urban green trees or to be dumped at landfill of the city.		Implementation Body	-Ha Nam province

Impacts	Mitigation measures	implementation period	Responsible party	Supervisor
	・Cover emission points (e.g., aeration basins, clarifiers, sludge thickeners, tanks, and channels), and vent emissions to control systems (e.g., compost beds, biofilters, chemical scrubbers, etc.) as needed to reduce odors and otherwise meet applicable national requirements and internationally accepted guidelines.		Implementation Body	-Ha Nam province
	・There shall be plans to periodically test and monitor air concentrations to obtain proper evaluation and control operation processes.		Implementation Body	-Ha Nam province
Resettlement and land acquisition	Make consensus with the Project Affected Persons (PAPs) for compensation for the land acquisition	Before construction	Project Implementation Body	-Ha Nam province
Poverty	・Make consensus with the Poor People for compensation measures ・Implementing income restoration program	Before construction	Project Implementation Body	-Ha Nam province
Working environment	・Provide equipment, and monitor and supervise to ensure worker safety.	During construction	Contractor	-Ha Nam province
	・Inform related parties of emergency telephone numbers for hospitals, police stations, local government, disaster prevention organizations, etc.		Contractor	-Ha Nam province
	・Install fences and warning signs, and allocate personnel at dangerous places.		Contractor	-Ha Nam province
	・Provide workers with safety equipment (helmets and earmuffs, etc.).		Contractor	-Ha Nam province
	・Prepare and disseminate clear operation rules for preventing unsanitary operation.	During operation	Implementation Body	-Ha Nam province
Accidents	Fire, falls, and electric shock ・Install fire prevention equipment	During construction	Contractor	-Ha Nam province
	・Periodically inspect safety equipment.		Contractor	-Ha Nam province
	Traffic accidents ・Collect materials dropped during transportation.		Contractor	-Ha Nam province
	・Notify related parties of hazard signs installed by investors.		Contractor	-Ha Nam province
	・Prepare and disseminate clear operation rules for preventing wastewater spill, others	During operation	Implementation Body	-Ha Nam province

Source: JICA Survey Team

Table 14.6-2 Mitigation Measures of Road Sector

Impacts	Mitigation measures	implementation period	Responsible party	Supervisor
Air pollution	・Carry out watering for dust control at least 3 times a day: in the morning, at noon, and in the afternoon during dry weather with temperatures of over 25oC, or in windy weather. Avoid overwatering since this may make the surroundings muddy.	During construction	Contractor	-Ha Nam province
	・Vehicles in Vietnam must undergo a regular emissions check and obtain certification: “Certificate of conformity from inspection of quality, technical safety and environmental protection” following Decision No. 35/2005/QD-BGTVT		Contractor	-Ha Nam province
	・Wash trucks to get rid of mud and sand before leaving the construction site to keep dust from spreading in the surrounding area.		Contractor	-Ha Nam province
	・Do not put vehicles and machines to run idle in more than 5 minutes.		Contractor	-Ha Nam province
	・Not use old vehicles for construction, to not overload vehicles, and to cover the material being transported.		Contractor	-Ha Nam province
	・Improve air quality will be achieved by alleviation of congestion through improving the road transport network in Ha Nam province.	During operation	Implementation Body	-Ha Nam province
Waste	・Sort waste into construction waste, hazardous waste, and general waste.	During construction	Contractor	-Ha Nam province
	・Contract local waste collection and recycling companies for waste collection (incl. Hazardous waste) based on relevant laws.		Contractor	-Ha Nam province
	・No burning, on-site burying or dumping of solid waste shall occur.		Contractor	-Ha Nam province
	Waste oil ・Avoid repairing trucks and machines at the construction site.		Contractor	-Ha Nam province
	・Provide oil recovery tank.		Contractor	-Ha Nam province
	・Collect and temporarily store used oil and grease separately in specialized containers and place in safe and fire-free areas with impermeable floors roofs, at a safe distance from fire sources.		Contractor	-Ha Nam province
Soil pollution	・Carefully manage waste (See “Waste”)	During construction	Contractor	-Ha Nam province
Noise and vibrations	・Restrict speed of vehicles.	During construction	Contractor	-Ha Nam province

Impacts	Mitigation measures	implementation period	Responsible party	Supervisor
	・Restrict the use of unnecessary horn.		Contractor	-Ha Nam province
	・Do not put vehicles and machines to run idle in more than 5 minutes.		Contractor	-Ha Nam province
	・Avoid construction operations generating great vibration and loud noise within the time between 6pm and 7am when construction takes place near residential areas.		Contractor	-Ha Nam province
	・Reduction of noise and vibration will be achieved by alleviation of congestion through improving the road transport network in Ha Nam province.	During operation	Implementation Body	-Ha Nam province
Resettlement and land acquisition	Make consensus with the Project Affected Persons (PAPs) for compensation for the land acquisition	Before construction	Project Implementation Body	-Ha Nam province
Poverty	・Make consensus with the Poor Peoples for compensation measures ・Implementing income restoration program	Before construction	Project Implementation Body	-Ha Nam province
Working environment	・Provide equipment, and monitor and supervise to ensure worker safety.	During construction	Contractor	-Ha Nam province
	・Inform related parties of emergency telephone numbers for hospitals, police stations, local government, disaster prevention organizations, etc.		Contractor	-Ha Nam province
	・Install fences and warning signs, and allocate personnel at dangerous places.		Contractor	-Ha Nam province
	・Provide workers with safety equipment (helmets and earmuffs, etc.).		Contractor	-Ha Nam province
	・Prepare and disseminate clear operation rules for preventing unsafety operation.	During operation	Implementation Body	-Ha Nam province
Accidents	Fire, falls, and electric shock ・Install fire prevention equipment	During construction	Contractor	-Ha Nam province
	・Periodically inspect safety equipment.		Contractor	-Ha Nam province
	Traffic accidents ・Collect materials dropped during transportation.		Contractor	-Ha Nam province
	・Notify related parties of hazard signs installed by investors.		Contractor	-Ha Nam province
	・Prepare and disseminate clear operation rules for preventing traffic accidents.	During operation	Implementation Body	-Ha Nam province

Source: JICA Survey Team

14.6.2 Environmental Management/Monitoring Plans

Draft monitoring plan for each sector is shown in **Table 14.6-3** and **Table 14.6-4**.

Table 14.6-3 Draft Monitoring Plan of the Sewerage Sector

Environmental item	Item	Location	Reporting system for responsible agency	Method	Frequency (stated period continued during operation)
During construction (construction stage)					
Air pollution	Microclimate conditions, CO, SO_2, NO_2, TSP, $PM_{2.5}$, CxHy, Pb	Sewage treatment facility area K1	Managed by: Investor	Based on QCVN 05: 2013/BTNMT	Every six months
Water Quality (wastewater)	pH, Temperature, Odor, BOD5, COD, TSS, Fe, Cu, As, Hg, Cd, Zn, Mn, Ammonia, Total N, Total P, Coliform	Sewage treatment facility area	Managed by: Investor Implemented by: Contractor	Based on QCVN 40:2011/BTNMT	Every six months
Water Quality (surface water)	pH, BOD_5, Temperature, DO, EC, Color, TSS, COD, Cl^-, NO_2^-, NO_3^-, Fe, Pb, Zn, As, T-N, T-P, Detergent/surfactant, oil and grease, Coliform	Drainage destination NM1	Managed by: Investor Implemented by: Contractor	Based on QCVN 08-MT:2015/BTNMT	Every six months
Waste	Waste management and treatment status	Construction site	Managed by: Investor Implemented by: Contractor	Monitor waste management and treatment status record	Once a month
Soil pollution	(See "Waste")				
Noise and vibrations	Noise and vibration level of construction work	Construction site K1	Managed by: Investor Implemented by: Contractor	Based on QCVN 26: 2010/BTNTMT for noise and 27:2010/BTNMT for vibrations.	Every six months
Resettlement and land acquisition	Details are proposed in the A-RAP.				
Poverty	Poverty Level (Annual household total income)	Targeted each poor household	Managed by: Investor Implemented by contracted consultant	On- site (each household) hearings	Every six months
Working environment	Working environment	Construction site	Managed by: Investor Implemented by: Contractor	Maintenance log for safety equipment of workers and construction machinery, usage record of medical facilities and other details to be determined upon conclusion of contractor agreement.	Determine upon conclusion of contractor agreement

Environmental item	Item	Location	Reporting system for responsible agency	Method	Frequency (stated period continued during operation)
Accidents	Safety measures, safety management conditions, accidents and measures	Construction site	Managed by: Investor Implemented by: Contractor	On-site inspection of safety measures and safety management conditions, review written report, or monitor record management upon an accident	Determine upon conclusion of contractor agreement
During operation(operation stage)					
Water quality (effluent wastewater)	pH, BOD_5, TSS, TDS, Sulfide (H_2S), Ammonia, Nitrate (NO_3), Animal fat and vegetable grease, Total surface-active substances, PO_4, Total Coliform	Sewage treatment facility area	Managed by: Investor	Based on QCVN 40:2011/BTNMT	Every six months
Water quality (surface water)	pH, BOD_5, Temperature, DO, EC, Color, TSS, COD, Cl^-, NO_2^-, NO_3^-, Fe, Pb, Zn, As, T-N, T-P, Detergent/surfactant, oil and grease, Coliform	Drainage destination NM1	Managed by: Investor	Based on QCVN 08-MT:2015/BTNMT	Every six months
Waste	Hazardous waste (Waste management and treatment status)	Sewage treatment facility area	Managed by: Investor	Monitor waste management and treatment status record Based on QCVN 07:2009/BTNMT	Once a month
	Sludge (volume, Cu, As, Zn, Pb, Cd, Cr)	Sewage treatment facility area	Managed by: Investor	QCVN 03-MT:2015/BTNMT, QCVN 50:2013/BTNMT	Every six months
Soil pollution	(See "Waste")				
Offensive odors	Status of implementation of tests and monitoring based on laws and regulations	Sewage treatment facility area	Managed by: Investor	Confirm implementation status of test and monitor air concentrations	Every three months
Working environment	Status of preventive measures for labor-related infractions	Sewage treatment facility area	Managed by: Investor	Initiatives to prevent labor-related infractions; investigation and measures to prevent reoccurrence when infractions are found	Determine upon conclusion of contractor agreement
Accidents	Safety measures, safety management	Sewage treatment facility area	Managed by: Investor	Initiatives for safety measures and management; record	Determine upon conclusion of

Environmental item	Item	Location	Reporting system for responsible agency	Method	Frequency (stated period continued during operation)
	conditions, accidents and measures			accidents and measures to prevent reoccurrence	contractor agreement

Source: JICA Survey Team

Table 14.6-4 Draft Monitoring Plan of the Road Sector

Environmental item	Item	Location	Reporting system for responsible agency	Method	Frequency (stated period continued during operation)
During construction (construction stage)					
Air pollution	Microclimate conditions, CO, SO_2, NO_2, TSP, $PM_{2.5}$, CxHy, Pb	Construction site K2, K3, K4	Managed by: Ha Nam province Implemented by: Contractor	Based on QCVN 05: 2013/BTNMT	Every six months
Waste	Waste management and treatment status	Construction site	Managed by: Ha Nam province Implemented by: Contractor	Monitor waste management and treatment status record	Once a month
Soil pollution	(See "Waste")				
Noise and vibrations	Noise and vibration level of construction work	Construction site K2, K3, K4	Managed by: Ha Nam province Implemented by: Contractor	Based on QCVN 26: 2010/BTNTMT for noise and 27:2010/BTNMT for vibrations.	Every six months
Resettlement and land acquisition	Details are proposed in the A-RAP.				
Poverty	Poverty Level (Annual household total income)	Targeted each poor household	Managed by: Investor Implemented by contracted consultant	On- site (each household) hearings	Every six months
Working environment	Working environment	Construction site	Managed by: Ha Nam province Implemented by: Contractor	Maintenance log for safety equipment of workers and construction machinery, usage record of medical facilities and other details to be determined upon conclusion of contractor agreement.	Determine upon conclusion of contractor agreement
Accidents	Safety measures, safety management conditions, accidents and measures	Construction site	Managed by: Ha Nam province Implemented by: Contractor	On-site inspection of safety measures and safety management conditions, review written report, or monitor record management upon an accident	Determine upon conclusion of contractor agreement
During operation(operation stage)					
Air pollution	Microclimate conditions, dust,	Project Road K2, K3, K4	Managed by: Investor	Based on QCVN 05: 2013/BTNMT	Every six months

Environmental item	Item	Location	Reporting system for responsible agency	Method	Frequency (stated period continued during operation)
	CO, SO_2, TSP, $PM_{2.5}$, CxHy, Pb				
Noise and vibration	Noise and vibration level	Project Road K2, K3, K4	Managed by: Investor	Based on QCVN 26: 2010/BTNTMT for noise and 27:2010/BTNMT for vibrations.	Every six months
Working environment	Working environment	Operation site	Managed by Investor	Initiatives for working environment improvement measures and management	Determine upon conclusion of contractor agreement
Accidents	Safety measures, safety management conditions, accidents and measures	Road development/ rehabilitation area	Managed by: Investor	Initiatives for traffic safety measures and management; record accidents and measures to prevention reoccurrence	Determine upon conclusion of contractor agreement

Source: JICA Survey Team

14.7 Project Impacts and Socio-Economic Profile in the Project Area

14.7.1 Method of Socio-Economic Survey (SES) and Inventory of Loss (IOL)

The methods used in the Abbreviated Resettlement Action Plan (A-RAP), which apply to components related to land acquisition and sites clearance for the project include:

Document Review

The Consultant collected, reviewed, studied and analyzed/assessed the documents relating to land acquisition, compensation and resettlement of Project. These documents were collected from PMU and ward/commune PCs of project area and they included (i) Project documents (Reports and drawings of project components); (ii) Cadastral maps, map extracts and Social – Economic reports provided by commune PCs; and (iii) policies of JICA, Government of Vietnam and Ha Nam province PC in order to (1) find out processes and regulations that were approved by Project documents; (2) find out technical measurements proposed for each Project component; (3) review socio – economic reports of locality; and (4) propose mitigation measures and guidelines for Project's next activities.

Qualitative Method

- Consultation and discussion with various stakeholders, including the implementation agencies and social organizations through consultation meetings, in-depth interviews, group discussions, and in-depth interviews with affected households, such as severely affected households, displaced households, vulnerable households.
- Hearing Surveys to the PAPs.
- Visiting field of resettlement sites and areas under research project to determine the potential impacts on local residents during the project implementation.

Quantitative Method

- From August 05, 2018 to August 25, 2018, the resettlement consultant group conducted socio-economic survey[2] and affected lands/assets in 08 communes/ wards will land acquisition and sites clearance: 4 communes of Duy Tien district (including

[2] *Using the socio-economic survey by questionnaire for the Preparatory Survey on the Investment Environment Improvement in Ha Nam Province project*

Tien Noi, Hoang Dong, Yen Bac and Dong Van) and 3 communes of Phu Ly city (including Liem Tiet, Liem Tuyen and Dinh Xa), and one communes of Thanh Liem district (Liem Can commune).

- In the November, 2018, the resettlement consultant group conducted socio-economic survey[3] and affected lands/assets in 08 communes/ wards will land acquisition and sites clearance: 4 communes of Duy Tien district (including Tien Noi, Hoang Dong, Yen Bac and Dong Van) and 3 communes of Phu Ly city (including Liem Tiet, Liem Tuyen and Dinh Xa), and one communes of Thanh Liem district (Liem Can commune).
- Socio – economic survey by questionnaire: Survey was carried out for: (i) severely affected household (loss 20% the total agricultural land area or more; affected on income); (ii) affected households on houses and structures (iii) vulnerable groups (female headed households, poor families, households with elderly, etc.). Moreover, the consultant unit also conducted a survey of over 10% of all marginally affected households. Total households were surveyed by questionnaire in the project area are 255/836 total affected households.
- The statistic of Inventory of Losses (IOL) was carried out in 100% of affected households.

14.7.2 Scope of Land Acquisition and Resettlement

An investigation, including a preliminary survey and affected quantity calculation, had been deployed for the affected people by land acquisition activities for implementing project in order to determine the loss of land and fixed assets such as: buildings, trees, livelihoods and community resources.

In terms of resettlement, it will not be necessary to relocate any households for the project, although some land acquisitions are to be needed by the project. The total households affected by the project is shown in **Table 14.7-1**.

Table 14.7-1 Summary and Classfication of Affected Households

No.	Items	Commune/ ward	Total
1	**Road Sector**		**776**
1.1	Center Road (LCB-01)	Dong Van town Hoang Dong commune Tien Noi commune	**127**
1.2	Expressway East Bypass Road (LCB-02)	Tien Noi commune Yen Bac commune Bach Thuong commune	-
1.3	Feeder Road North and South(LCB-03)		**203**
1.4	North-South and East- West Cross Road(LCB-04)		**446**
2	**Sewerage Sector**		**60**
2.1	Treatment Facilities	Dinh Xa commune	**60**
	Total		**836**

Source: JICA Survey Team

The survey results show that out of total 836 HHs, there are 74 vulnerable households (including: 23 poor households, 41 policy households, 02 elderly people and 09 households headed by women with dependents); there is no households affected business. There is no ethnic minority household to be affected by the project. The number of the affected households and structures are summarized in **Table 14.7-2**.

[3] *Using the socio-economic survey by questionnaire for the Preparatory Survey on the Investment Environment Improvement in Ha Nam Province project*

Table 14.7-2 Summary on the Number of Affected Households and Structures of Project

Content	Unit	Affected volume
A. Affected households	HHs	**836**
Household members	People	3,690
1. Households are affected by land acquisition		**794**
Of which: + Affected residential land	HHs	1
+ Affected agricultural land	HHs	790
+ Affected aquaculture land	HHs	3
2. Affected households on houses and structures	HHs	**44**
Of which:		
a, Affected households on houses and structures	HHs	**2**
b, Affected with graves	HHs	42
3. Affected households on trees and crops	HHs	**794**
4. *Physical Relocated households*	HHs	**0**
B. Total affected land area	m^2	**671,392**
- Area of affected residential land	m^2	41
- Area of affected paddy fields land	m^2	417,123
- Area of affected aquaculture land	m^2	5,040
- Area of affected public land	m^2	249,188
C. Households losing 20% or more of total agricultural landholdings or 10% or more for vulnerable households	HHs	**299**
D. Vulnerable group	HHs	**74**
Of which:		
+ Poor households	HHs	23
+ Policy households[4]	HHs	41
+ Elderly households	HHs	2
+ Women-headed households with dependents	HHs	8
E. Affected households on business	**HHs**	**0**

Note: Several households might have more than one type of land, therefore, total number per land type may be greater than total actual number of AHs
Source: JICA Survey Team

Result of the IOL shows a total of 836 households (HHs) to be affected by the project, of which 794 households are affected land and 42 households are affected graves. Out of the total 794 HHs, there are:

- 1 household affected residential land. But, there is no households have to relocate;
- 790 households affected agricultural land with 299 are severely affected households (225 of which have lost 20% or more of the total agricultural land area and 74 vulnerable households have lost 10% of their existing total cultivation land area);
- 3 households affected aquaculture land;

14.7.3 Impacts of Projects on Households and other Establishments

(1) Impact of residential land acquisition

There is only one household which may be affected by project implementation involving the acquisition of residential land and fixed assets along the road LCB-1 in Hoang Dong commune. Total residential

[4] *Policy households are those have merits with the country, including households with invalids, matyr, or th heroes of the people's armed forces meritted by the State*

land area affected is 41 m^2

(2) Impact on agricultural land

The Project implementation will affect agricultural land of 790 households (affected land area is 417,123 m^2). The agricultural land to be affected consist mostly of paddy fields, with some perennial and annual crops. Out of the 790 householeds (HHs) affected, some 299 HHs may be severely affected (225 HHs losing 20% or more of total agricultural land area and 74 HHs falling under the vulnerable group, losing 10% or more of their total agricultural land area).

(3) Impact on aquaculture land

The project implementation will affect on aquaculture land area owned by 3 households, of which 5 households are permanently affected with area of 1,250 m^2 and 3 households are indirectly affected. Because, the 3 households are land leased from commune people's committee for aquaculture with area of 5,040 m^2. The total affected aquaculture land area is 5,040 m^2.

(4) Impact on houses and structures

The Project has selected the optimum design to avoid and minimize the adverse impacts of land acquisition to households. However, the impact of land acquisition and site preparation is unavoidable.

According to the inventory survey results, 2 households on houses and structures will be affected.

(5) Impact on trees and crops

According to the inventory results, the implementation of project works will affect 209 fruit trees (longan, pomelo…); 246 banana trees; 5, 642 timber trees and about 415,010 m^2 of rice and other crops. Total number of households affected with regard to trees and crops is 794 households.

14.7.4 Socio-Economic Profile of the Project Affected Persons (PAPs)

In the November 2018, a socio-economic survey was conducted on 255 of the total 836 households affected by the project (accounting for about 30.5 % of total number of affected households).

(1) Demographic characteristics of the affected households

According to the survey of 255 families with 1,110 residents, women account for 48.1% and men account for 51.9%. Survey results show that the number of people per household is about 4.58, household size of 3-5 persons accounts for the highest rate of 72.4%; Households with 1-2 persons account for 6.3%. Households with more than 5 people account for 21.3%. On average, the number of people in working age is 2.2 persons/household; Average number of dependents is 2.2 persons/household.

All the affected households are Kinh people, without the presence of any ethnic minority group in the project area.

(2) Education

In general, the education level of the people affected directly by the project is relatively high. According to the survey results, among 255 interviewees, the number of household heads graduated high school accounts for the highest proportion of 38.7%; followed by secondary school with 35%. The number of interviewed household heads has college/university or post-university degree accounts for 6.5%. The number of household heads with primary school education level accounts for 19.4% and only 0.4% of households heads are illiterate.

Also according to the survey results, there is no significant difference in education level between men and women. Information on educational background is one among the basis for orienting the job change support for affected people at working age. With popular educational background of secondary school and high school levels, all stakeholders have discussed to project appropriate jobs and employment source for people in line with local general planning.

(3) Occupation of household heads

Among 255 surveyed households, the proportion of households mainly engaged in agriculture accounted for 61%; followed by 18.3% housewives and retired people, and 14,8% doing

business/services; the rest portion belongs to other sectors such as driving, free labor, workers ... Out of households affected on agricultural land, 299 households were severely affected due to loss of productive land. The survey results also showed that households affected on agricultural land were willing to participate in vocational training courses and agriculture extension programs of the project (cultivation and raising cattle) and desired to borrow loans for trading and business.

(4) Living standards and living facilities of the households

According to the Government's Decision No. 59/2015/QD-TTg, November 19, 2015 promulgating multidimensional poverty lines for the period 2016-2020, the poverty line for urban area is 900,000 VND/person/month. If household size is 4.4 people/households, household average income will be 3.96 million VND/households/month. According to the survey, there are 11 households having income less than 900,000 VND/person/month which is under the poverty line of MOLISA.

In general, household monthly expenditures account for 2/3 total of family income. The average income of the 255 HHs surveyed was about 14.5 million VND/household/month and the expenditure was about 13.2 million VND/household/month. Accordingly, the average income of 255 households is about 3.2 million VND/person/month, equivalent to 39.5 million VND/person/year and the average expenditure is 3.0 million VND/person/month, equivalent to 36 million VND/person/year. Therefore, households spend about 87% of their monthly income. On average, the remaining 13% is savings after spending.

(5) Vulnerable households

These are special groups that might suffer disproportionately impacts or might suffer risks of impoverishment due to impacts of resettlement. The group includes poor households, policy families, families deserving for the revolutions, the alone elder and women-headed households with dependents.

Obviously, in areas affected by the project, it is inevitable that fact that people living in more disadvantaged areas than surrounding communities. These objects often fall into the women-headed households with dependents, households with disabled, households falling into group below the poverty line, and landless households. These are the most vulnerable groups of land acquisition of the project. They may be people who can hardly be competitive on the labor market when their livelihoods depend on the lost land.

(6) Gender issues in the area

Through the surveys, men and women share many of the tasks related to farming as well as off-farm work. Women however have much more responsibility for household work such as cooking, and cleaning. The economic status, support system, and family income arrangements for each women head of household will need to be reviewed under the special assistance program to ensure that women head of households are not at risk of poverty and vulnerability from the project.

14.8 Necessary Compensation and Assistance Policies and Measures

14.8.1 Necessary Compensation Policies

(1) General principles

All projects affected people (PAP) who have assets within or reside within the area of project land-take before the cut-off date are entitled to compensation for their losses. Those who have lost their income and/or Subsidence will be eligible for livelihood rehabilitation assistance based on the criteria of eligibility defined by the project in consultation with the PAPs. If, by the end of the project, livelihoods have been shown not to be restored to pre-project levels, additional measures will be provided.

(a) The compensation, support price units will be determined timely and with consultation based on independent land appraisal results of the Independent Price Appraisal Unit hired by PMU. On-land crop/asset compensation price units will be applied as those issued annually by Ha Nam PPC based on market survey results of Ha Nam Province's DOC. The independent monitoring unit will assess compliance of these price units.

(b) All fees and taxes about land and/or house transfer will be exempted for the HHs who already paid registration fee before receiving land use right certificate. For HHs who already paid registration fee upon receiving Land Use Right Certificate will be exempted of registration fee

upon issuance of new land use right certificate. The local authorities will ensure that PAP choosing relocation on their own, obtain, without additional costs.

(c) Compensation-by-land-use-right-value principle.

(d) For HHs who have to displace, if they desire to be allocated with Resettlement land, they will be allocated with land in the resettlement site. The resettlement area will be planned properly and implemented in consultation with the PAPs. All basic infrastructures, such as paved roads, sidewalks, drainage, water supply, and electricity and telephone lines, will be provided.

(e) For HHs who have to relocate, if they don't want to be allocated with land in the resettlement site, then beside compensation, support payments, they will also be allocated with an additional support amount equivalent to the minimum infrastructure investment rate in accordance with relevant local regulations.

(f) Compensation for all residential, commercial, or other structures will be offered at the replacement cost, without any depreciation of the structure and without deduction for salvageable materials. Structures shall be evaluated individually. Any rates set by category of structure must use the highest value structure in that group (not the lowest).

(g) The PAPs will be provided with full assistance (including a transportation allowance) for transportation of personal belongings and assets, in addition to the compensation at replacement cost of their houses, lands and other properties.

(h) Compensation and rehabilitation assistance must be provided to each PAP at least 30 days prior to the taking of the assets for those who have not to relocate and 60 days for those who will have to relocate. Exceptions should be made in the case of vulnerable groups who may need more time.

(i) If, by the end of the project, livelihoods have been shown not to be restored to pre-project levels, additional measures will be provided.

(j) Financial services (such as loans or credit) will be provided to PAPs if needded. The amount will be paid per period and method of repayment will have to under the ability to pay of PAPs.

(k) Additional efforts, such as economic rehabilitation assistance, training and other forms of assistance, should be provided to PAPs losing income sources, especially to vulnerable groups, in order to enhance their future prospects toward livelihood restoration and improvement.

(l) The services and resources to serve the community in the resettlement site will be maintained or improved more than before relocation.

14.8.2 Eligibility and Entitlement (Entitlement Matrix)

(1) Eligibility for compensation and assistance

The eligibility for entitlement to compensation is determined by asset ownership criteria:

(i) Those who have formal legal rights to land (including customary and traditional rights recognized under the laws of the country. In the consideration, it is also useful to document how long they have been using the land or the assets associated with it;

(ii) Those who do not have formal legal rights to land at the time the census begins but have a claim to such land or assets provided that such claims are recognized under the laws of the country or become recognized through a process identified in the A-RAP;

(iii) Those who have no recognizable legal right or claim to the land they are occupying.

(2) Cut-off-Date

Persons covered the above under (i) and (ii) are provided compensation for the land they lose, and other assistance. Persons covered the above under (iii) are provided with resettlement assistance in lieu of compensation for the land they occupy, and other assistance. Persons who encroach on the area after the cut-off date are not entitled to compensation or any other form of resettlement assistance. All persons included in the (i), the (ii), or the (iii) are provided with compensation for loss of non-land assets that they are using or owning.

The Cut-off-Date based on the JICA Environmental Guidelines was declared when the Socio-Economic Survey was conducted in this preparatory survey. The establishment of the eligibility cut-off date under the JICA Environmental Guidelines is intended to prevent the influx of ineligible non-residents who might take advantage of Project entitlements. Anyone moving into the Project investment areas illegally after that date will not be entitled to compensation and assistance under the Project.

In terms of the Sewerage Sector as well, the Cut-off-Date was set after the Project Scope was revised.

On the other hand, Ha Nam Province will issue the Cut-off-Date based on the Vietnam's Law as the Detailed Design are started. Cut off date in Viet Nam (follow Article 67.1 of Land Law 2013) is the date when the Provincial People's Committee Ha Nam issues a notice about land acquisition. People whose land are acquired shall be given a notice about land acquisition by local authorities at least 90 days before the Detailed Design are started for agricultural land and 180 days before the Detailed Design are started for non-agricultural land. The notice will include the plan on land acquisition, survey, measurement and Detailed Measurement Survey (DMS).

(3) Determine the damage values and the Entitlements policy

Methods used to determine the damage value in projects are financed by Japanese ODA based on replacement cost. In this project, the damage includes the loss of land, the buildings and other assets. Replacement cost of land includes the land value is determined by the market price plus the cost to get the certificate of land use rights.

For housing and other construction works, the value is determined by the market price of building materials to build a replacement house with area and quality at least equal to the pre-project one. For these partially or totally affected works, the compensation values include market prices of building materials plus the cost of transporting materials, labor costs and contractor fees, registration fees and transfer tax. No depreciation of assets and the value of materials which affected households can take advantage of them.

In the implementation phase, the land independent valuation organization/ specialist will be leased to investigate and propose the replacement cost for all type of affected land (both agricultural and residential) and assets; the results will be the basis for Ha Nam Province People's Committee have decision on compensation rates, support to reflects the replacement cost.

In terms of the Entitlement Policy of the Project, those affected people will be entitled to the compensation, assistance and resettlement policy (if any) in accordance with the regulations of Vietnam and the JICA. Affected people will not be considered for compensation or support the project for the area after the cut-off date to be announced.

For the actual compensation will be done in cash for the value of lands based on the intensions of the Affected Person (AP)s, although the first option for the compensation is Land to Land based on World Bank Safeguard Operation Policy 4.12.

Table 14.8-1 shows the proposed entitlement matrix.

Table 14.8-1 Proposed Entitlement Matrix

No.	Type of loss	Application	Definition of entitled person	entitlements	Implementation issues
1	Loss of land	Permanent loss of agricultural land	User with legal or legalizable rights to use the affected land (790 HHs)	APs will be entitled to: (i) Compensation: The first option for the compensation is Land to Land based on World Bank Safeguard Policy 4.12. But the household will be compensated in cash for the value of land and crops of the acquired land area (100% replacement cost) based on the intensions of the Affected Person (AP)s, and (ii) For agricultural land in residential area, garden/pond land of the same land plot with house on it: Beside replacement cost-based compensation for agricultural land/or perennial crop land, there's also support equal to50% of the price of adjacent residential land of same location.	- After land acquisition, if the remaining land area is too small or distorted or inconvenient for drainage or production, it is that the project unit will acquire the rest for AHs.
			HHs not eligible for compensation for land losses	(i) Instead of land compensation, the HH will receive a support equal to 60% of land replacement cost. (ii) For poor peasant HHs of vulnerable group, including those without land: The local government will give them priority support with provision of agricultural land in accordance with land concession rate regulations applied in the locality in accordance with Decree No. 64/1993/CP, or, if there's no land to allocate, of if it is the HH's choice, beside the supports mentioned above, a vocational and job training program will be provided equal to at least two (2) times of value of agricultural land of the entire acquired land area (only applied for annual crop land). In case the HH desires to participate in a vocational training course, they can register to study at the province's vocational training center and will be exempted of study fee for this course (including primary, secondary and college levels) for people within labor age range (not applied for those who register to study outside of the province). (iii) Cash compensation for crop, tree losses on market Price basis	In case the AH uses public land for cultivation, and now the Project needs to acquire this land, then the HH will not be compensated in terms of land, yet will be compensated for crop, tree losses on market price basis. Restoration assistance will be provided to poor or vulnerable HHs if compensation by "land for cash" option is applied.
		Temporary loss of agricultural land	Users of temporary land or leased land but have no long-term legal land use right (LUR) (There is no Ahs identified at the time of the IOL implementation)	(i) As priority, compensation "leased land for leased land" at location acceptable to APs, or, if requested or there no reserved land to compensate "land for land", Cash compensation equal to remained investment put on the land or 30% of replacement cost; and, (ii) Cash compensation for loss of crops and trees at full replacement costs;	If the value of remained investment put by APs on the affected land is undoubtedly higher than 30% of the land replacement cost, the PMU and resettlement sites will revise and adjust adequately by case.

No.	Type of loss	Application	Definition of entitled person	entitlements	Implementation issues
2	Loss of residential land	Land acquired without structures built therein.	User of the affected land. (There is no Ahs identified at the time of the IOL implementation)	Cash compensation for land at (i) 100% of replacement cost of the land acquired to the legal/legalizable users; (ii) support by cash for value of investment in remaining land area or equal to 50% of replacement cost of that land area for user who does not have lawful land use right	
		Land acquired with structures built therein and the remaining land is sufficient to rebuild on	Households have to build houses on their remaining land. (1 HH)	General policy for residential land loss compensation is to compensate by cash: (i) Cash compensation for land at 100% of replacement cost of the land acquired to the legal/legalizable users; (ii) a support amount equal to value of the remaining land investment for HHs not eligible to for compensation by land, equal to 50% of replacement cost. a. Compensation for affected structures at 100% of replacement cost; and, b. If house/structure is partially affected, house users will be compensated additional cost for repairing and restoring their structures as before or even better (similar to 20% of the total values of affected structures).	
		Land acquired with structures built therein and the remaining land is not sufficient to rebuild on.	Relocating APs. (There is no Ahs identified at the time of the IOL implementation)	(1) entitlements for residential land is as follows: (i) The APs, who have legal or legalizable rights to the affected land, can opt to one of the followings: - Compensated with 100% of replacement cost and allocated with residential land at the project's resettlement site; - Compensated with 100% of replacement cost and provided with an additional support amount equivalent to the minimum infrastructure investment rate in accordance with related local regulations if the HH does not want to live in the resettlement site and want to find new place to reside themselves. (ii) The APs, who do not have legal or legalizable rights to the affected land, are entitled to the followings: - For HHs having other place(s) to reside in the same ward/commune with affected area, the Project will provide them with a support amount equal to the remaining in-land investment value, or equal to 50% of replacement cost of the land lot. - HHs not having land at the same ward/communes, in addition to the above support, will be allocated with a resettlement land plot or supported with a basic infrastructure investment rate if they want to relocate on their own.	;

No.	Type of loss	Application	Definition of entitled person	entitlements	Implementation issues
				- Poor HHs and those in vulnerable group ineligible for compensation for land and not having any other place to reside will be considered for exemption of a part of or entire of land use value payment in accordance with relevant regulations of the province. .- Compensation for affected structures (100% of replacement cost);	
3	House/structures and graves	Houses/structures located in the project recovered area.	Owners of Project affected structures. (2 HH)	(i) Compensation by cash for all affected structures equal to 100% of replacement cost of materials, man power, regardless of they have land use right certificate or construction license or not. Compensation amount is enough to build new structures equivalent to the old ones on market price basis; (ii) If the structure is partly affected, the project will provide compensation to help repair, restore its original condition or even better, equivalent to 20% of total value of the affected structure. (iii)Compensation and assistance amounts in cash, not taking into account of depreciation of use value as well as deduction of salvageable materials.	Compensation will be paid in cash, without any depreciation of the house/structure and deduction for salvageable materials. The compensation is calculated according to the actual affected area.
		Graves located in the affected areas.	Owners of graves (42 HHs)	APs are consulted on time for relocation suitably with local customs, faiths and the project implementation progress and entitled to cash compensation for all costs of exhuming, movement, and reburial and other related costs.	For ownerless affected graves, PMU will sign a contract with an independent unit for compensation and relocate them to new site
4	Loss of standing crops and trees	Crops affected	Owners of affected crops	APs are entitled to compensation for affected crops in cash at replacement cost.	APs will be given notice several months in advance regarding evacuation. Crops grown after issuance of the deadline will not be compensated.
		Trees affected	Owners of affected trees.	APs are entitled to compensation in cash at replacement cost on the basis of type, age, and productive value.	Replacement cost methods of crops and trees, aquaculture animals are made of the compensation rate for trees and crops by the Provincial People's Committee at the time of compensation to ensure replacement cost
5	Temporary impact during construction	Temporary loss of agricultural land	Users of affected land	(i) Compensation for one harvest of crops/trees at full replacement costs	If the quality of land will be radically changed when return to APs, requiring APs

No.	Type of loss	Application	Definition of entitled person	entitlements	Implementation issues
				(ii) Compensation for loss of net income from subsequent crops that cannot be planted for the duration of project temporary use, and (iii) Restoration of land to its previous or better quality by providing measures to improve land quality in cases of land being adversely affected or acidified, and (iv) If the duration of project's use the land exceed more than two years, then the APs have option to: 1) Continue to use land, or, (2) Give it to the Project and be compensated as permanent loss	to change in the types of land use, then APs should be compensated for all envisaged cost of losses.
		Temporary loss of residential land	Users of affected land	(i) Compensation for affected assets at replacement cost (ii) restoration of land to former conditions	If there are losses of income, the community will get full compensation for loss of production and the amount of compensation is to restore shared revenue or create new infrastructure.
		Temporary impact on business	Owner of business	(i) Compensation for loss of income during transition period, equivalent average monthly net income at least for three months. (ii) Compensation for affected assets at replacement cost (iii) Restoration of land to former conditions or rehabilitation to better conditions	
		Damages by contractors to private or public structures or land	Owner or person with use rights	(i)The contractor will be required to pay compensation immediately to affected families, groups, communities or government agencies. (ii) Damaged property will be restored immediately to its former condition.	Grants will be adjusted inflation at the time of compensation.
6	Loss of community assets	Community buildings, structures, community forest/grazing/or other land/ irrigation systems affected by temporary or permanent land acquisition or spoil disposal.	Village, Ward, Government Unit.	(i) Restoration of affected community buildings and structures to at least previous condition, or (ii) Replacement in areas identified in consultation with affected communities and relevant authorities, or (iii) Compensation at replacement cost for affected community land and assets.	If income loss is expected (e.g. irrigation, community forest, community grazing land), the village is entitled to compensation for the total production loss this compensation should be used collectively for income restoration measures and/or new infrastructure.

No.	Type of loss	Application	Definition of entitled person	entitlements	Implementation issues
7.	Subsidies and restoration assistance				
		Production restoration assistance	APs losing agricultural land including aquaculture land (790 Hhs)	(i) For Livelihood restoration: 15,000VND per m^2 agriculture land acquired. (ii) Vocational Training and Job Creation: The minimum support will be two times of agricultural land price for the whole acquired area (the land for annual tree only); (iii) In case, households need a vocational training, they will be admitted to a vocational center in the province and are exempted from tuition fees for such training course (including level of primary, secondary training and vocational college) for those in the working age (not applicable for those who enroll for a vocational training outside the province).	Concrete form of assistance will be intensively consulted with the farmers to meet their actual needs, assisting them able to restore or improve their earning capacity and income. - The forms of assistance should be consulted closely with appropriate and effective measures of agricultural encouragement to assist the poor to restore their income generating capacity and income levels
		Reward for timely hand-over	AHs handing premise timely (836 HHs)	Land users who move assets, crops and hand over cleared premise timely as required, meeting Client's requirement about project implementation timing will be rewarded depending on architectural structure class, yet with reward rate not more than 3,000,000 dong/HH.	
		Support for vulnerable group	HHs in vulnerable group (74 HHs)	The HHs, individuals with land acquired for the project including those living on public land or land of other individuals (i) in poor HH group (determined in accordance with MOLISA's criteria) will receive a support of 6,000,000 dong for each HH; (ii) in policy HH group or being those having contribution to the revolution, or those of vulnerable group determined by socio-economic surveying (if any) will receive a support of 3,000,000 dong/HH	

Source: JICA Survey Team

14.8.3 Income Restoration and Rehabilitation

(1) Income restoration program

The objective of income restoration program is to aid subjects-households incurring income damages due to project implementation: (i) changed occupations as a result of loss of agricultural land and (ii) terminated/affected production and business as a result of loss of premises, means of production et. Incomes shall be recovered the same as those before project implementation, or incomes shall be increased further. Make sure that displaced persons will adapt themselves to new conditions at the soonest.

The project ensures full compensation at replacement cost and type assistance policies (fund assistance and cultivation techniques for continued cultivation on their remaining land, etc.) for the land, buildings and assets. Besides, policies to support income restoration for these APs are guaranteed and fully of the project.

(2) Main needs for livelihood restoration/rehabilitation by the Affected Persons

The result of survey showed that out of 836 affected households, there is no case of households affected on business activities due to land acquisition. However, the project implementation will affect income of 299 severely-affected households due to loss of agricultural land (in which 225 households lost 20% or more of total agricultural production landholdings and 74 vulnerable households lost 10% or more of total existing cultivation landholdings).

For the 299 severely affected households losing 20% or more of agricultural land for implementing of the project. When asked about options for income restoration measures (those who are working in agriculture), all of them expressed their desire to receive appropriate compensation payment, and probably some more subsistence assistance for them to recover their losses (of agricultural land acquisition), the results recorded were following:

- 82% of those households requested for fund assistance and cultivation techniques for continued cultivation on their remaining land;
- 66% of households wish to be supported in vocational training and job placement to members in working age but have not stable jobs yet; and
- 38 % of households requested for a loan for changing their business direction.

(3) Income restoration measures

Households affected as the consequence of agricultural land acquisition and production systems destroyed must face the loss of production tools, since their production assets are affected or they have no alternative income sources. However, this Project will not cause any involuntary resettlement, but will cause land acquisition.

On the other hand, people who have high social standing and/or materials, economic conditions find it more difficult to recover than others, are more likely exposed to risks and exhaustion. These people may fall in groups of vulnerable households

With such special features of the project and the main needs for livelihood restoration/rehabilitation by the DPs, the income restoration will focus on the following directions: vocational training and job creation. For the DPs losing income and/or business/productive assets and for vulnerable groups, financial support is imperative. Main specifics are:

(i) Vocation al trainings and job creation
  - Cash allowance for vocational training and career monitoring
  - Vocational training allowance
  - Job creation allowance
  - Support for contracted abroad working

(ii) Support for vulnerable groups
  - Giving priority to vocational training or job replacement
  - Food or material assistance for extremely disadvantage households

(iii) Subsistence allowance for HHs impacted with agricultural land.

14.8.4 Implementation Organizations and Grievance Redress Mechanism of Compensation and Assistance Measures

(1) Implementation Organizations

Agencies in charge of land acquisition include:

- Ha Nam Province People's Committee (Provincial PCs)
- District/city People's Committee (DPCs)
- Project Management Unit (PMU)
- District/City Land Fund Development Center (LFDC)
- People's Committees of Project wards/communes
- Representatives of Community Affected by the project
- Independent Monitoring Agencies (IMA)
- Independent Valuation Agencies (IVA)

Provincial PCs

The Provincial PCs in each involved province are the responsible or authorized district/city PC to set up and direct a provincial resettlement appraisal council in accordance with the needs of the project. The Provincial PCs will take overall responsibility as follows:

- Approve land acquisitions and allocations in the Project;
- Make final decisions and release compensation rates for the compensation and assistance levels, and support policies for affected persons and vulnerable groups based on this A- RAP;
- Direct the coordination among the concerned agencies and the provincial departments to implement the compensation and assistance t in accordance with this A- RAP;
- Provide full budget for the resettlement activities; and
- Ensure that the resettlement activities of sub-projects are in accordance with this A- RAP.

District/city PCs

The District/City People's Committees are responsible for determining legal rights to land and structures on land, land acquisition and land allocation (residential land), appointing members of the Board/Council of resettlement of the district/city.

The District/city PCs will take overall responsibility as follows:

- Directing, organizing, disseminating propaganda and motivating all concerned organizations and individuals to comply with the compensation, assistance and resettlement policies.
- Directing the DRC to prepare and implement the compensation plan;
- Coordinating with the departments, divisions, organizations and the Client to implement the project; and
- Solving grievances related to compensation, assistance and resettlement.

Project Management Unit (PMU)

The Project Management Unit (PMU) will be established by the project owners for their projects. The PMU is a permanent agency responsible for the implementation of resettlement plan of the project. It is agreed that experienced qualified PMU staff will be selected to respond to the project social – environmental safeguards. The PMU responsibilities are mainly:

- On behalf of the project owner or the city, implement and monitor all resettlement activities within the project, under the management of the PPC or the district/city PC. To prepare, coordinate and monitor the A- RAP;
- To check and advise the PC on the compensation rates of land and other properties, in coordination with other related government departments, agencies of the province;
- To coordinate, supervise, and monitor the implementation of the Resettlement Plan activities in the province;
- To establish a contact mechanism to ensure that the technical assistance and logistics are suitable for the implementation of compensation and resettlement;

- To establish procedures for internal monitoring to supervise the compliance with the project policies;
- To establish procedures for monitoring coordination between contractors and local communities and ensure quick identification and compensation for impacts on public and private properties during the construction;
- To employ, monitor, and implement the recommendations of the independent monitoring agencies and independent price appraiser;
- To set procedures for quickly implementing necessary mechanisms for resolving complaints and grievances;
- To take over land acquisition from households and transfer to contractors' units; and
- To define reporting periodical system on resettlement activities to the JICA.

District/city Resettlement Council (DRC)

The District/city Resettlement Council is established by the District/City People's Committee at district/city which are affected by the land acquisition. Chair of DRC is leader of DPC.

The compensation and resettlement committee/council (CRC) of the district/city is responsible to:

- Plan and implement all daily A-RAP activities within the district/city.
- Responsible for directing and monitoring the Resettlement specialist in charge of inventory of land acquisition, completion of compensation plans, review of the compensation plans to submit the PCs of provinces or district/city (if authorized) for approval and coordinate with the PMU to pay compensation directly to each affected person after receiving compensation fund;
- Responsible for coordinating with relevant units for conciliation and resolution of complaints by project affected persons on entitlements and compensation rights;
- Establish, if necessary, the commune/ward CRCs and direct them in implementing the A-RAP activities;
- Take special care to the needs and aspirations of the particular groups of people (ethnic minorities) and the vulnerable people (children, the elderly, the household heads who are female/single);
- Cooperate closely with the independent monitoring agencies.

District/City Land Fund Development Center (LFDC)

- Preparing the plan or propose the clearance compensation plan for preparing the layout for the project implementation.
- Directly implementing the compensation and land acquisition. The clearance and compensation unit will organize the determination and verification to carry out the clearance compensation according to the approved plan
- Coordinating with the District/ward People's Committees, functional departments and the PMU to implement the site clearance effectively.

People's Committee of wards/ communes

Assigns tasks for communal officials to support the resettlement activities in their wards/communes are as follows:

- Support other units, organizations such as the PMU for information dissemination and organization of community meetings and counseling affected persons' comments;
- Support other organizations and units, including the PMU, for the replacement cost survey, detail measurement and inventory survey, and other resettlement activities;
- Participate in all activities of land acquisition and analysis of land origin, characteristics and use time, resettlement, restoration assistance, and social development support;
- Support affected persons in all A- RAP activities and living standard restoration. Notify DPs of the compensation schedule and monitoring of the compensation implementation and sign on contracts of compensation with DPs;
- Ensure the adequate implementation of mechanisms of resolving complaints to affected persons. Keep records of documents on complaints. Support, advice and guide affected persons in resolving complaints; and

- Certify the origin of land use of organizations, agencies, units, individuals, and households affected by the project.

Independent Monitoring Agency (IMA)
It is necessary to identify and hire an agency/ organization or research institute specializing in social sciences, to conduct socio-economic surveys, to monitor, and evaluate the implementation of the A-RAP. The IMP will report periodically on progress made and to make recommendations concerning resolving the problems detected in the monitoring process.

Independent Valuation Agency (IVA)
During the process of the implementing the project, there shall be an independent evaluation agency, in which the Project implementation body will hire to conduct replacement cost survey for land, properties and crops affected by the Project. The agency shall establish the replacement cost as basis for Ha Nam Province People's Committee to make decision on compensation rates close to market prices.

(2) Grievance Redress Mechanism of Compensation and Assistance Measures

1) Grievance Redress Responsibility

To ensure all complaints from affected people regarding land acquisition, compensation and resettlement…are resolved timely and reasonably, one grievance redress mechanism was established in this Resettlement Plan.

All the affected people can send their complaints and inquiries on their entitlements, compensation rate, support, income restoration. to the implementing agency without paying any cost during the resolution of these complaints at all levels.

The grievance redress mechanism follows the Law on Complaints No. 02/11/QH13 and regulations on complaints in Decree 75/2012/ND-CP dated 20/11/2012. The complaints will be resolved through 3 levels before going to the Court as the final resolution.

2) Grievance procedures

Questions and grievances from the project-affected people on the compensation entitlements, as well as compensation policy, compensation rates, land acquisition, resettlement and other entitlements to the life recovery program, shall be recognized and resolved by the functional units of all levels.

The Steps for raising complaints and complaint settlement as follows:

Step1: At the ward/commune People's Committee (Article 28 and Article 32 in the Law on Complaints 2011)
An aggrieved APs may bring his/her complaint in writing or verbally to officials of the People's Committee communes/wards. Members of the Committee ward/commune shall submit to the leadership ward/commune of this complaint to be resolved. Chairman ward/commune will hold separate meetings to address the complainant. Time to resolve complaints: within 30 days after receiving a complaint. The Secretariat of the Committee communes/wards is responsible for setting up and storing the entire file complaints are resolved by the People's Committee of the ward/commune.

Step 2: At the District/City People's Committee (Article 28 and Article 32 in the Law on Complaints 2011)
If after 30 days, the aggrieved household do not hear from PPC of wards, commune, or if the household are not satisfied with the decision to resolve their complaint, the household can present their case in writing or verbally to the District/City People's Committee. District/City PC will have 10 days to appraise the complaints and inform to the aggrieved household whether their complaint can be settled otherwise there will be clear reason. The time for settling the complaint is 30 days since the date of announcement on receiving the complaint. Within 03 working days since the date of issuing the decision for settling the complaint, District/City PC is responsible for sending the redress decision to the aggrieved household. The household can also bring their case to the court of District/City if they wish.

Step 3: At Provincial PC or the Court (Article 33, Law on Complaint 2011)
If after 30 days from presenting the complaint, the complainant does not hear from the City People's Committee, or the complainant is not satisfied with the decision to solve his/her complaint, the complainant may lodge complaints to the Committee provincial level together with City-level resolution and related ward/commune-level documents. Provincial PC will have 45 days to resolve the complaint to satisfy the parties involved. Provincial PC is responsible for keeping records of all complaints resolved by Provincial PC. The affected can also bring their case to court if they wish.

Step 4: At the court of province
If after 45 days the affected persons have received no feedback from Provincial PC, or not satisfied with the decision of the PPC made for his/her complaints, the complainant can be submitted their complaint to the Court to resolve. The court's decision will be final.

Decision on solving the complaints must be sent to the aggrieved PAPs and concerned parties and must be posted at the office of the People's Committee where the complaint is resolved. The decision/result on resolution is available at commune/ward level after 3 days, and at City level after 7 days.

14.8.5 Implementation Schedule of Compensation and Assistance Measures

(1) Main Activities of the A-RAP

To ensure the project to be implemented successfully and effectively, main activities will be established through a compensation schedule with specific timetable to evaluate the progress of work items at certain time. The plan should be prepared from beginning the project until completing the project. Main activities to be implemented include:

- Provincial PCs shall notify the cut-off date and compensation rates. All affected households will be informed fully of compensation entitlements and policies in the A-RAP, including the eligibility, entitlement policies, compensation mode and rate, schedule, grievances and redress mechanism;
- The PMU shall prepare Public information booklet (PIB),and released to affected households or informed at the meetings or public consultations. In addition, leaflet, panel and poster will be released to each household and publicity disclosed in such public places such as ward People's Committee, community house, medical stations and schools. Informing the land acquisition policy of the project, decision on approving the project and decision on approving project design;
- The local consulting organization shall carry out the socio-economic survey at the project area.
- Build up livelihood restoration programs/measures;
- Carry out the compensation, assistance, and livelihood restoration.

It should be evaluated the project impacts on affected households. One year after completing the project, a socio-economic survey will be carried out to evaluate project impacts on beneficiaries and affected households. Results of this socio-economic survey will be used for evaluating of impacts on community and learning lessons for activities, designing and implementing the project later

(2) Implementation Schedule

After finishing the Preparatory Survey, the Implementation schedule related to A-RAP activities in the detailed design phase and implementation phase are presented in **Table 14.8-2**.

This A-RAP in the preparatory survey phase could be regarded as the "Policy Framework for Compensation Support and Resettlement (CSR)", which is regulated on the Decree No. 47/2014/ND-CP dated May 15, 2014 in Vietnam.

Table 14.8-2 Implementation Schedule of the A-RAP Activities

Main activities
Detailed Design Phase
Review the A-RAP for Compensation, Support, and Resettlement (CSR) in accordance with the policies and conditions of Vietnams and the JICA Environmental Guidelines.
Socio-economic survey, preliminary inventory of losses (IOL), public consultation with affected persons and preparing A- RAP
If necessary, revise the A-RAP, which was prepared in the preparatory survey phase based on the above survey.
Submit the revised A-RAP to JICA Vietnamese Office and JICA will review it before its approval by Vietnamese side.
Confirm the latest A-RAP and prepare the Plan for CSR in accordance with the policies and condition on the revised A-RAP and the JICA Environmental Guidelines.
Submit the Plan for CSR to JICA Vietnamese Office and JICA will review it before its approval by Vietnamese side.
Based on the latest A-RAP, relevant authorities in Vietnam proceed the necessary procedures
Compensation and Assistance Program Implementation Phase
Implement public consultation and information disclosure, Detailed Measurement Survey (DMS), replacement cost
Implement the compensation payment and conduct internal/external monitoring of it
Implement the site clearance, relocation and restoration measures (if any) and conduct internal/external monitoring of it
Implement post-resettlement evaluation (if any)

Source: JICA Survey Team

14.8.6 Costs of Compensation and Assistance Measures

(1) Necessary replacement cost survey

As required by the JICA on Involuntary Resettlement, Replacement Costs Survey (RCS) will need to be done to establish basis for calculation of replacement costs for all the lands/crops/structures/assets that will be affected by the Project.

The establishment of compensation rates as a result of land acquisition and site clearance in Ha Nam Province has been carried out every year with adjustments according to market fluctuations.

In areas affected by the Project, the alignments basically affect land managed by the Commune People's Committees, agricultural land and a part of residential land. In such areas, there is almost no real estate market and few trading transactions relating to land and non-land assets.

Therefore, An independent price appraisal consultant is specialized in assessing costs of land/assets/structures to be affected under the Project, will be engaged by Ha Nam PMU to conduct replacement costs survey. The Replacement Costs Survey is detailed in Annex 1 of the Report.

During this preparatory survey phase, basis for calculating compensation payment proposed to affected households is at the replacement costs (for land and structures), and at market prices (for crops/trees and aquatic livestock), based on household's perceptions, local land transactions (for residential land), capacity of agricultural production (for agricultural land), local quotations for construction material and other assets; and referred to other current replacement cost surveys which have been carried out nearby.

(2) Cost estimates at preparation phase

Cost estimate for the A - RAP implementation includes:

- Cost for the compensation, assistance and resettlement: includes of the items which were described in the entitlement matrix;
- Cost for independent monitoring:
  - Cost of independent monitoring of A- RAP implementation is estimated at 1% of total cost of stage of DMS, compensation and restoration support;

- The independent monitoring consultant will prepare the technical and financial proposals for bidding. Actual cost will be decided through contract value for independent monitoring consultant.

- Cost for compensation, assistance and resettlement included costs of detailed measurement survey, land acquisition documentation, independent valuation cost, etc. It is estimated at 2% in maximum of total cost of compensation and restoration support;
- The independent monitoring consultant shall prepare the technical and financial proposals for bidding. Actual cost shall be decided through contract value for independent monitoring consultant;
- Cost for compensation, assistance and resettlement included costs of detailed measurement survey, land acquisition documentation, independent valuation cost, etc. It is estimated at 2% in maximum of total cost of compensation and restoration support;
- Contingency: The rate for contingency should be at about 10% of total cost of compensation and A- RAP preparation. The contingency will be used in cases of adjusted compensation rates due to inflation, or any adjustments during implementation of the approved A- RAP.

The estimated cost of implementing the A-RAP for project works is **95,048,739,000** VND, (equivalent to **4,096,000** USD). The summary of the estimated cost is shown in **Table 14.8-3**. The detailed cost estimate for each item is shown in Annex 2 of the Report.

Table 14.8-3 Summary of the Cost Estimate for A-RAP Implementation

TT	Item	**Total amount: exchange rate**: 1 USD = 23.200 VNĐ	
		VNĐ	USD
1	Compensation for land	22,881,850,000	986,287
2	Compensation for house and structures	139,928,000	6,031
3	Compensation for trees, crops and pet	5,312,124,000	228,971
4	Compensation for graves	876,000,000	37,759
5	Assistances: Subsistence allowance, Vocational training allowance and Support for vulnerable HH	51,658,185,000	2,226,646
6	Incentive bonus	2,508,000,000	108,103
7	Total items (1+2+3+4+5+6)	**83,376,087,000**	**3,593,797**
8	Management expense = 2% IX	1,667,521,740	71,876
9	Contingency (10% of total)	8,337,608,700	359,380
10	Other expense	1,667,521,740	71,876
-	Independent monitoring = 1 % IX	833,760,870	35,938
-	Replacement cost survey expense (temporary)	833,760,870	35,938
11	**Total items (7+8+9+10)**	**95,048,739,180**	**4,096,928**
	Rounding	**95,048,739,000**	**4,096,000**

Source: JICA Survey Team

14.8.7 Monitoring of Compensation and Assistance Measures

Monitoring and evaluation activities during the implementation period and after the resettlement stage are to ensure that the activities and commitments described in the A-RAP are fully and timely implemented, the Project Owner should maintain monitoring and evaluation of A-RAP implementation.

Monitor the implementation of the A-RAP to collect information regularly reflecting the results of A-RAP implementation. Evaluation of the A-RAP implementation aims to analyze the information collected during the monitoring process to assess the results achieved in accordance with agreed plans and methods.

Assessment of the A-RAP implementation meets the objective of "JICA Policy on involuntary resettlement". In the course of the implementation, the difference between the A-RAP and the actual implementation is that the PMU will propose timely remedial measures.

(1) Internal Monitoring

Internal monitoring of the A-RAP implementation of the project is the main responsibility of the implementation agency with the support of the project consultants. The implementation agencies will monitor the progress of A-RAP preparation and implementation throughout the regular progress reports. Internal monitoring aims to:

- Ensure that compensation payment for affected households for the different types of damage is implemented according to the compensation policy agreed in the A-RAP;
- Ensure that resettlement activities are implemented according to the compensation policy agreed in the A-RAP;
- Determine whether the conversion process, income restoration measures and resettlement assistance are provided on time or not;
- Evaluate whether the income restoration supports have been provided or not yet and propose corrective measures if targets of income restoration for households are not achieved;
- Disseminate public information and consultation procedures;
- Determine whether the complaint procedures have been followed or not and there is any outstanding issue needed the attention by the management level or not;
- Prioritize for interests and needs of affected people, especially poor and vulnerable households;
- Ensure transition between relocation, clearance and start of construction of civil works proceeds smoothly and that construction area will not be handed over until affected households have been compensated, supported and resettled satisfactorily.

The implementation agencies will collect information every month from the different resettlement committees. A database tracking the resettlement implementation of the Project will be maintained and updated monthly, including redressing of grievances (if any).

The implementation agencies will submit internal monitoring reports on the A-RAP implementation as a part of the quarterly report to be submitted to the JICA. The internal monitoring reports should contain the following information:

- Number of affected persons according to types of effect and project component and the status of compensation, relocation and income restoration for each item;
- The distributed costs for the activities or for compensation payment and disbursed cost for each activity;
- List of outstanding Complaints;
- The final results on solving complaints and any outstanding issues that demand management agencies at all levels to solve;
- Arisen issues in the implementation process;
- Updated actual schedule of resettlement activities

(2) External Monitoring

1) Specific Objectives of the External Monitoring

The general objectives of external monitoring are:

- To ensure that the standard of living of PAPs are restored or improved;
- To monitor whether the overall project and resettlement objectives are being met in accordance with the Resettlement Plan, and if not to suggest corrective measures;
- To assess if compensation and rehabilitation measures are sufficient and comply with the JICA;
- To monitor and provide advice on the prevention of potential risks posed by labor influx into the communities surrounding the project area (i.e. the people living or working in the communes immediately adjacent to the project site) during construction;
- To monitor and provide advice on the adequate protection of construction workers' safety at the construction site and the implementation of good work-place safety practices during construction;
- Monitor and provide advice on the adequate implementation of the project's Grievance Redress Mechanism (GRM); and to identify problems or potential problems and recommend remedies for problems.
-

2) Responsible Agencies

In accordance with the World Bank's requirements for consultant employment, Ha Nam PMU will hire an IMA to carry out the independent monitoring and evaluation of A-RAP implementation. This organization is called the Independent Monitoring Agency (IMA) which specializes in social sciences and has experience in independent monitoring of A-RAP. The IMA should start its work as soon as the project implementation commences.

3) Monitoring Methods

Monitoring methodology combines quantitative methods and qualitative included community meetings, focus group discussions, in-depth interviews and survey form. The sample size may be 100% of relocated HHs and severely affected HHs, and at least 20% of the remaining affected HH for each round of monitoring.

This survey should investigate both women, the elderly, and other vulnerable groups. There should be equal representation of both men and women.

Monitoring Report

Independent monitoring members must report once every six months and state the findings of the monitoring. These monitoring reports will be submitted to the PMU and then submitted to the JICA by the PMU. The Consultant submits the following types of Independent Monitoring reports: (i) Initial Report (ii) Periodic Report; (ii) Final Report.

The report will include (i) implementation progress of the A-RAP; (ii) the deviation, if any, with the terms and principles of the A-RAP; (iii) identifying existing problems and proposed solutions whereby implementing agencies are informed of the on-going situation and can address the problem in a timely manner; and (iv) developments of difficulties and issues identified in the previous report.

Independent monitoring will carry out an evaluation of the resettlement implementation status from 6 to 12 months after completion of all resettlement activities. The final evaluation report will be incorporated into the Project Completion Report.

14.9 Main Results of the Public Consultations

(1) Objectives of the Public Consultations

Main objectives of the Public Consultations are:

- To ensure that all affected persons and stakeholders will be involved in the planning and making decisions on involuntary resettlement related to them;
- Minimize the adverse impacts caused by involuntary resettlement;
- Avoid possible conflicts during project implementation.

(2) Methods and strategies of public involvements

The method of the public consultations includes through to community meetings, group meetings, group discussions, and socio-economic study.

At the beginning of the preparation phase, local authorities and leaders at different levels will be informed about the project, objectives and activities. They will be consulted and actively involved in discussions about the development needs and priorities. They can also contribute their opinions and ideas about the positive/negative impacts of the project that may occur and how to promote/reduce and increase their public interest in the project.

Before the detailed design, public consultations had been held in the affected wards/communes to provide information to the affected persons and provide opportunities for them to engage in open discussion on policies and procedures for the land acquisitions. Notice or invitation for the affected persons need to send at least two weeks in advance, to facilitate more participations for the public consultations.

The other strategies of public involvements are information aim to promote two-way communication between the project owner and project stakeholders, including affected people to ensure generally the public, and particularly the affected group, understand the project purpose, project design, potential positive and negative impacts of the project, and project policy on involuntary resettlement. It also creates opportunity for affected people to participate in all stages of resettlement implementation. Meaningful feedback from consultations will be considered and integrated in the project design and mitigation measures.

Information dissemination and public consultation methods include rapid assessment with involvement and consultation of stakeholders, using site-based techniques and household meetings and site visits, public meetings, focus group discussions, and socio-economic surveys.

(3) Public consultation during project's preparation stage

The Consultant has worked with stakeholders and local authorities to organize 2 consultations in 2016 and 2018. Community consultation meetings were conducted in communes/wards that implemented project works to inform and consult with local people and community about the project's policy and the interests of the people.

- In 2016: there were 14 consultations with local authorities and AHs. There were total 369 participants;
- In 2018: Because of changes in scale and location of the work, the Consultant held 07 consultations with 149 participants in affected communes where land was acquired.

The results of community consultation meetings with residents in the project area show that people in the project area are more active in expressing their opinions on the implementation of project items. The results of community consultation meetings in the communes/town in the project area are detailed in **Table 14.9-1**

Table 14.9-1 Public Consultation during Project Preparation Stage

No	Consultation in 2016			Consultation in 2018			Participant	Content/ program
	Location	Time	No. of Participant	Location	Time	No. of Participant		
1	At the culture house of Vu Xa village – Yen Bac commune	8h30 – Dated 2, December ,2016	24	At the People's Committee of Yen bac commune	8h30 – Date 25 Nov 2018	25	- Representatives of local authority and unions: Farmer association, Women's Union, National Front, Youth Group… - Representatives of affected households of project - Representatives of PMU - Representatives of consultant	1.Project introduction - Introduce project (objectives, location, scale and plan of project) - Technical issues of project; items, works implement in ward/commune - Related policies on compensation / resettlement of the GoV of Vietnam and the JICA of project 2. Consult idea of community about resettlement.
2	At the culture house of Thuong Am village – Tien Hai commune	14h – Dated 2, December ,2016	32	No consultation because of changes in scale and location of the work				
3	At the culture house of Tai 2 village – Dinh Xa commune	14h – Dated 3, December ,2016	25	At the People's Committee of Dinh Xa commune	14h00 – Date 28 Nov 2018	22		
4	At the People's Committee of Tien Noi commune	8h – Dated 5, December ,2016	26	At the People's Committee of Tien Noi commune	8h30 - Date 28 Nov 2018	22		
5	At the culture house of 4 village – Phu Van commune	14h – Dated 5, December ,2016	32	No consultation because of changes in scale and location of the work				
6	At the culture house of Dong Van village – Dong Van town	8h30 – Dated 6, December ,2016	32	At the People's Committee of Dong Van town	8h30 - Date 27 Nov 2018	19		
7	At the People's Committee of Hoang Dong commune	14h – Dated 6, December ,2016	23	At the People's Committee of Hoang Dong commune	14h – Date 26 Nov 2018	21		

No	Consultation in 2016			Consultation in 2018			Participant	Content/ program
	Location	Time	No. of Participant	Location	Time	No. of Participant		
8	At the People's Committee of Bach Thuong commune	8h30 – Dated 7, December ,2016	32	No consultation because of changes in scale and location of the work				
9	At the People's Committee of Liem Tiet commune	14h – Dated 7, December ,2016	39	At the People's Committee of Liem Tiet commune	14h00 – Date 27 Nov 2018	22		
10	At the People's Committee of Liem Can commune	14h – Dated 8, December ,2016	11	At the People's Committee of Liem Can commune	8h30 – Date 25 Nov 2018	25		
11	At the People's Committee of Tien Tan commune	8h – Dated 9, December ,2016	18	No consultation because of changes in scale and location of the work				
12	At the People's Committee of Chau Son ward	14h – Dated 9, December ,2016	21	Consultation on the environment issues. Because the participants only discussses the Phu Ly city Rehabitatiob Road (LCB-05) issues, which will not be caused any land acquisition.				

Source: JICA Survey Team

Results of the public consultation meetings with residents in the project area shows in the project area residents participated quite actively their opinions and on the implementation of the project categories. Results of public consultation meetings in the ward/commune in the project area are shown in **Table 14.9-2.**

Table 14.9-2 Main Participants Opinions and Responses on the Public Consultations during Project Preparation Stage

No.	Components/Works	Community's opinions	Consultant's Feedback	Conclusion
I	**Road Sector component**			
1	The road LCB1	The road LCB1 will be implemented in 3 communes of Tien Noi, Hoang Dong and Dong Van. - People expected the project will be soon implemented to avoid the "suspended" project. If JICA fund is approved, investment in	- The construction of LCB1 will affect residential land and additional house keeping works of a household in Bach Xa village, Bach Thuong commume. But, there is no relocated household by the Proejct. The remaining	Participants of the public consultation meetings in the project wards/communes agreed with and supported the project implementation

No.	Components/Works	Community's opinions	Consultant's Feedback	Conclusion
		upgrading road, installation of lighting system and water supply and drainage system should be made. - Households in Hoang Dong commune supported with adjustment of the design alternatives, re-alignment of the section in Bach Xa village – Hoang Dong commune to avoid relocation of 14 households. - There are 0.5km belonged to TNR urban area, and 1.2km crossing Dong Van III) were compensated and cleared by TNR development and Dong Van III. - It is suggested that the project should strictly comply to ensure the progress and quality of the project and that local people are involved in supervision during the project cycle. In addition, it is essential to prepare a clear plan to prior inform to the local authorities before implementing the project. - Compensation and assistance policies should be disclosed to AHs.	affected land is agricultural land. - Besides, auxiliary structures will be constructed, including: drainage system, sidewalks, green trees and lighting system on both sides of the road. - The project implementation agencies expected the local authorities and people to facilitate and support so that the project is early implemented to ensure the requested progress. - Before implementing the project, the Implementation Agencies will inform and send the project implementation plan to the local authorities.	
2	The road LCB 2	The road LCB2 will be implemented in 02 communes of Tien Noi and Yen Bac. - Local people are looking forward to the project to be soon implemented because this route has been seriously degraded, the road is very narrow and rugged, so it is hard to travel, and the road fails to meet the travel needs of the people. - If scope change (cross section reduced from 22.5m to 10.5m, length reduced to 3km). There are no households affected. Affected areas are public and transportation land. - During the construction phase, the construction unit should return the drainage ditches along the road to ensure irrigation and drainage into fields for households.	- The LCB 2 road will be designed with a width of 10.5m2. Designed speed:60km/h. - Along the LCB 2 road, structures such as sidewalks, green trees and drainage system will be built. - In the process of construction, the roads or drainage system in residential areas which are damaged by construction unit shall be reinstated. - Before implementing the project, the Implementation Agencies will inform and send the project implementation plan to the local authorities.	- 100% of participants of the public consultation meetings agreed with the project implementation.
3	The road LCB 3 (Northern and Southern branches)	- The road LCB3, the Northern branch crossed 3 communes of Tien Noi, Hoang Dong and Dong Van town.	- The construction of LCB3 (the North and South) road will mainly afect agricultural land and aquacultural land. There is no	- 100% of participants of the public consultation meetings agreed with the project

No.	Components/Works	Community's opinions	Consultant's Feedback	Conclusion
		The road LCB3, the northern branch in Tien Noi and Hoang Dong communes, Dong Van III Industrial Zone has conducted land acquisition and compensation payment for affected households. Currently, if the road is built, it will only acquire agricultural land of households in Dong Van town. - The road LCB3, the Southern branch: crossing 2 communes of Tien Noi and Hoang Dong. The construction of the road LCB3 will affect the agricultural land of farmers, aquaculture land and irrigation land managed by Tien Noi and Hoang Dong Commune People's Committees. - Construction of roads should be combined with construction of drainage systems and ditches to ensure drainage and irrigation for fields of households. - After land acquisition, if the remaining land area is too small or distorted or inconvenient for drainage or production, it is suggested that the project unit will acquire the rest for AHs. - The project implementation plan and progress should be informed to AHs so that they arrange the suitable cultivation plan - Compensation policies should be informed to AHs - AHs should be compensated adequately.	household affected with house and residential land. - Some sections on LCB3 road to the North and the South running through Dong Van 3 industrial zone have already acquired, thus there is no need for site clearance - The Consultlant will propose the Client to acquire the remaining land area for fields which are unviable for continued production after land acquisition. - Compensation policies for AHs will be complied with policies of the GoV and Donor. Beside compensation payments for affected land and non-land assets, AHs will receive other allowances such as subsistence allowance, job changing allowance, etc. - Before implementing the project, the Implementation Agencies will inform and send the project implementation plan to the local authorities.	implementation. AHs are willing to hand over the site to implement the project
4	The road LCB4 (North-south route and East-west route)	The road LCB4, North-south branch will cross 3 communes of Liem Tiet, Dinh Xa of Phu Ly city and Liem Can commune of Thanh Liem district. The road LCB4, East-west route will cross Liem Tiet commune. - The construction of these roads will affect agricultural land and aquaculture land of some households. No household is impacted with residential land or has to relocate. - Local authorities and residents supported the project	- In the course of survey, the design consultant has selected the most optimal option which limits impacts on residential land and houses of households in the end point of LCB4 road connnecting NH21 in Liem Tiet commune. - The construction of LBC4 will mainly affect agricultural and aquacultural land. - The Consultlant will propose the Client to acquire the remaining land area for fields which are unviable for continued production after land acquisition.	- 100% of participants of the public consultation meetings agreed with the project implementation. AHs are willing to hand over the site to implement the project

No.	Components/Works	Community's opinions	Consultant's Feedback	Conclusion
		implemented and desired the project to be implemented soon. - During the implementation, extent of impacts on households should be minimized - After land acquisition, if the remaining land area is too small or distorted or inconvenient for drainage or production, it is suggested that the project unit will acquire the rest for AHs. - The project implementation plan and progress should be informed to AHs so that they arrange the suitable cultivation plan - AHs should be informed of the compensation policies and compensated adequately.	- Before implementing the project, the Implementation Agencies will inform and send the project implementation plan to the local authorities. - Compensation policies for AHs will be complied with policies of the GoV and Donor. Beside compensation payments for affected land and non-land assets, AHs will receive other allowances such as subsistence allowance, job changing allowance, etc.	
II	**Sewerage Sector component**			
1	Wastewater treatment plant	Wastewater treatment plant will be built in Dinh Xa commune of Phu Ly city - The project implementation will affect agricultural land of households in commune. - Construction of treatment plant should be applied with advanced technologies to avoid environmental pollution such as odor, dust, etc. which affects living conditions of local people. - The implementation plan and progress should be informed to AHs so that they arrange the suitable cultivation plan. - The compensation policies should be informed to AHs	- The location of WWTP is in the paddy field of Tai 2 village that is far from residential area. Therefore, no household is affected with residential landThe affected lands mainly are agricultural land and irrigation land. - In terms of wastewater treatment technology: process of trickling filter (PTF) is studied and used by the pMU. This is among advanced treatment technologies with advantages which fits in natural conditions of Ha Nam provinceCompensation policies for AHs will be complied with policies of the GoV and Donor. Beside compensation payments for affected land and non-land assets, AHs will receive other allowances such as subsistence allowance, job changing allowance, etc. Before implementing works in the localities, the project implementation unit should prepare a clear work plan to priorily inform to the local authorities.	- Local authorities and households supported the project implementation
2	Main Sewer	Area of affected public land is: traffic land, irrigation land of 03 ward/communes Dinh Xa, Liem Chinh and Liem Tuyen.	- Wastewater collection pipelines from Viet Duc and Bach Mai hospitals will be installed along the road from Phu Ly to My Loc (NH21b) and the road connecting Ha Noi - Hai Phong expressway,	Local authorities and households supported the project implementation

No.	Components/Works	Community's opinions	Consultant's Feedback	Conclusion
		Thus, there will be no household affected with land due to construction of wastewater drainage pipeline.	then it will be led to the wastewater treatment plant in Dinh Xa commune. - After treatment, treated wastewater will be led to along irrigation ditches and discharged into Bien Hoa river - Thus, there will be no household affected with land due to construction of wastewater drainage pipeline. The affected land mainly transport and agricultural land managed by ward/communal PC.	

Source: JICA Survey Team

(4) Public Consultation during Project Implementation Stage

During the project implementation, the PMU/DPC/DCRC, with the support of the project consultants, will undertake the following tasks:

a) Providing information to relevant agencies at all levels throughout training workshops. Provide detail information on the project policies and implementation procedures.

b) Organizing information dissemination and consultation to all affected persons during the project implementation.

c) Updates the unit prices based on the results of replacement cost survey, and reconfirm the scale of land acquisition and impacts on properties based on the results, consultation to affected persons.

d) Then, Council/ Board Compensation, Resettlement district/city will apply prices, calculate compensation rights, and complete calculated compensation plan for each household affected. PMU will present information about entitlements directly to the affected persons during the next visits to the household.

e) Each household will in turn engage in the measurement, asset inventory, and drawing up the housing / land purchase is revoked and sign the inventory of damaged assets.

f) Each family will be involved to consider the draft detailed plan for compensation, support and resettlement, and detailed spreadsheet listing each household with specific levels of influence, compensation rates, based and estimated compensation payment for each household.

g) Households have the rights to reflect and exchange questions about the calculation of compensation and their questions have been answered satisfactorily in accordance with the specific situation, including issues related to resettlement as price, installment payments and documentation procedures in place new ownership.

h) Households will be involved in the process of reviewing the detailed plans on compensation, assistance and resettlement and detailed spreadsheet listing each household with a specific level of influence, compensation rates, base and estimated pay compensation, support for each household.

i) Afterwards, the district/city clearance compensation board will calculate compensation, assistance and resettlement (if any) based on the price list and complete detailed plans on compensation, assistance and resettlement for damages household harmful project affected. PMU will disseminate information about the rights of people affected in subsequent consultations with families during the deployment of this resettlement plan.

j) The property compensation plan finalizes affected assets and compensation entitlements of households, which must be signed by affected persons to demonstrate their concurrence with the evaluated results. Any questions of affected persons on the content of the compensation plan must be recorded at this time.

k) Send invitations to the APs to inform and explain the plan clearly impacts / consequences of each plan / plan for compensation, support if any

l) A letter/questionnaire about compensation plans will be given to all PAPs entitled to relocation (a) to inform them about compensation plans (a clear explanation of the consequences of choosing each option will be given), (b) to request that PAPs confirm their choice of resettlement option and their preliminary confirmation of resettlement site location, and (c) to propose the PAPs to clarify services that they are using such as education/health/market and distance of access to those services to ensure development of the future infrastructure service.

After the project is approved, the mass media, including television programs and local newspapers will widely introduce proposals at public locations, including the information on the objectives, components and operations of the project.

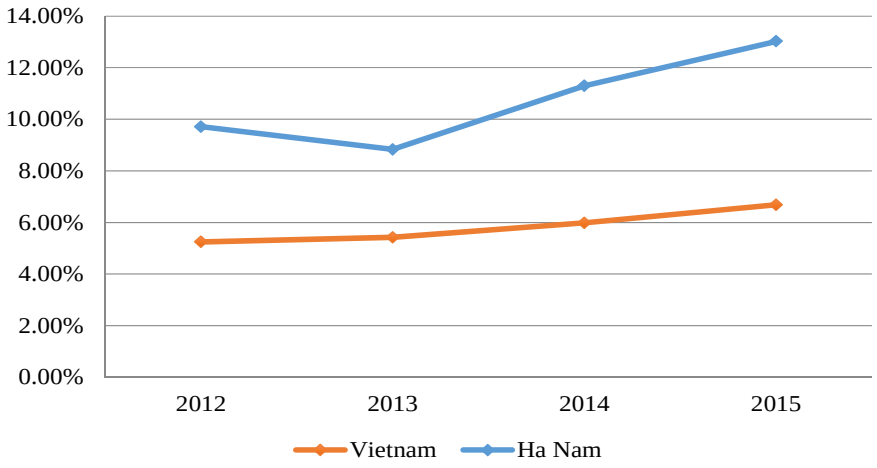
CHAPTER 15 ECONOMIC AND FINANCIAL ANALYSIS

15.1 Financial Status of the Executing Agency

The financial status of the project executing agency, Ha Nam Provincial People's Committee (HNPPC), is examined in this section.

15.1.1 Macro Economy and Financial Status

Ha Nam Province is one of the fastest growing provinces in Vietnam. While Vietnam has achieved an average GDP growth rate at constant 2010 prices of 5.8% from 2012 to 2015, Ha Nam Province has achieved average GDP growth rate at constant 2010 prices of 10.7% for the same period (**Figure 15.1-1**).

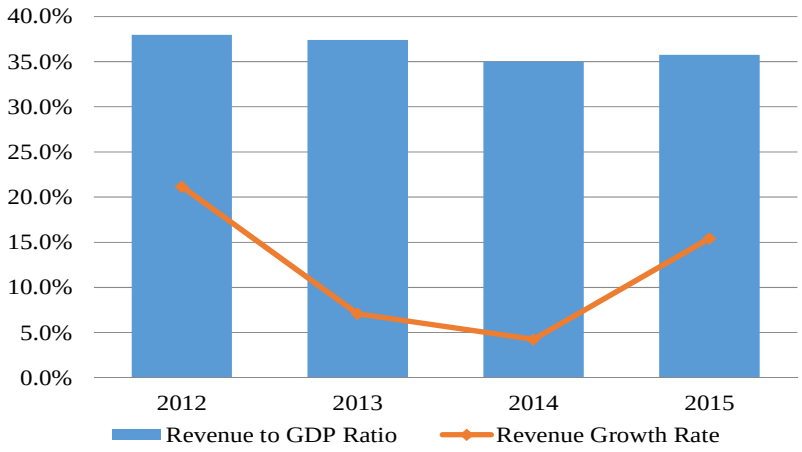


Source: General Statistics Office of Vietnam

Figure 15.1-1 GDP Growth Rate at Constant 2010 Prices in Vietnam and Ha Nam

The high GDP growth rate in Ha Nam Province has been achieved due to the growing investment in the province. The investment volume has reached 15,183 billion VND in 2015, 68% of GDP at constant 2010 prices, with a compound average growth rate (CAGR) of 11% from 2011 to 2015. With an increasing number of industrial zones in the province, domestic as well as foreign investment realized in the province has grown rapidly.

Under the sound macroeconomic conditions, the fiscal position has also been positive. The revenue to GDP ratio has been maintained at more than 35% for the past four years with CAGR of 11% (**Figure 15.1-2**).



Source: Ha Nam Department of Finance

Figure 15.1-2 Revenue Trend: Revenue to GDP Ratio and Growth Rate

15.1.2 Revenue

The total revenue of Ha Nam Province in 2015 was recorded as 7,922 billion VND. The revenue has been increased with a compound average growth rate (CAGR) of 12% from 2011 to 2015. The revenue is composed of provincial revenue and revenue allocated from the central government. Approximately 60% of the total revenue is its own source and the rest is allocated from the central government.

There are two main provincial revenues. One is local taxes such as agriculture land tax, registration fee, lottery, etc. The other is the national taxes allocated to each province such as business enterprises tax, personal income tax, fuel charge, etc. These national taxes are basically collected in the province, and then the central government allocates 100%[1] of this tax to Ha Nam Province. These two tax revenues can be increased with the effort of Ha Nam Province. In fact, these revenues, especially national taxes, have annually increased with the growth of industrial zones. As Ha Nam Province People's Committee has doubled the fuel charge paid by petroleum companies in 2015, it has increased 214% year-on-year in 2015.

The revenue allocated from the central government mainly comes from a subsidy and a special purpose budget. The subsidy from the central government is allocated in order to cover a deficit of provincial budget based on the balance of provincial revenue and expenditure. The annual subsidy has been almost fixed for five years from 2011 to 2015 by 1,039 billion VND. Therefore, the subsidy for the next five years from 2016 to 2020 shall be set based on the balance of its revenue and expenditure in 2015. The special purpose budget is for the inter-regional projects of other Ministries which are implemented in Ha Nam Province.

[1] The allocation ratio of national tax is different from each province. For example, the ratio in Hanoi is 42% which collects more revenue than other provinces.

Table 15.1-1 Revenue of Ha Nam Province

Unit: million VND

	2011	2012	2013	2014	2015	2015 (YoY)	2015 (Ratio)
TOTAL REVENUE	**5,074,576**	**6,148,585**	**6,584,616**	**6,864,076**	**7,922,800**	**15.4%**	**100%**
Revenue of province	**3,155,886**	**3,670,973**	**4,424,032**	**4,145,628**	**4,751,918**	**14.6%**	**60.0%**
Dosmetic Revenue from local tax	684,976	571,039	595,078	666,743	812,887	21.9%	10.3%
Agriculture land use tax	1,060	1,089	1,092	437	388	-11.2%	0.0%
Registration fee	51,753	59,967	59,097	72,666	110,426	52.0%	1.4%
Charger, fee	32,913	47,655	59,478	73,821	92,414	25.2%	1.2%
Land revenue	539,590	400,249	405,984	432,513	496,848	14.9%	6.3%
Other revenue	59,660	62,079	69,427	87,306	112,811	29.2%	1.4%
Dosmetic Revenue allocated from national tax	1,292,651	1,741,598	2,255,636	2,411,371	2,651,124	9.9%	33.5%
Revenue from business enterprisesand individuals	1,184,056	1,611,629	2,111,409	2,263,184	2,382,651	5.3%	30.1%
Personal income tax	62,895	79,007	99,108	103,770	128,697	24.0%	1.6%
Fuel charge	45,700	50,962	45,119	44,417	139,776	214.7%	1.8%
Aid revenue (excluding aids for lending)	485	2,000	2,071	-	-	-	-
Revenue from budget balance of previous year	60,889	66,794	72,746	37,677	30,248	-19.7%	0.4%
Balance brought forward of previous year	783,490	838,681	792,752	789,413	1,013,566	28.4%	12.8%
Income from mobilized in investment in accordance with Clause 3 Article 8 of State Budget Law	30,000	100,000	365,000	90,000	70,000	-22.2%	0.9%
Revenue managed by disbursement units through the state budget	303,395	350,861	340,749	150,424	174,093	15.7%	2.2%
Revenue allocated from central government	**1,918,690**	**2,477,612**	**2,160,584**	**2,718,448**	**3,170,882**	**16.6%**	**40.0%**
Subsidy from central government	1,013,371	1,038,529	1,038,529	1,038,529	1,038,529	0.0%	13.1%
Special purpose budget allocation	905,319	1,439,083	941,129	1,363,298	1,776,945	30.3%	22.4%
Increase of basic salary for officials			180,926	316,621	355,408	12.3%	4.5%

Source: Ha Nam Department of Finance

15.1.3 Expenditure

The total expenditure of Ha Nam Province in 2015 was 5,139 billion VND. The expenditure has been increased with a CAGR of 9% from 2011 to 2015. More than 60% of the expenditure is for current expenditures including health, population and family planning, and administrative management which share almost half of the total expenditure.

Next, the province has spent on expenditure of infrastructure development with approximately 15% of the total expenditure. The infrastructure development has been maintained at about 800 billion VND annually; on the other hand, the special purpose budget has been varied each year.

Table 15.1-2 Expenditure of Ha Nam Province

Unit: million VND

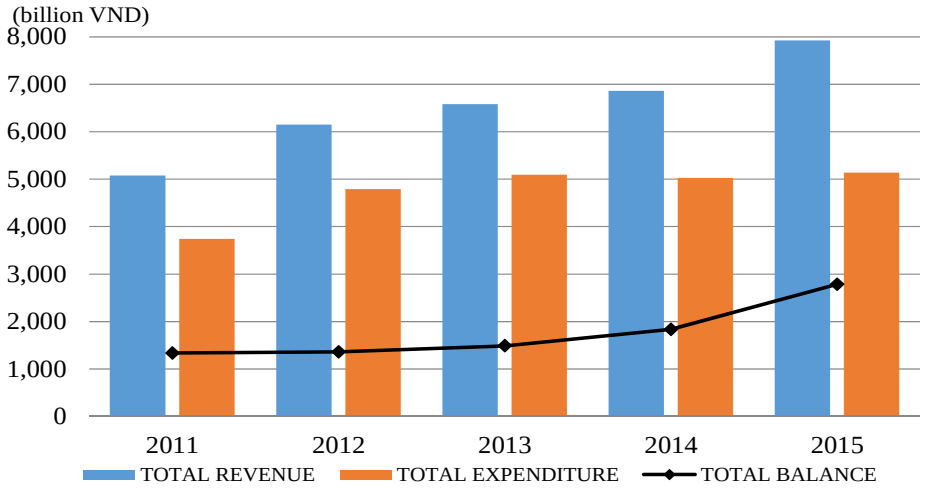
	2011	2012	2013	2014	2015	2015 (YoY)	2015 (Ratio)
TOTAL EXPENDITURE	**3,739,992**	**4,790,272**	**5,096,820**	**5,030,295**	**5,139,450**	**2.2%**	**100%**
Province budget expenditure	**2,926,368**	**3,868,314**	**4,629,443**	**4,350,304**	**4,203,444**	**-3.4%**	**81.8%**
Expenditure on infrastructure development	821,553	891,751	1,214,937	823,181	784,493	-4.7%	15.3%
Payment for principal and interest of mobilized in investment in accordance with Clause 3 Article 8 of State Budget Law	25,000	27,500	30,000	55,000	24,500	-55.5%	0.5%
Current expenditure	1,853,508	2,621,062	3,047,415	3,379,821	3,265,310	-3.4%	63.5%
Expenditure from revenue managed by disbursement units through the state budget	226,307	328,001	337,091	92,302	129,141	39.9%	2.5%
Central budget expenditure	**813,624**	**921,958**	**467,377**	**679,991**	**936,006**	37.6%	18.2%
Special purpose budget	813,624	921,958	467,377	679,991	936,006	37.6%	18.2%

Source: Ha Nam Department of Finance

15.1.4 Balance

Based on the revenue and expenditure of the province, the fiscal balance is shown in **Figure 15.1-3**. The fiscal balance has been maintained as a positive over the past five years, and the fiscal surplus has

been increased with a CAGR of 22%. However, it will turn negative without considering the revenue allocated from the central government, therefore, the budget from the central government functions to offset the fiscal deficits of the province.



Source: Ha Nam Department of Finance

Figure 15.1-3 Fiscal Balance

15.1.5 Expenditure on Infrastructure Development

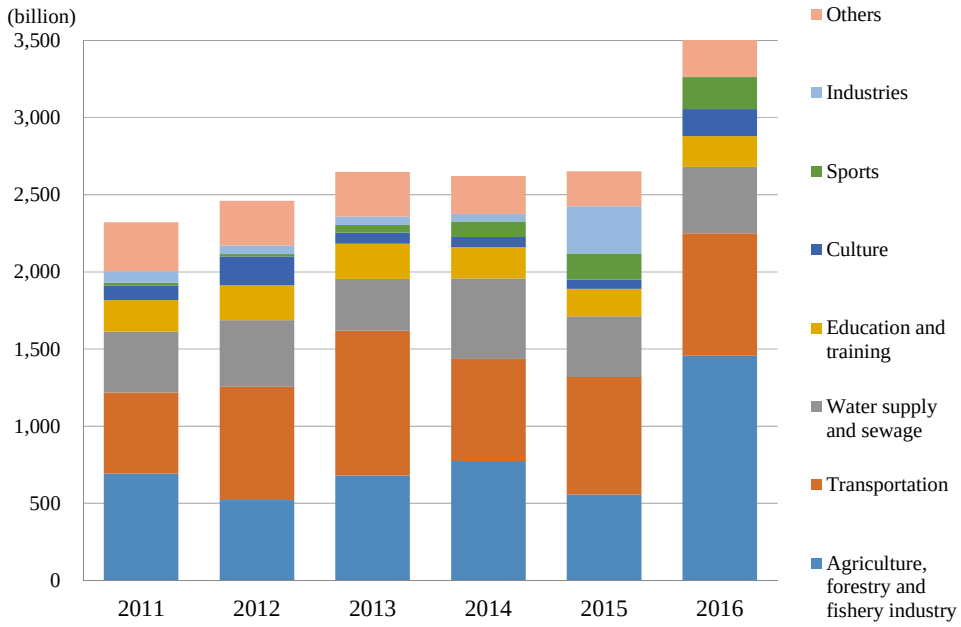
According to the Department of Planning and Investment of the Ha Nam Province, the total expenditure for infrastructure development was recorded at 2,651 billion VND in 2015 and 3,537 billion VND as of November 2016. It has been increased with a CAGR of 9.4% from 2012 to 2016. Out of the total expenditure in 2016, agriculture, forestry and the sea food industry accounts for more than 40% of the total infrastructure development, it has increased 1.6 times compared to 2015. The sector is followed by transportation with 22%, and next water supply and sewerage with 12%.

The infrastructure development expenditure is composed by various sources, as the total figure is far bigger than the “expenditure on infrastructure development” in the provincial budget shown in **Table 15.1-2**. It is composed of the central government budget, provincial government budget, central government bond, the preferential loans from Vietnam Development Bank (VDB), state bonds, ODA and others, while the bonds and loans are not included in the fiscal balance calculation. The budget of preferential loans from the Vietnam development bank (VDB) followed by clause 3 article 8 of the state budget law, that the province can borrow a loan up to 30% of annual development infrastructure in case of a shortage in the infrastructure budget. The loan condition is that the repayment of the principal is five years including a 1-year grace period without interest. This budget is limited to use for regional transportation, sewerage, and fishery promotion. On the other hand, the ODA budget is allocated for toll road and sewerage projects funded by World Bank.

In Ha Nam, the characteristics of fund source are varied depending on sectors. The transportation budget is mainly composed of provincial and central budgets, state bonds, and preferential loans from VDB. The budget of the agriculture, forestry and the sea food industry comes from the central budget and state bonds. The budget of the water supply and sewerage is mainly from the central budget and ODA.

The figure of the infrastructure development expenditure of the province shows that HNPPC has sufficient financial capacity to cover the operation and maintenance (O&M) costs and the non-eligible portion of the initial investment of the ODA projects. The infrastructure expenditure of the Ha Nam province has recorded VND 3,537 billion in 2016, and continued its fiscal surplus over the past five years, therefore, the annual O&M cost of VND 6,578 million after 2022 (the figure will increase in accordance with the increase in the sewerage volume) and the non-eligible portion of the initial

investment of the ODA projects in total of VND 704,283 million from 2017 to 2022 will be able to be covered by HNPPC.



Source: Department of Planning and Investment, Ha Nam Province

Figure 15.1-4 Infrastructure Development Expenditure by Sectors (2011-2016)

15.2 Financial Status of O&M Institutions

During the O&M of the sewerage project, Ha Nam Provincial People's Committee will authorize a private company to operate and maintain the sewerage plant, and for the road project, the Department of Transport (DoT) will be the responsible organization to operate and maintain the road. The financial status of O&M institutions in both sewerage sector and road sector is examined in this section.

15.2.1 O&M Institution in Sewerage Sector

Prospective O&M institutions in sewerage sector are described in **Chapter 7**.

15.2.2 O&M Institution in Road Sector

(1) Overview

The Department of Transport (DOT) of Ha Nam Province implements the operation and maintenance for national and provincial roads.

(2) Budget for O&M

The budget of operation and maintenance for national roads is allocated from a transport O&M fund under MOT, collected from revenue from toll roads, vehicle registration fees[2], and vehicle inspection fees. The budget for provincial roads is from the provincial budget and an additional budget is allocated from the transport O&M fund. Ha Nam Province collects vehicle registration fees and vehicle inspection fees, and then the transport O&M fund allocates 60% of these fees to DOT as additional budget.

The budget for national roads is approved by the central government based on the development plan of DOT. The budget of provincial roads is inspected and evaluated by the Ministry of Finance (MOF)

[2] Vehicle registration fees are charged from all types of vehicles, though fees of motorbikes are expected to be abolished from 2016.

based on the development plan of DOF and then approved by the Provincial People's Committee. In case of large repairs, the budget is periodically allocated from fund under the central government, and a detailed development plan is necessary to be approved.

The O&M cost of Ha Nam roads is shown in the following table. The cost includes equipment and materials cost, manpower cost, and tax.

Table 15.2-1 Operation and Maintenance Cost of Roads

Unit: million VND.

	2012	2013	2014	2015
National roads	3,304	4,574	2,681	2,696
Provincial Roads	5,207	3,847	4,118	3,647
Total	8,511	8,421	6,799	6,343

Source: Department of Transport of Ha Nam Province

15.3 Water and Sewage Tariff

15.3.1 Current Tariff

(1) Water Tariff

According to a decree on clean water production, supply and consumption, 117/2007/ND-CP, provincial-level Peoples Committees shall approve water price schemes, and water supply units can decide the price of clean water to receive reasonable profits based on the calculation of clean water production and business costs.

The price shall be fixed at a maximum for ten years, and the price shall be revised by the authorization of Ha Nam provincial People Committee in case of high inflation. The water tariff in Ha Nam province in 2016 is shown in the following table. According to HANWACO, the tariff is not expected to change until 2020.

Table 15.3-1 Water Tariff

Category	2004-2009	2010-2020
Residential	3,500 VND/m^3	5,700 VND/m^3
Government Office	N.A.	9,500 VND/m^3
Factories in industrial zone	7,000 VND/m^3	11,500VND/m^3
Business Office	N.A.	13,500 VND/m^3

Source: HANWACO

(2) Sewage Tariff

According to the decree on environmental protection charges for sewerage water, 25/2013/ND-CP, the Sewerage tariff shall be collected as environmental protection charges with the water tariff and tax by water supply units[3]. Monthly, water supply units have to remit the collected environmental protection charge amounts into the state budget. For daily-life Sewerage water, the environmental protection charge rates shall be calculated in percentage (%) of the selling price of 1m3 of clean water but must not exceed 10% of the non-VAT clean water selling price. The sewerage tariff is different from regions, because of setting up for the percentage up to 10% of water tariff. The current sewerage tariff of Ha Nam in 2016 is only 2-3% of the water tariff, with the details as follows:

[3] Currently No. 80/2014/ND-CP "Decree on Water Drainage and Wastewater Treatment" has been effective, however, 25/2013/ND-CP has been still applied in practice. Under the new Decree, the sewerage tariff shall be calculated by expenses for water drainage and wastewater treatment services, and a reasonable profit. Expenses for water drainage services include expenses for operation, maintenance, repair, depreciation of the system, etc.

Table 15.3-2 Sewerage Tariff (Environment Protection Fee)

Category	2016	Ratio of Water Tariff
Residential	150 VND/m^3	2.63%
Government Office	200 VND/m^3	2.11%
Factories in industrial zone	300 VND/m^3	2.61%
Business Office	300 VND/m^3	2.22%

Source: HANWACO

15.3.2 Future Tariff Estimation

Based on the previous tariff increase from 3,500 VND/m^3 (2004-2009) to 5,700 VND/m3 in 2010, it increased 10.25% annually. Therefore, the future tariff is also expected to increase by 10% annually without considering the inflation effect. The estimated future tariff is shown in the following table. The sewerage tariff will be determined between 2-10% of the water tariff.

Table 15.3-3 Estimated Water Tariff

Category	2021-2030	2031-2040	2041-2049
Residential (VND/m^3)	14,784	38,347	99,462
Government Office (VND/m^3)	24,641	63,911	165,769
Factories in industrial zone (VND/m^3)	29,828	77,366	200,668
Business Office (VND/m^3)	35,016	90,821	235,567

Source: JICA Survey Team

15.4 Economic Analysis

15.4.1 Basic Conditions

(1) General

The main purpose of the economic analysis is to prove the effects of the implementation of the project from the viewpoint of the national economy and evaluate the economic validity of the project. Economic analysis estimates the degree to which extent this project contributes to the national economy by analyzing the consumption of the resources that is a pivotal element of the national economy.

The economic internal rate of return (EIRR), net present value (NPV), and benefit-cost ratio (B/C ratio) will be used to evaluate the economic analysis results as evaluation indicators.

The economic analysis uses discounted cash flow analysis for cost-benefit analysis. This method compares economic benefits and economic costs.

In this study, each project of sewerage and road is analyzed separately.

(2) Target Area

The target area of the economic analysis is the Hospital Area, with the coverage area of 930 ha.

(3) Economic Price

For the economic analysis, financial costs are converted to economic costs by deducting the tax and subsidies portion, and applying a standard conversion factor (SCF) to the portion of non-trade goods. For this project, a value of 0.85[4] is applied to the local portion of costs in order to adjust the price.

(4) Economic Benefits

While “With Project” means implementation of the proposed project, “Without Project” stands for the

[4] Refer to the value of SCF based on “The Comprehensive Study on the Sustainable Development of Transport System in Vietnam (VITRANSS 2), 2010”

situation without such an investment. The quantified economic benefits that would be realized from the implementation of the project are defined as the difference of the overall project impacts between "With Project" and "Without Project."

(5) Basic Assumption

The following basic assumptions are set up.

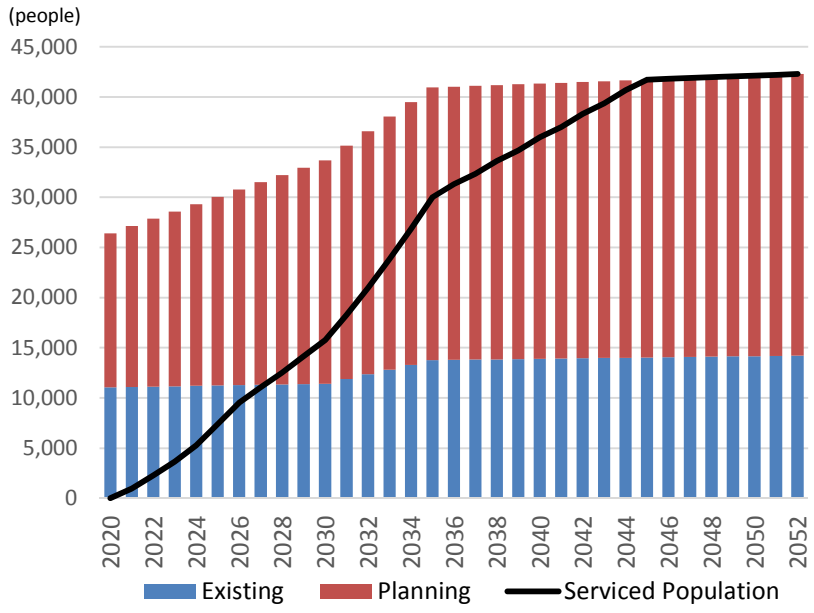
- Project life: 30 years after the commencement of construction (2019-2048).
- (Construction Period: 2019-2025; 7 years, Operation Period: 2023-2048; 26 years)
- Discount rate: 12%.
- The base year for the price is 2018.
- The exchange rate: USD 1 = JPY 108.0, USD 1 = VND 22,439, VND 1 = JPY 0.00481 (As of February, 2019)

15.4.2 Sewerage Sector

(1) Demand Projection

1) Target Population

The target population has been assumed as **Figure 15.4-1**. The population in 2020 is assumed to be 26,400 (existing population as 11,050 and planning population as 15,350), and the existing population will increase by the annual average of 1.49% and the planning population will increase by 3.89% on annual average until 2035, and the annual growth rate of both the existing and planning population will be 0.19% after 2035. The serviced population of the sewerage plant will reach 100% in 2045. The detail assumption of the target population is described in **Chapter 2**.



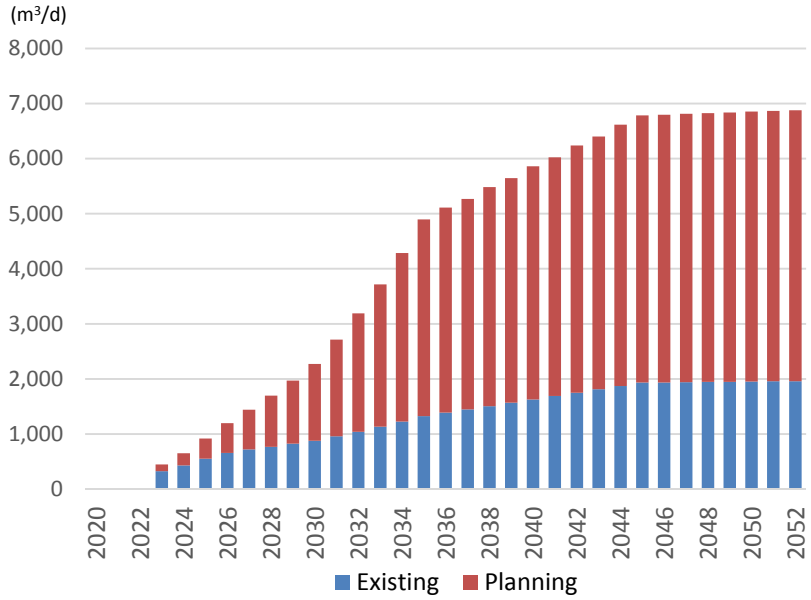
Source: JICA Survey Team

Figure 15.4-1 Target Population

2) Sewerage Volume

After the operation of the sewerage plant in 2023, the sewerage volume will increase to cover the increasing target population. By starting the sewerage plant with 446 m^3/day in 2023, the volume will increase rapidly till 2035 up to 4,897 m^3/day, and it will increase gradually after 2035. The detail

assumption of the sewerage demand is described in **Chapter 2**.



Source: JICA Survey Team

Figure 15.4-2 Target Sewerage Demand

(2) Project Benefits

The quantified project benefits that would be realized from the implementation of the Sewerage project are defined as the following. The estimations of the project benefits are based on "IRR Calculation Manual" announced by JICA in September 2017.

1) Public Health Benefits

The infectious diseases caused by water borne diseases such as diarrhea, infectious gastroenteritis, malaria and dysentery is expected to be decreased by 3.26%, which is ratio of the number who were infected by water borne diseases, according to Ha Nam Statistical Yearbook 2015. The benefits are estimated by the deduction of medical expense based on the average annual medical expense per person for 4,029,117 VND in Vietnam[6] with the design population in the target area.

Table 15.4-1 Public Health Benefits

Category	
Annual Medical Expenditure in 2011 (Red River Delta)	2,247,000 VND/person
CPI	8.70%
Annual Medical Expenditure in 2018 (after Inflation)	4,029,117 VND/person
Ratio of People Affected by Epidemic Infected Cases out of Total Population	3.26%

Source: JICA Survey Team

2) Public User Benefits

At present, most of the households, hospitals and universities use septic tanks. However, septic tanks will be replaced after the installment of a sewerage infrastructure in the target area, which is considered as public user benefits by improving the environment. The new septic tank installment fees and existing septic tank O&M fees can be considered as benefits to the project. The construction fee of a new septic tank is 6.5 million VND per household, and the maintenance fee for once in two years is 2 million VND, and the cleaning cost for once in five years is 1.5 million VND[9]. The figure has been divided by an

[6] Refer to the expense for Vietnam Ministry of Health "Joint Annual Health Review 2015", and estimated 2018 price with CPI 8.7%.

[9] Quotation by a local construction company

average number of household of 3.82[10] to calculate the fee per person.

Table 15.4-2 Public User Benefits

Category	Installing Fee per person (VND)	O&M per person (VND/2years)	Cleaning Cost (VND/5years)
Septic Tank	1,723,499	523,560	392,670

Source: JICA Survey Team

3) New Supply of Sewerage Services (Price×Additional Supply)

The Willingness-to-pay (WTP) is one of the project benefits in economic analysis by estimating a money value through users' revealed preferences or stated preferences. Since the WTP approach was not possible to estimate due to lack of information, the new supply of sewerage services (price×additional supply) has been calculated by using long-run marginal cost (LRMC).

The LRMC is defined as the incremental system cost of supplying one unit of sustained service with optimal adjustments in the capacity[11], calculated by project costs, CRF (Capital Recovery Factor) and O&M costs. **Figure 15.4-3** shows the LRMC formula, and **Table 15.4-3** shows the LRMC value in 2023.

$$\text{LRMC} = \text{Project Cost} \times \text{CRF} + \text{O\&M Cost}$$

$$\text{CRF} = \frac{i(1+i)^n}{(1+i)^n - 1}$$

i: discount rate, n: project life

Figure 15.4-3 LRMC Formula

Table 15.4-3 LRMC (2023)

Category	
CAPEX (mil VND)	861,155
OPEX (2023) (mil VND)	1,358
Discount Rate	12%
Project Life	30
CRF	0.124143658
LRMC	108,265

The estimated three project benefits are shown in the following table:

Table 15.4-4 Project Benefits for Sewerage

Unit: million VND

Year	Public Health Benefits	Public User Benefits	LRMC
2023	481	2,378	102,890
2035	3,943	5,446	104,965

Source: JICA Survey Team

[10] Refer to Ha Nam Statistical Yearbook 2015

[11] "Utility Tariff Setting for Economic Efficiency and Financial Sustainability" (2008) ADB

(3) Project Costs and O&M Costs

The financial price and economic price of the project costs and O&M costs are shown in the following tables (the values in the table are the ones calculated before re-appraisal meeting held in March 2019).

Table 15.4-5 Project Costs for Sewerage

Item		Total			
		FC	LC	Total Economic Cost	Total Financial Cost
		(million JPN)	(million VND)	(million VND)	(million VND)
A. ELIGIBLE PORTION					
I) Procurement / Construction		1,142	608,522	662,423	845,872
	Base Cost	1,005	491,224	626,490	700,174
	Price Escalation	82	88,320	0	105,419
	Physical Contingency	54	28,977	35,933	40,280
II) Consulting Services		619	44,161	155,434	172,912
	Base Cost	557	37,402	147,515	153,126
	Price Escalation	33	4,656	0	11,553
	Physical Contingency	29	2,103	7,918	8,234
Total (I + II)		1,761	652,683	817,857	1,018,784
B. NON ELIGIBLE PORTION					
a	Land Acquisition	0	0	0	0
b	Administration Cost	0	50,939	43,298	50,939
c	VAT	0	84,587	0	84,587
d	Tax on Consulting Services	0	25,937	0	25,937
e	Import Tax	0	7,121	0	7,121
Total (a+b+c+d+e)		0	168,584	43,298	168,584
TOTAL (A + B)		1,761	821,267	861,155	1,187,368
C. Interests during Construction		41	0	0	8,486
D. Front End Fee		10	0	0	2,038
GRAND TOTAL (A+B+C+D)		1,812	821,267	861,155	1,197,891

Source: JICA Survey Team

Table 15.4-6 O&M Costs for Sewerage

Fixed Cost			
a. Personnel	895	million VND	for entire project period
b. Annual Maintenance Cost	504.5	million VND	965.8 million after 2035
Variable Cost			
c. Electric Power	850	VND/m^3	in accordance with planned sewerage volume
d. Chemical	453	VND/m^3	
e. Sludge Disposal	63	VND/m^3	
Replacement Cost			
f. Infrastructure Replacement Cost	140,374	million VND	in 2035 for replacement; the salvage value is added at the end of the project
f. Infrastructure Replacement Cost	94,158	million VND	in 2042 for replacement; the salvage value is added at the end of the project

Source: JICA Survey Team

(4) Cost Benefit Analysis

Based on the above estimated economic benefits and costs, the cost benefit analysis is estimated. The calculation results are summarized as follows (the values in the table are the ones calculated before re-appraisal meeting held in March 2019).

The EIRR shows 13.2%, which exceeds the value of the opportunity cost of 12.0%. The sewerage project is significant public infrastructure for the basic needs of citizens and it would address the development issues of the country.

Table 15.4-7 Summary of Cost Benefit Analysis for Sewerage

Indicator	Result
EIRR	13.2%
B/C (at discount rate of 12%)	1.06
NPV (VND million, at discount rate of 12%)	32,459

Source: JICA Survey Team

Table 15.4-8 Cash Flow of Cost Benefit Analysis for Sewerage

Unit: million VND (2018 Economic Price)

Year	No. of Years	Cost			Benefit				Net Cash Flow
		Investment	O&M	Total	Public Health Benefits	Public User Benefits	LRMC (Long Run Marginal Cost)	Total	
2018	0	0		0				0	0
2019	1	27,520		27,520				0	-27,520
2020	2	40,900		40,900				0	-40,900
2021	3	67,777		67,777				0	-67,777
2022	4	322,892		322,892				0	-322,892
2023	5	248,529	1,358	249,887	481	2,378	108,265	111,124	-138,763
2024	6	115,811	1,435	117,246	692	5,534	108,342	114,569	-2,678
2025	7	37,726	1,537	39,263	968	3,619	108,444	113,031	73,768
2026	8		1,642	1,642	1,252	8,712	108,549	118,513	116,871
2027	9		1,735	1,735	1,450	6,938	108,642	117,029	115,295
2028	10		1,831	1,831	1,643	9,083	108,738	119,464	117,633
2029	11		1,936	1,936	1,859	2,827	108,843	113,528	111,592
2030	12		2,050	2,050	2,070	11,026	108,957	122,053	120,003
2031	13		2,216	2,216	2,404	4,378	109,123	115,904	113,688
2032	14		2,397	2,397	2,757	23,868	109,304	135,929	133,532
2033	15		2,595	2,595	3,133	4,929	109,502	117,564	114,969
2034	16		2,809	2,809	3,528	19,251	109,716	132,495	129,685
2035	17	119,318	3,434	122,752	3,943	5,446	110,341	119,730	-3,022
2036	18		3,513	3,513	4,112	18,616	110,420	133,148	129,635
2037	19		3,574	3,574	4,246	14,453	110,481	129,181	125,606
2038	20		3,655	3,655	4,417	19,848	110,562	134,827	131,172
2039	21		3,717	3,717	4,552	1,775	110,624	116,951	113,235
2040	22		3,797	3,797	4,724	21,090	110,704	136,519	132,722
2041	23		3,859	3,859	4,860	1,775	110,766	117,401	113,542
2042	24	80,034	3,940	83,974	5,033	37,385	110,847	153,265	69,291
2043	25		4,003	4,003	5,170	1,792	110,910	117,872	113,869
2044	26		4,084	4,084	5,343	23,573	110,991	139,908	135,824
2045	27		4,147	4,147	5,481	1,810	111,054	118,345	114,198
2046	28		4,152	4,152	5,492	22,028	111,059	138,579	134,426
2047	29		4,158	4,158	5,503	16,608	111,065	133,176	129,018
2048	30	-123,639	4,162	-119,477	5,513	22,094	111,069	138,676	258,153
Total		1,060,507	73,575	1,134,082	85,113	288,743	2,746,248	3,120,104	1,986,022
NPV		539,674	17,327	500,934	16,973	67,234	855,813	533,393	32,459
B/C		discount rate 12%							1.06
EIRR									13.2%

Source: JICA Survey Team

(5) Sensitive Analysis

The sensitive analysis for a 10% increase in project cost as well as a 10% decrease in estimated benefits is implemented. The results are shown in the following table (the values in the table are the ones calculated before re-appraisal meeting held in March 2019).

EIRR does not exceed the opportunity cost of 12% in all cases.

Table 15.4-9 Results of Sensitive Analysis for Sewerage

	Base	**Benefit -10%**	**Cost +10%**	**Benefit -10%& Cost +10%**
EIRR	13.2%	11.6%	11.8%	10.2%

Source: JICA Survey Team

15.4.3 Road Sector

(1) Project Benefits

The quantified project benefits that would be realized from the implementation of the road projects are defined as the difference of vehicle operation costs and passenger travel time costs between "with project" and "without project" for LCB-1 to LCB-5. For the LCB-6 rehabilitation road, estimation of benefit is not specified how to calculate of the world. Therefore, the estimation of EIRR for the road sector shall be calculated using benefit for LCB-1 to LCB-4 and cost for LCB-1 to LCB-5.

The following quantified benefits are expected.

- Savings of vehicle operating costs (VOC)
- Savings of traveler's time costs (TTC)

VOC by vehicle types was estimated by updating the value based on the "Preparatory survey on Lach Huyen Port infrastructure construction project (road and bridge portion) in the Socialist Republic of Vietnam, 2010", using the consumer price index (9.0%/year). The VOC per unit distance was estimated by type of vehicle being composed of the following components; they are a) fuel cost, b) oil cost (engine, other oil), c) tire cost, d) repair cost, e) depreciation cost, f) capital opportunity cost, g) crew cost, h) overhead cost and i) other costs (vehicle inspection and insurance). The types of vehicles are motor-cycle, cars, bus and truck. The formula of VOC unit is shown in below;

$$VOC = a + b + c + d + e + f + g + h + i \ (VND/veh*km) \qquad (1)$$

Where;

a: Fuel cost
b: Oil Cost
c: Tire cost
d: Repair cost
e: Depreciation cost
f: Capital opportunity cost
g: Crew cost
h: Overhead cost
i: Other costs

TTC was also estimated by updating the value of working time of passengers by vehicle type (motor-cycle, car, bus and truck) based on the "Preparatory survey on Lach Huyen Port infrastructure construction project (road and bridge portion) in the Socialist Republic of Vietnam, 2010", using the CPI (6.5%/year). The formula of TTC unit is shown in below;

$$TTC = A / B * C \ (VND/veh*min) \qquad (2)$$

Where;

A: Total of worker average cash wage per month

B: Worker average business working hour per month

C: Average number of passengers

The balance of VOC by vehicle type is appropriate for the following reasons;

- The balance of VOC was determined compared with the balance of VOC in Philippines.
- VOC for Bus and Truck is similar to Philippines.
- VOC for motorcycle is applied compared with PCU ratio (Motorcycle: 0.3).

Table 15.4-10 Vehicle Operating Costs (VOC) in 2010

Unit: VND/Vehicle・km

Speed(km/hr)	Motor-cycle	Car	Bus	Truck
5	2,620	6,179	8,232	15,983
10	1,506	3,753	5,147	9,785
20	919	2,457	3,492	6,603
30	718	2,010	2,743	5,005
40	597	1,752	2,362	4,256
50	538	1,646	2,251	3,963
60	528	1,664	2,288	3,895
70	533	1,590	2,242	3,648
80	544	1,793	2,573	4,232

Source: Preparatory survey on Lach Huyen Port infrastructure construction project (road and bridge portion) in the Socialist Republic of Vietnam,2010

Table 15.4-11 Vehicle Operating Costs (VOC) in 2016

Unit: VND/Vehicle・km

Speed (m/hr)	Motor-cycle	Car	Bus	Truck
5	4,394	10,363	13,806	26,805
10	2,526	6,294	8,632	16,410
20	1,541	4,121	5,856	11,074
30	1,204	3,371	4,600	8,394
40	1,001	2,938	3,961	7,138
50	902	2,761	3,775	6,646
60	886	2,791	3,837	6,532
70	894	2,667	3,760	6,118
80	912	3,007	4,315	7,097

Source: Estimated by JICA Survey Team

The balance of TTC by vehicle type is appropriate for the following reasons:

- The balance of TTC was determined utilizing hourly cost of passenger and number of passenger
- Hourly cost of passengers for motorcycles, buses and trucks is 14,600 VND/hour in 2010, for car is 17,300 VND/hour in 2010.
- Number of passengers was applied as Motorcycle: 1 person, Car: 4 persons, Bus: 10 persons and Truck: 2 persons.

Table 15.4-12 Time Value by Vehicle Type in 2010

Speed (km/hr)	Motor-cycle	Car	Bus	Truck
Hourly Cost (VND/hr)	14,600	69,200	146,000	29,200

Source: Preparatory survey on Lach Huyen Port infrastructure construction project (road and bridge portion) in the Socialist Republic of Vietnam,2010

Table 15.4-13 Time Value by Vehicle Type in 2016

Speed (km/hr)	Motor-cycle	Car	Bus	Truck
Hourly Cost (VND/hr)	24,486	116,055	244,857	48,971

Source: Estimated by JICA Survey Team

Table 15.4-14 Project Benefits for Road

Benefits (million VND/year)			
Year	VOC	TTC	Total
2021	203,673	432,737	636,410
2030	227,071	495,718	722,789

Source: JICA Survey Team

(2) Project Costs and O&M Costs

The financial price and economic price of the project costs and O&M costs are shown in the following table:

Table 15.4-15 Project Costs for Roads

Item	Financial Price (Million VND)	Economic Price (Million VND)
1. Construction Cost	1,241,108	1,054,942
2. Land Acquisition Cost	97,230	82,646
3. Price Escalation	88,361	75,107
4. Physical Contingency	66,422	56,459
5. Consultancy Service	119,128	101,259
6. Administration Cost	80,561	68,477
7. VAT	139,486	0
8. Tax on Consulting Service	17,869	15,189
9. Import Tax	0	0
10. interest during Construction	10,728	9,119
11. Front end Fee	3,028	2,574
GRAND TOTAL	1,863,921	1,465,770

Source: JICA Survey Team

Table 15.4-16 O&M Costs for Roads

Breakdown of cost	Total financial cost	Total economic cost
Center Road (LCB-1)	78	67
Expressway East Bypass Road (LCB-2)	155	132
Feeder Road North and South (LCB-3)	108	91
North-South and East-West Cross Road (LCB-4)	96	82
Phu Ly City Rehabilitation (LCB-5)	87	74
Total	524	446

Source: JICA Survey Team

(3) Cost Benefit Analysis

Based on the above estimated economic benefits and costs, the cost benefit analysis is estimated. The calculation results are summarized as follows.

The EIRR shows 26.2%, which exceeds the opportunity cost of 12% with a positive NPV. This means that the project implementation is assessed as having economic validity from the viewpoint of the national economy.

Table 15.4-17 Summary of Cost Benefit Analysis for Roads

Indicator		
EIRR	B/C (at discount rate of 12%)	NPV (VND million, at discount rate of 12%)
26.2%	8.65	2,834,542

Source: JICA Survey Team

Table 15.4-18 Cash Flow of Cost Benefit Analysis for Roads

Unit: million VND (2017 Economic Price)

Year	Cost			Benefit			Net Cash Flow
	Investment	O&M	Total	VOC	TTC	Total	
2017	0		0				0
2018	0		0				0
2019	73,288		73,288				-73,288
2020	293,154		293,154				-293,154
2021	732,885		732,885				-732,885
2022	293,154		293,154				-293,154
2023	73,288	260	73,548	60,682	126,196	186,878	113,330
2024		446	446	107,883	243,516	351,399	350,954
2025		446	446	111,884	274,110	385,993	385,548
2026		446	446	116,032	308,547	424,579	424,134
2027		446	446	120,335	347,311	467,646	467,200
2028		446	446	124,797	390,945	515,741	515,296
2029		446	446	129,424	440,060	569,485	569,039
2030		446	446	134,223	495,347	629,570	629,124
2031		446	446	139,200	557,579	696,779	696,334
2032		446	446	144,362	627,630	771,991	771,546
2033		446	446	149,715	706,481	856,196	855,750
2034		446	446	155,266	795,239	950,505	950,059
2035		446	446	161,023	895,147	1,056,171	1,055,725
2036		446	446	166,994	1,007,608	1,174,602	1,174,156
2037		446	446	173,186	1,134,197	1,307,383	1,306,938
2038		446	446	179,608	1,276,691	1,456,298	1,455,853
2039		446	446	186,267	1,437,086	1,623,353	1,622,908
2040		446	446	193,174	1,617,632	1,810,806	1,810,361
2041		446	446	200,337	1,820,861	2,021,198	2,020,752
2042		446	446	207,765	2,049,622	2,257,388	2,256,942
2043		446	446	215,469	2,307,124	2,522,593	2,522,147
2044		446	446	223,459	2,596,976	2,820,435	2,819,989
2045		446	446	231,745	2,923,243	3,154,988	3,154,542
2046		446	446	240,338	3,290,501	3,530,838	3,530,393
2047		446	446	249,249	3,703,898	3,953,147	3,952,702
2048		446	446	258,491	4,169,232	4,427,723	4,427,278
2049		446	446	268,076	4,693,027	4,961,104	4,960,658
2050		446	446	278,016	5,282,629	5,560,646	5,560,200
2051		446	446	288,325	5,946,305	6,234,630	6,234,184
2052		446	446	299,016	6,693,360	6,992,376	6,991,931
Total	1,465,770	13,181	1,478,951	5,514,342	58,158,098	63,672,440	62,193,489
NPV	836,001	3,423	837,736	1,091,006	6,157,419	7,248,425	2,834,542
B/C	discount rate 12%						8.65
EIRR							26.2%

Source: JICA Survey Team

(4) Sensitive Analysis

Sensitive analysis for a 10% increase in project cost as well as a 10% decrease in estimated benefits and sensitive analysis for in case of lack one subject road are implemented. The results are shown in the following table:

EIRR shows economic feasibility in all cases.

Table 15.4-19 Results of Sensitive Analysis for Roads

Case	Base	Benefit -10%	Cost +10%	Benefit -10%&Cost +10%
EIRR	26.2%	24.8%	24.9%	23.6%

Source: JICA Survey Team

15.5 Financial Analysis

The financial analysis of the sewerage sector in Hospital Area has been conducted, and the financial analysis of the road sector has not been conducted as the project will not collect fees from the users.

15.5.1 Estimated Tariff Revenues

Sewerage revenues have been estimated based on 2.11% of water tariff for the Hospital Area as shown in **Table 15.3-2**. The annual tariff revenue will be 85 million in 2023 and 2,411 million in 2035.

Table 15.5-1 Estimated Tariff Fee for Financial Analysis

Category	2021-2030	2031-2040	2041-2047
University/Hospital (VND/m^3)	520	1,349	3,498

Source: JICA Survey Team

15.5.2 Project Costs and O&M Costs

Project costs and O&M costs are referred to the financial cost in **Table 15.4-5**.

15.5.3 Cash Flow Analysis

(1) Cash Flow of Sewerage Project

Based on the estimated revenues and costs, the financial internal rate of return (FIRR) without loan was calculated. The result was -11.9%, which did not show the financial feasibility (the values in the table are the ones calculated before re-appraisal meeting held in March 2019).

Table 15.5-2 Cash Flow of Sewerage Project

unit: million VND

Year	No. of years	Out-Flow			In-Flow		Cash Flow for FIRR
		Investment Cost	O&M Cost	Total	Revenue	Total	
2018	0	0		0		0	0
2019	1	63,551		63,551		0	-63,551
2020	2	92,965		92,965		0	-92,965
2021	3	167,185		167,185		0	-167,185
2022	4	824,638		824,638		0	-824,638
2023	5	652,123	1,598	653,721	85	85	-653,636
2024	6	308,864	1,689	310,553	123	123	-310,429
2025	7	107,349	1,808	109,157	174	174	-108,983
2026	8		1,932	1,932	227	227	-1,705
2027	9		2,041	2,041	274	274	-1,767
2028	10		2,154	2,154	322	322	-1,832
2029	11		2,277	2,277	374	374	-1,903
2030	12		2,412	2,412	432	432	-1,980
2031	13		2,607	2,607	1,336	1,336	-1,271
2032	14		2,820	2,820	1,572	1,572	-1,248
2033	15		3,053	3,053	1,830	1,830	-1,223
2034	16		3,305	3,305	2,109	2,109	-1,196
2035	17	140,374	4,040	144,414	2,411	2,411	-142,003
2036	18		4,133	4,133	2,515	2,515	-1,618
2037	19		4,205	4,205	2,594	2,594	-1,611
2038	20		4,299	4,299	2,699	2,699	-1,601
2039	21		4,372	4,372	2,780	2,780	-1,593
2040	22		4,467	4,467	2,884	2,884	-1,583
2041	23		4,540	4,540	7,689	7,689	3,149
2042	24	94,158	4,635	98,793	7,962	7,962	-90,831
2043	25		4,709	4,709	8,174	8,174	3,465
2044	26		4,805	4,805	8,448	8,448	3,643
2045	27		4,879	4,879	8,662	8,662	3,782
2046	28		4,885	4,885	8,678	8,678	3,793
2047	29		4,892	4,892	8,697	8,697	3,806
2048	30	-145,457	4,897	-140,561	8,711	8,711	149,272
Total		2,451,208	86,559	2,537,766	83,050	83,050	-2,454,716
FIRR							**-11.9%**

Source: JICA Survey Team

(2) O&M Cost Coverage

The initial capital investment of the sewerage plant cannot achieve to break even, however, the O&M cost can be covered by the sewerage tariff revenue at the later stage of the project. As shown in **Table 15.5-2**, the tariff revenue exceeds the O&M cost in 2041, and the cumulative cash balance turns positive in 2048. This shows that Ha Nam Provincial People's Committee will be able to cover the O&M cost by operating the sewerage plant if the capital investment is not considered.

For cost recovery, it is noted that, for example, 3,171 billion VND (in 2015), or 40% of revenue, is provided as a subsidy from the central government (see **Table 15.1-1**). The subsidy amount is reviewed once every five years and it the next review is carried out 2021. The subsidy is reviewed according to local development conditions.

(3) Tariff Increase

Increasing the sewerage tariff to expand revenue will not be realistic, but the estimation has been made

to increase the tariff to cover both the initial investment and the O&M cost. It has been found that by increasing 27 times of the sewerage tariff, the FIRR will be positive of 0.2%. The cumulative cash balance will only be positive in 2048. When the estimated water supply tariff as shown in **Table 15.3-3** is applied to the sewerage project, the FIRR will be 3.2%.

(4) Investment Subsidy

A case of applying subsidy to the investment cost of both initial investment cost and replacement cost has been examined. It has been found that the subsidy coverage ratio of 100% needs to be applied to achieve positive FIRR of 0.1%. The cumulative cash balance will only be positive in 2048. This shows that achieving financial viability will only be possible through increasing the tariff or applying subsidy to the capital cost.

CHAPTER 16 PROJECT EFFECTS

16.1 Sewerage Sector

Operation and effect indicators are set to evaluate impact of project implementation quantitatively and qualitatively. In order to evaluate the impact of implementing the project in the sewerage sector, the indicators for two years after completion of the project (2026), are as set in the following table.

Table 16.1-1 Operation and Effect Indicators (Sewerage Sector)

Indicators	Present (2016)	2 years after completion of the project (2026)	Remarks
Operation Indicator (Target Area)			
Population Treated (person) (Number of persons who live in households the wastewater from which is collected through main sewers (interceptors) and treated in WWTP though households may not be directly connected to main sewers.)	0	12,100	Due to lack of actual data, population in 2026 is estimated by using population in 2020 (values in Table 2.3.1) and population treated in 2030. Considering actual progress of development, rate of occupation in new residential area and existing residential area are set at 0% and 100% respectively, population in the target area in 2020 is estimated at 11,050=15,350 x 0%+11,050 x 100%. Population in the target area in 2030 is estimated at 20,318 =8,908(22,270 x 40%) +11,410(11,410 x 100%). By interpolating values of 2020 and 2030, population in the target area is in 2026 is estimated at 16,610=5,340+11,270 Then, population treated in the target area in 2026 is estimated at 12,100=5,340 x 1.0+11,270 x 0.6 =5,340+6,760
Amount of Wastewater Treated (m^3/day) (Total annual wastewater volume divided by 365 days. The wastewater volume which is collected to WWTP and discharged without treatment should not be included.)	0	1,700	Average daily wastewater flow in 2026 is estimated by using population treated in 2026 and wastewater per-capita in Table 2.3-9. Average daily wastewater flow in 2026: 1,700 m^3/day= 5,340+ x 157 L/capita / 1000 + 6,760 x 128 L/capita / 1000
Rate of Facility Utilization (%)	0	68	Maximum daily wastewater: 2,040 (=1,700 x 1.2) Rate of facility utilization = (Maximum daily Wastewater flow/Capacity of WWTP)= 2,040/3,000
BOD Concentration (mg/L) (Weekly analyzed data of BOD concentration (Not average but maximum))	220	30	220 mg/L: Estimated influent wastewater quality to WWTP 30 mg/L: Allowable effluent water quality for WWTP
Covered Ratio of Main Sewer (%)	0	100	Length in project scope (20.4 km)/ Total length in planning area (20.4 km)
Suspended Solid Concentration (mg/l)	250	50	250 mg/L: Estimated influent wastewater quality to WWTP 50 mg/L: Allowable effluent water

Indicators	Present (2016)	2 years after completion of the project (2026)	Remarks
			quality for WWTP
Amount of Sludge Disposal (t/year)	0	621	Daily average amount of sludge in 2030 is estimated at 2.3 t/day [(2.8 t/day: sludge volume from WWTP in 2030)/1.2 (ratio of daily maximum /daily average wastewater). Daily average amount of sludge in 2026 is estimated at 1.7 t/day [=2.3 x 1,700/2,275(Average daily wastewater in 2030)]. Thus, sludge disposal in 2026 is estimated at 621 t/day (1.7 x 365).
Rate of Service Charge Recovery (%)	0	80	80% is assumed due to lack of information.
Effect Indicator			
[Target Area]			
Percentage of Population Served (%)	0	73	Population in the target area in 2026: 16,610 Population treated in the target area in 2026: 12,100 Thus, 73%=12,100/16,610 x 100 is obtained.
[Ha Nam Province]			
Percentage of Population Served (%)	2	4	Total population of Ha Nam Province in 2016: 806,000 (which is estimated based on the trend of population in 2014 and 2015). Total population of Ha Nam Province in 2026: 812,000 (which is estimated in this Survey). Service population of exiting WWTP (Quy Luu WWTP) is estimated based on the capacity of 2,500 m^3/day and wastewater per capita (159 L/capita/day=180 L/capita/day x 0.8 (wastewater conversion rate) x 1.1(groundwater flow). As a result, 15,800 (2,500x1000/159) people is obtained. Service population of WWTP (Capacity 1500 m^3/day) funded by WB is estimated at 7,495(=14,990/2) people. 14,990 is equivalent to capacity of 3,000 m^3/day. Percentage of Population Served in 2016 (%): 2%=15,800/806,000 Percentage of Population Served in 2026 (%): 4%=(15,800+7,495+12,100)/812,000

Source: JICA Survey team

16.2 Road Sector

Project effects indicators applied for road sector are Traffic Volume, Vehicle Operation Cost (VOC), Travel Time Cost (TTC) for road projects and average travel speed in Ha Nam Province.

(1) Traffic Volume

Table 16.2-1 shows traffic volumes in 2021, 2026 and 2031.

Table 16.2-1 Traffic Volume (Veh/day))

Unit: Veh/day

Subject Road	Year	Motor cycle	Passenger Car	Bus	Truck	Total
Center Road (LCB-1)	2021	15,763	3,663	807	9,427	29,660
	2026	22,023	4,519	1,024	9,749	37,315
	2031	22,365	6,624	595	11,578	41,162
Expressway East Bypass Road (LCB-2)	2021	5,703	1,236	612	1,687	9,238
	2026	9,697	1,911	803	2,589	15,000
	2031	10,101	2,190	527	3,903	16,721
Feeder Road North (LCB-3)	2021	9,060	1,951	1,092	5,055	17,157
	2026	16,239	2,454	1,455	5,873	26,022
	2031	28,308	3,331	1,050	9,095	41,784
Feeder Road South (LCB-3)	2021	11,631	4,028	452	8,237	24,348
	2026	20,544	4,678	498	14,702	40,423
	2031	26,135	8,269	351	16,544	51,300
North-South Cross Road (LCB-4)	2021	5,528	1,368	37	4,037	10,970
	2026	8,477	1,392	38	4,092	13,999
	2031	8,287	3,143	290	8,614	20,333
East-West Cross Road (LCB-4)	2021	10,403	2,534	0	8,085	21,023
	2026	9,315	2,807	0	7,371	19,493
	2031	8,340	3,109	376	6,720	18,545

Source: JICA Survey Team

(2) Total Number of Passenger and Commodity Weight

Table 16.2-2 shows the total number of passenger and commodity weight calculated based on OD survey which was carried out in the previous survey. As a result of total number of passenger and commodity weight, construction of subject roads (LCB-1 though LCB-5) will effectively give economic impact in Ha Nam Province.

Table 16.2-2 Total Number of Passenger and Commodity Weight

	Total Number of Passenger (Persons/day)	Total Commodity Weight (Tons/day)
Year 2016 (for reference)	-	-
Year 2021	811,218	1,354,169
Year 2026	892,658	1,497,725
Year 2031	1,107,807	1,924,544

Source: JICA Survey Team

(3) Total Vehicle Time Savings (Veh-Hour) and Total Vehicle Distance (Veh-km)

Table 16.2-3 and **Table 16.2-4** show the reduction of effects of Vehicle Time Savings and Vehicle Distance. As a result of reduction of effects of VOC and TTC, subject roads (LCB-1 though LCB-5) will have economic impact in Ha Nam Province.

Table 16.2-3 Total Vehicle Time Savings (Veh-hour)

		Year 2016 (for reference)	Year 2021 (Starting year)	Year 2026 (2 years after completion of the project)	Year 2031
Total Vehicle Hour	W/O Project	230,260	361,379	503,599	701,789
	W/ Project	-	307,686	433,380	610,423
	Saving per day	-	53,692	70,218	91,366
	Saving per year	-	19.6 Million Hours	25.6 Million Hours	33.3 Million Hours

Source: JICA Survey Team

Table 16.2-4 Total Vehicle Distance (Veh-km)

		Year 2016 (for reference)	Year 2021 (Starting year)	Year 2026 (2 years after completion of the project)	Year 2031
Total Vehicle Distance	W/O Project	4,186,546	5,723,048	7,207,245	9,076,348
	W/ Project	-	5,520,561	7,009,934	8,901,119
	Saving per day	-	202,487	197,311	175,229
	Saving per year	-	73.9 Million km	72.0 Million km	64.0 Million km

Source: JICA Survey Team

(4) Average Travel Speed

Table 16.2-5 shows reduction of effect of average travel speed in Ha Nam Province. Reduction of average travel speed is 2.1 km/h in 2021, 1.9 km/h in 2026, and 1.6 km/h in 2031. No major difference is identified in the result of reduction of average travel speed in years of 2021, 2026 and 2031.

Table 16.2-5 Reduction of Average Travel Speed

	Average Travel Speed (km/h)		
	With	Without	Without-With
Year 2016 (for reference)	-	18.2	-
Year 2021	17.9	15.8	2.1
Year 2026	16.2	14.3	1.9
Year 2031	14.6	12.9	1.6

Source: JICA Survey Team

(5) Summary of Operation and Effect Indicators (Road Sector)

Based on the descriptions from (1) to (3), operation and effect indicators in road sector for two years after completion of the project (2026), are set as shown in **Table 16.2-6**.

Table 16.2-6 Operation and Effect Indicators (Road Sector)

Indicators	Present (2016)	2 years after completion of the project (2026)	Remarks
Operation Indicator			
Daily Traffic Volume (Veh/day)	-	-	This indicator is set in this project, because AADT (Annual Average Daily Traffic) is not available due to the lack of seasonal data in Ha Nam Province.
1) Center Road (LCB-1)	0	37,315	
2) Expressway East Bypass Road (LCB-2)	0	15,000	
3-1) Feeder Road North (LCB-3)	0	26,022	
3-2) Feeder Road South (LCB-3)	0	40,423	
4-1) North-South Cross Road (LCB-4)	0	13,999	
4-2) East-West Cross Road (LCB-4)	0	19,493	

Indicators	Present (2016)	2 years after completion of the project (2026)	Remarks
Effect Indicator			
Average Travel Speed (km/h)	18.2	16.2	This indicator is calculated, targeting entire Ha Nam Province.
Total Number of Passenger (Persons/day)	0	892,658	
Total Commodity Weight (Ton/day)	0	1,497,725	
Total Vehicle Time Savings (Million veh*hour/year)	0	25.6	
Total Vehicle Distance Savings (Million veh*km/year)	0	72.0	

Source: JICA Survey Team

CHAPTER 17 INVESTMENT PROMOTION STRATEGY

17.1 Background and Purpose

Ha Nam Province has been active in promoting investment opportunities to Japanese investors. Their initiatives, such as 10 commitments, Japan Desk, and broachers in Japanese language are highly appreciated by Japanese companies. Ha Nam Provincial government aims to attract more investors for Dong Van III Industrial Park, which is exclusively designed for Japanese companies

With this in mind, the purpose of this project activity is to build a network, thorough which Ha Nam Province can promote Dong Van III more effectively and efficiently to potential Japanese companies (especially mid to small size businesses which Ha Nam targets at).

17.2 Summary of Activities

(1) Building networks with medium and small sized companies

In order to build networks with medium and small sized companies in Japan, DI has visited branch offices in Vietnam of Japanese local banks

- Hokkoku, Toyama Dai-ichi, Joyo, Yokohama, Chiba, Tama Shinkin, Okazaki Shinkin, Nagoya, Gamagori Shinkin, Juroku, Gifu Shinkin, Ogaki Kyoritsu, Shizuoka, Yamanashi Chuo, Senshu Ikeda, Kyoto, Nanto, Minato, Mie, Chugoku, Hiroshima, Fukuoka (, and SMBC)

(2) Assessment of promotional messages

In order to explore room for improvement in public relations activities, DI has interviewed Ha Nam PPC, Japanese companies in Dong Van II Industrial Park and a Japanese company BTD who assists Japanese companies entering into Vietnam market

- Provincial Government: DPI (Department of Planning and Investment), DoIT (Department of Industry and Trade)
- Dong Van II Industrial Park: Honda Motor Co., Ltd., Sumitomo Wiring Systems, Ltd., Showa Denko Rare Earth, Sinfonia Microtec Co., Ltd., Meitoku Engineering Co., Ltd.
- BTD

17.3 Findings

17.3.1 Major Issues and Possible Solutions

(1) Regarding "How to promote?"

[Issue #1]

- Ha Nam investment promotion heavily relies on BTD's volunteering activities
  - However, BTD has experiences piled up for 25 years to support provincial government. Therefore, it is not easy to transfer BTD's function to any other entity

[Solution for issue #1]

- BTD agreed to continue their support for free of charge for the time being
  - BTD will stay in charge of liaisons function between provincial government (Japan Desk) and medium and small sized company networks

[Issue #2]

- BTD is supporting to hold investment attraction seminars in Japan based on requests from provincial government. However, BTD doesn't have a branch office in Japan and it causes difficulty to hold systematic and sustainable attraction activities in Japan.
  - Attraction seminars have been hold every few years or annually in Japan in the past

- Seminars have been held in Tokyo, Kanagawa, Saitama, Shizuoka, Ibaraki, Tochigi, Nagoya, Gifu, Toyama, Hyogo, Kyoto, Osaka, Hiroshima, Fukuoka, Saga and so on
- Different from Tan Long Industrial Park operated by Sumitomo Corporation and VSIP sponsored by Mitsubishi Corp., and other industrial parks partnering with Forval company (which is also a support company like BTD), BTD doesn't have a branch office in Japan and thus holding seminars and following up after seminars are difficult.

[Solution for issue #2]

- In order to build networks with medium and small sized companies in Japan, DI has visited branch offices in Vietnam of Japanese local banks, Hokkoku, Toyama Dai-ichi, Joyo, Yokohama, Chiba, Tama Shinkin, Okazaki Shinkin, Nagoya, Gamagori Shinkin, Juroku, Gifu Shinkin, Ogaki Kyoritsu, Shizuoka, Yamanashi Chuo, Senshu Ikeda, Kyoto, Nanto, Minato, Mie, Chugoku, Hiroshima, Fukuoka (, and SMBC)
  - **Table 17.3-1** is a list of local banks with potential partner companies who may be interested in investing in Ha Nam

Table 17.3-1 List of Local Banks with Customers who may be interested in Ha Nam

Assigned to	Bank Name	Trends of business partners' business expansion	Relationship with Ha Nam
(Own company)	THE BANK OF FUKUOKA, LTD.	● Approximately 100 of their main business partners are already operating in Vietnam together with Aichi and Gifu ● North Vietnam: 40 companies or less, South Vietnam: 60 companies or less ● More companies especially manufacturers still have a strong intention to expand business to Vietnam, and want their market share to grow to the top in the domestic market in Vietnam. (Easy access to Ha Noi from Ha Nam is a strength)	Hashima Co., Ltd. Osawa Wax Co., Ltd. (Both are in Dong VanII)
BIDV (HCMC)	Gifu Shinkin Bank	● Many of their local business partners are textile and apparel manufacturers ● Companies who started to consider expanding business to Vietnam have increased due to rising labor cost in China	Same as above
(Own company)	THE BANK OF FUKUOKA, LTD.	● Approximately 70 local companies who operating in Vietnam ● North Vietnam: 30 companies, South Vietnam: 40 companies ● More companies are active to expand business to Vietnam including at the investigation stage (Examples: Kubarahonke, Yamamoto Industries, Ltd. TOMITA Pharmaceutical Co., Ltd.…) ● All companies who are considering expanding business to Vietnam make contacts to "Kyushu Vietnam Friendship Association". Therefore, networking with this association is important.	
BIDV (Hanoi)	The Shizuoka Bank, Ltd.	● 100 of their business partners, most of them are manufacturers, are already operating in Vietnam ● Among them, North Vietnam: 65%, South Vietnam: 35% ● Yamaha Motor Co., Ltd. and their suppliers are operating in North Vietnam mostly Noi Bai	

Assigned to	Bank Name	Trends of business partners' business expansion	Relationship with Ha Nam
		Industrial Park	
Same as above	THE OKAZAKI SHINKIN BANK	● 100 of their business partners, mostly related to the automotive industry, are already operating business in Vietnam ● Continuous inquiries from manufactures and construction companies about expansion business to Vietnam ● About 50% of them are considering targeting Vietnam (In order to meet the timing when technical interns return to Vietnam)	
SMBC (Hanoi)	The MIE BANK	● Approximately 30 companies from this area are operating in Vietnam ● 15 companies, mostly manufactures in North Vietnam and 15 companies together with manufacturers and IT (offshore development) in North Vietnam ● Mie Prefecture has Suzuka Circuit, and they have many Honda suppliers. Corporate activities to seek the destination to relocate production from China.	Sumitomo Wiring Systems, Ltd. (Subsidiary is in Dong VanII)

Source: JICA Survey Team

(2) Regarding "What promotional messages to communicate?"

[Issue]

- Fundamentally, Ha Nam Province's supportive attitude, represented by "10 commitments", is highly appreciated by the companies operating in Ha Nam Province
  - ✧ If power cut is planned and it affects our factory operation, the plan can be changed to minimalize the impact on our operation by contacting provincial government through Japan Desk (Honda Motor Co., Ltd.)
  - ✧ One typhoon caused a long-term power cut, however, thanks to Japan Desk that got involved with negotiation with Ha Nam Power Company, it enabled faster restoration of power supply. (Sumitomo Wiring Systems, Ltd.)
  - ✧ Annual meeting with all companies located in the industrial parks sponsored by provincial government is held and the companies can tell their requests directly to provincial government. Many companies highly appreciate such provincial open attitudes of provincial government. (Honda Motor Co., Ltd.)
- However, there is a possibility that messages from a provincial government is not always a strong appeal from Japanese companies who are considering expanding business to Vietnam
  - ➢ For example, Japanese potential investors do not necessarily understand "24 hour-power supply" is great unless they know that the unstable power supply in industrial parks in Vietnam is the biggest issue
  - ➢ Moreover, power supply has become more stable in industrial parks in other provinces too and not to differentiate themselves from other industrial parks
  - ➢ Also, Brochures are mainly created as Public Relations contents, which helped by JICA, brush up will be recommendable considering above points.

[Solution]

- Based on the opinions from the local banks and companies who are located in Dong Van II, update the public relations contents to interests of small and medium sized companies or the latest local information
  - ➢ For example, Japanese companies have more interests in living environment (especially medical environment and so on) of Japanese employee stationed in Vietnam

- To appeal easily accessible from Ha Noi, to refer medical condition in Ha Noi could enhance the attraction

17.3.2 Minute of Visiting related Parties

Attached please find the minute of visiting related Japanese parties as a detailed report of current activities.

- Local Banks：There are big regional differences between structures of industries and intentions to expand business to Vietnam. Minutes of visiting of THE BANK OF FUKUOKA, LTD., The Ogaki Kyoritsu Bank, Ltd.(OKB)and The Shizuoka Bank, Ltd., who could hear useful opinions are attached to this report.
- Dong VanII Industrial Park：Hearing surveys with Honda Motor Co., Ltd., and Sumitomo Wiring Systems, Ltd. are attached
- Investment Support in Ha Nam：Discussion with BTD is attached

(Appendix) Minute of visiting related parties

THE BANK OF FUKUOKA, LTD. Ho Chi Minh Branch

- 70 local companies who are operating in South Vietnam and North Vietnam(duplicated)
  - 30 companies in North
    - TOTO Ltd. (Manufacturer and sales in North, only distributer in South)
    - MIDORI ANZEN Co., Ltd. (Manufacturing work uniforms, safe shoes)
    - TAKAGI CO., LTD. (Sprinkler and water purification system for home use)
  - 40 companies in South
    - YASKAWA Electric Corporation
    - Tsuchiya Co., Ltd. (Exclusive supplier of hairs for Dyson vacuum cleaners. Manufacturing hairs for outside of screen door frame)
    - F&B as well (However, chain-store expansion is impossible. Run as a solo store)

- Active trends to expand business to Vietnam
  - Kubarahonke (Restaurant in Takashimaya. Trends to set up a domestic factory in Vietnam)
  - Yamamoto Industries, Ltd. (Manufacturer for drum can. Under investigation to expand business to Vietnam)
  - TOMITA Pharmaceutical Co., Ltd (Wholesaler for medicine. Under investigation to expand business to Vietnam)

- Major companies to expand business to Vietnam are small and medium sized companies than large corporations
  - Vietnam is at the tide turning from blue ocean to red ocean.
  - The seismic center for large corporation has been shifted
  - Only one year to be left for small and medium sized companies to harvest the blue ocean in Vietnam

- Trends in agriculture related industries
  - Asia development trade (Japanese pickles supplier in Oita)
    - Initially, their business model is manufacture in China and import to Japan
    - Retailers won't purchase made in China pickles. They are considering to switch production base to Vietnam
    - They acknowledge to improve quality for vegetables first. They are seeking reliable farmers.
  - Mr. Tsuji of Saga University is an instructor of agricultural techniques in South and North Vietnam

- The following associations have strong connections to contact local companies
  - Kyushu Vietnam Friendship Association
    - Kyushu Economic Federation is their supporter. Top is a brother of Mr. Aso, Finance Minister. Big influence to local business.
    - The acting top is Vietnam Airline Fukuoka Branch Manager.
    - All companies who are considering to expand business to Vietnam make contacts to this association.

  - Fukuoka Asia Business Center
    - An extra-departmental organization of the prefecture with a great influence
  - Vietnamese consul general is in Fukuoka and cooperative
  - Additionally, there is a Vietnamese (Japanese speaker) in THE BANK OF FUKUOKA, LTD. International Department
    - Vice president is also from International Department

The Ogaki Kyoritsu Bank, Ltd. (OKB) Ho Chi Minh Branch

- Companies from Gifu Prefecture and Aichi Prefecture to expand business to Vietnam

- Approximately 120 companies
- About 100 companies among them excluding large corporations such as Toyota are doing business with them mainly (Transaction portion of OKB is small)
  - MUTO CO., LTD., Mugegawa Seiko, Kyowa (welding business), Aoki Corporation (pajamas for GUNZE)
- 40 companies or more in North, 60 companies or more in South, rest of them spread out in Da Nang or An Giang.

- Changes of center to expand business to Vietnam
  - Every Japanese large corporation expanded business to Vietnam in '12～13.
  - Until around '14, small and medium sized companies under them (OKB's thing) expanded business to Vietnam following big corporations.
  - Inquiries from small sized companies (the annual turnover is less than billion yen) has been increasing since '15

- As to expansion business to Vietnam, multiple companies are working in real time
  - KANAYAMA KASEI CO., LTD. (written again) : Established a factory in Dong VanII('16)
  - Company T (Competitor of KANAYAMA KASEI CO., LTD.): Business negotiation to supply polipots for Japan flower is ongoing.
    - Actually, cost and quality imports from Japan will exceed purchasing in Vietnam
    - Part of products made in Japan are sold in AEON and so on.
- Gifu Prefecture has a partnership with Nghe An Province
  - Yabashi Holdings Co., Ltd. is mining lime in Nghe An Province. There is a rumor that Yabashi has an influential voice to Provincial Governor of Gifu Prefecture is background factor.
  - Prefectural governor of Gifu Prefecture has met with Mr. Ha, Cheer person of BIDV has become a trigger to receive FDI proposals from BIDV like an arrow, and prefectural officers were busy in handling them.
    - Mr. Ha retired from chairperson this summer
  - Therefore, Prefectural governor of Gifu Prefecture visited Nghe An Province in July of last year and this May
    - Recent purpose is to attract tourists to Gifu Prefecture, promotion of Hida beef and attract foreign students and so on

- Local companies operating in Dong VanII
  - Hashima Co., Ltd. (Manufacturers for inspection equipment such as needle detectors and metal detectors)
    - Big client for OKB Gifu branch
    - OKB received a request from President of this company to gather Japanese company for taking provincial government. OKB worked hard and gathered 50 companies
    - Honestly, they didn't know about Ha Nam Province and asked, "What is Ha Nam Province?", but as a nature of a local bank, they have to meet his request as a big client.
  - OSAWA WAX CO., LTD.
    - Manufacturer for plastic
    - Two Subsidiary companies are already operating in Dong VanII(Osawa Vietnam and Osawa Trading)
    - ※ Will expand business to Dong VanIII based on our visit to Ha Nam on the other day
  - KANAYAMA KASEI CO., LTD.
    - Manufacturer for polipots, for exports to Japan (Soft plastic black pots which are used in greenhouse
  - Maruito Co., Ltd. (Textile manufacturer): No deal with OKB

- There is an impression from companies considering expanding business to Vietnam that they have strong intention to make their market share to grow to the top in the domestic market in

Vietnam

- Therefore, easy accessible to Ha Noi = market is quite appealing ＞ rather than access to Hai Phong, considering export to overseas

The Shizuoka Bank, Ltd. (BIDV Ha Noi)

- Has established representative office in Ha Noi 5 years before
  - Initially it was located inside of ANZ (Australia and New Zealand Banking Group Limited)
    - Moved out due to no contacts with Japanese companies
  - Next it was relocated to inside of Credit Saison Co., Ltd. local corporation in Ha Noi
    - Moved out due to closure of Ha Noi office of Credit Saison Co., Ltd.
  - BIDV
    - Currently two staff are transferred to BIDV

- Companies in Shizuoka
  - Main company is Yamaha Motor for motorbikes
  - 100 companies who have head offices in Shizuoka are already operating in Vietnam
  - Most of them are manufactures and therefore located in North

- Interests in agricultures
  - Two tea companies are already operating in Vietnam
    - Satoen is one of them visited by Da Lat visiting Japan mission
  - By the way, both companies are dealing Japanese tea.
    - (Reference) Japanese tea requires winter season (during this season, tea stores some kind of materials and make astringency.
  - Therefore, Da Lat is not suitable for good Japanese tea. North is suitable due to cold winter.
  - Occasional consultation related to agricultures
    - Lately, there are companies who has interests in dairy firming

- Three companies in Ha Nam Province
  - Two companies in Dong VanII (resin mold company, paper strings)
  - One more company

- Industrial parks have needs beside expansion of business to overseas
  - Needs for relocation from ready-build factories
  - Needs for relocation from China

- Japanese companies tend to be concerned about employees stationed abroad in choosing industrial park
  - Especially for the first employee sent from Japan
  - The commutable area from Ha Noi is a big advantage
  - Their concerns:
    - Medical
    - Meals
    - Housing (Serviced apartment is preferable)
    - Commute (It is preferable to offer discounted toll of the expressway as a benefit)
  - It must be good to appeal these merits
- 10 Commitments seems to be quite “for professionals”
  - In order to understand the value “24 hour-power supply”, we must know that the unstable power supply is the biggest issue in other industrial parks.
  - The value could not be understandable for newcomers to Vietnam

Sumitomo Wiring Systems, Ltd. (Dong VanII Industrial Park)

- Line of business
  - Receiving orders from Sumitomo Wiring Systems, Ltd.
  - Assembling of wire harnesses export to USA and Japan

- Size／Number of employees
  - 6,000 employees in Dong VanII factory
  - 4,000 employees in Nam Dinh Factory (Will be expanded in April 2017：No land was available in Dong VanII)
  - Female 96% (Assembling), Male 4%(Hard labor)

- Merit：Compared to Nam Dinh Factory, next province, obvious differences for support, quality of employees
  - Relatively hard-working employees
    - ✧ It is often said that "Purchasing and HR can have candidates even without salary". In other word, the illegal acts are often rampant
    - ✧ We need to take caution in Ha Nam, too but we feel at ease to have a proper person
- Merit：Easily accessible from Ha Noi
  - Mr. Furutani stays in Ha Noi, too
  - 50 minutes by car. Share a company car including a driver with two people (sponsored by a company)

- Issue：There are only two manufacturers, Honda and Sumitomo Wiring Systems, Ltd. with over 10,000 employees. Manufacturers with this size are facing the risk of shortage of workers.
  - Raise of wages in South Korea and China, improvement of working environment (Air-conditioning is installed, free meals or no violation etc.

- Issues：Factory's management association (They seems to be a Vietnamese company attending DPI's visit) is not that good
  - Administration fee has been raised without any clear reason (Besides, made a sudden notice not to all but to the company individually)
  - Asking the reason of raise of administration fee, "we will implement this" but never implement.
    - ✧ For example, it is dangerous that a coconut tree is caught on the electric wire and we suggest them to take action, but there is no sign to do so.

Honda Motor Co., Ltd. (Dong VanII Industrial Park)

- Company Profile
  - Head office and main factory are located in Vinh Phuc Province (7,000 employees@65ha)
    - ✧ Manufacturing four-wheels and two-wheels vehicles exporting to JP/EU/Philippine
  - Dong VanII is positioned as the third domestic factory (2,000 employees@27ha)
    - ✧ For domestic market
    - ✧ Manufacturing 5 million cars per year (Up to 10 million cars can be manufactured in the future
  - Sales office in Ha Noi and HCMC

- Background of move in
  - Needs for production base followed by Vinh Phuc(Especially, to expand market to South, seeking in South of Ha Noi)
  - Comparative analysis of HCMC, Dong Nai, Hue, Vin Phuc
  - It is difficult to compare and asses from the same point of view, but considered the following points of view
    - ✧ Easily to secure labor
    - ✧ Physical distance from suppliers (Transportation cost)
    - ✧ Support from provincial government (Due to no specific experience to operate in industrial park, wanted to help out from troubles)

- Assessment point
  - Strong support from PPC is greatly appreciated.

- ✧ Annual exchange opinion and hearing meeting with all the companies located in province is held - open attitude from provincial government is appreciated.
- ✧ Hearings are held for all nationalities as the first part, Japanese companies and Korean companies are divided as the second part.

- Improvements (Based on satisfaction overall)
  - ➢ Quality of water is not stable
  - ➢ Lack of housing. Due to shortage of labor force in Ha Nam province, securing labor force from other provinces. However, due to lack of high-quality housings, it has become obstacles for recruitment Ha Nam Province
  - ➢ Chinese or Korean companies are lack of awareness of compliance and overtime is common in Chinese or Korean companies, however, not in Japanese companies. As a result, it causes the wage differentials between Chinese or Korean companies and Japanese companies, and competitiveness in recruitment market has been discouraged
    - ✧ This is not a problem of a province but a central government. Maximum hours in excess of statutory working hours is too short for actual.
  - ➢ Approaches from departments besides Japan Desk are actually not good
    - ✧ However, we still can manage to push through Japan Desk
  - ➢ Traffic safety inside factory should be more strict
    - ✧ A few of honda employees have been dead due to traffic accidents in the past three years：Big truck was parked on the dark street in the nighttime and their motorbikes crashed etc.
    - ✧ Safety management is stricter in Thang Long Industrial Park

BTD Mr. Nakagawa

【Summary】

- As an issue, acknowledgement that BTD is overloaded is true, but it is not a point to worry
  - ➢ BTD (＝Mr. Nakagawa) has experiences piled up for 25 years to support Ha Nam province
  - ➢ It is impossible to replace the function by filling how many external people
- At least around three more years, needs to make up their minds to support provincial government with free of charge
  - ➢ Involve money (Charge province or JICA) Every trials were filed in the past (Vinh Phuc Province, Binh Duong Province, Ba Ria-Vung Tau Province・・・)
- If possible, it is important to hold the first promotional event next March to use networks with local banks and local governments build for this project
  - ➢ Mr. Yamamoto, Deputy Director-General of JICA stated not to request improvement to provincial government but to enhance promotion activities in corporation with DI through this project

【Details】

- Support for investment attraction for industry is not working effectively if money is involved. In order to make it effective, BTD must work with free of charge at least for three more years
  - ➢ Failure cases of Vinh Phuc Province
    - ✧ Had Mr. Taoki of Nippon Koei Co., Ltd. station for three years with JICA fund, but no achievement JICA
    - ✧ JICA fund for stationed person is treated as provincial debt. Therefore, provincial government is demanding high requirements against the stationed person repeatedly to recover the costs (province is not cooperative for their requirements)
  - ➢ Failure cases of Binh Duong Province
    - ✧ Foval's model is to charge provincial government for consulting fee, clients for commission (by adding intermediate charge to land sublease, providing various services)
    - ✧ As a position of an agency, they got bad reputations from provincial governments and clients for disintermediation despite their incomplete services.

- Failure case of Va Vung Tau (not about money)
  - Staff from large corporations such as Fujitsu are stationed
  - They don't understand worries from small and medium sized companies and it is not that functional.

- Grow a function as a liaison between networks and provincial governments to fulfill a function as a support desk for each local bank
  - Actually, the Juroku Bank, Ltd. and BTD are going to sign agreements and BTD will set up "The Juroku Bank, Ltd. Support Desk" (Agreement will be signed within this year)
  - To choose a bank as a business partner is a hard decision. There are three banks in Gifu Prefecture…
  - However, OKB has a partnership with Forval and promote investment to Binh Duong Province. Therefore, OKB is not proper candidate as a partner.
  - It is necessary to choose local banks without any connection with other provinces as much as possible (The partnership banks with Forval can be reviewed on their webpage)

CHAPTER 18 TOTAL PROJECT COST AND PROJECT IMPLEMENTATION SCHEDULE

18.1 Total Project Cost

The total project cost is shown in **Table 18.1-1**.

Table 18.1-1 Total Project Cost

Item	Sewerage Sector				Road Sector				Total			
	Foreign Currency (Mil. JPY)	Local Currency (Mil. VND)	TOTAL		Foreign Currency (Mil. JPY)	Local Currency (Mil. VND)	TOTAL		Foreign Currency (Mil. JPY)	Local Currency (Mil. VND)	TOTAL	
			Mil. VND	Mil. JPY			Mil. VND	Mil. JPY			Mil. VND	Mil. JPY
1. Construction Cost	989	556,122	763,874	3,636	0	1,224,840	1,224,840	5,830	989	1,780,962	1,988,715	9,466
2. Land Acquisition Cost	0	3,490	3,490	17	0	97,230	97,230	463	0	100,719	100,719	479
3. Price Escalation	51	45,576	56,357	268	0	87,189	87,189	415	51	132,765	143,546	683
4. Physical Contingency	52	30,085	41,012	195	0	65,550	65,550	312	52	95,635	106,561	507
5. Consultancy Service	373	33,445	111,704	532	391	37,021	119,128	567	763	70,466	230,832	1,099
6. Administration Cost	0	48,822	48,822	232	0	79,645	79,645	379	0	128,467	128,467	612
7. VAT	0	86,124	86,124	410	0	137,655	137,655	655	0	223,779	223,779	1,065
8. Tax on Consulting Services	0	16,756	16,756	80	0	17,869	17,869	85	0	34,625	34,625	165
9. Import Tax	0	6,884	6,884	33	0	0	0	0	0	6,884	6,884	33
10. Interest during Construction	40	0	8,315	40	50	0	10,589	50	90	0	18,905	90
11. Front end Fee	9	0	1,946	9	14	0	2,991	14	24	0	4,937	24
GRAND TOTAL	1,514	827,303	1,145,283	5,452	455	1,747,000	1,842,687	8,771	1,969	2,574,303	2,987,970	14,223

Source: JICA Survey Team

18.2 Project Implementation Schedule

The project implementation is shown in **Table 18.2-1**.

Table 18.2-1 Project Implementation Schedule

Item	Period	2017	2018	2019	2020	2021	2022	2023	2024	2025
		9 10 11 12		1 2 3 4 5 6 7 8 9 10 11 12	1 2 3 4 5 6 7 8 9 10 11 12	1 2 3 4 5 6 7 8 9 10 11 12	1 2 3 4 5 6 7 8 9 10 11 12	1 2 3 4 5 6 7 8 9 10 11 12	1 2 3 4 5 6 7 8 9 10 11 12	1 2 3 4 5 6
Sewerage Sector										
Pledge		●								
Signing of Loan Agreement				●						
Consulting Service										
Selection of Consulting Firm (D/D, T/A and C/S)	**11**			1 1 1 1 1 1 1 1 1 1 1 1						
Detailed Design (D/D)	**10**				1 1 1 1 1 1 1 1 1 1					
Tender Assistance (T/A)	**13**					1 1 1 1 1 1 1 1 1 1 1 1 1				
Construction Supervision	**36**						1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1			
Land Acquisition	**11**			1 1 1 1 1 1 1 1 1 1 1 1						
Road Sector										
Pledge		●								
Signing of Loan Agreement				●						
Consulting Service										
Selection of Consulting Firm (D/D, T/A and C/S)	**11**			1 1 1 1 1 1 1 1 1 1 1						
Detailed Design (D/D)	**6**				1 1 1 1 1 1					
Tender Assistance (T/A)	**5**					1 1 1 1 1				
Construction Supervision	**18**					1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1				
Land Acquisition	**12**			1 1 1 1 1 1 1 1 1 1 1 1						

Source: JICA Survey Team

CHAPTER 19 RECOMMENDATION

19.1 Sewerage Sector

Recommendations for the sewerage sector are as follows:

- Project cost for branch sewer installation is not included in the proposed Yen Loan project. Therefore, Ha Nam Province or developers, should install branch sewer by their own budget. In addition, Phu Ly City should facilitate house connections to optimize the sewerage system established in this Project. To facilitate house connections, financial assistance to each household and public campaign for facilitation of house connections is recommendable.
- In this Project, interval of manholes become longer especially in sewer pipe installed, applying the jacking method. The training for staff to properly maintain the sewer pipe will be required.
- As for operation and maintenance for constructed and installed facilities in the Project, training of the staff by the Contractor in trial operation period will be required, especially for PTF, which is a newly introduced technology in Ha Nam Province.

19.2 Road Sector

Recommendations for road sector are as follows:

- Geological survey including consolidation tests for soft cohesive soil shall be conducted at the locations of abutment and flyover piers which are planned to be constructed. With the results of geological survey, length of the pile foundations shall be determined, then construction cost will be finalized.
- Installation work for flyover crossing over the Expressway including necessary traffic control shall be conducted during night time (From 8:00 PM till 5:00 AM) to minimize traffic disturbance. Ha Nam PPC (HNPPC) shall have close consultation meetings with the Vietnam Expressway Corporation (VEC) regarding this matter and get the approval for construction from VEC.
- Surcharge method is recommended as the measure to prevent damages around boundary between structures and embankment portions due to settlement of embankment on soft ground, method of which is used as reliable and effective countermeasures with low costs against settlement of embankments on soft ground.