SOCIALIST REPUBLIC OF VIETNAM
PEOPLE'S COMMITTEE OF HAI PHONG CITY

SOCIALIST REPUBLIC OF VIETNAM
PREPARATORY SURVEY
ON
HAI PHONG ARTERIAL ROAD
CONSTRUCTION PROJECT

REPORT ON ENVIRONMENTAL IMPACT ASSESSMENT (EIA) RING ROAD 3

December 2016

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

CHODAI CO., LTD.
ORIENTAL CONSULTANTS GLOBAL CO., LTD.
ALMEC VPI CO., LTD.

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HAI PHONG CITY PEOPLE'S COMMITTEE

HAI PHONG BRIDGE PROJECTS MANAGEMENT DEPARTMENT

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report on
environmental impact assessment

hai phong RING ROAD No.3 CONSTRUCTION PROJECT

Hai Phong, November 2016

HAI PHONG CITY PEOPLE'S COMMITTEE

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report on
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hai phong RING ROAD No.3 CONSTRUCTION PROJECT

PROJECT OWNER

EIA REPORT PREPARATION CONSULTANT AGENCY

JICA'S PREPARATORY SURVEY TEAM

TEAM LEADER

TRANSPORT ENGINEERING DESIGN INCORPORATION (TEDI)

Hai Phong, November 2016

LIST OF CONTENT

- Results of biological surveys

+ Table 1: List of plant at Project region

+ Table 2: List of birds at Project region

+ Table 3: List of mammals at Project region

+ Table 4: List of Reptilia and amphibia at Project region

+ Table 5: List of Phytoplankton at Project region

+ Table 6: List of Zooplankton at Project region

+ Table 7: List of Zoobenthos at Project region

+ Table 8: List of fish at Project region

+ Table 9: List of sea fish at Project region

+ Density of phytoplankton at sampling stations

+ List of phytoplankton at sampling stations

+ Density of Zooplanktony at sampling stations

+ List of Zooplanktony at sampling stations

+ Zoobenthos biomass density at sampling stations

3. Appendix 3: Public Consultation

- Public Consultation – Stage 1 (April-May, 2015)

- Public Consultation – Stage 1 (December, 2015)

4. Appendix 4: Picture of Environmental suveys

INTRODUCTION

1. Background

1.1. Origin, Project's Formation, and necessity of the project investment

Currently, transport connection within Hai Phong City between two banks of Cam River is realized via Binh Bridge and Kien Bridge. Kien Bridge among others under National Highway No. 10 improvement and extension project situates in the upstream of Cam River; Binh Bridge connects the inner city with Thuy Nguyen District. With the increasing demand of passenger and cargo transport, it is expected, in early 2020, transport flow on these two bridges will exceed the permissible limit, due to the development of new urban areas in the North and the increased flow of cargoes through Hai Phong international gateway port.

The fact has shown, recently, the growth rate of Thuy Nguyen District is very high, which attracts many local and foreign enterprises to invest in the locality: VSIP Haiphong Township, Industrial & Service Park, Ben Rung Industrial Zone

On the other hand, according to "Hai Phong City Master Plan to 2025, and Vision to 2050", Hai Phong City plans to redevelop the existing city center area and develop a new residential and industrial complex on the North bank of the Cam River. Thus, implementation of Ring Road No.3 project is necessary to improve the road network connecting the existing city center with the new city center on the Northern side of the Cam River.

Therefore, it is crucial to invest in the Ring Road No.3 project which connects Lach Huyen International Port, Dinh Vu – Cat Hai Industrial Zone in the South with NH No.10. Moreover, thanks to development of the Ben Rung Urban Area on the North bank of the Ruot Lon River, Ring Road No.3 will help to disperse the traffic flow into the center of the City from Lach Huyen International Port and Dinh Vu – Cat Hai Industrial Zone, and consequently help to mitigate traffic congestion usually occurring in the center area of Hai Phong City.

b. Background of the Project

Ring Road No.3 Construction Project was one among three components of the previous Hai Phong Arterial Road Construction Project. With a great concern of the project, Japan International Cooperation Agency (JICA) has sent a preparatory survey team leaded by Chodai Co.Ltd to carry out a survey, including EIA report preparation for the project, in order to form an ODA project (SAPROF). The JICA's study team

submitted the final report to Hai Phong People's Committee for comments on December 22, 2015.

On February 5, 2016, the urban development construction project management board and JICA study team signed the Minutes of Discussion regarding deployment of Hai Phong arterial trunk road construction project, which was divided into 03 component projects: Nguyen Trai Bridge construction project, Vu Yen Bridge construction project, and Ring Road 3 construction project (connecting from Vu Yen Bridge to intersection of National Highway 10).

On October 25, 2016, Hai Phong People's Committee issued the Notice No. 391/TB-UBND regarding conclusion of Hai Phong People's Committee Chairman in the meeting on project owner replacement. Accordingly, Hai Phong People's Committee has entrusted Hai Phong bridge projects management board to be the project owner. All procedures related to change of the project owner from the urban development construction project management board to Hai Phong bridge projects management board will completed in November 2016.

1.2. Entity in Charge of Approval of the Project Investment Policy

a. Entity in Charge of Approval of the Project Investment Policy

Ring Road No.3 Construction Project is a new construction project under Group A in accordance with Article 8 and 17 of Public Investment Law No. 49/2014/QH13 adopted by the XIIIth National Assembly at the 7th session on June 18, 2014. Investment policy of the project has been decided by the Prime Minister.

b. Entity in charge of approval on the FS report

The FS report has been approved by the Chairman of Hai Phong People's Committee.

1.3. Entity in Charge of Approval of the EIA report

This transport project is subject to preparation of EIA report according to regulations in the Appendix II, Decree No. 18/2015/ND-CP dated 14/2/2015 of the Government stipulating on environmental protection assessment, strategic environmental assessment, environmental impact assessment and environmental protection plans. Because the investment policy of the project was decided by the Prime Minister, EIA report of the project will be approved by MONRE according to Appendix III, Decree No. 18/2015/ND-CP. In addition to that, when the project is formed with JICA's cooperation, contents of the EIA report must comply with Guidelines on environment and social considerations of JICA issued in April 2010 (hereinafter referred to as "JICA Environmental Guideline").

1.4. Relationship with Other Relevant Approved Projects and Master Plans

The relevant projects and master plans:

- Hai Phong Road Transport Master Plan up to 2020 and Vison to 2030 approved by HPPC at the Resolution No.32/2014/NQ-HDND dated on December 11th 2014;
- The adjusted land use planning at scale 1/2000, VSIP Haiphong Township, Industrial & Service Park project in accordance with the Decision No. 674/QD-UBND dated 11/5/2012 of Hai Phong People's Committee;
- The adjusted detailed master plan at scale 1/2000 and regulations on management as per the adjusted detailed master plan at scale 1/2000 of Ngo Quyen District to 2025 according to the Decision No. 2224/QD-UBND dated 11/11/2013 of Hai Phong People's Committee;
- Hanoi – Hai Phong Expressway Construction Project;
- Lach Huyen International Port Construction Project;
- Tan Vu – Lach Huyen Road Construction Project.

Other approved Master Plans in the same geographic area of this Project were also reviewed in order to avoid conflicts between the Project and these plans.

2. Legal and Technical Bases of the EIA Study

2.1. Legal Bases and Technical Documents

a. Legal Bases and Technical Documents consist of the followings*:*

- Vietnam legal documents on EIA:
  - National Law on Environmental Protection No. 55/2014/QH13 approved at the 7th of the VIIIth National Assembly on June 23rd, 2014, and became effective from January 1, 2015;
  - Decree No. 18/2015/ND-CP dated on February, 14th 2015 issued by the Central Goverment on environmental protection assessment, strategic environmental assessment, environmental impact assessment and environmental protection plans;
  - Circular No.27/2015/TT-BTNMT dated on May, 29th 2015 of MONRE on environmental protection assessment, strategic environmental assessment, environmental impact assessment and environmental protection plans;
- Vietnam legal documents on environment and land resources:
  - Land Law No. 45/2013/QH13 adopted by the XIIIth National Assembly of Socialist Republic of Vietnam in the sixth session on November 29th, 2013;
  - National Law on Water Resource No. 17/2012/QH13 adopted by the XIIIth

National Assembly of Socialist Republic of Vietnam in the 3rd session on June 21, 2012;

- National Law on Biological Diversity No. 20/2008/ QH12 adopted by the twelfth National Assembly of Socialist Republic of Vietnam in the fourth session on November 13th, 2008;
- Decree No.38/2015/ND-CP dated on April, 24th 2015 of Central Government on management of waste and discarded materials;
- Decree No.03/2015/ND-CP dated January, 6th 2015 of Central Government on determination damages to the environment;
- Decree No.42/2012/ND-CP dated November 5th 2012 of Central Government on management and use of rice-farming land;
- Decree No.179/2013/ND-CP dated December 31st 2013 of Central Government on the sanction of administrative violations in the domain of environmental protection;
- Decree No.43/2014/ND-CP date May 15th 2014 of Central Government on detailing a number of articles of the Land Law;
- Decree No.47/2014/ND-CP dated May 15th 2014 of Central Government on providing for the compensations, supports and resettlement upon State land recovery;
- Decree No. 43/2015/ND-CP dated 06/5/2015 of the Government stipulating on preparation and management of protection corridor of water resources;
- Decree No. 201/2013/ND-CP dated 27/7/2013 of the Government detailing implementation of some articles of Law on Water Resources;
- Circular No.32/2015/TT-BGTVT dated July 24th 2015 of MOT on regulations on environmental protection in traffic infrastructure development;
- Circular No.36/2015/TT-BTNMT dated June 30th 2015 of MONRE on management of hazardous wastes;
- Circular No.28/2011/TT-BTNMT dated August 1st 2011 of MONRE on providing guidelines on technical process of surrounding air environment monitoring and noise;
- Circular No.29/2011/TT-BTNMT dated August 1st 2011 of MONRE on regulations on continental water surface environment monitoring;
- Circular No.30/2011/TT-BTNMT dated August 1st 2011 of MONRE on regulations on technical process of underground water environment monitoring;
- Circular No.33/2011/TT-BTNMT dated August 1st 2011 of MONRE on

regulations on technical process of soil environment monitoring;

- Circular No.39/2011/TT-BGTVT dated May 18th 2011 of MOT on guiding a number of articles of the Government's Decree No. 11/2010/ND-CP of February 24th 2010 on the management and protection of road infrastructure facilities.
- Circular No. 37/2014/TT-BTNMT dated June 30th 2014 of MONRE detailing compensation, support, resettlement upon the State's land recovery;

– Applicable codes and standards :

- TCVN7210:2002 Vibration and shock. Vibration from road vehicles– permissible limits for environment of public and residential areas;
- QCVN 03-MT:2015/BTNMT, National technical standard on permissible limits of heavy metals in soils;
- QCVN 05:2013/BTNMT, National technical standard on surrounding air quality;
- QCVN 06:2009/BTNMT, National technical standard on some hazardous substance in surrounding air;
- QCVN 07: 2009/BTNMT, National technical standard on Hazardous Waste Thresholds;
- QCVN 08-MT:2015/BTNMT, National technical standard on surface water quality;
- QCVN 09-MT:2015/BTNMT, National technical standard on underground water quality;
- QCVN 14:2008/BTNMT, National technical standard on domestic waste water;
- QCVN 26:2010/BTNMT, National technical standard on noise level;
- QCVN 27:2010/BTNMT, National technical standard on vibration level;
- QCVN 40:2011/BTNMT, National technical standard on industrial waste water;
- QCVN 43:2012/BTNMT, National technical standard on sediment quality;
- Environmental standards of international organizations such as World Health Organization (WHO), etc.

2.2. Legal Documents relevant to the Project

a1. Vietnamese side

- National Law on Construction No. 50/2014/QH13 approved at the seventh session of the XIIIth National Assembly on June 18th 2014 and became effective from January 1, 2015;
- Road Traffic Law adopted on 13th November, 2008 at the 4th session of the XIIth National Assembly;
- National Law on Dike No. 79/2006/QH11 adopted on November 29th 2006 at the tenth session of the XIth National Assembly;
- National Law on amending and supplementing a number of articles of law on inland waterway transport No. 48/2014/QH13 adopted on June 17th 2014 at the seventh session of the XIIIth National Assembly;
- National Law on Inland Waterway Transport No.23/2004/QH11 adopted on June 15th 2004 at the fifth sessions of the XIth National Assembly and became effective from January 1, 2005.
- Decree No.46/2015/ND-CP dated May 12th 2015 of Central Government on quality control and maintenance of construction works;
- Decree No.100/2013/ND-CP dated on September 3rd 2013 of Central Government on amending and supplementing a number of articles of the government Decree no. 11/2010/ND-CP dated February 24th 2010 of Government regulations on management and protection of road infrastructure facilities;
- Decree No.11/2010/ND-CP dated February 24th 2010 of Central Government regulations on management and protection of road infrastructure facilities;
- Decree No.32/2015/ND-CP dated March 25th 2012 of Central Government on construction cost management;
- Decision No. 1448/QD-TTg dated 16/9/2009 of the Prime Minister approving the adjusted construction planning of Hai Phong City to 2025 and in vision to 2050;
- Document No. 6146/BKHDT-KTDN dated 01/9/2015 of MPI on preparation of FS report for Nguyen Trai and Vu Yen Bridges Construction Investment Project, Hai Phong City;
- Resolution No. 32/2014/NQ-HDND dated 11/12/2014 of the City's People's Council approving Hai Phong City roadway transportation planning to 2020 and in vision to 2030;

- Document No. 684/VP-GT dated 20/5/2015 of the City's People's Committee regarding implementation of Nguyen Trai Bridge and Vu Yen Bridge construction investment project;
- Document No. 3381/VP-GT dated 08/9/2015 of the City's People's Committee on formation of FS report of Nguyen Trai Bridge and Vu Yen Bridge construction investment project;
- Other relevant documents.

2.3. Other relevant documents

JICA Guidelines for Environmental and Social Considerations, 2010 (as the Project is classified as A-Category).

2.4. Documents and Data Made by the Project Owner

- Report on Pre-Feasibility Study of the Project;
- Survey data on environmental resources and socio-economic condition in the Project area.

Details of the environmental surveys (sampling locations, parameters, frequency, measurement time, etc.), and results of the surveys are presented in the section on quality of the current physical environment in Chapter 2 of this report. Data collection method was determined by experienced environmental experts.

In addition, as mentioned in Chapter 6, the first and second rounds of public consultation meetings were organized at 10 affected communes to disseminate information on the Project and concurrently collect comments/ opinions of affected people and other relevant entities.

3. Organizations in charge of the EIA Study for the Project

EIA report of the Project is prepared by the Project Owner (the HPPC Management Unit of Urban Development Construction) and handed over Hai Phong bridge projects management board for implementation in accordance with the Notice No. 391/TB-UBND dated 25/10/2016 of Hai Phong City's People's Committee thực hiện with assistance from the Environmental Sub-Consultant entrusted by the JICA Preparatory Survey Team.

a. Project Owner

- The Project Owner: Hai Phong People's Committee
- Project Management Agency: Hai Phong bridge projects management board
  - Representative: Mr. Do Tuan Anh; Position: General Director;
  - Address: No. 14, Minh Khai Street –Hong Bang District – Hai Phong.
  - Telephone: 031.3747866; Fax: 031.3842436.

b. Consultant agency

- Consultant agency assisting in EIA report preparation: JICA Preparatory Survey Team (CHODAI Co., Ltd., Oriental Consultants Global Co., Ltd. and Almec VPI Co., Ltd);
- Environmental Sub-Consultant: Transport Engineering Design Incorporation (TEDI)
  - ✓ Representative: Mr. Pham Huu Son Position: General Director
  - ✓ Address: 278 Ton Duc Thang Street, Dong Da District, Hanoi City
  - ✓ Telephone: 04.38514431 Fax: 04.38514980
- The Training and Advisory Center of Science and Technology for Marine Environment Protection (TCEP) – Vietnam Maritime University (in charge of carrying out surveys on ambient air and quality)
  - ✓ Representative: Bui Dinh Hoan Position: Director
  - ✓ Address: No109 block A5 – Vietnam Maritime University, 848 Lach Tray street, Hai Phong
  - ✓ Telephone: 031.3828803

After carried out the preliminary examination and the field reconnaissance surveys, the first round of Public Consultation Meetings was organized in April and May 2015. Participants to these meetings were local residents including the project-affected households, local mass organizations, etc. Results of these meetings are described in Chapter 6 of this EIA report. Predicted environment impacts and correspondent proposed mitigation measures are described in Chapter 3, 4 and 5 of this EIA report.

The participants in EIA reports of projects is the EIA experts knowledgeable in the field of depth with the following representatives:

No.	Full name	Position/ Organization	Academic title and major of training	In charge of	Signature of EIA participants
A	**Member of the Project Owner**				
1	Mr Dao Ngoc Sy	Vice Director	Bridge and Road Engineer	Overall management	
2	Mr. Nguyen Hong Phong	Manger of Planning Department	Economic masters	Coordination	
3	Mr. Dinh Duc Thinh	Manger of Evaluation Department	Bridge and Road Engineer	Coordination	
4	Mr. Tran Van Tu	Manger of Organization – Administration Department	Civil Engineer	Coordination	
5	Mr. Dinh Phu Hieu	Manger of Technical Department	Bridge and Road Engineer	Coordination	
B	**List of EIA and EIA report preparation participants**				
2	Mr. Nguyen Thanh Chinh	Director of Envinronment Company – (TEDI-ENVICO)	Master of Science, Environmental Science	Overall management of survey works and EIA report preparation	
3	Mr. Pham The Giang	Deputy Director - (TEDI-ENVICO)	Environment Hydrological Engineer Certificate of Environmental Hydrological survey, in 2012 (Certificate No.: KS-04-03085-A)	- Chief of EIA - Generally in charge of EIA report quality - In charge of Chapter 3, Chapter 4 and Conclusion	
4	Mr. Nguyen Dinh	Expert (TEDI-ENVICO)	Master of Science, Environmental Science	- Calculation and forecast of noise and vibration impacts	

No.	Full name	Position/ Organization	Academic title and major of training	In charge of	Signature of EIA participants
5	Mr. Le Viet Cao	Expert (TEDI-ENVICO)	Environmental Technology Engineer	- Calculation and forecast of impacts by dust, exhaust emission	
6	Pham Thanh Hao	Expert (TEDI-ENVICO)	Environmental economics bachelor	- In charge of economic conditions of the locality and impacted households. Assess economic impacts and propose mitigation measures	
7	Ms. Nguyen Thi Hong Van	Expert (TEDI-ENVICO)	Environmental economics engineer, Road engineer.	- In charge of Chapter 1 and Chapter 5	
8	Ms. Tran Phuong Lan	Expert (TEDI-ENVICO)	Bachelor of Laws, Environmental Law and Policies.	- In charge of introduction chapter	
9	Ms. Ho Thi Thuy	Expert (TEDI-ENVICO)	Bachelor of Science in History	- In charge of Chapter 2. In charge of social impact assessment and propose mitigation measures	
10	Mr. Dang Vu Hien	Expert (TEDI-ENVICO)	Biotechnology Engineer; professional certificate of environmental processing technology design, in 2011 (Certificate No.: KS-281-00478)	- Survey team leader - Prepare conditions of living being resources, assess impacts on living being resources and propose mitigation measures	
11	Ms. Ngo Thi Thanh Hoa	Expert (TEDI-ENVICO)	Environmental engineering technology engineer	- In charge of Chapter 6 and table of contents, appendixes - Implement administrative procedures	
12	Mr	Institute of	Biology Bachelor	In charge of conditions	

No.	Full name	Position/ Organization	Academic title and major of training	In charge of	Signature of EIA participants
	Phan Van Mach	Ecology and living being resources		of living being resources, assess impacts on living being resources and propose mitigation measures	
	And collaborators				

4. Methods applied in preparing the EIA report

a. Methods for EIA

a1. Statistical method

Use statistical data of Hai Phong City as well as study results in order to analyze and assess resource and environmental, economic - social, ecological conditions, etc. (Chapter 2 and 3).

a2. Analysis method

Compare parameters of environmental conditions with current Vietnamese codes: determination of environmental impacts of the project helps assess changes of parameters of environmental quality during project construction and operation stages.

a3. Specialist method

This method is used in assessment of impacts on natural objects such as hydro-meteorology, resources, environment and communities in order to calculate and forecast impacts, and propose mitigation measures of adverse impacts on the environment and society in the project construction area.

a4. Quick assessment method

This method is to determine and assess pollution load from project activities as well as to assess their impacts on the environment. This method is mainly used in Chapter 3 of the Report.

a5. Models method

This method is used to forecast the scale and level of impacts on the environment. This method is mainly used in Chapter 3 of the Report.

b. Other methods

b1. Method of measurement and sampling on site and analysis in the laboratory

To determine locations of measurement and sampling points of environmental parameters serving analysis and assessment of conditions of environmental quality in the project area. This method is mainly used in Chapter 2 of the Report.

b2. Social investigation method (Public consultation)

This method is used during interview of the local authorities and people surrounding the project implementation area. The method is mainly used in Chapter 2 and Chapter 6 of the Report.

CHAPTER I. BRIEF DESCRIPTION OF THE PROJECT

1.1. Name of the Project

Ring Road 3 construction project.

1.2. Project Owner

- The Project Owner: Hai Phong People's Committee
- Project Management Agency: Hai Phong Bridge Projects Management Department
  - ✓ Representative: Mr. Do Tuan Anh; Position: General Director;
  - ✓ Address: No. 14, Minh Khai Street –Hong Bang District – Hai Phong.
  - ✓ Telephone: 031.3747866; Fax: 031.3842436.

1.3. Geographical location

1.3.1. Construction Investment Scale of the Project

a. Scope of the Project

Ring Road No. 3 construction project locates in the territories of the following communes: Kenh Giang, Dong Son, Hoa Binh, An Lu, Trung Ha, Thuy Trieu, Ngu Lao, Phuc Le, Pha Le, and Lap Le in huy Nguyen District.

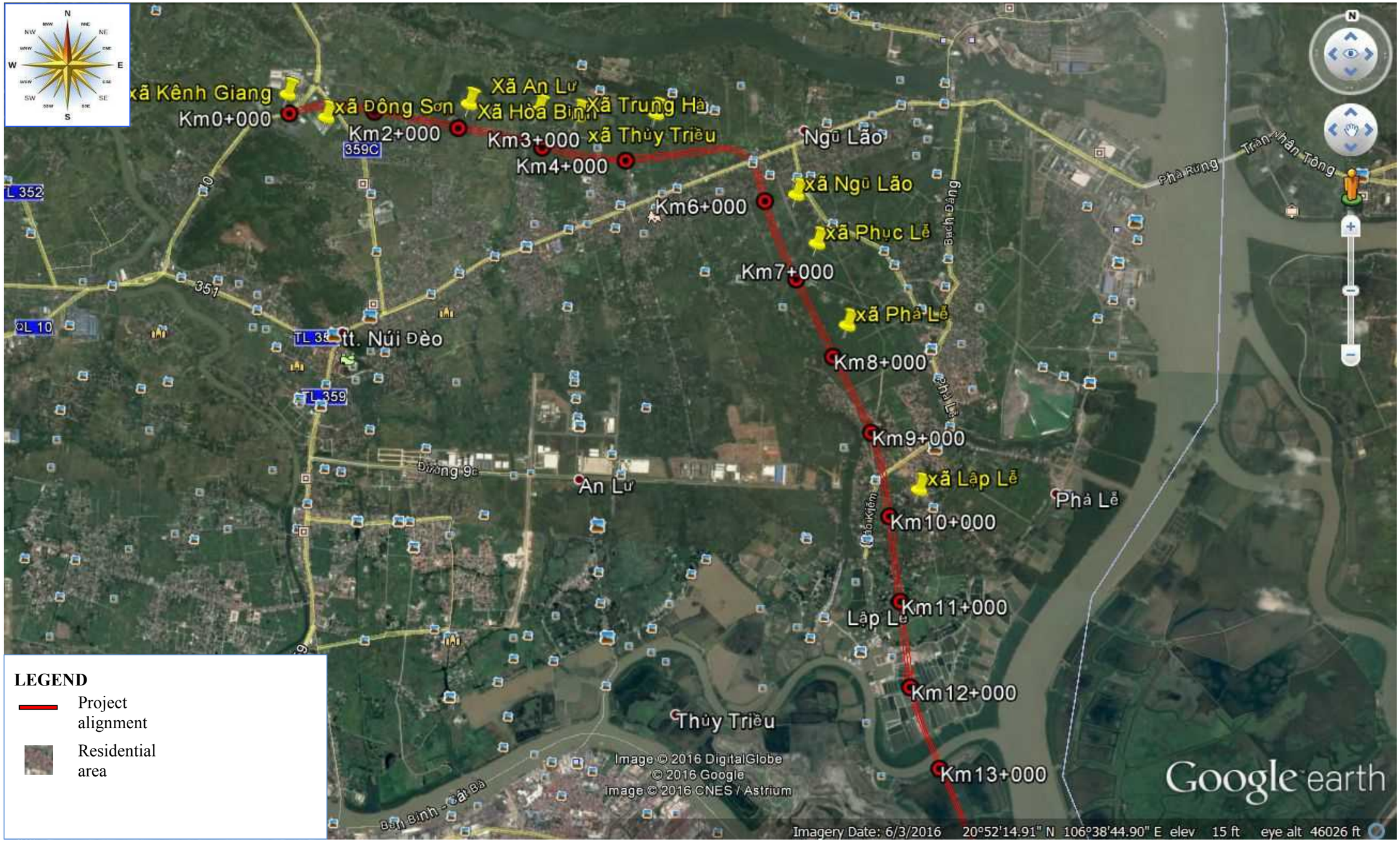


Figure 1.1. Sitemap of the Project

1.3.2. Geographical Location of the Project

The Project is located in 10 communes/wards of Thuy Nguyen district.

Natural and socio-economic factors around the Project area are as followings (figure 1.1):

- *Transport system along the route:* The main roads in the project area include: National Road No.10, Provincial Road No. 359, Road No. 9C, VSIP Road, and several communal roads. The traffic volumes on National Road No.10, Provincial Road No. 359 and Provincial are relatively heavy.
- *River system and waterway transport*: The bridges and road planned by the Project will cross over the Cam River, Ruot Lon River and tributaries of Gia River, which are sources of surface water for irrigation activities in the project area. On the right bank of the Cam River, where Nguyen Trai and Vu Yen bridges are planned, there are Hoang Dieu and Hai An Ports, respectively. In the upstream of Ring Road 3, there is Hoang Dieu port; in the upstream of Ruot Lon Bridge on the left bank of Ruot Lon River, there is Mat Rong fishing port.
- *Residents and economic activities*: Residents concentrate in the interchanges between roads of the project and NR10, PR359 and roads in Ngu Lao commune. Economic activities are mainly agriculture and small business.
- *Cultural, history and other structures:* There are Hoa Binh primary and secondary schools in the project area.

Alignment alternatives are considered and shown in figure 1.2; comparison of alternatives are presented in table 1.1.

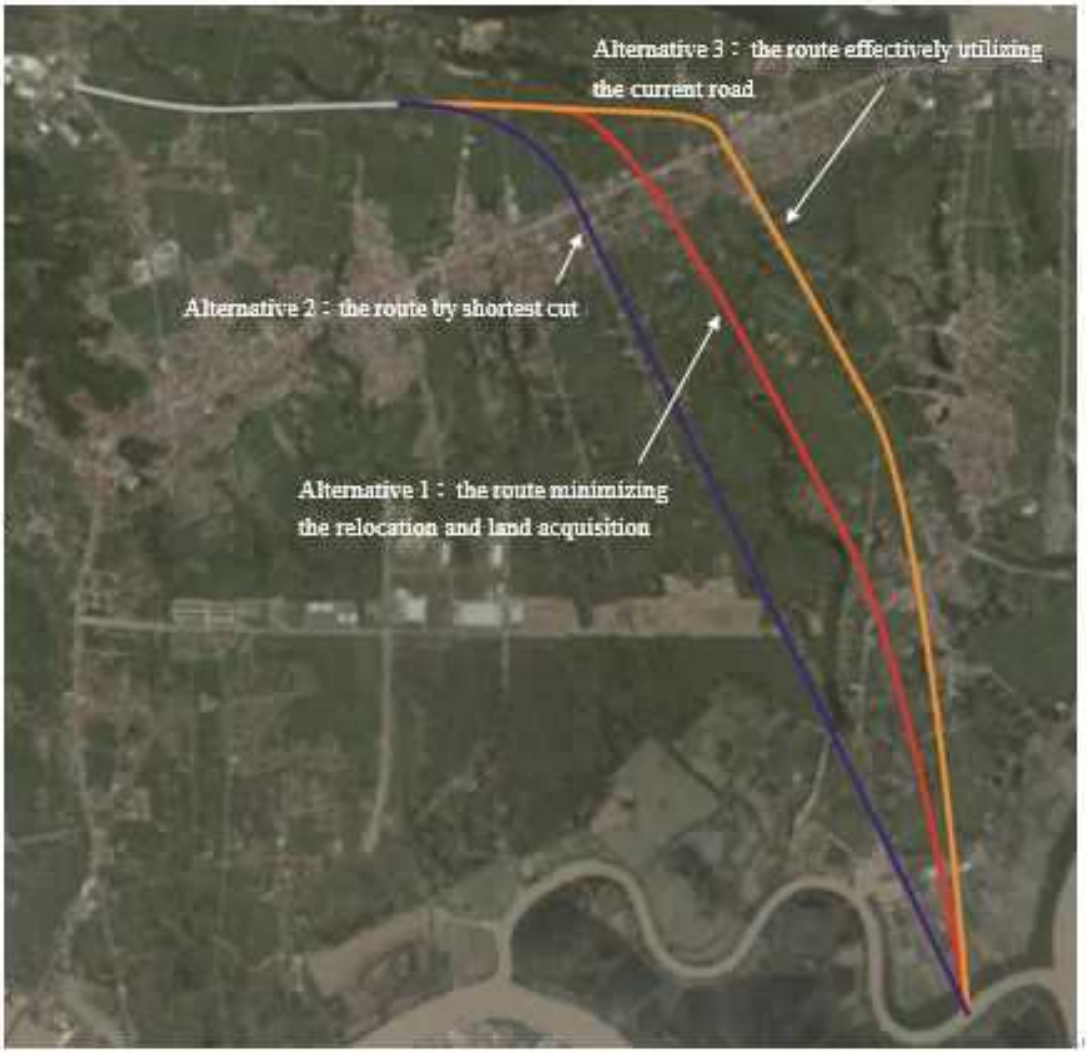


Figure 1.2. Alignment alternatives of Ring Road No. 3

Table 1.1. Comparison and Evaluation of Alternatives for Ring Road 3

Evaluation ◎ : Best alternative, ○ : Second-best alternative, △ : Possible if no other alternative, × : Unsuitable alternative

Alternative	Alternative 0 : No structure	Alternative 1: Route minimizing relocation and land acquisition	Alternative 2: Shortest route	Alternative 3: Route effectively utilizing the existing road
Summary and aim	Status quo, no construction (no environmental or social impact).	Minimize the number of relocation households without road alignment and loss of network function. Road length: 13km	Connect the starting point (Vu Yen Island) and ending point (QL10) using the shortest route. Road length: 11.6km	Use and widen the existing road to the extent possible. Road length: 13.5km
Social impact	◎	○	×	×
	No land acquisition (existing or new) required.	Relocation of 500 households and land acquisition of 650,000m^2 is required, but the social impact is the smallest of all the other alternatives (except the zero-option). The possibility of small-scale community distribution since the road hinders pedestrian traffic between residential areas, agricultural areas and public facilities.	Relocation of 100 households more than Alternative 1 and land acquisition of 580,000m^2 is required. The possibility of small-scale community distribution since the road hinders pedestrian traffic between residential areas, agricultural areas and public facilities.	Since this route widens the exiting road and takes a roundabout route, the road becomes long (1~2km). Relocation of 100 households more than Alternative 1 and land acquisition of 675,000m^2 which is the largest area of all alternatives is required. The possibility of small-scale community distribution since the road hinders pedestrian traffic between residential areas, agricultural areas and public facilities.
Impact on natural environment (mangrove forests)	◎	○	○	○
	Status quo, no impact.	8,650m^2 of the mangrove forests and part of the wetlands are affected by excavation or construction during the construction period.	8,650m^2 of the mangrove forests and part of the wetlands are affected by excavation or construction during the construction period.	8,650m^2 of the mangrove forests and part of the wetlands are affected by excavation or construction during the construction period.

Alternative	Alternative 0 : No structure	Alternative 1: Route minimizing relocation and land acquisition	Alternative 2: Shortest route	Alternative 3: Route effectively utilizing the existing road
Impact on living environment / pollution	×	◎	◎	○
	There is no effect on the planned site, but for Hai Phong City, worsened traffic congestion leads to reduced average travel speed and increased stop-start traffic even with current traffic volume. This in turn results in increased fuel consumption and air pollutant emissions in Hai Phong City.	Although more regional traffic is expected to increase roadside air pollution, noise and vibration, such emissions and noise are diffused.	Although more regional traffic is expected to increase roadside air pollution, noise and vibration, such emissions and noise are diffused.	Although more regional traffic is expected to increase roadside air pollution, noise and vibration, such emissions and noise are diffused. This route is planned to pass existing settlements, and the impact on the living environment is therefore less than for Alternative 1 and Alternative 2.
Road transport system	×	○	◎	△
	Since there is no traffic connection between Vu Yen Island and Thuy Nguyen district, the traffic flow from Vu Yen Island to the south side of the Cam River is cut off.	Sufficient traffic capacity ensures traffic flow and safety.	Sufficient traffic capacity ensures traffic flow and safety. Especially the linear road alignment has better traffic functions.	Sufficient traffic capacity ensures traffic flow and safety, but the route along the existing road alignment may cause traffic congestion.
Road safety	◎	○	○	△
	Status quo, no impact.	Capable of causing traffic accidents due to new road construction.	Capable of causing traffic accidents due to new road construction.	Capable of causing traffic accidents due to widening of the existing road. Safety measures need to be developed.
Impact on socio-economic activity and regional development	×	◎	◎	◎
	Decreased traffic flow and safety negatively affects socio-economic activity, which limits the development of the entire Hai Phong area.	Smooth and safe traffic promotes socio-economic activity and regional development. More employment opportunities for local workers and consumption during the construction period will also lead to increased regional income.	Smooth and safe traffic promotes socio-economic activity and regional development. More employment opportunities for local workers and consumption during the construction period will also lead to increased regional income.	Smooth and safe traffic promotes socio-economic activity and regional development. More employment opportunities for local workers and consumption during the construction period will also lead to increased regional income.

Alternative	Alternative 0 : No structure	Alternative 1: Route minimizing relocation and land acquisition	Alternative 2: Shortest route	Alternative 3: Route effectively utilizing the existing road
Project cost	◎	△	○	△
	No land acquisition or construction costs.	The resettlement cost is the smallest, but land acquisition costs are larger than for Alternative 3. Since the road length is longer than for Alternative 2, the construction cost is also higher than for Alternative 2.	The land acquisition cost is the smallest, but resettlement costs are larger than for Alternative 1 (but still smaller than for Alternative 3). Since the road length is the shortest, the construction cost is lower than for Alternative 1.	By widening the existing road, land acquisition costs are reduced. But the resettlement cost is larger than for Alternative 1 and 2. Since the road length is the longest, the construction cost is the highest of all alternatives.
Maintenance costs	◎	○	○	○
	No maintenance costs.	The whole length is paved with asphalt, and structures such a bridges and slope protection systems are relatively small. Maintenance costs are relatively low compared with the other alternatives.	The whole length is paved with asphalt, and structures such a bridges and slope protection systems are relatively small. Maintenance costs are relatively low compared with the other alternatives.	The whole length is paved with asphalt, and structures such a bridges and slope protection systems are relatively small. Maintenance costs are relatively low compared with the other alternatives.
Overall evaluation	×	◎	○	△
		Alternative 1 is expected to improve the living environment, road transportation system, and socio-economic activity. Since the impact on the living environment is the lowest of all alternatives, the route which minimizes relocation and land acquisition is recommended as the best alternative.		

1.4. Major Contents of the Project

1.4.1. Objectives of the Project

Ring Road No.3 is planned to connect Lach Huyen International Port, and Dinh Vu – Cat Hai Industrial Zone with National Highway No.10 and the developing Ben Rung Urban Area on the north bank of the Ruot Lon River. Thus, Ring Road No.3 will help to disperse the traffic flows into the center of the City from Lach Huyen International Port and Dinh Vu – Cat Hai Industrial Zone, and consequently help to mitigate traffic congestion often occurring in the center area of Hai Phong City.

1.4.2. Quantities and Scopes of Project Items

1.4.2.1. Preparation Phase

The items executed in the preparation phase consists of the followings:

- Site clearance: compensation and resettlement, demolition of houses, etc.
- Construction site preparation.

1.4.2.1.1 Site Clearance

Scope of site clearance: 2m and 7m from the embankment talus, excavation foundation talus top or outer edge of bridges, other structures such as linear drainage system, collector roads system (if any) to each side for the route and bridges, respectively. In the clearance area, the whole land will be acquired while houses, architectural works, trees and crops will have to be relocated for the construction of the Project. The site clearance quantities are shown in Table 1.2.

Table 1.2. Site Clearance Quantities

No.	Item	Unit	Quantity
I	**Land occupancy**		
1	***Non-agricultural land***		
	Residential land	m^2	75,960
2	***Agricultural land***		
	Agricultural land	m^2	560,116
	Aquaculture land	m^2	126,456
3	***Business land***	m^2	17,000
4	***Public land***	m^2	186,971
II	**Houses, properties. etc., on land**		
1	***Houses of all kinds***		
	1-storey houses	m^2	10,917
	2-storey houses	m^2	7,043
	3-storey houses	m^2	3,844
	Over 3-storey houses	m^2	3,150
2	***Grave relocation***		-
	Tomb	pcs	212
3	***Electric power poles***	pcs	70
4	***Channels and ditches***	m	2,900

1.4.2.1.2. Construction site levelling

The Site is arranged in two banks of Ruot Lon River in the area of Ruot Lon Bridge each with the construction area of about 0.3ha (including super-T beam fabrication area, beam yard, beam casting yard, concrete mixing plant, warehouse, site office and worker camps). Each bridge at 3 intersections on the road is arranged with 01 construction site with the area of around 0.1ha (including beam yard, warehouse, site office and worker camps).

At peak times, at each site of Ruot Lon Bridge, there are about 100 workers while there are around 50 workers at each of other sites.

1.4.2.2. Construction Phase

The works items include the followings:

- Main items:
  - Construction of Ring Road No. 3 with a total length of around 13.6 kilometers. On the route, it needs to construct 4 bridges including 1 bridge crossing Ruot Lon River and 3 bridges crossing interchanges, and a number of culverts crossing roads.

- Drainage system, lighting system, protection and traffic safety works.

- Auxiliary items:
  - Water and electric power supply utilities;
  - Construction yards;
  - Sources of materials.

1.4.2.2.1. Main items of the Project in construction phase

a. Bridges

a1. Scale and Technical Standards

- Permanent bridges;
- Design standard: National Building Code 104-2007 (Urban Road Design Standard) and National Building Code 4054-2005 (Motorway – Design Requirements);
- Longitudinal slope: 4%;
- Bridge design standard: 22 TCN-272-05;
- Earthquakes: in accordance with 22 TCN-272-05;
- Cross section: 4 lanes, with of lane 3.75m.

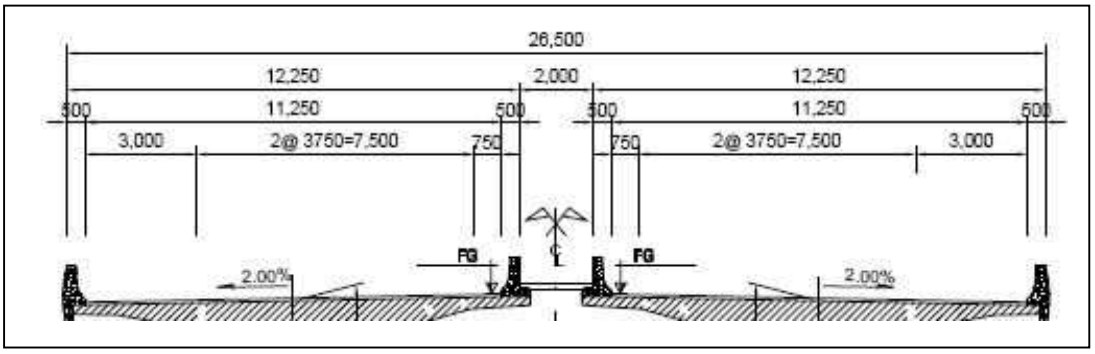


Figure 1.8. Cross Section of Bridges on Ring Road No. 3

For the Ruot Lon bridges cross the Ruot Lon river

- Design water level frequency: flood frequency P=1%; ensuring required navigation clearance to navigable water level P=5%;

Navigational clearance for Ruot Lon Bridge: in accordance with Grade-2 River Standard (7mx40m).

a2. Sizes and Structures of Bridges

Sizes and structures of the bridges are described in Table 1.4; plan view and general layout of the bridge are presented in figure 1.5 (see details in Appendix 2).

Table 1.4. Sizes and Structures of Bridges Planned by the Project

No.	Name of bridge (Chainage)	Length of bridge (m)	Width of bridge floor (m)	Superstructure	Substructure	Remark
1	Interchange No. 1 (Km0+490)	359	22.5	Beam of super T with length of 40m: 7@40m	Steel pipe pile with D=0.9m at abutment and pier	Interchange No.1
2	Interchange No. 2 (Km5+500)	279	22.5	Beam of super T with length of 40m: 5@40m	Steel pipe pile with D=0.9m at abutment and pier	Interchange No.2
3	Interchange No. 3 (Km9+700)	319	22.5	Beam of super T with length of 40m: 6@40m	Steel pipe pile with D=0.9m at abutment and pier	Interchange No.3
	Ruot Lon Bridge	579	26,5	Main span: cantilever structure with 50+80+50m Approaching span: Beam of super T with length of 40m: 4@40m and 4@40m	Steel pipe pile with D=0.9m at abutment and pier	With navigable

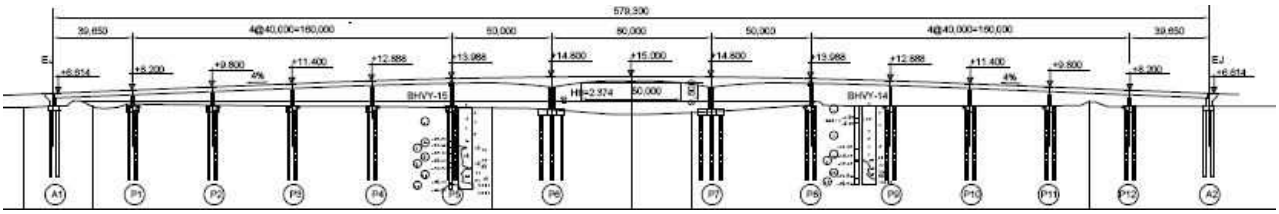


Figure 1.5. Span Diagram of Ruot Lon Bridge

b. Road works

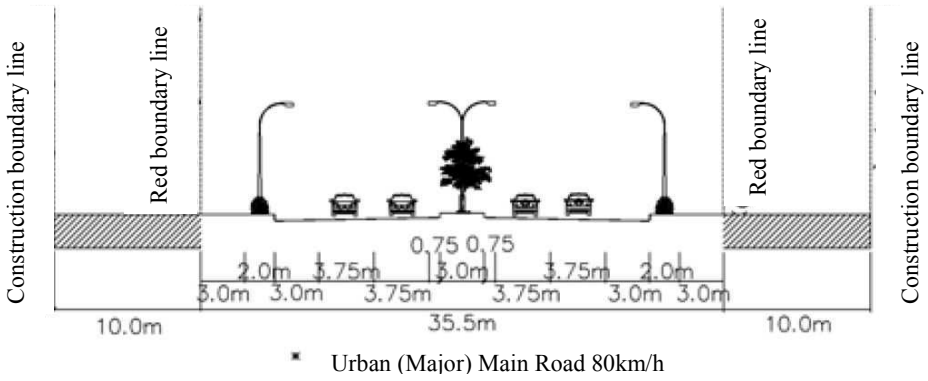
- **Road design standards:**

  + Design standard: TCXDVN 104-2007 and TCVN4054-2005;
  + Urban type: Urban and Suburban;
  + Road type: Plain Grade 3 urban road;
  + Design speed: 80km/h.

- **Scope of roadbed cross section:**

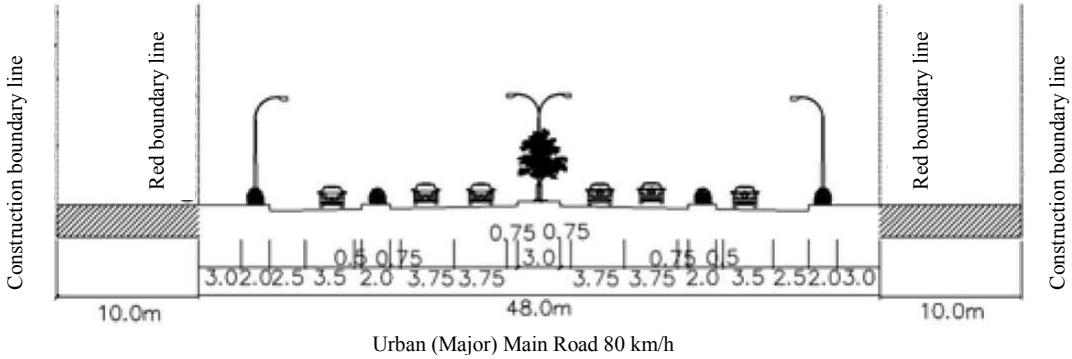
  - Segments without collector roads: Roadbed width: B = 35.5m, without collector roads on both sides. Details are provided in Figure 1.6.

  - Segments with collector roads: Roadbed width: B = 48.0m, without collector roads on both sides. Details are provided in Figure 1.7.



Urban (Major) Main Road 80km/h

Figure 1.6. Typical road cross section of Ring Road No. 3 – without collector roads



Urban (Major) Main Road 80 km/h

Figure 1.7. Typical road cross section of Ring Road No. 3 – with collector roads

b3. Roadbed structure

- Sand embankment for roadbed with required compaction density of K ≥ 0.95, sand embankment for foundation bottom junction, ensuring compaction density of K ≥ 0.98 and thickness of 0.5m;

- Roadbed slope of 1/1.75, slope covered by soil with plasticity index of greater than or equal to 7 and thickness of 1.0m;
- Talus reinforcement: All roadbed slope is grown with grass to prevent erosion.

b4. Road surface structure

+ Travel lane

E_{yc}= 188.413333 (Mpa), K_{cd}^{dv}= 1.1

		t(cm)	
Surface Course	Bituminous layer type I (Surface Course) (BTNC20, Crushed Stone>50%)	6	
Binder Course	Bituminous layer type I(Binder Course) (BTNC25, Crushed Stone>50%)	7	
Asphalt Treated Base	Black crushed stone mixed with compact asphalt	10	Total 90cm
Base	Crushed Stone Aggregate Base Class I	67	
Embankment	Clay and loam, CBR=6		

Total Thickness 90cm + Subgrade 30cm

+ Service road

E_{yc}= 188.413333 (Mpa), K_{cd}^{dv}= 1.1

		t(cm)	
Surface Course	Bituminous layer type I (Surface Course) (BTNC20, Crushed Stone>50%)	6	
Binder Course	Bituminous layer type I(Binder Course) (BTNC25, Crushed Stone>50%)	7	
Asphalt Treated Base	Black crushed stone mixed with compact asphalt	10	Total 90cm
Base	Crushed Stone Aggregate Base Class I	67	
Embankment	Clay and loam, CBR=6		

Total Thickness 90cm + Subgrade 30cm

+ Side work

	t (cm)
INTERLOCKING (t=6cm)	6
COMPACTED YELLOW SAND (t=5cm)	5
Total thickness 11cm	

c. Interchanges

03 interchanges on the Ring road No.3 component with details as shown in Figure 1.8.

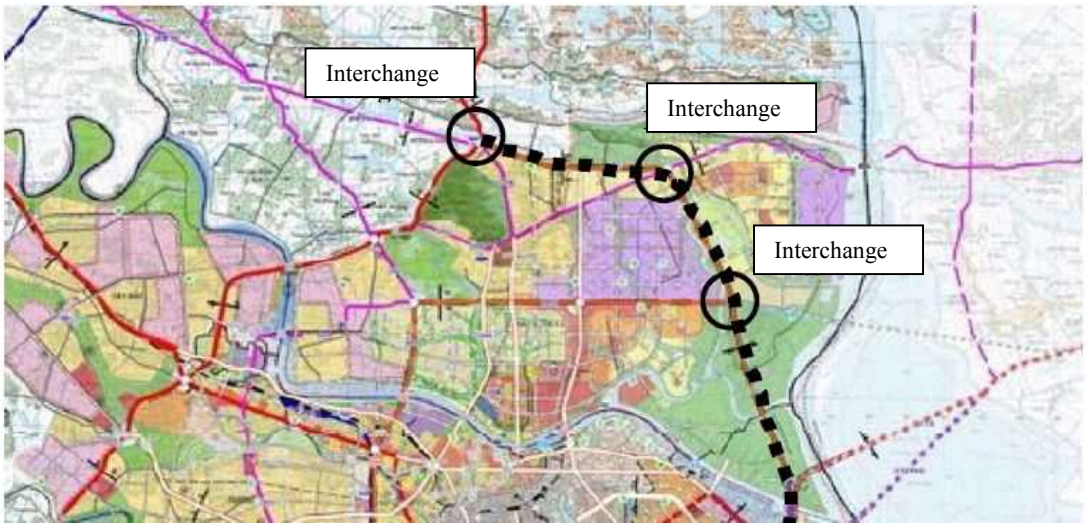


Figure 1.8. Interchanges in Ring Road 3

For the interchange name and d interchange surrounding features, refer to Table 1.5.

Table 1.5. Statistics of interchanges

No.	Name of interchange	Remark
1	Interchange No. 1	The existing national road surface locate in residential areas
2	Interchange No. 2	Crowded residential area
3	Interchange No. 3	Rice paddies

d. Road crossing culverts

Aperture locations of culvert on the route are provided in Table 1.6.

Table 1.6. Statistics of road crossing culverts

No.	Location	Type of culvert	Size of culvert (m)
1	Km1+510	Box	1(B=3xH=2)
2	Km2+470	Box	1(B=0.5xH=0.6)
3	Km2+735	Box	1(B=14xH=2)
4	Km4+009	Box	1(B=1.5xH=1.5)
5	Km4+018	Box	1(B=1.5xH=1.5)
6	Km4+250	Box	1(B=3xH=2)
7	Km4+520	Box	1(B=3xH=2)
8	Km7+275	Box	1(B=0.5xH=0.6)
9	Km8+100	Box	1(B=0.5xH=0.6)
10	Km8+550	Box	1(B=3xH=2)
11	Km8+940	Box	1(B=3xH=2)
12	Km9+263	Box	1(B=6xH=2)
13	Km9+915	Box	1(B=20xH=2)
14	Km10+460	Box	1(B=6xH=2)
15	Km10+630	Box	1(B=3xH=2)
16	Km11+015	Box	1(B=1.5xH=1.5)
17	Km11+455	Box	1(B=3xH=2)

e. Lighting and traffic safety system

e.1. Lighting system

Lighting posts on bridges are put at different length on both sides with the gap of 40m to guarantee lighting for traffic activities.

e.2. Sign posts and boards

Construction works such as poles, signboards, milestones, markings, railing and fencing, etc. Shall be executed synchronously in accordance with the "National Technical Regulations on Road Signs QCVN 41: 2012/BGTVT".

1.4.3. Construction measures and quantities of works under the Project

1.4.3.1. Site clearance

The Project Owner shall be responsible for ensuring sufficient and timely supply of required documents and schedules of the Project as well as packages in accordance with each construction phase and fund allocation plans for the site clearance to be completed on time.

The fundings for site clearance and resettlement will be granted to each locality by the investment decisionmaker.

The Site clearance will be separated into independent sub-projects to be conducted by the Land Fund Development Centres of districts. In the project's context, the households subject to land acquisition will be considered for inclusion in newly

constructed resettlement areas under the arrangement of the City's Site Clearance Committee or Land Fund Development Centre.

After the completion of the land acquisition, the People's Committee of the province where the project is located will proceed to hand over the Site to the Project Owner for carrying out works items.

1.4.3.2. Key Construction Measures

a. Site Preparation

The Preparatory work shall be undertaken to serve the construction activities. Key issues include the activities of preparing the site and installing the work items such as concrete mixing plant, equipment maintenance station, workers' camps, erecting mixing plants on barges and constructing duty roads for road and bridge execution.

Access road to the construction site must be constructed before construction of substructure.

b. Bridge Construction

b1. Lower structure construction

b1.1. Abutment construction

- Levelling the site, locating the abutment center line, pile lines, executing steel pipe piles for the bridges under the project. Precaution is made to ground water table and excavation depth about 4.5 – 5.0m (total 2.0m soil covering pile head and 2.0 – 2.5m thickness of pile head), steel pile cofferdam system is required in order to construct the substructure. The diagram of steel pile cofferdam is shown in the figure 1.9.

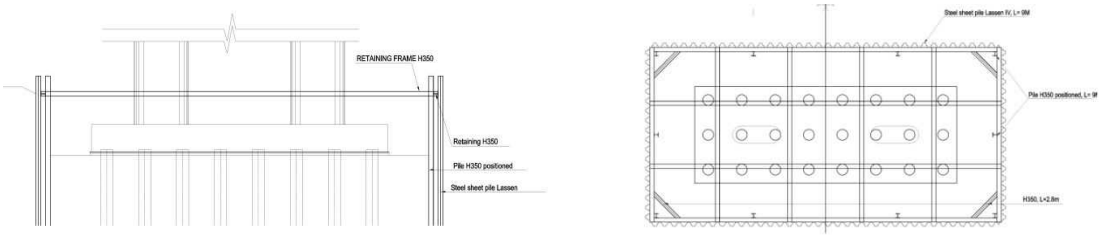


Figure 1.9. Diagram of steel pile cofferdam

- Excavating foundation pits, installing rebars, building formwork and concreting footings. Backfilling to a footing peak.
- Executing body wall, side wall and abutment top wall.
- Landfilling abutments, constructing transition slabs and slope protection and finishing abutments.

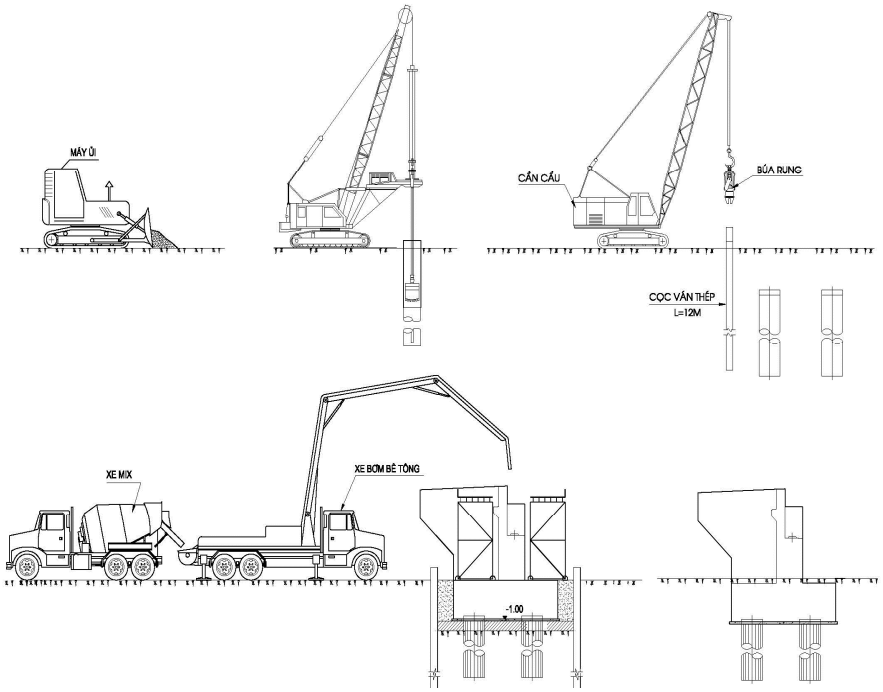


Figure 1.10. Abutment construction

b1.2. Support construction

- Levelling the site, locating abutment center lines and pile lines.
- Use dedicated machines to construct steel pipe piles.
- During construction of substructures on ground, precaution is made to ground water table and excavation depth about 4.5 – 5.0m (total 2.0m soil covering pile head and 2.0 – 2.5m thickness of pile head), steel pile cofferdam system is required in order to construct the substructure. The diagram of steel pile cofferdam is shown in the figure 1.16.

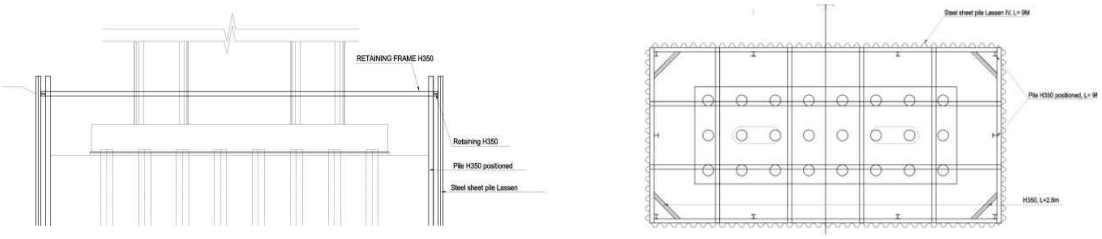


Figure 1.11. Diagram of steel pile cofferdam

- Linking steel braces into the pile casings, installing pre-cast reinforced concrete slabs around and underneath the tower base. Concreting bottom seal, suctioning water out of foundation pits, installing rebars, and concreting footings.
- Erecting formwork, rebar and concreting abutment body and cap beam.
- Finishing abutments.

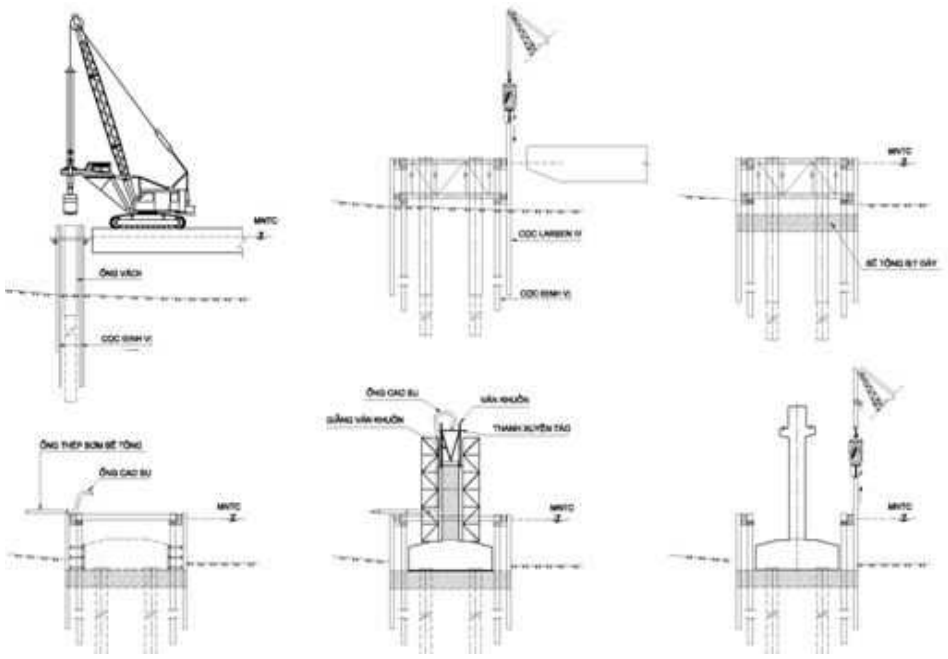


Figure 1.12. Support construction

b1.3. Construction of main supports

- Locating abutment center lines and pile lines.
- Using a pile press standing on a floating system to execute steel pipe piles surrounding abutments and piles inside the footing system.

+ ***Method statement of steel pipe sheet pile foundation (SPSP) on river***

Piers P6, P7 supporting the cantilever main span of Ruot Lon bridge locate on Ruot Lon river. Barges will be used for construction of piers P6, P7.

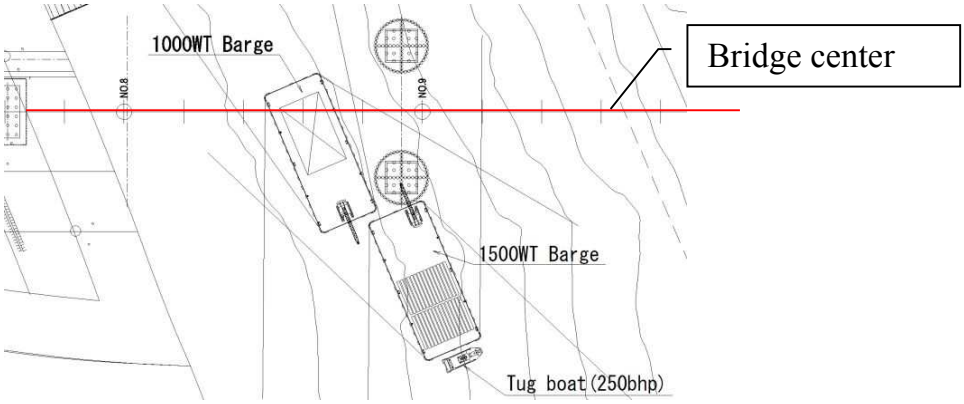


Figure 1.18. Construction of steel pipe sheet pile foundation

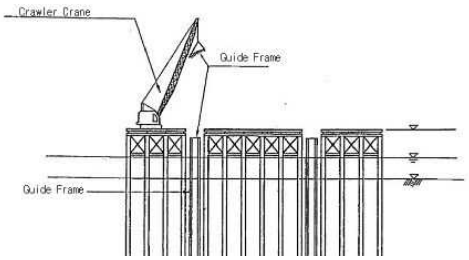
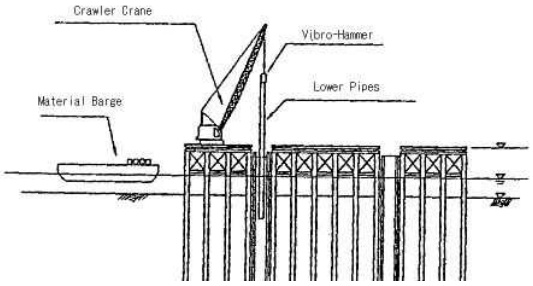
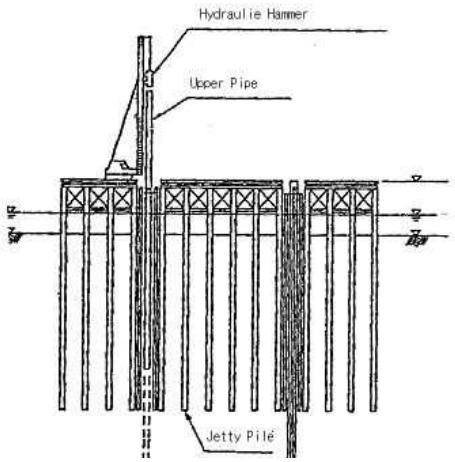
The annual highest water level in July and August is at +2.0m. The highest water level in the last 15 years reaches +2.37m in 2005. Therefore, the height of cofferdam piles is proposed at +3.0m in the method statement of cofferdam piles on Ruot Lon River.

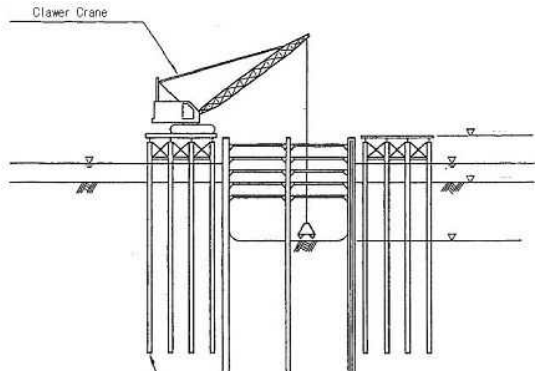
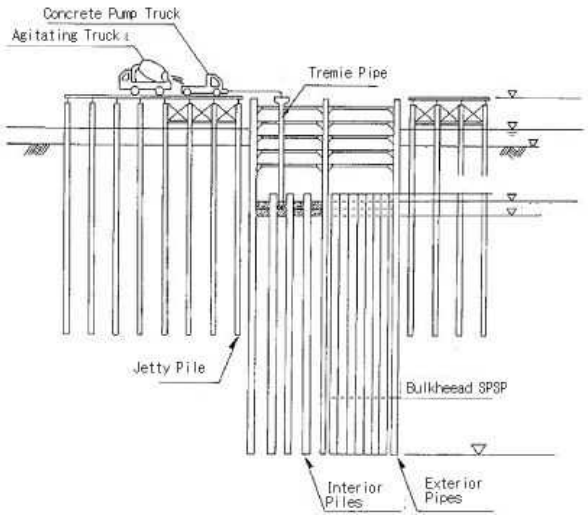
+ ***Construction of steel pipe sheet pile foundation system (SPSP) on ground***

During construction of substructures on ground, precaution is made to ground water table and excavation depth about 4.5 – 5.0m (total 2.0m soil covering pile head and 2.0 – 2.5m thickness of pile head); steel pile cofferdam system is required in order to construct the substructure.

+ Method statement of steel pipe sheet pile foundation (SPSP)

Some main steps in construction of steel pipe sheet pile foundation are shown in the below figure. Description in the brackets is applied in case temporary truss structure is use.

Description	Diagram
Construction of temporary truss: **Installation of guide frame:** - Guide frame is used effectively to drive SPSP in case of changing pipe center.	
Driving SPSP (lower pipes): - Vibro hammer may be selected to drive lower pipes. - Precaution is made when adjusting pipe center and inclination angle.	
Driving SPSP **(upper pipes):** - Weld upper pipes with lower pipes which have been driven into ground. - Hydraulic hammer will be used to drive pipes finally.	

Excavation and formworks: - Excavate inside SPSP by clamshell excavator. - Install formworks, then suction out water to the height of next formwork.	
Concreting bottom seal (tremie concrete): - Concrete bottom seal after sand backfilling. - A tremie pipe is used to pour concrete underwater to avoid concrete segregation. **Concreting upper slab:** - Suction out water inside SPSP and clean pipe surface and seal concrete. - Weld anchor into interior surface of pipes to link cofferdam pile and upper slab. - Concrete upper slab by tremie pipe.	

– Linking steel braces into the pile casings, installing pre-cast reinforced concrete slabs around and underneath the tower base. Concreting bottom seal, suctioning water out of foundation pits, installing rebars and concreting footings.

– Erecting formwork, rebar and concreting abutment body and cap beam.

– Finishing piers.

b2. Superstructure construction

b2.1. Superstructure

(1) Cantilever main spans of Ruot Lon Bridge

– Construction of blocks on top of piers P6 and P7: Installing steel scaffolding and load testing. Installing formwork, rebar, cable and high-tension steel bars. Concreting, stressing cables and erecting cast vehicles;

– Construction of girder blocks on piers P6 and P7: Preparing formwork. Installing rebar and cable, concreting. Stressing high-tension cable. Horizontally moving to the next blocks;

- Construction of blocks on scaffolding: installing steel scaffolding and load testing. Installing rebar, cables and concreting. Stressing high-tension cable;
- Construction of closure segment block No. 1: Preparing formwork. Installing rebar, high-tension cable and concreting. Stressing high-tension cable at side span bottom. Relocating structures and temporary abutments;
- Construction of closure segment block No. 2: Removing 1 casting vehicle. Preparing formwork. Installing rebar high-tension cable and concreting. Stressing high-tension cable at beam bottom;
- Finishing of bridge: Relocating construction equipment. Concreting barrier and handrail. Constructing bridge surface. Installing expansion joints. Installing drainage system.

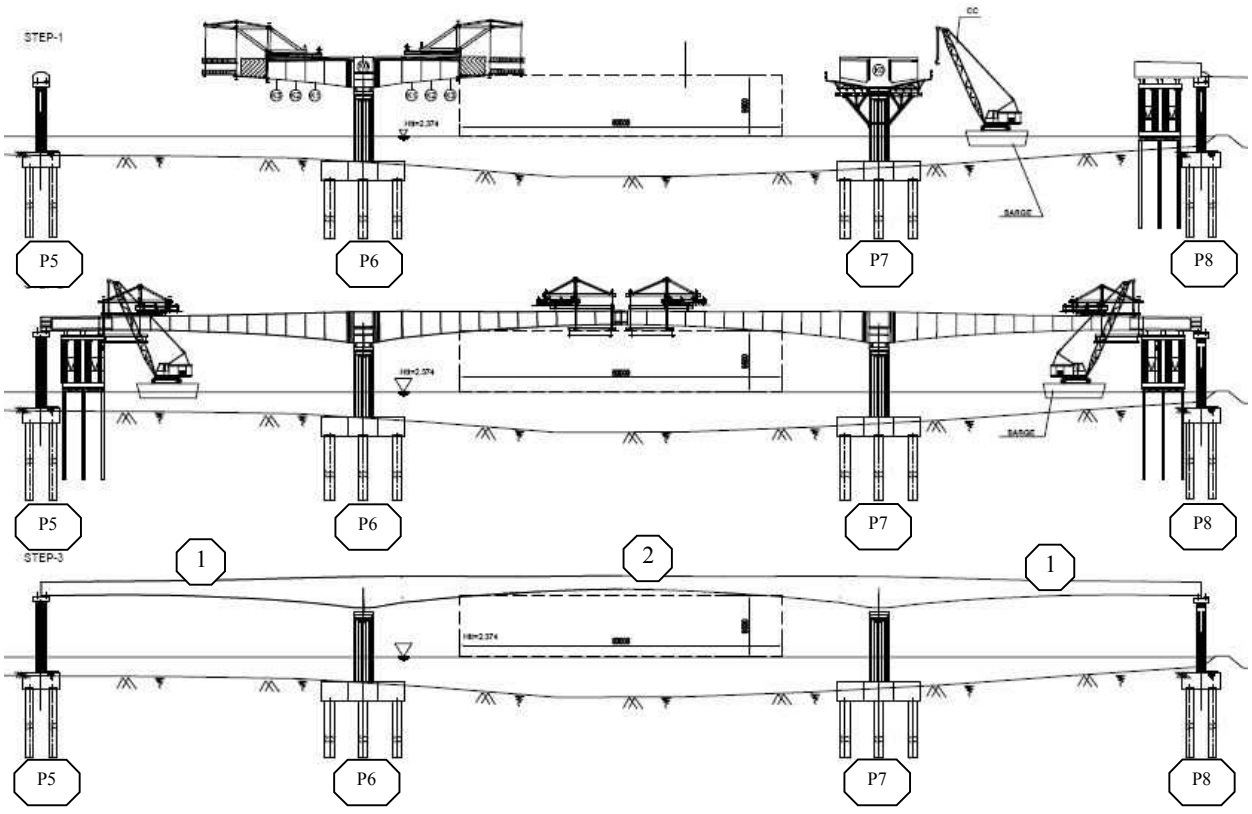


Figure 1.13. Construction of cantilever main spans of Ruot Lon Bridge

(2) Super-T girder span

Super-T girders (L=38.3m and W= 70 tons) of approach bridge will be fabricated in accordance with the approved construction drawings and stored in a good manner at the girder storage yard until installation works start. To give priority for installation of precast girders, transportation of girders from the casting yard to installation places at the approach bridge must be done with trailers under a strict traffic control. Installation with crawler cranes is carried out at two ends (see the below figure).

After installation, concreting deck slabs/ cross girders and super-T girders will be implemented with concrete pumps and agitator trucks.

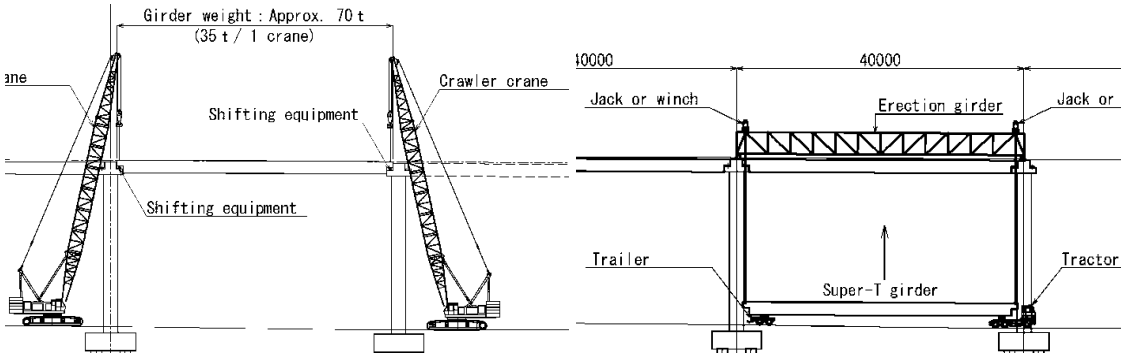


Figure 1.14. Construction of approaching bridge (Super-T span)

b2.2 Construction of roadbed and pavement

The bid packages shall be executed simultaneously (the division of bid packages will be determined during the technical design and construction drawings), in which the road section under each package shall be usually constructed completely for every 200m segment.

- Constructing surface drainage system.
- The roadbed shall be constructed mechanically and manually. The construction must comply with the roadbed and pavement construction process.
- The embankment speed shall be controlled not to exceed the design speed.
- Materials shall not be piled on the embankment. The packing materials shall be leveled immediately when they are delivered to the site. The vibrating roller shall not be used when the construction is carried out near residential areas or other important works.
- The construction of pavement subgrade shall comply with standards on macadam layer in motorways pavement structure - materials, construction and acceptance shall be in accordance with current national technical regulations.
- The construction of fine-grained and coarse-grained tight asphalt concrete layers shall comply with the standard on hot asphalt concrete pavement – construction and acceptance shall be in accordance with current national technical regulations.

1.4.3.3. Construction quantities

a. Road construction quantities

The road construction quantities are provided in Table 1.7.

Table 1.7. Road construction quantities of the Project

No.	Item	Unit	Quantity
1	**Roadbed**		
-	Soil excavation	m3	8,055
-	Embankment	m3	485,783
-	Road bed	m3	112,724
-	Strip topsoil	m3	376,556
2	**Road surface**		
-	6cm asphalt concrete surface	m2	579,659
-	7cm asphalt concrete binder	m2	459,794
-	10cm asphalt treated base	m2	459,794
-	67cm Aggregate base	m2	303,278

b. Bridge construction quantities

The bridge construction quantities are shown in Table 1.8.

Table 1.8. Bridge construction quantities

No	Item	Unit	Quantity			
			Bridge at intercha -nge 1	**Bridge at intercha -nge 2**	**Bridge at intercha - nge 2**	**Ruot Lon bridge**
I	**Super Structure**					
1	**Cast-in-place concrete**					
	Concrete C40 for Box girder	m3	7,117	-	-	-
	Concrete C40 for CIP fill concrete desk panel	m3	685	-	-	-
	Concrete C35	m3	1,918	1,276	1,342	1,534
	Concrete C25	m3	185	166	129	148
2	**Pre-cast concrete**					
	Concrete C50 (for super T only)	girder	97	87	68	77
	Concrete C25	m3	147	132	103	118
3	**Reinforcing steel, PC strand**					
	Reinforcement steel bars SD390	ton	4,193	439	341	390

No	Item	Unit	Quantity			
			Bridge at intercha -nge 1	Bridge at intercha -nge 2	Bridge at intercha - nge 2	Ruot Lon bridge
4	**Bearing**					
	POT bearing	nos	4	-		
	Pot bearing (for super T)	nos	20	18	14	16
	Rubber bearing	nos	174	157	122	139
5	**Expansion joint**					
	Finger type joint	m	-	21	18	18
	Length for Longitude	m	113	-	-	-
6	**Asphalt concrete**					
	Asphalt concrete area	m2	8,796	6,845	7,825	14,186
II	**Sub Structure**					
1	**Steel pile pile**					
	D90cm	pile	272	160	128	144
	Pile length	m	12,000	6,400	5,120	5,760
2	**Concrete**					
	Pier cap of pier (concrete C30 for file cap)	m3	2,496	2,496	1,997	2,247
	Pier column and beam (concrete C30 for pier)	m3	3,717	3,717	2,973	3,345
	Leveling concrete (concrete C10 for blinding concrete)	m3	130	130	104	117
3	**Steel bar**					
	Reinforcement steel bars SD390 (D10-all)	kg	621,294	621,294	497,035	559,164
4	**Earth work**					
	Excavation within cofferdam	m3	13,027	10,856	8,685	9,770
5	**Cofferdam**					
	Steel sheet pile	pile	1,451	1,451	1,161	1,306
	Sheet pile length	m	17,408	17,408	13,926	15,667
	Weight of metal	ton	226,210	226,210	180,968	203,589

1.4.4. Construction machinery and equipment

The list of major machinery and equipment expected to be used in construction is presented in Table 1.9 and Table 1.10.

Table 1.9. Road construction machinery and equipment

No.	Construction equipment	Unit	Road of Vu Yen bridge
1	110CV bulldozers	shift	95,349
2	110CV graders	shift	333
3	10-ton trucks	shift	92,501
4	5m^3 water tank trucks	shift	1,594
5	Air compressor 600m3/h	shift	1,981
6	1.6m^3 excavators	shift	1,788
7	16-ton tire rollers	shift	11,548
8	16-ton tire rollers	shift	2,755
9	50-60m3/h spreaders	shift	286
10	25-ton vibrating rollers	shift	1,594
11	10-ton steel-tired rollers	shift	6,424
12	130CV ÷ 140CV spreaders	shift	922
13	2.3m^3 tilt loaders	shift	2,454
	Total	**shift**	**219,529**

Table 1.10. Bridge construction machinery and equipment

No.	Construction equipment	Unit	Quantity			
			Ruot Lon bridge	Bridge of Intercha -nge 1	Bridge of Intercha -nge 2	Bridge of Intercha -nge 1
1	Pneumatic hammer	shift	166	-	-	-
2	BP170 pile hammers	shift	396	1083	867	975
3	Truck Crane 16T	shift	396	-	-	-
4	Truck Crane 25T	shift	3,580	1279	1024	1152
5	Truck Crane 100T	shift	480	-	-	-
6	Truck Crane 200T	shift	480	-	-	-
7	250T jack	shift	802	-	-	-
8	Concrete Pump 50m^3/h	shift	2,119	174	139	157
9	Water Pump 14KW (200m^3/h)	shift	664	-	-	-
10	Water Pump 20KW	shift	760	-	-	-

11	Water Pump 6.5KW	shift	34	-	-	-
12	9m3 mortar pump	shift	232	-	-	-
13	10kW wirerope cutter	shift	885	-	-	-
14	1,7KW handheld wire cutter	shift	738	176	100	135
15	5KW wire cutting & bending machine	shift	1,413	795	454	613
16	16-ton tire rollers	shift	2	5	4	5
17	Tampers	shift	154	664	531	598
18	1,5KW needle vibrator	shift	2,369	758	433	584
19	2,8KW needle vibrator	shift	334	-	-	-
20	10-ton steel-tired rollers	shift	3	5	4	5
21	Crawler Excavator 1,6m^3	shift	11	11	9	10
22	23KW welding machine	shift	10,317	2236	1278	1725
23	300m^3/h diesel air compressor	shift	63	-	-	-
24	Diesel Air compressors with capacity of 360m^3/h	shift	53	9	5	7
25	Diesel Air compressors with capacity of 600m^3/h	shift	607	9	5	7
26	130CV ÷ 140CV spreaders	shift	1	5	3	4
27	110 CV bulldozers	shift	180	22	17	20
28	0.8T crane	shift	37	-	-	-
29	1,25m^3 excavators	shift	353	33	26	29
30	10.7m^3 mixing trucks	shift	1,349	314	180	242
31	10-ton trucks	shift	145	305	174	235
33	150CV carrying ships	shift	387	-	-	-
34	5T electrical hoist	shift	31	-	-	-
35	200T Barges	shift	1,606	-	-	-
36	400T Barges	shift	932	-	-	-
	Sub- total	shift	***32,078***	***7,883***	***5,255***	***6,503***
	Total	shift				**51,719**

1.4.5. Materials, fuel (input) and the products (output) in the pre-construction phase and construction phase

a. Materials, fuel (input)

a1. Gasoline, oil

Gasoline, oil to buy at dealers in the Hai Phong city.

a2. Construction Materials

Materials such as soil, rock and sand for construction of bridges and roads in the components of the Project were purchased at active material pits in the area near the Project, which shown in Table 1.11 and Figure 1.15.

Table 1.12. Material Pits tentatively supplied to the project

No.	Name	Location	Quantity (million m^3)	Materials transport road	Distance
I	**Borrow pit**				
1	Dong Than 1	Minh Duc town, Thuy Nguyen District, Hai Phong city	0.1	Tan Duc road, NH10, PR359, Road No.9C, VSIP road, Bach Dang road	7km
2	Dong Than 1	Minh Duc town, Thuy Nguyen District, Hai Phong city	0.5	Tan Duc road, NH No.10, PR No.359, Road No.9C, VSIP road	
II	Quarry				
1	Ha Son	Minh Duc town, Thuy Nguyen District, Hai Phong city	0.8	Tan Duc road, NH No.10, PR No.359, Road No.9C, VSIP road	6km
2	Phuong Mai	Phuong Nam commune, Uong Bi town, Quang Ninh province (near Da Bac bridge)	1.0	- Waterway: Bach Dang river, Cam river - Road: NH No.10	Waterway: 10km
III	**Sand Stockpile**				
1	Quan Toan	On the Cam river, at Quan Toan area, Hai Phong city	Exploited on Cam river with big quantity	Waterway: Cam river	- Ruot Lon bridge: 14km

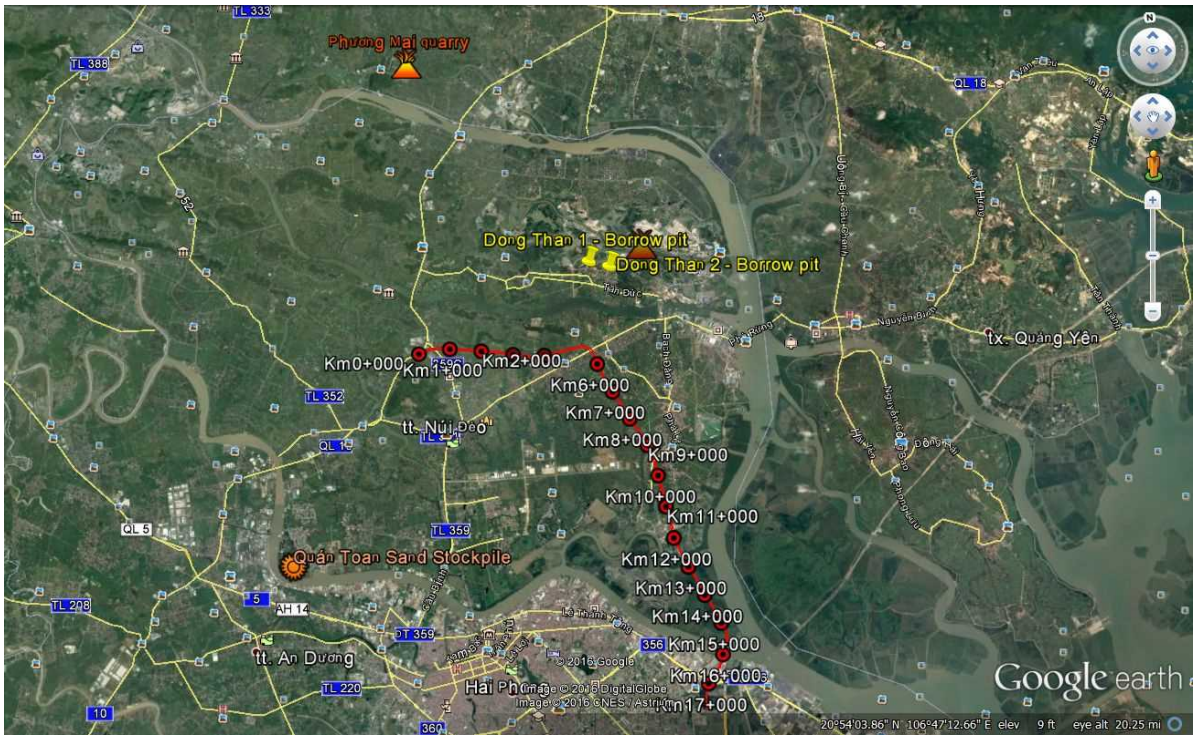


Figure 1.15. Location of material pits tentatively supplied to the project

a3. Cement

Cement will be purchased at Cement and Chinfon Cement factory in Hai Phong with capacity of 3 million tons / year. The factory located at Minh Duc Town, Thuy Nguyen District, distant to town center about 5km.

a4. Asphalt

Asphalt will be purchased at the existing production facilities in the Hai Phong city, such as: Manh Tien Transport Company Limited, headquartered at Group No. 5, area No. 7, Quan Toan Ward, Hong Bang District, Hai Phong city have asphalt concrete factory with capacity: 8 ÷ 100 tons /a hour.

a5. Water and Power Supply

- ***Water supply***

Water is taken from water supplies (for segment through the residential areas, the constructor will work with competent authorities to agree on water for construction and living activities) and surface water in rivers and ditches. Also, water for domestic activities may be bought in form of water tanks for living activities on Site.

– For construction: River water is planned to be used for washing tires and watering for moistening and anti-dust near the construction area and on Site.

– For living activities of construction workers: The daily water amount used for

living activities is 25 liters/person/day and 45 liters/person/day based on water norms applicable to site construction workers under 20TCN 4474 TC - 87 "norms of water used for meal cooking" and 20TCN33- 85 "norms of bathing and washing water", respectively.

- ***Power supply***

The contractor will work with the electricity authorities of the city to agree on the supply of electricity used for daily activities at the site and construction. This power source will be taken from the common one of the province through specific connections leading to the site and construction areas.

b. Products (output)

The output of the construction phase of the Project is bridges and roads. Besides incurred waste soil and stones, waste construction materials.

The volume of organic sludge generated by the Project shall be received and treated in Trang Cat dumping by Hai Phong Drainage one member limited company.

The volume of solid waste generated by the Project shall be received on the disposal of the Hai Phong Urban Environment Company Limited.

1.4.6. Project schedule

The construction period for Ring Road No.3 is 42 months.

1.4.7. Investment costs

The total investments of the Project will be estimated during the next stage of project preparation.

1.4.8. Organizational management and implementation Of the Project

a. Construction pre-construction phase and construction phase

The Project Owner of the Ring Road 3 Bridge Construction Project is People's Committee of Hai Phong city. In particular, the Hai Phong City Bridge Projects Management Department directly manage the activities of the Project and simultaneously perform regular reporting mechanism to the People's Committee of Hai Phong city; People's Committee of Hai Phong city carried out the inspection activities of the Hai Phong City Bridge Projects Management Department and is responsible for timely handling matters beyond the competence of the Hai Phong City Bridge Projects Management Department to ensure the progress and requirements of the Project.

b. Operation phase

After the completion of construction, the Project will be handed over to the management organizations, as follows:

+ Roads, pavements: Department of Transportation;

+ Water supply: Hai Phong Water Supply Company Limited;

+ Drainage: Hai Phong drainage Company Limited;

+ Lighting: Hai Phong lighting power Company Limited;

+ Trees: Parks and greenery Hai Phong Company Limited.

+ Management and supervision of the environment: Department of Natural Resources and Environment.

Management diagram is shown in Figure 1.16.

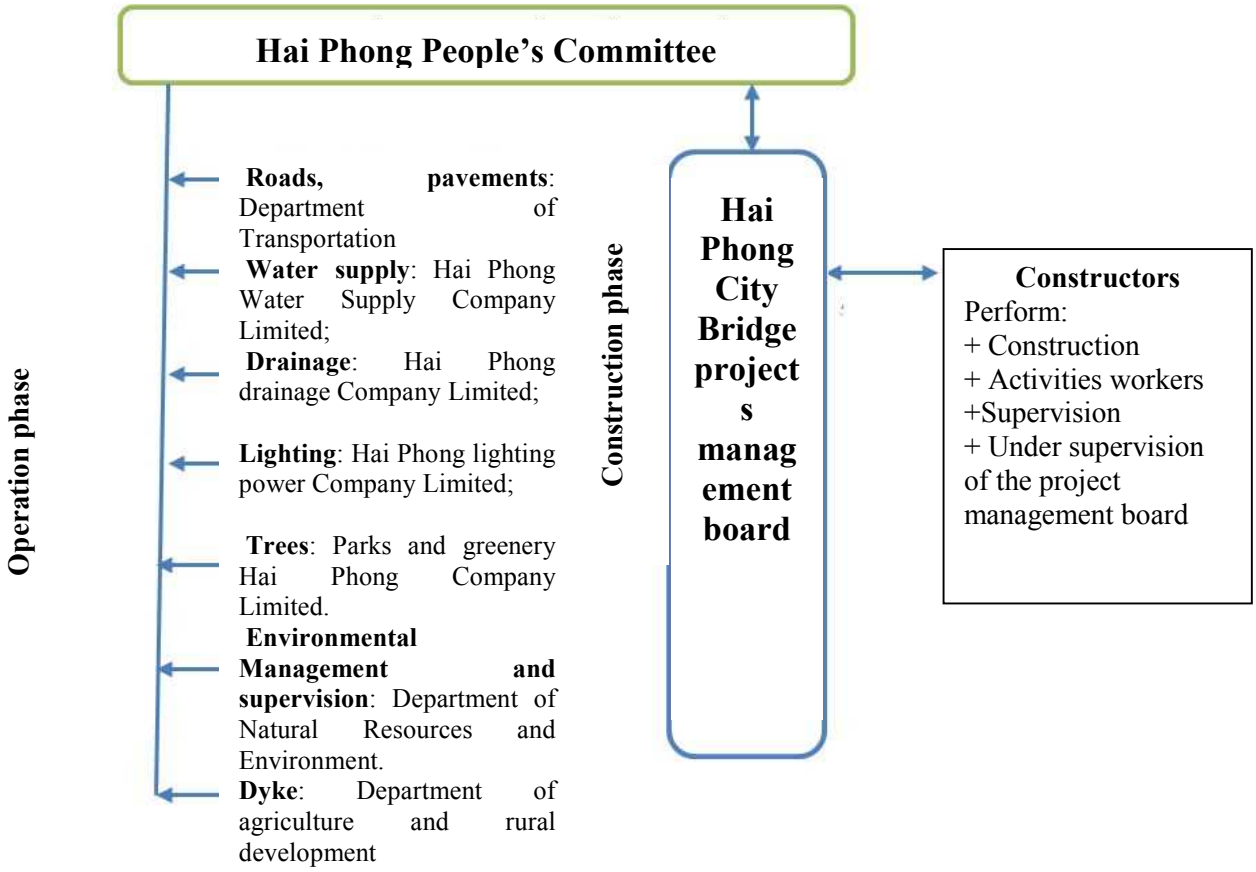


Figure 1.16. Management diagram

CHAPTER II. NATURAL ENVIRONMENTAL AND SOCIO-ECONOMIC CONDITIONS OF PROJECT LOCATION

2.1. Natural Environmental Conditions

2.1.1. Geographical and geological conditions

a. Geographical features

Ring Road No. 3 (RR3) construction project locates in the territories of Kenh Giang, Dong Son, Hoa Binh, An Lu, Trung Ha, Thuy Trieu, Ngu Lao, Phuc Le, Pha Le, and Lap Le communes in Thuy Nguyen district and Dong Hai 2 ward of Hai An district, Hai Phong City.

Geography of the project area

The project locates in the districts of Thuy Nguyen and Hai An, Hai Phong City.

Hai Phong is a midland of plain dotted with hills, accounting for about 15% of the total area, mainly distributed in the north. Southern part of Hai Phong has low and relatively flat terrain representing the typical type of primitive plains towards the sea with height of 0.7 to 3 m above sea.

The project location is quite flat with average natural ground elevation of 0.3 – 2.5 m. The terrain lowers from the northeast to the southwest – the flow direction of rivers in the area.

The route mainly passes through fields and residential area; aquaculture ponds are near Ruot Lon River. The Project route is divided by Ruot Lon rivers and other small rivers, and systems of irrigation ditches and roads.

Geographical features of the Project location is an important part to be considered in the environmental impact assessment report in order to determine the scope of project area and impacted objects, such as to specify: the project location's terrain is flat or low-lying, or alternated by high mountains; the project passes through residential, agricultural or forestry area; whether or not the project affects hydrological system of rivers, fields or coastal regions, etc. The suitability of the project location for natural environmental conditions shall be determined based on the complexity of the terrain.

b. Geotechnical and stratum features

b.1. Geological features of the project area

b.1.1. Sediments before quaternary

Sediments before quaternary in Hai Phong include following types:

(1) Do Son formation: quartzite sandstone, conglomerate, red sandstone ; mainly distributed in Do Son area; thickness : 250m

(2) Carbon- Permian formation: in Cat Ba, Con Voi mountain, including limestone, siliceous marl; thickness: 250-280m

(3) Ha Coi formation: In Thuy Nguyen, represented by red sediment including sandstone, medium layered siltstone; thickness: 200-300m.

b.1.2. Quaternary sediments

Hai Phong's geologic structure is covered by recent sediments, accounting for approximately 3/4 of area of the city. These sediments are divided into 5 stratigraphic units corresponding to 19 types of origin:

(1) Le Chi formation originates from river and sea, in the territory of Hai Phong (seen in Giang Bien, Vinh Bao) including 3 sections

- Section 1: Medium-grained to coarse-grained sand mixed with breakstone, grit, and pebble (size: 1-2,50cm, thickness: 6,0m)

- Section 2: Fine-grained sand mixed with a little breakstone, grit, small gravel, and gray clay slurry, thickness: 6,0m)

- Section 3 : Dark gray fine-grained sand and powder; thickness: 16,50m

(2) Hanoi formation: divided into 2 types of origin

- River source sediments: the lower layer is pebble, mixed with powder sand; the upper layer is dust sand; the edge is pebble and gravel, maximum thickness: 50m

- River flood source sediments : pebble, gravel, breakstone with dust sand, thickness: 3-5.0m

(3) Vinh Phuc formation : including medium-grained to coarse-grained sand and a little grit mixed with fine-grained sand in the lower layer and yellow-gray patchy clay in the upper layer; thickness: 10-15.0m

(4) Hai Hung formation : including river-sea, sea-swamp, sea, lake-swamp source sediments. It is composed of brown clay, sand, peat coal and green-gray or dark-gray clay layers containing plant relics. Thickness : 8 – 15.0m. Having strong subsidence and being near the ground, this weak layer must be treated before starting construction.

(5) Thai Binh formation: This is the top layer, being composed of clay and fine sand, blank-gray clay; layers of pebble, sand, and gravel are also seen in stream and river bed; thickness: 12.0m. This very weak layer must be treated before starting construction.

b.2. Stratigraphic features and physical properties of rock stratum

- *Stratigraphic features and physical properties of rock stratum in RR3 area:*

Based on borehole results along RR3 (see Figure 2.1), the stratigraphic layers top-down include :

- Plastic stiff yielding fluvial alluvial cohesive soil layer, having dark gray, green-gray, tan, sepia, or light gray color with thickness of 8 ÷ 11m.

- Medium stiff – yielding gravel, sandy clay layer, having dark gray, tan, sepia color with a thickness of 4 ÷ 17m.

- Medium hard - hard pelite layer, having sepia color with thickness of 2.7 - 4.45m.

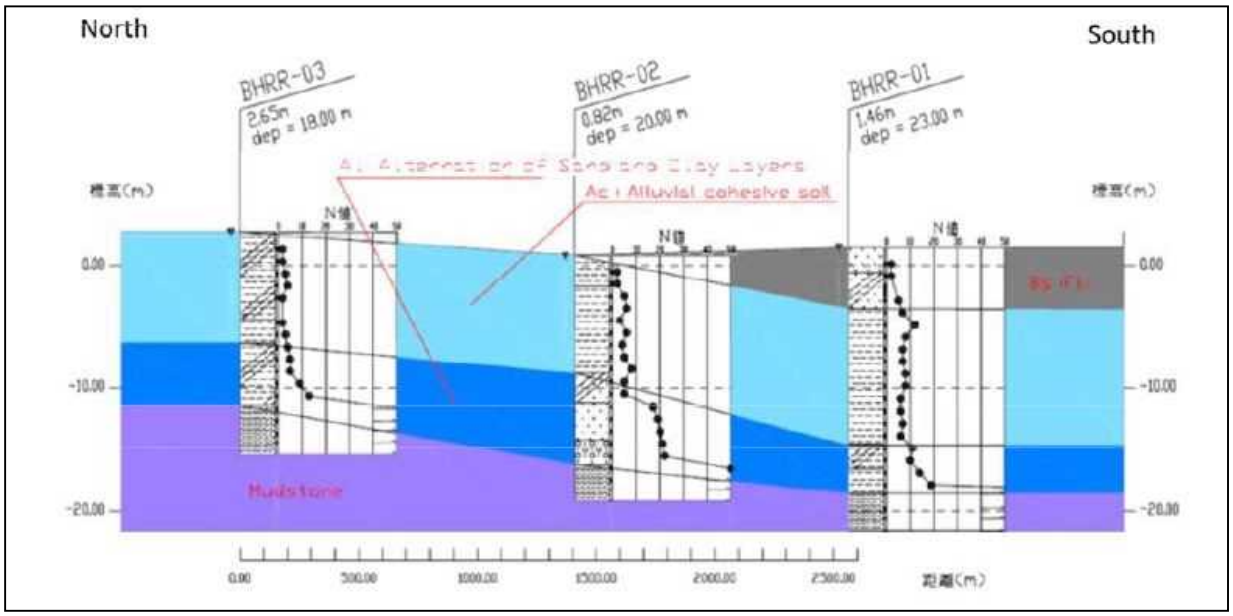


Figure 2.1. Stratigraphic features of rock stratum in RR3 area

b.3. Hydrologic geology

Hai Phong has 2 aquifers in Quaternary sediments. The first layer is located in the sandy and silty clay layer, with the average depth of 18m; meanwhile water in the second layer cannot be used since it has high salinity.

Geological and stratigraphic features of the Project location is an important part to be considered in the environmental impact assessment report in order to determine the stability of construction works; bearing capacity of the soil, potential risks like settlement, sag, crack of adjacent buildings, etc.. The suitability of the project location for natural environmental conditions shall be determined based on the complexity of the terrain.

2.1.2. Climatic and meteorologic conditions

2.1.2.1. Characteristics of meteorologic conditions

The process of spreading and metabolizing substances in air environment depends on meteorologic factors, including:

- Air temperature;
- Air humidity;
- Rainfall;
- Atmospheric stability.

Hai Phong has tropical monsoon climate, with hot, humid and rainy weather. There are two main seasons: rainy and dry seasons. The former lasts from May to October with hot, humid and rainy weather. The latter lasts from November to April of the following year with cold weather and little rainfall.

Based on continuous monitoring data in several years (2009 - 2013) collected by Phu Lien hydrometeorological station, meteorological characteristics of the Project location are summarized as follows.

a. Air temperature

Based on continuous monitoring data in 2005 - 2013 collected by Phu Lien hydrometeorological station, monthly and annual average temperature are listed and shown in Table 2.1.

Table 2.1. Monthly average temperature at Phu Lien hydrometeorological station

(Unit: ^{o}C)

Month	2008	2009	2010	2011	2012	2013	Average
January	15.1	15.5	17.2	12.4	14.2	15.0	14.9
February	15.0	20.9	19.2	16.5	15.5	19.1	17.7
March	20.0	20.1	20.3	16.1	19.1	22.1	19.6
April	23.5	23.1	22.2	22.4	24.3	23.4	23.2
May	26.0	25.5	26.9	25.5	27.4	27.2	26.4
June	27.2	28.7	29.1	28.3	28.8	28.1	28.4
July	28.1	28.4	29.2	26.4	28.3	27.5	28.0
August	25.7	28.4	27.0	27.8	27.9	28.0	27.5
September	27.0	27.5	27.2	26.4	27.3	26.2	26.9

Month	2008	2009	2010	2011	2012	2013	Average
October	25.9	25.5	24.6	23.6	25.4	24.8	25.0
November	21.0	20.6	20.5	22.9	22.4	21.7	21.5
December	18.9	18.7	19.0	16.7	18.6	15.9	18.0
Annual	22.8	23.6	23.5	22.1	23.3	23.3	23.1

Source: Phu Lien hydrometeorological station, 2008 - 2013.

– The annual average temperature in the area is 23.1°C. The lowest average temperature is 14.9°C in January; the highest average temperature is 28.4°C in June. There is a large difference in temperature between the two seasons, about 12.0 - 15.9°C.

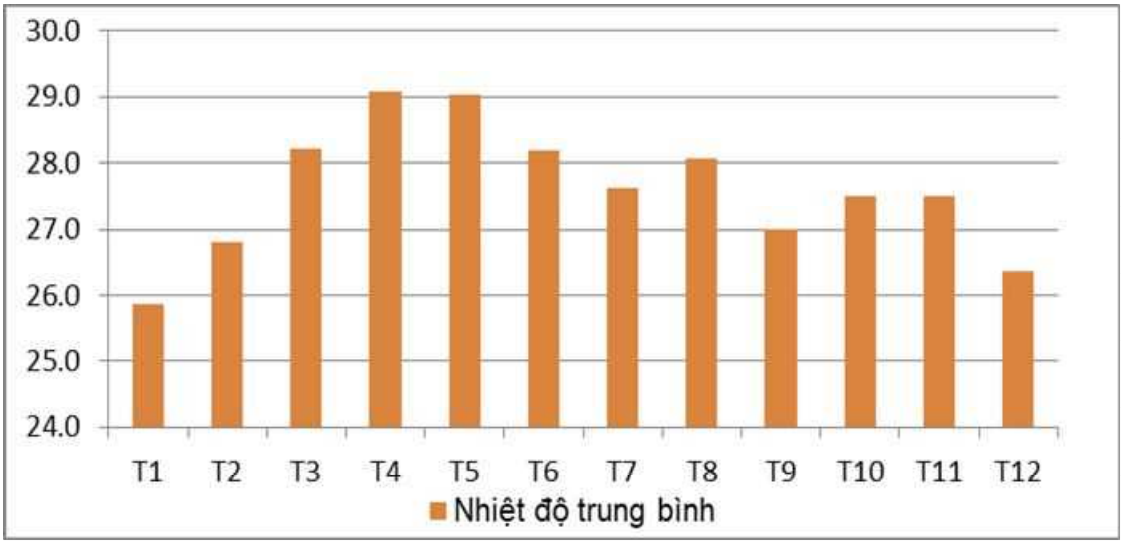


Figure 2.2. Temperature characteristics in Project location

Note: Air temperature directly influences the spread and metabolism of pollutants in the atmosphere. The higher temperature will cause the larger speed of chemical reactions in the atmosphere and the shorter lifetime of the pollutants in the atmosphere

b. Air humidity

Monthly and annual air humidity are summarized and shown in Table 2.2

- The annual average relative humidity in the project location ranges from 83-92%, humidity in rainy season is much lower than that in dry season;
- Lowest relative humidity falls in October, November and December.

Table 2.2. Air humidity at Phu Lien hydrometeorological station

(Unit: %)

Month	2008	2009	2010	2011	2012	2013	Average
January	88	78	91	86	96	89	88
February	86	94	91	91	95	92	92
March	89	93	91	91	93	90	91
April	91	92	95	90	91	90	92
May	88	89	91	90	90	89	90
June	92	89	85	90	86	84	88
July	87	89	87	89	88	90	88
August	92	88	93	90	88	89	90
September	90	89	91	90	81	89	88
October	86	87	81	88	83	77	84
November	80	80	81	86	89	82	83
December	84	86	85	79	87	75	83
Annual	88	88	89	88	89	86	88

Source: Phu Lien hydrometeorological station, 2008 - 2013.

Note: Apart from affecting the metabolism of air pollutants, air humidity is a microclimate factor influencing human health.

c. Rainfall

Monthly and annual average rainfall in the Project location are shown in Table 2.3

- Total annual average rainfall in Project location ranges from 1.544 mm to 2.763mm;
- Rainy season: Total rainfall during this season accounts for 78.3% of the annual rainfall; the highest rainfall falls in August and September.
- Dry season: each month has only a few rainy days on average, mostly light rain and drizzle. The lowest rainfall falls in of November, December, January and February.

Table 2.3. Monthly and annual average rainfall at Phu Lien station

(Unit: mm)

Month	2008	2009	2010	2011	2012	2013	Average
January	61	155	87	9	43	22	63
February	34	209	14	17	25	22	54
March	34	201	5	83	47	76	74
April	39	231	91	61	55	44	87
May	170	255	169	179	506	284	261
June	214	221	247	327	194	146	225
July	134	284	181	284	336	599	303
August	373	284	532	255	428	290	360
September	384	275	211	385	71	324	275
October	30	255	20	97	322	23	125
November	56	206	117	58	79	92	101
December	15	187	10	31	20	33	49
Annual	1.544	2.763	1.684	1.786	2.126	1.955	1.976

Source: Phu Lien hydrometeorological station, 2008 - 2013.

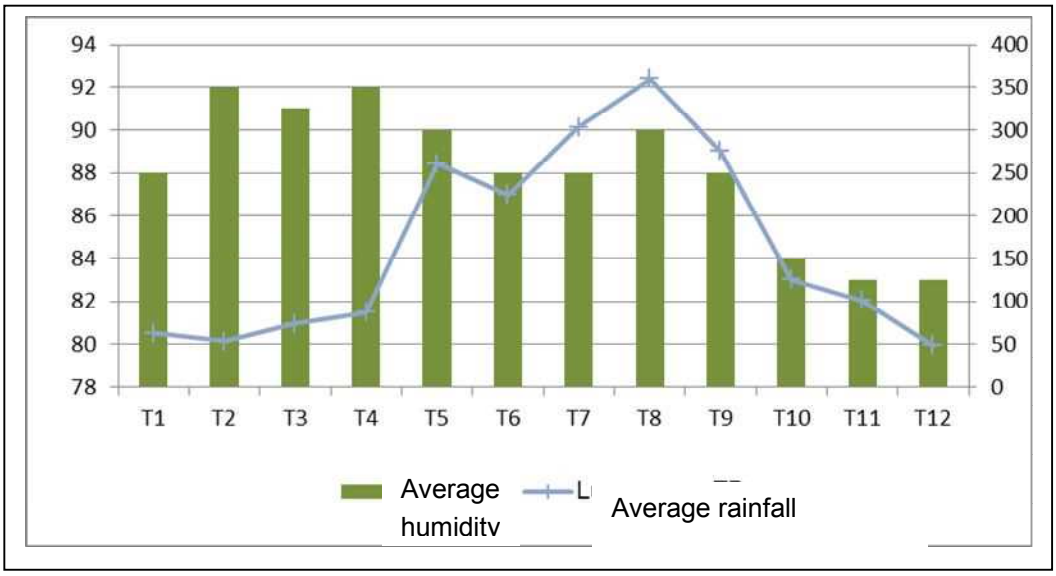


Figure 2.3. Humidity and rainfall chart

Note: Rain helps to purify and dilute pollutants in air environment. Rain also creates runoff to sweep away substances on the ground to water flow.

d. Wind

Based on statistical observation data at Phu Lien hydrometeorological station in 2005 - 2013, wind direction, frequency and speed are summarized as follows:

- Northeast winds prevail during dry season with monthly average speed of 2.8 to 3.2 m/s; East and southeast winds – rainy season with monthly average speed of 2.8 - 3.5m/s.
- Annual average wind speed is 3.0 m/s.

Table 2.4. Wind Characteristics

(Unit: m/s)

Station	Month												Annual
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	
Phu Lien	2.8	2.8	2.8	3.2	3.5	3.2	3.3	2.8	2.8	3.2	3.1	2.9	3.0

Source: Phu Lien hydrometeorological station, 2008 - 2013.

Note: Wind is the most important factor affecting the spread of air pollutants. The higher wind speed will cause the farther dispersion of air pollutants, and the smaller concentration of pollutants. Vice versa, low speed of wind will make pollutants concentrate near the waste source.

e. Atmospheric stability

Atmospheric stability may be determined by the average wind speed, solar radiation during the day and cloud cover at night according to Pasquill classification table (Table 2.5). Atmospheric stability in project location belongs to type B (medium unstable) during the day in dry season and sunny days in rainy season. Atmospheric stability were selected based on: (i) the average wind speed in project location during rainy season and dry season, respectively from 2.8 - 3.5 m/s and 2.8 - 3.2 m/s; (ii) large amount of solar radiation (> 140kcal/cm2); (iii) the average amount of cloud cover of 6/10 - 7/10 of the sky and 8/10 during rainy season; however, the amount of cloud cover is < 5/10 during dry season.

Table 2.5. Classification of atmospheric stability (Pasquill, 1961)

Wind speed at a height of 10m (m/s)	During the day, according to sunshine			At night according to cloud cover	
	Strong ($h_o > 60^o$)	Medium ($h_o=35^o \div 60^o$)	Light ($h_o= 15^o \div 35^o$)	A lot of cloud, Cloud density> 4/8	A few clouds, Cloud density <4/8
< 2	A	A ÷ B	B ÷ C	-	-
2 ÷ 3	A ÷ B	B	C	E	F
3 ÷ 4	B	B ÷ C	C	D	E
5 ÷ 6	C	C ÷ D	D	D	D
> 6	C	D	D	D	D

Note:

A: strong unstable. *D: neutral.* *h_o: solar altitude angle.*
B: medium unstable. *E: medium stable.*
C: weak unstable. *F: stable.*

The atmospheric stability decides the ability to move up air pollutants.

2.1.2.2. Special weather phenomena

a. Storm, strong wind

Storm: In July, August and September every year, 1 to 2 storms and 3 to 4 tropical depressions on average often lands in Hai Phong area. Storms or tropical depressions are usually accompanied by heavy rain and strong winds.

2.1.3. Hydrological / oceanographical conditions

2.1.3.1. Hydrological features

a. Hydrological features of big rivers in Project location

Cam and Bach Dang rivers are two big rivers in the project area. Belonging to Thai Binh river system, these two rivers share the similar hydrological features with Thai Binh river systems.

Bach Dang River: With a length of over 32km, Bach Dang River is a branch of Kinch Mon River running into the sea at Nam Trieu Estuary and is the northern and northeast boundary of Hai Phong and Quang Ninh. The estuary is wide and deep.

Cam River: Being a branch of Kinh Mon River, Cam River runs through the inner part of Hai Phong city into the sea at Cam Estuary. Cam River is 30km long, 500 - 600m wide and 6-8m deep. Cam River connects to Bach Dang River through Dinh Vu Canal. The average flow rate of the river is 750-1200m/h with silt content of 3.9kg/cm^3.

Bach Dang and Cam rivers have great significance for Hai Phong in terms of traffic. However, they have too large amount of silt at estuary, about more than 130 million m^3/year.

Cam and Bach Dang rivers' hydrological condition is relatively complicated, affected by both rain causing flood from upstream and tide from the sea. Every year, flow can be divided into two relatively clear periods: flood season and dry season, corresponding to time of high and low rainfall. Flood season usually starts from June to November, the highest annual flood peak usually occurs in July and August. Dry season falls in the remaining months, especially January.

b. Infield hydrological condition

Dyke system for separating river and infield area are installed in the project location on both sides of Cam and Bach Dang rivers. System of infield canals, ditches, and rivers such as Kenh Giang River or branch of Gia River connects to Cam and Bach Dang rivers through regulating bulkheads. Therefore, infield hydrological condition mainly depends on infield flood condition.

Irrigation system in the project area includes regulating works at barrages, drains, system of embankments and river dykes.

2.1.3.2. Oceanographical features

The flow regime of Hai Phong coastal and estuarine area is directly affected by Cam, Bach Dang and Chanh rivers, etc., and tidal flow. River flow has special influence to the general flow of the estuarine area. In flood season, upstream water of the said rivers runs into sea. Under the interaction of tidal flow and flood flow, water is under pressure during rising tide; accordingly during falling tide, resonance between tidal flow and river flow will cause huge flow rate. The survey results conducted at two estuaries and coastal area before the island show that, the flow in coastal and estuarine areas has complex regime representing the interactions between: river water – river bottom terrain - wave - tide.

Costal area in Hai Phong has regular diurnal tide regime. There is once high water and once low water every 25 days a month. This area has relatively high tidal range in Northern Vietnam. Average time of rising tide is 11-12h, falling tide 13-14h. A tide peak (high water) and a neap tide (low water) occur every day. On average, 2 periods of high tide lasting for 11-13 days with the water level fluctuation amplitude of 2.0m take place every month. During low tide, diurnal tide properties decrease significantly, semidiurnal tide properties increase, and 2 tide peaks appear every day. Annually, tide has large range during May, June, July and October, November, December, and small range during March, April and August, September.

Some tidal characteristics (Hon Dau Station - chart datum):

- Average water level for many years: 1.9 m, in which the level of +2.5 - +3.0m occurs on most days of every month for > 2 - 3h.
- The highest water level : + 4.21m (22/10/1985)
- The lowest water level : - 0.03m (02/01/1991)
- Highest tidal range during the day : + 3.94m (23/12/1968)

2.1.4. Situation of quality of environmental elements: land, water, air

The survey, measurement and analysis of environmental quality elements were carried out in August 2015.

Figure 2.5 shows the location map of the measurement sites. These sites were selected based on the following criteria:

- Representativeness of selected locations for the environment status in the area;
- Characteristics of emission sources;
- Sensitivity of recepients.

Table 2.6. shows the characteristics of the measurement sites at the time of survey

Table 2.6. Locations and parameters for survey of environmental quality

No.	Locations	Sign	Coordinate	Weather	Time	Traffic & socio-economic characteristics
1.	***Air, noise, vibration***					
(1)	The start point of Ring Road No. 3 (intersection with NH No. 10)	RR-KK1, RR-O1, RR-R1	20°56'37" N 106°40'20" E	Rainy	8/2015	There are few houses on both sides of National Highway No. 10
(2)	Intersection of Ring Road No. 3 and a road in the residential area – Ha Luan Village (Km1+500)	RR-KK2, RR-O2, RR-R2	20°56'30" N 106°40'54" E	shady, sunny at noon	8/2015	Residential area of Ha Luan Village
(3)	Intersection of Ring Road No. 3 and a road in the residential area (Km3+620)	RR-KK3, RR-O3, RR-R3	20°56'17.2" N 106°42'11" E	Sunny	8/2015	Paddy field surrounds the measurement site
(4)	Intersection of Ring Road No. 3 and Provincial Road No. 359 (Km5+500)	RR-KK4, RR-O4, RR-R4	20°56'17" N 106°43'11" E	Sunny	8/2015	Populous residential area on both sides of Provincial Road No. 359
(5)	Intersection of Ring Road No. 3 and a local road (Km7+940)	RR-KK5, RR-O5, RR-R5	20°54'51" N 106°43'54" E	Sunny	8/2015	Populous residential area on the west side, and paddy field on the east side
(6)	Intersection of Ring Road No. 3 and a local road (Km9+500)	RR-KK6, RR-O6, RR-R6	20°54'20" N 106°44'10" E	Sunny	8/2015	Populous residential areas on both sides of the local road
(7)	Intersection of Ring Road No. 3 and a road in Cap Village (Km11+300)	RR-KK7, RR-O7, RR-R7	20°53'22"N 106°44'17" E	Sunny	8/2015	Paddy field on both sides of the local road
(8)	Northern bank of Ruot Lon River (Km12+200)	RR-KK8, RR-O8, RR-R8	20°52'47"N 106°44'24"E	Sunny	8/2015	There are aquaculture ponds around the measurement site
(9)	Southern bank of Ruot Lon River (Km13+650)	RR-KK9, RR-O9,	20°52'13"N 106°44'53"E	Sunny	8/2015	There are aquaculture ponds around the measurement site

No.	Locations	Sign	Coordinate	Weather	Time	Traffic & socio-economic characteristics
		RR-R9				
2.	*Surface water*					
(1)	Kenh Giang River	RR-Nm1	20°56'32"N 106°40'8"E	Sunny	8/2015	The river is small, used mainly for irrigation
(2)	A small river at Km2+600	RR-Nm2	20°56'20"N 106°41'39"E	Sunny	8/2015	As above
(3)	A small river at Km6+900	RR-Nm3	20°55'34"N 106°43'32"E	Sunny	8/2015	As above
(4)	At a site 300m upstream of Ruot Lon Bridge	RR-Nm4	20°52'30"N 106°44'29"E	Sunny	8/2015	The width of the river is large, also used for waterway transportation
(5)	At a site 300 m downstream of Ruot Lon Bridge	RR-Nm5	20°52'42"N 106°44'48"E	Sunny	8/2015	As above
3.	*Underground water*					
(1)	Residential area at Dong Son Commune, Thuy Nguyen District	RR-Nn1	20°56'27"N 106°40'30"E	Sunny	8/2015	Residential area
(2)	Residential area at Trung Ha Commune, Thuy Nguyen District	RR-Nn2	20°56'12"N 106°42'11"E	Sunny	8/2015	As above
(3)	Residential area at Ngu Lao Commune, Thuy Nguyen District (RR3 intersecting with provincial road 359)	RR-Nn3	20°56'14"N 106°43'17"E	Sunny	8/2015	As above
(4)	Residential area at Lap Le Commune, Thuy Nguyen District	RR-Nn4	20°54'16"N 106°44'8"E	Sunny	8/2015	Residential area

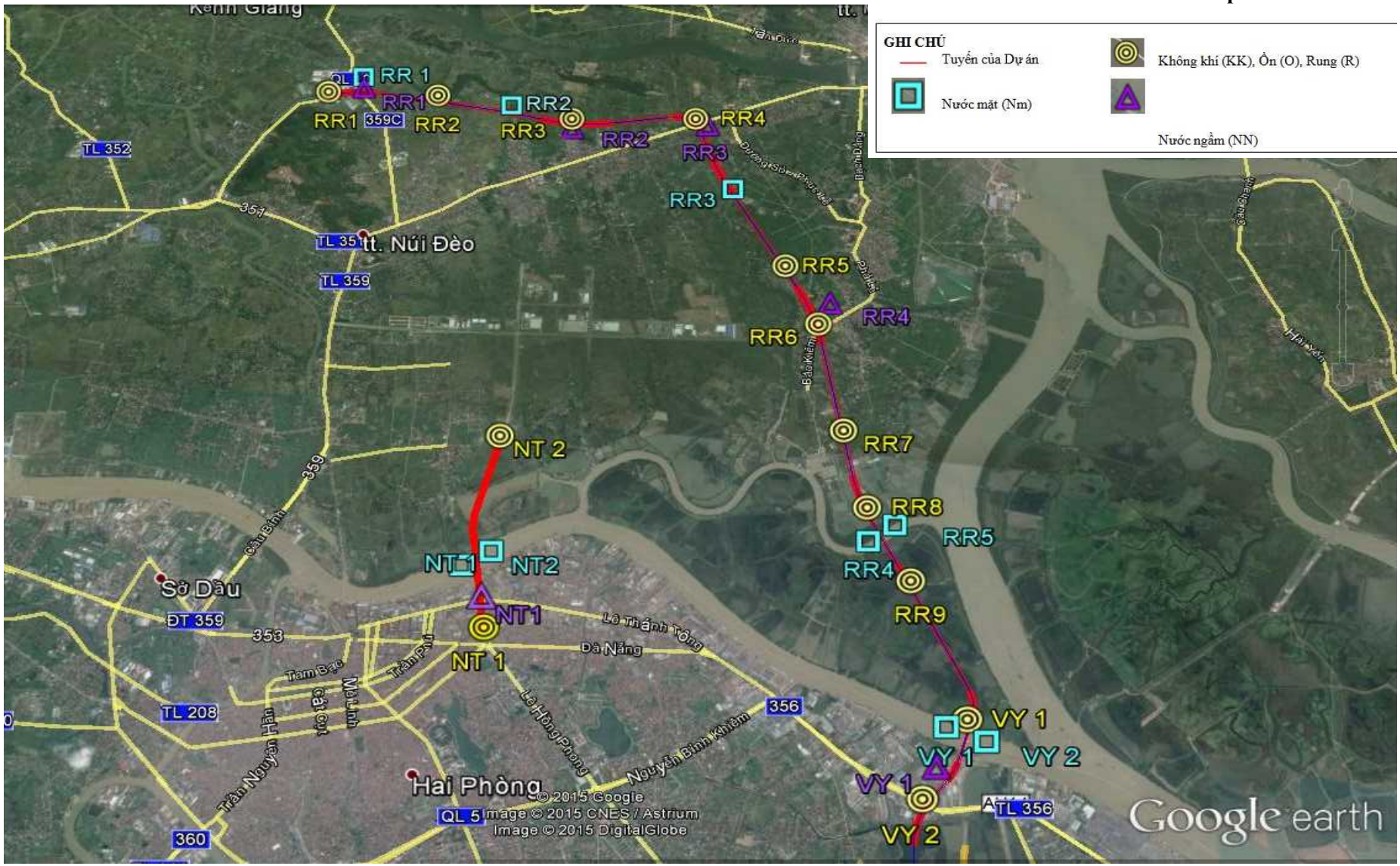


Figure 2.4. Environment Quality Survey Locations along the alignment of the Project

Environmental Impact Assessment Report

2.1.4.1. Air Quality

a. Basis for comparison

QCVN 05:2013/BTNMT – National Technical Regulation on Ambient Air Quality.

b. Assessment

Results of measurement are shown in Table 2.7, shown in Figure 2.5. Detailed results are presented in Appendix 2 – Report of Natural Environmental Baseline Survey.

Table 2.7. Results of air quality measurements

No.	Sign	Location	Average	Content (μg/m3)				
				TSP	PM10	SO_2	NO_2	CO
1	RR-KK1	The start point of Ring Road No. 3 (intersection with NH No. 10)	24h	144	37	20	19	682
2	RR-KK2	Intersection of Ring Road No. 3 and a road in the residential area – Ha Luan Village (Km1+500)	24h	50	42	38	55	891
3	RR-KK3	Intersection of Ring Road No. 3 and a road in the residential area (Km3+620)	24h	77	60	44	64	926
4	RR-KK4	Intersection of Ring Road No. 3 and Provincial Road No. 359 (Km5+500)	24h	247	205	70	93	1154
5	RR-KK5	Intersection of Ring Road No. 3 and a local road (Km7+940)	24h	82	68	43	31	958
6	RR-KK6	Intersection of Ring Road No. 3 and a local road (Km9+500)	24h	106	68	45	55	1120
7	RR-KK7	Intersection of Ring Road No. 3 and a road in Cap Village (Km11+300)	24h	61	56	48	54	1310
8	RR-KK8	Northern bank of Ruot Lon River (Km12+200)	24h	71	56	22	34	940
9	RR-KK9	Southern bank of Ruot Lon River (Km13+650)	24h	68	55	20	34	867
	QCVN 05:2013/BTNMT		**24h**	**200**	**150**	**125**	**100**	**-**

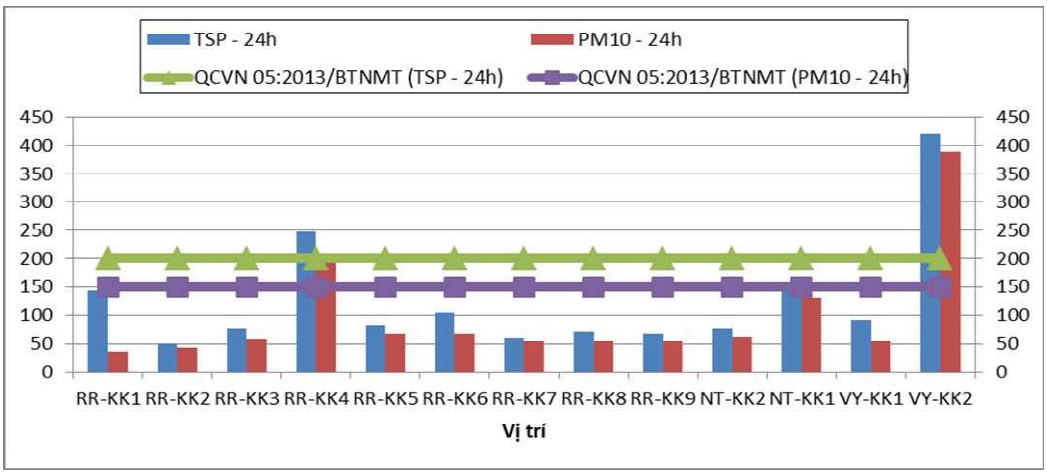


Figure 2.5. TSP and PM10 contents in the air

Comparing to the QCVN 05:2013/BTNMT, it is found that:

- Total suspended particulates (TSP) and PM10: TSP and PM10 contents at the intersection between RR 3 and the provincial road 359 (RR-KK4) exceed the permissible limit from 1.2 to 1.3 times. Though the traffic flow is high at the start point of intersection between RR3 and the National Highway 10, the content of TSP and PM10 is lower than the permissible limit. The reason is it rained on the day the measure takes place.
- Concentrations of SO_2, NO_2: At the remaining measured locations, concentration of toxic gases on 24h average is lower than the permissible limit.

2.1.4.2. Noise level

a. Basis for comparison

QCVN 26:2010/BTNMT, National Technical Regulations on Noise.

b. Assessment

Noise level measurement results are summarized in Table 2.8, illustrated in Figure 2.6. The detailed results are presented in Appendix 2 – Report of Natural Environmental Baseline Survey.

Table 2.8. Summary of noise level measurement results

No.	Sign	Location	Average value	L_{Aeq}
1	RR-O1	The start point of Ring Road No. 3 (intersection with NH No. 10)	**6h – 21h**	72.8
2	RR-O2	Intersection of Ring Road No. 3 and a road in the residential area – Ha Luan Village (Km1+500)		54.3
3	RR-O3	Intersection of Ring Road No. 3 and a road in the residential area (Km3+620)		57.4
4	RR-O4	Intersection of Ring Road No. 3 and Provincial Road No. 359 (Km5+500)		69.3
5	RR-O5	Intersection of Ring Road No. 3 and a local road (Km7+940)		55.4
6	RR-O6	Intersection of Ring Road No. 3 and a local road (Km9+500)		63.1
7	RR-O7	Intersection of Ring Road No. 3 and a road in Cap Village (Km11+300)		54.2
8	RR-O8	Northern bank of Ruot Lon River (Km12+200)		51.3
9	RR-O9	Southern bank of Ruot Lon River (Km13+650)		51.6
	QCVN 26:2010/BTNMT			70

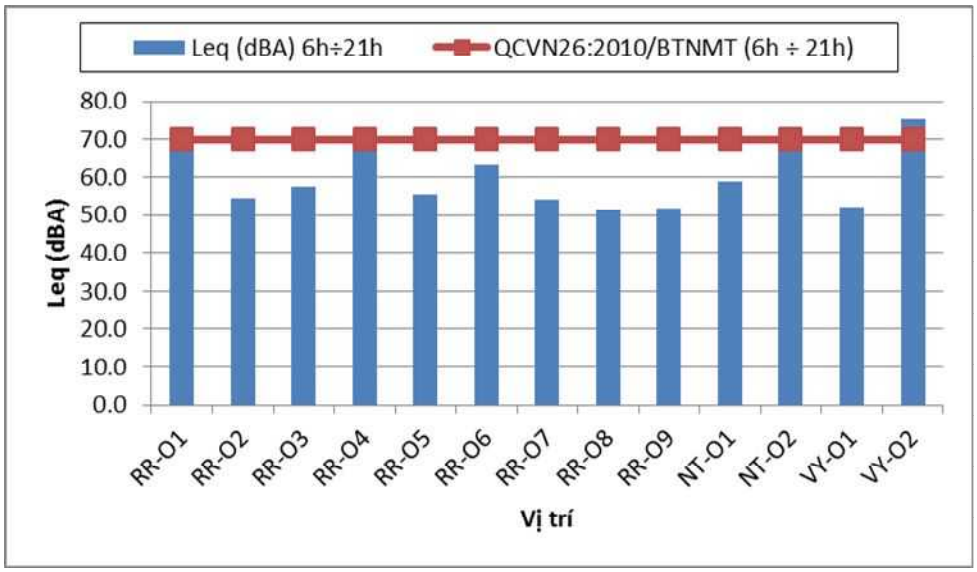


Figure 2.6. Status noise level of the Project area

Comparing with QCVN 26:2010/BTNMT has shown noise level measured at the intersection between RR3 and National Highway 10 (RR-O1), and Provincial Road 359 (RR-O4). The remaining locations have noise level lower than the permissible limit.

2.1.4.3. Vibration level

a. Basis for comparison

QCVN 27:2010/BTNMT – National Technical Regulations on Vibration.

b. Assessment

Measurement results are summarized in Table 2.9, illustrated in Figure 2.7. The detailed result is presented in Appendix 2 – Report of Natural Environmental Baseline Survey.

Table 2.9. Summary of vibration level measurement results (dB)

No.	Sign	Location	Average value	L_{10}
1	RR-R1	The start point of Ring Road No. 3 (intersection with NH No. 10)	**6h – 21h**	62.0
2	RR-R2	Intersection of Ring Road No. 3 and a road in the residential area – Ha Luan Village (Km1+500)		52.6
3	RR-R3	Intersection of Ring Road No. 3 and a road in the residential area (Km3+620)		48.0
4	RR-R4	Intersection of Ring Road No. 3 and Provincial Road No. 359 (Km5+500)		60.8
5	RR-R5	Intersection of Ring Road No. 3 and a local road (Km7+940)		53.9

No.	Sign	Location	Average value	L_{10}
6	RR-R6	Intersection of Ring Road No. 3 and a local road (Km9+500)	**6h – 21h**	50.7
7	RR-R7	Intersection of Ring Road No. 3 and a road in Cap Village (Km11+300)		44.7
8	RR-R8	Northern bank of Ruot Lon River (Km12+200)		42.5
9	RR-R9	Southern bank of Ruot Lon River (Km13+650)		42.2
	QCVN 27:2010/BTNMT			**75**

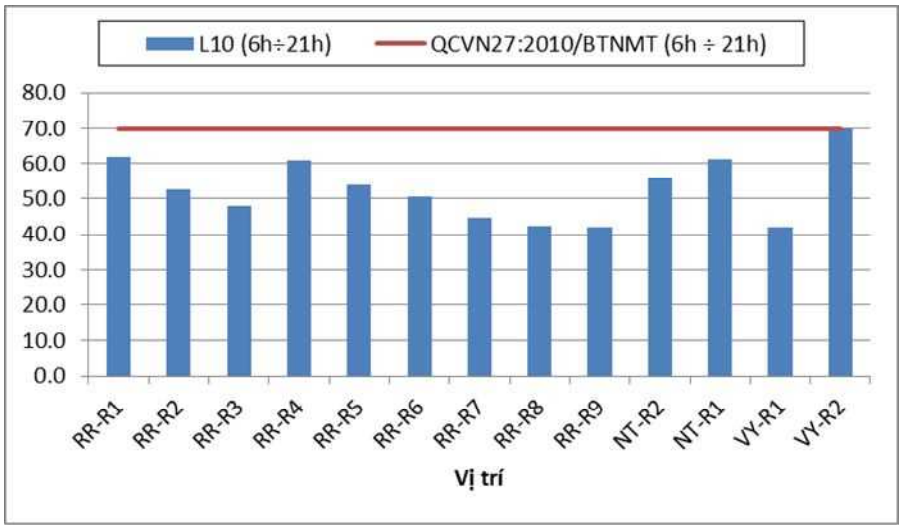


Figure 2.7. The status of vibration at the project area

Comparing with the allowable limit in accordance with QCVN 27:2010/BTNMT, it can be seen that the vibration level measured in the project area is lower than the allowable limit**.**

2.1.4.4. Surface water quality

a. Basis for comparison

QCVN 08-MT:2015/BTNMT – National Technical Regulation on Surface Water Quality.

b. Assessment

Surface water quality measurement and analysis results are summarized in Table 2.10, and Appendix 2 – Report of Natural Environmental Baseline Survey.

Table 2.10. Analytical results of surface water quality

No.	Locations	Sign	Tide	t^0C	pH	DO	BOD 5 (mg/ L)	SS (mg/L)	Coliform (MPN/100mL)
1	Kenh Giang River	RR-Nm1		31.2	7.1	2	7	4	900
2	A small river at Km2+600	RR-Nm2		31.4	7.0	2	6	4	900
3	A small river at Km6+900	RR-Nm3		30.9	6.9	3	7	3	900
4	At a site 300m upstream of Ruot Lon Bridge	RR-Nm4		30.7	7.1	4	6	3	800
5	At a site 300m downstream of Ruot Lon Bridge	RR-Nm5		30.8	7.3	4	6	3	800
QCVN 08-MT:2015/BTNMT (B1)				**-**	**5.5 - 9**	**≥ 4**	**15**	**50**	**7500**
QCVN 08-MT:2015/BTNMT (B2)				**-**	**5.5 - 9**	**≥ 2**	**25**	**100**	**10000**

Note: QCVN 08-MT: 2015/BTNMT - *National Technical Regulations on Surface Water Quality; Type B1: For irrigation purpose or other purposes requiring the same water quality or the purposes such as type B2; B2: Waterway traffic and other purposes requiring low quality of water*

- For physio-chemical features, values are within the permissible limit type B1;
- For bio-chemical factors (DO, BOD_5), DO values of water took from 3 canals along RR3 (i.e. Kenh Giang Canal RR-Nm1, canal at km2+600 RR-Nm2, and canal at km6+900 RR-Nm3) do not meet water standards for surface water type B1 (water usable for irrigation). Locations on Ruot Lon River meet B1 water standard, and BOD5 at all location reaches the permissible limit type B1.
- Coliform at all locations is lower than the permissible limit type B1.

In general, the quality of surface water in the project area is in compliance with QCVN 08-MT: 2015/BTNMT (B1), and is usable for irrigation.

2.1.4.5. Underground water quality

a. Basis for comparison

QCVN 09-MT:2015/BTNMT - National Technical Regulations on Underground Water Quality.

b. Assessment

Underground water quality measurement and analysis results are summarized in

Table 2.11, and Appendix 3 - Report of Natural Environmental Baseline Survey.

Table 2.11. Summary of underground water quality analysis results

No.	Location	Sample sign	Temp (^{0}C)	pH	Conductivity (ms/m)	BOD (mg/l)	Coliform (100ml)	Depth of well (m)
1	Residential area at Ha Luan, Hoa Binh Commune, Thuy Nguyen District	RR-Nn1	29.2	6.9	23.8	4	undetected	10
2	Residential area at Trai hamlet, Trung Ha Commune, Thuy Nguyen District	RR-Nn2	29.0	6.7	25.4	3	3	30
3	Residential area at Trung Son hamlet, Ngu Lao Commune, Thuy Nguyen District (RR3 intersecting with provincial road 359)	RR-Nn3	27.6	6.8	20.9	2	3	5
4	Residential area at Bao Kiem hamlet, Lap Le Commune, Thuy Nguyen District	RR-Nn4	28.1	6.7	22.7	2	3	6-7
QCVN 09-MT:2015/BTNMT			**-**	**5.5 – 8.5**	**-**		**3**	

Comparing with QCVN 09-MT: 2015/BTNMT has shown:

- For physio-chemical features, values are within the permissible limit;
- Microbiological factors (Coliform) were found in underground water sample took from the wells in the residential areas in Hoa Binh Commune, Trung Ha Commune, Ngu Lao Commune, and Lap Le Commune. Other parameters met allowable limits stated in QCVN 09-MT: 2015/BTNMT.

2.1.4.6. Assessment on appropriateness of the project location to the surrounding natural environment

The RR3 construction project runs through a flat terrain, mainly with fields and few residential areas.

Natural environmental characteristics of the Project site were studied and taken into consideration during the route alignment planning, in order to minimize impacts to natural environment. Ruot Lon Bridge is planned to be at the location where the width of the river is relatively large, and the riverbed erosion as well as the deformation of the riverbanks are not observed. The sustainability of the bridge foundations can be expected because the riverbed may not be significantly fluctuated by the appearances of the bridge foundations. Besides, the project has studied several alternatives to solve the remaining issues and avoid impacts on the structure stability as well as on the adjacent works. The project will minimize and not cause the impacts that change natural environment factors in the project area.

2.1.5. Current status of biological resources

2.1.5.1 Method of surveys on biological resources

The study on biological resources was conducted in two stages. In the first stage, a literature review was carried out by the ecological experts to grasp the overall condition of biological resources in a large area covering about 2.5 km ~ 3.0 km around the project area. In the second stage, during July and August 2015, a number of field surveys were carried out by a survey team led by an ecological expert to collect samples on sites, identify species of flora and fauna, etc., along the project area. In addition to the field surveys, the survey team also carried out the hearings to local residents, fishermen, owners of the aquaculture ponds, along the project area in order to collect supplemental information on the local biodiversity.

The objects of the survey and data collection consists of (1) Coastal natural mangrove vegetation and species of wild plants, crops and food crops; (2) Groups of natural animals like birds, mammals, reptiles, and amphibians; (3) Groups of aquatic organisms like plankton, benthos and fish.

Survey method and result of the survey are summarized and described in a report

attached to the EIA Report for the Project (Appendix 3 – Report of Ecosystem Survey). Only essential parts of the survey are described in this section.

2.1.5.2. Current biological resources in the region – based on the literature review

According to the literature review, the biological resources in a large area covering about 2.5 – 3.0 km around the project area are as followings:

a. Plant

a.1. Flora

The species of flora identified in the study area includes 224 species of 63 *trichophyte families* belonging to *Pteridophyta* and *Angiospermae* (see also Table 1 of Appendix 2). In particular, *Dicotyledon* belonging to *Angiospermae* has the highest number of species and families (159 species of 50 families, accounting for 78% of total families and 71% of total species). *Monocotyledon* has only 57 species of 9 families (accounting for 14% of total families and 25% of total species), but a large number of these individuals inhabits in meadows and fields. *Pteridophyta* have only 8 species (lowest rate), accounting for 4% of total species of 5 families including *Pteridaceae*, *Oleadraceae*, *Schizeaceae*, and *Dennstaedtiaceae*.

The flora in the study area is various in living forms, including woody plants, shrubs, vines, herbaceous plants, aquatic plants, parasitic plants, semi-parasitic plants, epiphyte plants, pillar-shaped plants like *Arecaceae* and *Cocos nucifera* and underground stem plants, etc. The 7 main living forms are identified as followings:

Woody plants falls into around 24 species, mainly including major mangrove species like *Sonneratia caseolaris, Kandelia obovata, Rhizophora stylosa*, etc., some other mangrove plants such as *Hibiscus tiliaceus and Thespesis populnea* and some other crops such as *Casuarina equisetifolia, Terminalia catappa, Muntingia culabura, Eucalyptus camphora, Khaya seneganensis, Melia azedarach, Delonix regia* and *Acacia magnum, etc.*

Shrubs exist with about 25 species, mainly including wild plants such as species of *Verbenaceae* families: *Clerodendron inemer, Clerodendron kaepferi, Clerodendron cyrtofillum, Lantana camara, vitex trifolia; Pandanus odoratissimus* and many other species of *Ceasalpiniaceae* family.

Shrubs often grow on hillocks or along high banks of ponds embanked for a long time or along dykes, etc. Herbaceous plants have more than 100 species (highest rate) accounting for 61.1%, mainly including species *of Poaceae, Cyperaceae and Asteraceae*. They commonly grow in tidal-submerged land areas, bogs, meadows, rivers and seas.

Species of vines makes up for 9% of the total species, like *Ipomoea obscura,* Cucurbitaceae like *Zehneria indica*, Fabaceae like *Deris trifoliata* and *Canavalia*

lineata, among which, Deris *trifoliata* is the most common kind of vines in the mangrove vegetation, distributed mainly on high ground of less tidal land areas.

Aquatic plants are mainly distributed in ponds, low-lying fields, riparian areas and those near the estuary. This group of plants is sensitive to impacts of the water environment, especially wastewater from aquaculture farming activities.

The group of parasitic and semi-parasitic plants consists of the only species - *Cuscutachinensis,* living on shrubs such as *Pluchea indica* along rivers and seas.

a.2. Vegetation

The following vegetation structures have been found in the study area:

a.2.1. Mangrove vegetation (mangrove ecosystem)

The study area is an alluvial area formed by Thai Binh River and Bach Dang River. Although these rivers bring to the area a large amount of alluvium and nutrient, the natural mangrove forests in the area cannot grow densely due to the strong wind and strong wave on the land characterized by vacant terrain. Main vegetation communities include the followings:

- *Sonneratia caseolaris* dominates in the community of brackish water plants, with the height of 8 - 10 meters, diameter at breast height of 9 - 12 cm and density of 3,850 plants/ha (154 Sonneratia caseolaris in a sample plot: 20mx20m). *Acanthus ilicifolius* is growing under its canopy, in upstream areas (even in the areas far more than 30 km away from the sea) of Ruot Lon River and other rivers.

Sonneratia caseolaris.

Acanthus ilicifolius and Acromstichum aureum

- *Avicennia marina* pioneering community along mudflats near estuaries, *Sonneratia caseolaris, Kandelia candel and Aegiceras corniculatum.*

- Mixed community of *Rhizophora stylosa - Kandelia obovata* and other species like *Bruguiera gymnorrhiza and Aegiceras corniculatum.*

- *Aegiceras corniculatum* dominates in the low shrub community. Other secondary species include *Bruguiera gymnorrhiza and Avicennia marina.*

Kandelia obovata, Sonneratia caseolaris.

Rhizophora stylosa.

a.2.2. Freshwater aquatic vegetation (freshwater aquatic ecosystem).

Aquatic plants communities include *Nymphaea pubescens, Eichhornia crassipes, Pistia stratiotes, Ludwigia adscendens, Hydrilla verticillata, Hydrilla verticillata, Utricularia aurea, Ipomoea aquatica* and *Cyperus,* etc.

a.2.3. Artificial vegetation

Perennial plants communities include *Casuarina equisetifolia;* Other broad-leaved trees *(Eucalyptus spp., Acacia auriculiformis* and *Acacia mangium, etc.)* and perennial plants and shade trees in residential areas, village roads and streets (*Artocarpus heterophyllus, Melia azedarach, Dracontomelon duperreanum, Cleistocalyx operculatus, areca catechu, Polyscias fruticosa, Delonix regia, Terminalia catappa, Casuarina equisetifolia, Cocos nucifera* and *Bambusa spp, etc.).*

Annual plants communities include *Oryza sativa*; Annual terrestrial plants grown on sand dunes and alluvial soil (*Zea mays, Dioscorea esculenta var. fasciculata,* vegetables and crops of all kinds, *etc.*); *Musa paradisiaca* grown in gardens in residential areas and riverside areas. Annual terrestrial plants and short-term industrial plants on ground and 3-season paddy fields (kinds of *Fabaceae, Manihot esculenta, Zea mays,* vegetables and crops, etc.); fields and gardens around houses in residential areas (*Oryza spp., Manihot esculenta, Zea mays,* kinds of vegetables, etc.*).*

No precious and rare plant species listed in Vietnam's Red Data Book 2007 was seen in the surveyed area.

b. Birds

According to the observation on-site in recent years and published materials on birds in coastal areas of the Red River Delta written by domestic and foreign authors, 117 species of 30 families of 13 orders have been listed (see *Table 2, Appendix 2*).

Birdlife is quite diversified with approximately 50 species of migratory birds. Two orders with largest number of species are *Passeriformes* (44 species, accounting for 37%) and *Charadriiformes* (26 species, accounting for 26%). The other orders have fewer species, 1 - 11 species, ranging from 1 to 8%. Migratory birds mostly live in mangrove areas along the estuaries towards Dinh Vu Island, Dam Nha Mac Lagoon and Cat Hai Island. Other groups of birds, especially *Passeriformes* are distributed throughout the region; some species are distributed in the riverside areas. No precious and rare birds listed in Vietnam's Red Data Book 2007 were observed in the surveyed area.

There are several alluvial areas (such as Dam Nha Mac Lagoon, Dinh Vu Island, etc.) located about 3 - 5 km away from the project area, where the mangrove forests are grown for long time ago in the past. The alluvial areas are relatively large and rich in species of coastal aquatic animals as foods for migratory birds from the North to Australia or vice versa. The migratory birds usually observed in these areas fall into two orders of *Anseriformes* and *Charadriiformes*. There are about 50 species of migratory birds accounting for about 40% of the total number of existing bird species in the area. Thus, it can be seen that the two above-mentioned orders are the typical bird species in the area.

c. Mammals

14 mammal species of 6 families falling into 4 mammal orders are found, including: *Insectivora; Chiroptera; Carnivora,* and *Rodentia* distributed in the area (*Table 3 of Appendix 2*). There are few species due to small areas of natural land, and dense residential areas. Among them, *Chiroptera* and *Rodentia* have the highest number of species (6 species for each order, together accounting for 43% of the total species). Most of them are common species of mammals, widely distributed in the northern delta area. *Lutra lutra* is a precious and rare species listed in Vietnam's Red Data Book – VU grade (Vulnerable). This species was rarely observed in the aquaculture ponds along Ruot Lon and Cam rivers towards Vu Yen Island and adjacent islands. However, recently, there is not any documents about appearance of these species in the project area.

d. Reptilia and amphibia

13 species of 7 families falling into 4 orders under 2 classes of *Amphibia* and *Reptilia* (*Table 4 of Appendix 2*) are listed. Among them, snake group, *Mabuya sp. group* and *Amphibia group* have the highest number of species (4 species, accounting for 31%). The final group is *Turtle group* (1 species, accounting for 7%). Toads of *Bufonidae family* of *Amphibia group* are usually distributed in humid residential areas, where there are lots of insects. The group of species of *Ranidae* is distributed in ponds and low-lying fields along rivers and along Ruot Lon and Cam river dikes and unpopulated

areas. Reptilia and amphibia are commonly seen in the northern delta area, distributed in riverside ground and uncultivated unfrequented wilderness. Two species of precious and rare reptilia and amphibia being listed in Vietnam's Red Data Book are *Gekko gecko* - VU grade (Vulnerable) and *Ptyas korros* – EN grade (Endangered). They were observed sometimes in the areas with many wild plants along unfrequented dykes, marshes and ponds, especially in mangrove areas along Cam and Ruot Lon rivers and adjacent areas. However, they are rarely observed and recently, there is not any documents about appearance of these species in the project area.

e. Fish and fishery

Freshwater fish includes wild and farm-raised fish; 61 species of 22 families of orders, including *anguilliformes; Clupeiformes; Osmeriformes; Characiformes; Cypriniformes; Siluriformes; Synbranchiformes; Perciformes; Cyprinodontiformes* and *Pleuronectiformes* (*Table 8 of Appendix 2*) have been identified. In particular, *Cyprinidae* has the highest number of species, many of them are farmed fish with economic values (37 species, accounting for 59%), followed by *Perciformes* (10 species, accounting for 17%). Other orders have low number of species (1 to 4 species, accounting for 2 to 6%).

Among freshwater fish in the study area, 3 precious and rare species of fish are listed in Vietnam's Red Data Book, namely *Clupanodon thrissa, Tenualosa reevesii, Elopichthys bambus* of EN grade (Endangered). These species are distributed along Ruot Lon, Cam and Bach Dang Rivers at the intersection of brackish and seawater. These widespread species live in many coastal and estuarine areas in northern region.

Fishing seldom takes place in rivers since fish farming ponds were prepared in the area near Ruot Lon River and Vu Yen Island. Farmed fish includes *Oreochromis niloticus, Oreochromis mossambicus, Cyprinus carpio, Ctenopharyngodon idellus,* etc.

2.1.5.3. Current biological resources in the area along the project road alignment – based on the field survey

The field surveys on biological resources were carried out in August 2015 in the area within 50-70m from the centerline of the project road alignment. Results of the surveys are summarized as followings.

a. Phytoplankton

Based on analysis results of samples taken in Ruot Lon and Cam rivers, in the bridge construction area, there are 95 species of phytoplankton falling into 4 algae divisions including: *Bacillariophyta*, *Chlorophyta, Cyanophyta* and *Euglenophyta* (*Table 5 of Appendix 2*). Among them, *Bacillariophyta* has the highest number of species (41 species, accounting for 43%), followed by *Chlorophyta* (29 species, accounting for

30%), *Euglenophyta* (14 species, accounting for 15%), and finally *Cyanophyta* (11 species, accounting for 12%).

The areas around Ruot Lon bridges have 72 species. Most of the phytoplankton are common and widespread species, which are frequently seen in natural freshwater areas in coastal and estuarine regions, among which *Bacillariophyta* group accounts for the highest rate in terms of composition and quantity density.

The density of phytoplankton in the area around Ruot Lon Bridge ranges from 1417.5 Tb/l to 4422.6 Tb/l, i.e. 2721.2 Tb/l on average. *Bacillariophyta* has the highest average density of phytoplankton (39%), followed by *Cyanophyta* (32%), *Chlorophyta* (25%) and finally *Euglenophyta* (4%).

The density of phytoplankton in the survey area shows no abnormality and significant difference from the results of previous surveys conducted in Hai Phong estuarine areas.

b. Zooplankton

It has been identified 62 species and species groups of zooplankton belonging to *Copepoda, Cladocera, Rotatoria* and other groups such as *Crustacea, Mollusca, Ostracoda* and *Polychaete*, etc. (*Table 6 of Appendix 2*). Among them, *Cladocera* has the highest number of species (27 species, accounting for 44%), followed by *Copepoda* (18 species, accounting for 29%), *Rotatoria* (13 species, accounting for 21 %), and other groups (4 species, taking 6%).

The area of Ruot Lon Bridge has 44 species of zooplankton. Most of the zooplankton in the survey area is widely distributed in natural water areas in the North of Vietnam. *Cladocera* has the highest number of species; meanwhile *Copepoda* has the highest density of quantity.

c. Zoobenthos

41 species of zoobenthos of *Mollusca, Arthropoda (Crustacea - Decapoda)* and insect groups have been identified at the planned bridge construction sites (*Table 7 of Appendix 2*). Among them, *Mollusca, Bivalvia,* and *Gastropoda* (25 species, accounting for 61%). *Arthropoda, Crustacea* and Insect have 16 species and groups of species, accounting for 39%).

The area of Ruot Lon Bridge has 20 species of zoobenthos. The identified zoobenthos are commonly and widely distributed in many areas in Northern Vietnam. No typical or endemic species in the area have been found.

The density of zoobenthos at the planned Nguyen Trai Bridge construction site ranges from 5 to 48 zoobenthos/m^2, i.e. 21.9 zoobenthos/m^2 on average. Zoobenthos biomass ranges from 4.15 to 16.96 g/m^2, i.e. 18.04 g/m^2 on average. *Gastropoda* and *Bivalvia* have the highest average density among zoobenthos. Other groups have insignificant density.

The density of zoobenthos at the planned Vu Yen Bridge construction site ranges from 7 to 28 zoobenthos/m^2, i.e. 18.44 zoobenthos/m^2 on average. Zoobenthos biomass is between 7.2 and 44.6 g/m^2, averagely 18.9 g/m^2. *Gastropoda* and *Bivalvia* have the highest average density of zoobenthos. Other groups have insignificant density.

The density of zoobenthos at the planned Ruot Lon Bridge construction site has been observed at between 3 and 88 zoobenthos/m^2, averagely 35.7 zoobenthos/m^2. Zoobenthos biomass ranges from 6.1 to 28.7 g/m^2, i.e. 14.5 g/m^2 on average. *Gastropoda* and *Bivalvia* have the highest average density of zoobenthos. Other groups have insignificant density.

d. Flora

The project is planned to pass through a number of residential areas, rice fields, aquaculture ponds, and mangrove forests along Ruot Lon and Cam rivers. There are about 181 species of plants (*Table 1 of Appendix 2*) with various living forms, including woody plants, shrubs, vines, herbaceous plants, aquatic plants, parasitic plants, semi-parasitic plants, epiphyte plants, pillar-shaped plants like *Arecaceae* and *Cocos nucifera*, underground stem plants, etc. The structure of vegetation is as follows:

d.1. Communities of mangrove vegetation:

- *Sonneratia caseolaris* (with *Acanthus ilicifolius* growing under its canopy) dominates in the community of brackish water plants on the river banks of Ruot Lon River, Cam River and other rivers. *Sonneratia caseolaris* can be found even at the location 30 km far away from the seashore. *Sonneratia caseolaris* is the main vegetation growing in the areas (totally about 1.2 ha) affected by the construction of Ruot Lon Bridge approach. It is estimated the occupied area is about 1.02ha mangrove forest (mainly *Sonneratia caseolaris*)

- *Avicennia marina*, *Sonneratia caseolaris, Kandelia candel,* and *Aegiceras corniculatum* can be found growing along the mudflats near the estuaries.

- *Aegiceras corniculatum* dominates in the low shrub community, with other secondary species including *Bruguiera gymnorrhiza,* and *Avicennia marina*.

d.2. Grassland and wild low shrubs

Most of the shrubs growing in uncultivated land along dykes and Cam and Ruot Lon Rivers belong to *Poaceae*.

Sonneratia caseolaris is the main mangrove tree growing on the banks of Ruot Lon River, tentative construction area of the bridge

d.3. Freshwater aquatic vegetation

Aquatic plants communities include *Nymphaea pubescens, Eichhornia crassipes, Pistia stratiotes, Ludwigia adscendens, Hydrilla verticillata, Hydrilla verticillata, Utricularia aurea, Ipomoea aquatica, Cyperus,* etc.

d.4. Artificial vegetation

This vegetation includes the following communities: Perennial plants communities *(Casuarina equisetifolia);* broad-leaved trees *(Eucalyptus spp., Acacia auriculiformis, Acacia mangium, etc.);* perennial plants in urban residential areas *(Artocarpus heterophyllus, Melia azedarach, Cocos nucifera, Areca catechu, Bambusa spp., etc.)*; annual crop communities *(Oryza sativa, Zea mays,* and other kinds of vegetable*)*; *musa paradisiacal* is grown in gardens with or without alternate crops; annual terrestrial plants and short-term industrial plants on ground and 3-season paddy fields (kinds of *Fabaceae, Manihot esculenta, Zea mays*, and other kinds of vegetable); crop fields and gardens around houses in residential areas (*Oryza spp., Manihot esculenta, Zea mays,* etc.).

No precious and rare plant species listed in Vietnam's Red Data Book were seen in the survey area.

e. Fauna

Animals along the route include groups of birds, mammals, amphibians, and reptiles, commonly seen in northern delta provinces; nonetheless, there are few species and low density of quantity. Apart from wild animals, some animal species are raised for food or ornament. However, no special attention should be paid to this low quantity and normal condition (*Table 2, 3 and 4 of Appendix 2).*

f. Aquatic organisms

Aquatic organisms along the planned road route include groups of common plankton, benthos. There are no typical or endemic species for the area. Groups of plankton and benthos have average densitie (*Table 6, 7, 8 – Appendix 2*).

Freshwater fish includes wild and farm-raised fish widely distributed throughout Northern delta provinces. *Oreochromis niloticus, Oreochromis mossambicus, Cyprinus carpio, Ctenopharyngodon idellus*, etc., are raised in some ponds near Ruot Lon River and on Vu Yen Island.

2.2. Social and economic conditions

2.2.1. Social and economic conditions of Hai Phong city[1]

Hai Phong has a total natural area of 1,527.4 km^2 with 1.9674 million inhabitants, consisting of 15 administrative units at rural district level (7 inner district, 6 suburb district and 2 island districts), average population density of the city is 1,288 people/km^2.

2.2.1.1. Economic conditions of Hai Phong city

a. Economic growth and structure transformation

The average growth rate of the period 2011-2015 reaches 9.07%. The ratio of Hai Phong GDP in the GDP of the whole country increases from 2.7% in 2010 to 3.5% in 2015. GDP ratio of industry, construction and service sectors increases from 90.3% in 2011 to 92.37% in 2015. According to statistical data of Hai Phong city in 2015 (as per comparison price in 2010), the total GDP is 88,407.2 billion VND, GDP of agriculture, forestry and aquaculture is 6,478.0 billion VND, industry and construction is 32,370.5 billion VND.

b. Agriculture, forestry and aquaculture sector

This section takes an important part in maintaining the economic growth rate and social stability on the city locality. The growth rate of production value and GDP growth rate of the section within 5 years from 2011-2015 reach 3.26%/year and 2.48%/year, respectively. Internal structure of this section has changed positively, the ratio of agricultural and forestry production decreases to 65.46% in 2015; ratio of aquaculture increases to 34.54% in 2015. In agriculture, ratio of cultivation ratio decreases to 47.72%, husbandry and agricultural service increase to 47.3% and 5.14%, namely as follows:

- *Agriculture*: the total area of rice cultivating land of 2015 in the whole city is 75,800 ha with the annual rice productivity 478,300 tons corresponding to the agricultural production value (as per comparison price in 2010) at 10,002.8 billion VND.
- *Forestry*: Forestry productivity value in 2015 in the whole city is 40.5 billion VND (as per comparison price in 2010).
- *Aquaculture*: in 2015, on the whole city, aquacultural products are exploited at 66,488 tons; aquacultural productivity at 53,798 tons with the total value at 4,094.9 billion VND (as per comparison price in 2010). Aquacultural economy develops both in aquaculture and exploitation; the average growth rate of aquacultural production in the period 2011 – 2015 is estimated at 7.07%/year, double the growth rate of the sector. In which, exploitation value increases 6.55%/year, aquacultural and service value increases 7.48%/year. Aquaculture will follow intensive farming method and semi-

[1] - National defense- security, socio-economic development report of Hai Phong city in 5 years from 2011 – 2015
- 2015 Hai Phong statistical data of Hai Phong statistical department

intensive farming method. The number of production and processing facilities in the city accounts for 75% of the value of the Northern major economic region; refrigerator store accounts for 50% of the capacity of refrigerator store in Norther aquaculture processing and production. Logistics for aquaculture are focused, strengthened and extended.

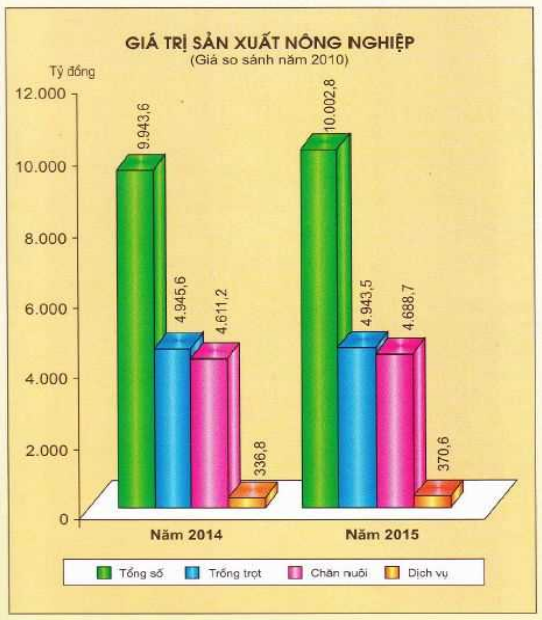


Figure 2.8. Agricultural production in Hai Phong City in 2015

c. Industry – construction sector

This sector still maintains rather good growth rate as compared to the average rate of the whole country. On average, from 2011-2015, GDP of this sector has increased 8.71%/year. The industry of the city ranks 7th in production value in the country and ranking 3rd in the Northern region (after Hanoi, Bac Ninh). Hai Phong is becoming an important step in the industrial production chain. GDP growth rate of the industrial sector has reached 9.44%/year for the period 2011 – 2015. The industrial production develops mainly in industrial zones and clusters. There are 16 industrial zone projects with the total area of 5,695ha on the locality of Hai Phong. Internal structure of the sector has changed positively in the orientation of developing major, potential industries and those relate to seas and export good production. Some high-tech industries have formed such as production of electric, electronic devices, health tools, precision tools, office equipment and computers.

Regarding construction industry, the growth rate of construction for the period 2011-2015 is 5.29%/year. In which, non-state sector makes up 80% of the production value. The followings are specific data of this sector in 2015:

- *Industry*: In December 2015, the development index of the industrial production increased 113.21% as compared to the same period of last year. The production value reached 150,192.3 billion VND (as per comparison price in 2010) for industries of mineral exploitation, processing and fabrication, power supply and production, gases,

hot water, water vapor, and air conditioning, water supply, management and treatment of waste and waste water.

- *Construction*: The production value of this sector in 2015 reached 18,185.9 billion VND (as per comparison price in 2010).

d. Service sector

The service sector makes up a high percentage in GDP. On average from 2011-2015, this sector increased 10.39%/year, which is higher than the growth rate of the city's GDP. Hai Phong has become a big service center of the Northern coastal region. GDP of the service sector ranked 2nd in the Red river delta (after Hanoi). It is also a focal point of the Northern region in aspects of import and export of container goods, gasoline and oil, and other good from/to other countries on the world.

Commercial activities have developed strongly and comprehensively during the last 5 years of 2011-2015. The retail sales of goods and revenue of consumption services increased 18.52%/year on average. The total value of exports reached over 15.77 billion USD with the annual average growth rate at 15.87%/year. The total value of import reached 16.07 billion USD with the annual average growth rate at 15.15%/year. The tourism industry has developed considerably; the number of visitors has increased 9.6%/year on average for the period 2011 – 2015. Marine port services have developed rapidly and contributed greatly into the economic development of the city. The followings are data of 2015:

- *Trade*: In 2015, the retail sales of goods and social services was 80,672.7 billion VND.
- *Tourism*: In 2015, the number of tourists was 5.639 million people with the total revenue of stay, food and drink, and travelling was 12,297.2 billion VND.
- *Transportation*: In 2015, the total carried goods volume was 119.266 million tons, in which roadway was 83.059 million tons; volume of circulated goods was 71,794.1 million tons.km, in which roadway was 8,776.5 million tons.km; the revenue of freight transport was 20,649.6 billion VND, in which roadway was 7,727.8 billion VND; the volume of carried passengers was 43.235 million people, in which roadway was 39.87 million people.

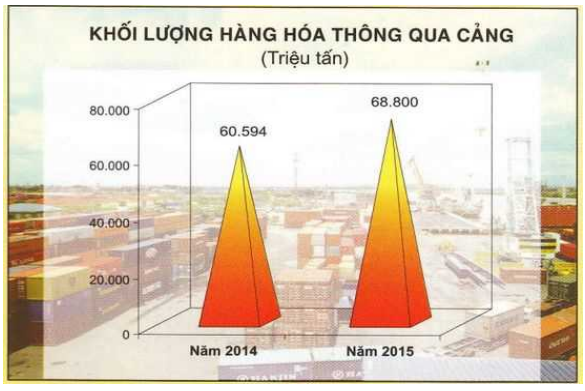


Figure 2.9. Volume of goods through ports of Hai Phong city in 2015

2.2.1.2. Cultural and social conditions of Hai Phong city

a. Education and training

Education and training sector has developed comprehensively on both scale and quality. Schooling infrastructures and facilities have been improved; quality of teaching staff has been enhanced. In 2015, there were 471 schools, including 216 primary schools, 187 secondary schools, 55 high schools and 2 upper secondary schools. The total number of students was 296,115, including 154,896 students of primary schools, 88,679 students of secondary schools, 52,540 students of high schools.

b. Health, health care, and population

Prevention and fighting of epidemic diseases are implemented to actively and timely discover, treat, blockade, constrain and stamp out epidemic diseases without fatal damages. Food safety and hygiene has been pushed up with activities of dissemination, supervision, periodic and unscheduled checking and inspection with food and drink processing and business establishments.

The health examination and curing network from the city to the grass root units has been strengthened and expanded. HIV/AIDS prevention and fighting has been concentrated and implemented effectively and comprehensively.

c. Culture and sports

Cultural, sports and historical works have great concern of the city for improvement and upgrading. Cultural and public arts develop widely and deeply.

2.2.2. Socio-economic conditions of the project area

2.2.2.1. Thuy Nguyen District[2]

a. Population and labor

Thuy Nguyen district is home to around 320,000 people, of which about 49.3% is male and 50.7% is female. Natural population growth rate accounts for about 0.99%. Population density reaches about 1,215 people/km^2. Working-age population accounts for 50.6%, of which 41% are working in district's economic sector. Currently, labor force is mainly engaged in farming accounting for 78% of the total employees working in economic sector.

b. Economy

In 2015, Thuy Nguyen district's total production value of all sectors reached 14,639.6

[2]Result report of implementing Socio-economic development mission in2015 of Thuy Nguyen District People's Committee

billion VND. Agriculture - fisheries sector accounted for 17.8%, industry & construction sector 48.1%, service sector 34.1%.

- For agriculture – fisheries sector, the production value reached 2,599.4 billion VND. In which:

+ Cultivation: rice-cultivated area reached 12,892 ha with productivity of 63.62 quintals/ha/crop. Vegetable cultivated area of all kinds reached 1.863ha with productivity of 37,581 tons. The production value of cultivation reached 727.9 billion VND.

+ Husbandry: There were 80,206 pigs, 2,847 cattle, 1 million poultry. The value of husbandry reached 751.8 billion VND.

+ Aquaculture: Aquaculture area reached 1,541 ha with breeding yield of 6,536 tons, and catching yield of 26,880 tons. The value of the sector reached 1,078 billion VND.

- For industry – construction sector, production value reached 7,047.7 billion VND, of which industry accounted for 3,233.5 billion VND, and construction 3,814.2 billion VND. The main products include stones of all types reaching 1.7 million m3, lime 445,100 tons, metal casting 80,200 tons, textiles 20.1 million products, cement 75,000 tons, tiles of all kinds 150 million pieces.

- Service (trade and service) sector reached 4,992.5 billion VND, of which transport service accounted for 1,765.8 billion VND, trade – service 2,304.3 billion VND, and other services 922.4 billion VND.

c. Infrastructure

National Highway No.10 is the main route connecting National Highway No.5 and National Highway No.18. Besides, Provincial Roads No.351, 352, and 359 have been completed. In addition, many inter-village and inter-commune roads have been concreted under the National Target Program for New Rural Construction.

The district has 84km of inland waterway, mainly for transport of building materials. There are river ports such as Da Bac, Xuan Lai, Kien, Minh Duc, Cong Son and Lap Le river wharves.

National electric grid has currently installed in all communes and towns of Thuy Nguyen district. The district also has 282 substations with 373 km high-voltage and low-voltage transmission lines. Maintenance and repair of transmission lines and substations have been maintained regularly. There are 198 pump stations.

Around 80% of the population in communes and town of Thuy Nguyen district is provided with clean water, the rest use groundwater resources. More than 66 small water plants are available.

d. Environmental sanitation

Regular waste collection unit is established in each communes and towns. All households are using septic tank toilet. Waste treatment system is also installed in breeding farm.

e. Education and public health

In terms of education and training, district's system of vocational schools and centers have been upgraded to meet training requirements. There are 37 kindergartens, 38 primary schools, 37 secondary schools, and 7 high schools in the district, of which 73 schools meet national standards.

In terms of health, healthcare quality has been improved; doctors and nurses have been trained to improve proficiency. Health care service in all communes and towns in the district meets national standards. There are 1 hospital, 4 general clinics and 37 communal health stations with a total of 474 beds and 378 medical workers. Currently, all grassroot-level health units have 1-2 doctors.

2.2.2.2. Hai An district[3]

a. Population and Labor

Hai An district is home to around 77,600 people, of which about 49.6% is male and 50.4% is female. Natural population growth rate accounts for about 0.61%. Population density reaches about 739.6 people/km^2.

b. Economy

The total production value of all economic sectors in the locality is 25,377.6 billion VND. The total production value of industries managed by Hai An district reaches 3,819.1 billion VND. Industry – small industry and handicrafts account for 7.5%, construction accounts for 48.2%, trade – services 41.7%, agriculture – aquaculture 2.6%.

c. Infrastructure

Roadway transport system in the project area is relatively complete with urban roads. All roads have drainage and lighting systems. Currently, the district continues developing the roadway transport system with interchange and road extension projects.

Cam river is a major waterway route and plays an important role in marine port services and economic activities. It is also a main route of ships and boats entering Hai An and Dinh Vu ports for trade.

All residents in the district have been provided with power supply for domestic and business activities.

All residents are provided with fresh water for daily life.

[3] - Report on realizing socio-economic development mission in 2015 of Ngo Quyen District People's Committee

d. Environmental sanitation

Regular waste collection unit is established in the district. All households are using septic tank toilet.

e. Education and public health

There are 20 schools in the district, of which 18 schools meet national standards according to Ministry of Education and Training's criteria.
National target programs of health, population, family and children have been fully implemented. All children are fully immunized.

2.2.3. Economic conditions of households affected by the project

2.2.3.1. The area and land structure of communes related to the project

Table 2.12. Land area in the project area

Unit: ha

No.	Commune	Area	Agricultural land	Forestry land	Residential land	Dedicated land	Unused land
1	Kenh Giang	736.7	416.4	43.9	87.7	110.0	12.8
2	Dong Son	455.9	248.8	23.6	65.6	82.2	9.1
3	Hoa Binh	647.5	334.4	34.0	106.2	91.7	-
4	An Lu	641.8	383.3	-	71.0	125.8	2.4
5	Trung Ha	391.4	215.1	33.7	39.3	59.8	0.5
6	Thuy Trieu	837.2	389.6	13.4	58.1	98.6	22.7
7	Ngu Lao	525.6	274.7	7.8	85.8	115.8	26.0
8	Phuc Le	587.8	245.3	38.5	71.7	156.7	4.8
9	Pha Le	416.8	198.9	22.6	46.2	24.8	-
10	Lap Le	1172.6	712.3	75.0	113.9	132.9	42.9
11	Dong Hai 2	491.87	89.72	-	84.65	-	54.88
Total/average		6905.2	3508.5	292.5	830.2	998.3	176.1
Ratio (%)			50.8	4.2	12.0	14.5	2.5

2.2.3.2. Census

According to survey results and census of affected people, the Project could affect 1,846 households (107 households are living together with agriculture land owners) with a total of 6,184 people and 7 organizations. All affected people are the Kinh (100%). No ethnic minorities in project areas. The average scale of the demographic affected households is 3.35 persons per household ; the average percentage of women is 50.4% of the total affected population, slightly higher than the percentage of men (49.6%).

Table 2.13 Population by gender

No.	Commune	HHs	Persons	Gender	
				Male	Female
1	May To	85	226	101	125
2	Dong Son	12	39	19	20
3	Hoa Binh	307	979	502	477
4	An Lu	36	155	81	74
5	Trung Ha	223	460	231	229
6	Thuy Trieu	216	907	462	445
7	Ngu Lao	301	914	487	427
8	Phuc Le	6	26	18	8
9	Pha Le	277	1145	540	605
10	Lap Le	383	1333	624	709
	Grand total	1,846	6,184	3,065	3,119

2.2.3.3. Source of Income

Regarding occupation of interviewed households, as shown in Table below, the largest proportion is staff of Wards (accounted for 20.5%), the next is worker (14.7%) and trading (13.2%). In Thuy Nguyen District area, the largest proportion is agriculture (61.3%), the next is worker (14.7%) and trading (12.1%). Almost people who have income from fishery and aquaculture are in Lap Le Commune.

Table 2.14 Structure of Affected Population by Main Occupation

No.	Commune	Main occupation (%)						
		Agri-culture	Trading	Worker	Wage labor	Fisher-men	Aqua-culture	Other
1	May To	0	13.2	14.7	20.5	0	0	51.6
2	Dong Son	8.1	62.2	5.4	8.1	0	0	16.2
3	Hoa Binh	40.0	9.5	25.4	5.3	0	0	19.8
4	An Lu	78.8	1.3	17.9	0	0	0	2.0
5	Trung Ha	73.5	9.0	14.6	2.0	0.5	0.2	0.2
6	Thuy Trieu	70.1	8.7	15.6	2.6	0	0	3.0
7	Ngu Lao	57.8	9.3	18.8	4.3	0	0.4	9.4
8	Phuc Le	100	0	0	0	0	0	0
9	Pha Le	68.5	0.3	11.7	1.5	1.4	0	16.6
10	Lap Le	54.9	8.9	8.2	2.7	5.4	4.0	15.9
	Total	61.3	12.1	13.1	2.9	0.8	0.6	9.2

Table 2.15 Distribution of affected households by income per capita (%)

Commune	Distribution of affected households by income per capita (1,000VND/person/month)				Average income per capita (VND/person/month)
	<250	250-500	500-1000	>1000	
May To	0.00	0.00	2.16	97.84	6,502,302
Dong Son	0.00	0.00	0.00	100.00	13,319,048
Hoa Binh	0.11	3.04	15.86	80.99	3,257,987
An Lu	0.00	79.29	0.00	20.71	1,209,071
Trung Ha	0.00	0.00	15.95	84.05	2,187,500
Ngu Lao	1.09	8.07	22.02	68.81	3,677,291
Pha Le	35.19	33.56	1.82	29.43	1,259,756
Lap Le	27.29	30.72	11.44	30.56	2,549,000

2.2.3.4. Household Assets

Living conditions of the households are summarized in the following Table 2.16 ~ Table 2.18.

Table 2.16 Living Conditions of Affected People - Source of Water and Electricity

No	Commune	Electric (%)		Water (%)			
		Meter	Indirect	Tap-water	Excavated well	Rainwater	Other
1	May To	100	0	96.5	0	7.0	0
2	Dong Son	100	0	100	15.3	38.5	0
3	Hoa Binh	99.3	0.7	90.5	20.4	24.3	0.3
4	An Lu	100	0	100	63.6	96.9	0
5	Trung Ha	99.6	0.8	89.2	10.8	0	0
6	Thuy Trieu	99.8	0.2	90.3	8.1	21.4	0
7	Ngu Lao	99.75	0.55	95.75	30.1	59.9	0.25
8	Phuc Le	100	0	100	0	28.6	0
9	Pha Le	100	0	98.9	10.0	59.4	0
10	Lap Le	90.2	5.55	90.55	14	67.75	2.8
	Total	98.9%	0.78%	95.4%	35.8%	1.0%	3.2%

Note: Percentage is calculated based on the number of persons answering "yes" per total interviewed persons. The total of percentages may be more than 100% because interviewee can select multi-choice for a same question.

Table 2.17 Living Conditions of Affected People – Sanitation

No	Commune	Septic tank (%)	Unseptic tank (%)	Without toilet (%)
1	May To	100	0	0
2	Dong Son	100	0	0
3	Hoa Binh	76.7	23.4	0
4	An Lu	97.0	3.0	0
5	Trung Ha	70.9	26.9	0
6	Thuy Trieu	89.2	10.8	0
7	Ngu Lao	91.15	11.85	0.55
8	Phuc Le	57.1	42.9	0
9	Pha Le	99.3	0.7	0
10	Lap Le	84.95	2.95	0.85
	Total	**86.63**	**12.25**	**0.14**

Note: Percentage is calculated based on the number of persons answering "yes" per total of interviewed persons. The total of percentages may be more than 100% because interviewee can select multi-choice for a same question.

Table 2.18 Assets of Affected People

No	Item	Percentage (%)
I	**Agricultural Equipment/ Tools**	
1	Field Engine	0.64
2	Towing vehicle	0.28
3	Beater	0.64
4	Reaping - machine	1.07
5	Water truck	0.14
6	Hand pump	4.33
7	Electric pump	12.00
II	**Asset in family**	
1	Television	97.59
2	Refrigerator	85.01
3	Gas cooker	90.34
4	Electric cooker	14.06
5	Electric heater	35.01
6	Electric fan	85.72
7	Washing machine	18.47
8	Microwave oven	3.69
9	Radio set	3.41
10	Computer	20.31
11	Telephone	67.68
12	Air Conditioner	14.84
III	**Other assets**	
1	Bicycle	94.96
2	Motorcycle	82.17
3	Three-wheel vehicle	1.07
4	Car	1.42
5	Truck	1.28
6	Passenger car	0.21
7	Pulling cattle	0.14
8	Other	0.78

Note: Percentage is calculated based on the number of persons answering "yes" per total interviewed persons. The total of percentages may be more than 100% because interviewee can select multi-choice for a same question.

2.2.3.5. Vulnerable Group

Vulnerable households are defined as the households living under poverty line, female-headed households and social policy treated households. These households are listed in the Table 2.19.

Table 2.19 List of Vulnerable Households

No	Ward/Commune	Poor HH		Female-headed		Social Policy	
		Quantity	%	Quantity	%	Quantity	%
1	Dong Son	0	0	1	8.3	1	8.3
2	Hoa Binh	5	1.6	48	15.6	31	10.1
3	An Lu	2	5.5	6	16.7	1	2.8
4	Trung Ha	2	0.8	48	21.5	4	1.8
5	Thuy Trieu	2	0.9	45	20.8	10	4
6	Ngu Lao	7	2.3	52	17.3	26	8.6
7	Phuc Le	0	0	0	0.0	0	0.0
8	Pha Le	5	1.8	209	75.5	32	11.6
9	Lap Le	11	2.8	118	30.8	71	18.5
Total		**34**	**1.57**	**566**	**25.24**	**190**	**8.22**

2.2.4. The parties affected by the Project

Based on the survey conducted along the Project route and study of plan of the project route, parties affected by the Project are identified, recognized and shown in following table and figure.

Figure 2.9 Location map of impact sites

Table 2.20 Anticipated major site specific impacts

Site No.	Pre-construction phase & Construction phase	Operation phase
4	- Ruot Lon River water may be temporarily polluted during construction. - River transportation may be temporarily obstructed during construction. - About 1.2 ha of mangrove forest in the area under the planned bridge in the north will be lost to make land for the construction site.	- A part of mangrove forest ecosystem on the north side of Ruot Lon River may be seriously affected by the appearance of the approach road and traffic flow on the bridge/road.
5	- A part of aquaculture ponds will be lost to make land for the construction site.	- Aquaculture ponds around the planned road may be affected by air pollution, noise, polluted water, etc. from the traffic flow on the road.
6	- A number of high voltage electric poles shall be relocated.	- Aquaculture ponds around the planned road may be affected by air pollution, noise, polluted water, etc. from the traffic flow on the road.
7	- A section of Lap Le Dyke will be affected.	
8	- A section of the rural road (Lang Cap Road) will be affected.	
9	- A part of paddy field will be lost to make land for the road. - Irrigation network for the paddy field may be affected.	- Paddy field and irrigation network around the road may be affected by air pollution, polluted water, water flow obstruction, etc.
10	- A part of a cemetery (km 10+500) shall be lost to make land for the road. - A part of paddy field will be lost to make land for the road. - Irrigation network for the paddy field may be affected.	- Paddy field and irrigation network around the road may be affected by air pollution, polluted water, water flow obstruction, etc. - Irrigation network for the paddy field may be affected.
11	- Several sections of rural roads (i.e. Ngang Road, Oi Road, and Tran Hung Dao Road) will be affected. - A number of houses around the intersection between the planned road and Ngang Road (km 9+500) shall be relocated.	- The new road may cause split of communities and hinder accessibility of local residents. - House around the intersection may be affected by increased air pollution, noise, etc. from the new road. - Lap Le Commune Health Care Station (km 9+500) may be affected by increased air pollution, noise, etc. from the new road.
12	- Several sections of rural roads (i.e. Lach Se Con Road, Lach Se Road, and Duong Luc Road) will be affected. - Road construction will make local residents difficult to go from their house on the west side of the road to the paddy field on the east side of the road.	- The new road will hinder accessibility of local residents in going from their house on the west side of the road to the paddy field on the east side of the road. - Irrigation system for rice fields may be affected.
13	- A part of paddy field will be lost to make land for the road. - Irrigation network for the paddy field may be affected.	- The new road will cause split of paddy field and hindrance of accessibility of local residents.
14	- A section of the canal located in km 7+000 will be affected. - A section of a local road (km 6+680) shall be affected.	- The new road will cause split of paddy field and hindrance of accessibility of local residents.

Site No.	Pre-construction phase & Construction phase	Operation phase
15	- A part of paddy field will be lost to make land for the road. - A small road between My Dong Village (hamlet 9) and Khuong Lu Village (hamlet 8) (km8+700~9+500) will be lost.	- The new road will cause split of paddy field and hindrance of accessibility of local residents. - Irrigation network for the paddy fields may be affected.
16	- A number of houses shall be relocated. - 3 worship halls in My Dong village may be affected. - A section of Provincial Road No. 359 (km 5+400) will be affected.	- The new road will cause split of My Dong Village and Khuong Lu Village. - Residential area along the new road may be affected by increased air pollution, noise, etc.
17	- A part of paddy field will be lost. - Several local roads will be affected. - Several low voltage electric poles shall be relocated.	- The new road will cause split of paddy field and hindrance of accessibility of local residents. - Paddy field and irrigation network around the road may be affected by air pollution, polluted water, water flow obstruction, etc.
18	- A part of paddy field will be lost. - Several local roads will be affected. - Several high voltage electric poles shall be relocated.	- The new road will cause split of paddy field and hindrance of accessibility of local residents. - Paddy field and irrigation network around the road may be affected by air pollution, polluted water, water flow obstruction, etc.
19	- A part of paddy field will be lost. - Several local roads will be affected. - A canal (km 2+730) shall be affected.	- The new road will cause split of paddy field and hindrance of accessibility of local residents. - Paddy field and irrigation network around the road may be affected by air pollution, polluted water, water flow obstruction, etc.
20	- A part of paddy field will be lost. - Several local roads will be affected. - A section of Thanh Binh inter-village Road (local road, km 1+500) will be affected.	- The new road will cause split of paddy field and hindrance of accessibility of local residents. - Paddy field and irrigation network around the road may be affected by air pollution, polluted water, water flow obstruction, etc.
21	- A number of houses in the north of Ha Luan Village (km 1+200~km1+310) shall be relocated. - A part of paddy field will be lost.	- The new road will cause hindrance of accessibility of local residents. - Residential area may be affected by noise, air pollution, etc. from the new road.
22	- A section of Provincial Road No. 359C will be affected. - A number of houses (km 0+500) shall be relocated. - Several factories around the intersection of National Highway No.10 and the planned road (km 0+000) shall be relocated. - A canal (km 0+100 ~ km 0+300) shall be affected.	- Residential area around the intersection of National Highway No.10 and the new road may be affected by noise, air pollution, etc. from the new road.

Table 2.21. Potentially affected parties along the Project route

No	Affected parties/ station	Distance from ROW to the parties (m)	Note
1	Residential houses located along the both sides of road at the intersection No.1 (Km0+500)	10	
2	Residential area in Ha Luan village, Hoa Binh commune at section Km1+300 – Km1+500	10-20	Route goes through the village
3	Hoa Binh Secondary School and Hoa Binh High School	350	The schools are located on Thanh Binh street (inter-communal road)
4	Residential area of Ngu Lao commune at the interchange No.2 between Project route and Provincial Road 359	5	Route goes through the residential area
5	Residential area in Ngu Lao commune at the section Km5+420 – Km5+940	10 – 30	Route goes through the residential area
6	Residential area at the section Km8+700 – Km8+850	10 – 50	Route goes through the residential area
7	Residential area Km9+300 - Km9+500	10 – 50	Route goes through the residential area
8	Lap Le Commune Health Station - Km9+500	90	Right of the centerline
9	Lap Le Commune People's Committee - Km9+500	200	Left of the centerline

CHAPTER III. ASSESSMENT AND FORECAST OF ENVIRONMENTAL IMPACTS OF THE PROJECT

3.1 Assessment of environmental impacts in the preparation stage

3.1.1. Assessment of environmental impacts in the preparation stage

a. Sources of Impacts/Generation Activities

a1. Impacts on relocating entities

The project will occupy around 75,960 m^2 of residential land. 206 households will have houses acquired for the project.

a2. Impacts of permanent or temporary occupancy of agricultural land

- The Project will permanently occupy around 686,572 m^2 of agricultural land, of which 560,116 m^2 as rice growing land and 126,116 m^2 of aquaculture land; the project will also permanently occupy 17,000 m^2 of land for production and business purposes and 186,971 m^2 of public land. Total 1,548 households will be affected by acquisition of agricultural land, of which 100 households will lose residential and agricultural land.
- Construction site of each bridge at the intersection will temporarily occupy about 0.1ha of agricultural land, each construction site of the Ruot Lon Bridge will temporarily occupy 0.3ha agricultural land.

a3. Impacts to existing social infrastructure and service

- Relocation of power posts: 70 power posts;
- Ditch renovation along the road: 2,900m.

a4. Impacts of grave relocation

The project will relocate 212 graves within the project site clearance along the alignment of the Project.

b. Assessment

3.1.1.1. Impacts on permanent land acquisition

** Relocating and resettlement*

The households to be relocated will face issues due to involuntary resettlement and losses, including:

- Loss of houses and community relations: The households to be relocated have lived in the area for a long time. Once relocated, the neighborhood and family

relationships maintained for generations will be interrupted.

- Loss of production facilities: Besides the current area of agricultural land allocated according to the norms prescribed by the localities, the households to be relocated also lose a garden area adjacent to the residential land where they use to plant perennial and short-term crops to generate incomes. The households to be relocated are mainly agricultural households without additional jobs. When relocated, without farming land, their life will encounter many difficulties.
- Loss of community resources such as natural habitats and cultural features: the households to be relocated are living peacefully in the clean environment with good living conditions such as access roads, electricity, water, etc. Once relocated, they may lose their current living conditions.

The results of public consultation have shown that the households to be relocated all wish to have fair compensation and to be relocated near their current residential area. For the project, the households subject to land acquisition will be considered for inclusion in the newly constructed resettlement area under the arrangement of the site clearance management unit/City land bank development center.

** Loss of productive land*

Losing land fields, farmers will lose daily food supplies and income from sale of agricultural products in markets; losing land for aquaculture, farmers no longer have the main source of income together with the assets equipped for improving aquaculture ponds. Losing this main source of income, households in the area have to cope with problems such as food and monthly income to live on.

The damage caused by permanent appropriation of farmland can be determined by the method of quick assessment. Accordingly, the extent of damage is calculated by multiplying factors of land area being acquired, rice/fish productivity, duration of appropriation of land and declared unit price of agricultural products.

Table 3.1. Damage caused by permanent appropriation of farmland

Type of land	Area (ha)	Damage on rice yield (ton/year)	Economic damage (VND million/ year)
Land for rice fields	56	784	3,371 ~ 5,409
Land for aquaculture	12.65	50.6 ~ 86.02	1,113 ~ 1,892

	
Rice fields	Aquacultural farming ponds

Figure 3.1. Agricultural land acquisition

3.1.1.2. Impacts of temporary occupancy of land

The construction sites of the bridges at the 03 intersection and construction site of northern bank of Ruot Lon Bridge will be set up in the agriculture land. Construction site for the south bank of Ruot Lon Bridge will be on the Vu Yen Island on the area for aquaculture which is currently being under the site clearance process for the Project of constructing Amusement house and Entertainment Park on Vu Yen Island funded by Vingroup.

Households affected by temporary land occupation will be affected by loss of income and soil quality when the site is restored in the future. Therefore, it is required to discuss thoroughly with land owners in term of compensation to get agreement from these households.

3.1.1.3. Impact to the poor

According to the census survey, number of vulnerable households (female-headed households and social policy households) are listed as below (Table 3.2). These households will face difficulty to restore their living and livelihood after resettlement. Special assistants should be provided to them as described in RAP

Table 3.2 Number of Vulnerable Households in the affected ward/commune

No	Ward/Commune	Poor HHs		Female-headed HH		Social Policy HH	
		Qty	%	Qty	%	Qty	%
1	Dong Son	0	0	1	8.3	1	8.3
2	Hoa Binh	5	1.6	48	15.6	31	10.1
3	An Lu	2	5.5	6	16.7	1	2.8
4	Trung Ha	2	0.8	48	21.5	4	1.8
5	Thuy Trieu	2	0.9	45	20.8	10	4
6	Ngu Lao	7	2.3	52	17.3	26	8.6
7	Phuc Le	0	0	0	0.0	0	0.0
8	Pha Le	5	1.8	209	75.5	32	11.6
9	Lap Le	11	2.8	118	30.8	71	18.5
	Total	**34**		**527**		**176**	

Source: Result of census survey, JICA Study Team, August 2015

3.1.1.4. Spiritual impacts on families having graves on the land

Due to spiritual elements and practices, it is complicated and costly for Vietnamese families to move graves to other places, including costs of demolishing, digging, building new graves, and costs of worship on "good day". Without proper consideration or with inadequate compensation for the displacement of graves shall cause not only social effects but also conflicts between affected people and the construction team, even prolonging time of site clearance.

3.1.1.5. Impacts to local economy (such as employment and livelihood)

For constructing new road, which cuts through the NH10, PR359 and communal roads and runs through densely populated and business areas, some shops, business establishments located adjacent to the road at the intersections with the alignment of the Project will be relocated. Details of the affected shops/business establishments shall be described in separate reports (RAP).

Owners of shops, business establishments will have difficulty in restoring production and business.

On the other hand, some local people can have the opportunity to be employed by the Contractors of the Project.

3.1.1.6. Impact to land use and utilization of local resources

The plan for construction of the Ring road No.3 has been approved, with the route mainly running through agricultural land. According to the planning, land use objectives will not change.

3.1.1.7. Impacts to existing social infrastructure and service

(1). Relocation of power poles

70 power poles and many utility works on the roads at the intersections with the route of this project will be relocated. According to the construction sequence of the transport projects, new power poles will be constructed before power cut. After completing construction and commissioning, the project will ask local electricity authority to cut power and remove the old transmission line to move to new transmission line. Detailed steps are addressed in the design and cost for this implementation is taken from the project's budget. Therefore, the time when people having interrupted power supply is negligible. The impact caused by the relocation of power poles will not be considerable.

(2) Renovation of ditch

It is potential that ditch renovation will interrupt irrigation water sources, thereby affecting agricultural production. However, under regulations, transport construction projects are not allowed to interrupt irrigation water sources. Thus, the design for ditch renovation is itself an investment item under the Project. Whereby:

- Ditch renovation will be conducted in the dry season and completed by the rainy one to minimize impacts on cultivation seasons;
- Temporary ditches will be made before cofferdams are created at the construction site;
- Irrigation works will be constructed at the former flow positions. After completion, the water flow will be converted back to its original position. Temporary ditches will be filled back and the original surface is reverted.

The above-mentioned contents belong to the investment project and will be included in the contract signed with the construction contractor. The entire operation takes place within the project's site clearance scope with costs from the funding of the project, as specified in the total investments. Thus, the supply of irrigation water is virtually uninterrupted by ditch renovation. The damages caused by the interruption of irrigation water for agriculture is excluded.

3.1.1.8. Impact to eco-system (impact to mangrove forests)

There is an area of mangrove vegetation (mainly cork sour Sonneratia) in the south and north area of Ruot Lon bridge on the banks of Cam river. The construction of the bridge will affect around 1.02ha of this vegetation.

3.1.1.9. Misdistribution of benefit and damage

Some households will be relocated because the Project. The displaced families are subject to the severe impact on the lives and their livelihoods. However, these households may be affected to different extents.

On the other hand, in the operation stage, households not being relocated can benefit from the project, thanks to improvement for business environment and rising land prices ... after the Project is completed.

3.1.1.10. The existing assets of the society, social organizations at the local (community Split)

Construction of a route with roadbed from 45.5 to 68m and multiple lanes can obstruct movement and interaction of households living along the sides of the route, affecting daily life of people who have been close neighbors or relatives before the project. The route also affect agricultural production activities of local people.

3.1.1.11. Incidents caused by eplosives of UXO

During the Vietnam War, Hai Phong City was burdened with lethal weapons notably bombs and mines. Though the clearance of unexploded bombs/mines has been carried out since the date of National reunification, there are still the risks of bombs/mines remaining underground, so it is required to take care of safety for workers when constructing the route. Uncleaned bombs/explosive materials on construction site can harm the workers and residents in the area, not only during construction time but also after the project being completed and brought into operation.

One specialized contractor from military team of Ministry of National Defense will be appointed for the clearance of unexploded ordnance in the project area.

3.1.2. Impacts of site clearance and preparation of construction yards

a. Sources of Impacts/Generation Activities

a1. Dust

During the preparation stage of construction, the source of impact on air environment is dust, arising from:

- Demolition of houses in the residential areas on NH10 at the start point (Km0+000 – Km0+500), residential area in Ha Luan village, Hoa Binh commune (Km1+300 – Km1+500), residential area in Ngu Lao commune – the intersection between Ring Road 3 with PR359 (Km5+420 – Km5+940), residential area Km8+700 – Km8+850, Km9+300 - Km9+500;
- Activities of leveling the site to set up beam casting yard and other ancillary items on 3 bridges at the intersection and Ruot Lon Bridge.

a2. Solid waste

Solid waste arising during the project preparation stage includes

- Waste from demolishing houses
- Waste from cutting and clearing trees;
- Waste from preparing the construction site.

Details on the number, category and composition of solid waste are shown in Table 3.3.

Table 3.3. Waste generating during the construction prepartion phase

No.	Activity	Type	Quantity	Generating area	Period
1	Demolition of houses	Waste (concrete, brick, wood, etc.)	30,200 m^3	Residential areas located from Km0+000 – Km0+500, Km1+300 – Km1+500, Km5+420 – Km5+940, Km8+700 – Km8+850, Km9+300 - Km9+500	2 weeks
2	Tree cutting down and clearing	Wood, leaves	Not much	Along the route	1 week
3	Site and equipment installation	Waste (wood, paper, iron and steel, etc.)	Difficult to quantify	Construction sites	1-2 months

a3. Noise

The noise level in the preparatory phase is determined based on:

- Typical noise level of construction equipment (Table 3.4);
- The formula for calculating the total noise:

$$\mathbf{L_{\Sigma} = 10lg} \sum_{i}^{n} 10^{0,1.Li}$$

Trong đó in which:

- *L_{Σ} : total noise level;*
- *Li: source noise level No. i;*
- *n: total noise sources.*

Source: Pham Ngoc Dang 2003. The air environment. Scientific Publishing House 2003

Table 3.4. Typical noise levels (dBA) from construction equipment (dBA)

Site Clearance		Digging and Earth moving		Pneumatic tool	81-98
Bulldozer	80	Bulldozer	80	Crane	75-77
Front end loader	72-80	Backhoe	72-93	Welding machine	71-82
Dump struck	83-94	Dump truck	83-94	Concrete mixer	74-88
Grading and compacting		Jack hammer	80-93	Concrete pump	81-84
Grade	80-93	Landscaping and clean-up		Concrete vibrator	76
Roller	73-75	Bulldozer	80	Air compressor	74-87
Paving		Excavator	72-93	Pneumatic tool	81-98
Spreader	86-88	Truck	83-94	Bulldozer	80
Truck	83-94	Paver	86-88	Cement and dump trucks	83-94
Tamper	74-77	Structure Construction		Truck	83-94

Source: U.S. Environmental Protection Agency, Noise from Construction Equipment and Operation, Building Equipment and Home Appliances, NJID, 300.1, 31 December 1971

With the equipment used to operate the items, identified sources of noise levels from these activities:

- Demolition activities (trucks, bulldozers): 84.8 ~ 94.2dBA;
- Activities grader (graders, rollers): 80.8 ~ 93.1dBA.

This noise level does not arise continuously, only appears when the operation of construction equipment.

3.1.2.1. Air pollution (dust)

Demolition of residential houses & buildings

Normally, demolition of residential houses may generate dust around the area of demolition. Dust emission depends on several factors, including building materials, project size, and demolition method (manual or motorized).

Most of the residential houses along the route of the project are 4-grade houses or 2-3 storey houses. This is rural area so houses are distanced by surrounding gardens. Therefore, dust pollution is caused in the demolition process but in negligible volume.

Site and duty road leveling

Land leveling at construction sites will generate dust and causes poor air quality.

Through TEDI's experience in construction supervision of the Project in the Northern delta region near Haiphong city, it is found that the air environment being 25 ~ 35m far away from the site leveling area will be contaminated by dust at an insignificant level (lower than 2 times of the acceptable level under the National Standard QCVN 05: 2013/BTNMT). The pollution period will last about 1 to 2 months at the beam-casting site leveling areas and the duty roads along Ruot Lon bridge and 3 bridges at the intersection. Due to the great environmental load together with no surrounding residential areas, the dust pollution impacts are considered negligible.

3.1.2.2. Waste

Wastes will be generated from demolition works, cutting down of street trees, preparation of construction yards, etc.

Substances including conventional solid waste, scrap and garbage may not cause pollution, leading to the severe environmental degradation. But, if they are not collected promptly and appropriately, they may be scattered into the surrounding areas, polluting the environment, and facilitating the development of harmful organisms (rats, cockroaches, etc.).

3.1.2.3. Noise and vibration

Noise and vibration will be generated from demolition works, leveling construction yards, etc.

Table 3.5 presents the noise arising from the operation of buildings demolition of the project appeared in the residential area adjacent to the clearance area - the noise impact. Impact noise level is determined based on:

- Source noise level demolition operations (trucks, bulldozers) is 84.8 ~ 94.2dBA;
- The noise degradation in distance is calculated by the following formula:

$$\Delta L = 20 \lg \left(\frac{r_2}{r_1}\right)^{1+a} (dB) \quad \text{(for point source)}$$

In which:

ΔL: noise degradation in the distance of r_2 in comparison with noise source;

R1: distance of noise source (r_1=8m).

a: impact coefficient of surface topography on noise absorption and reaction. *(a=0.1 – land for planting grass)*

(Source: Pham Ngoc Dang 2003. Air Environment. Scientific Publishing house - KHKT 2003.)

Table 3.5. Exceeded noise levels caused by demolition of buildings

Location where demolition of buildings may occur	Distance (*) (m)	Allowable maximum noise levels stated in QCVN26:2012/BTNMT: 70 dBA in daytime (6:00~21:00) 55 dBA in night-time (21:00~6:00)			
		Daytime		Night-time	
		Min 6-21h	Max 6-21h	Min 21-6h	Max 21-6h
The residential area at intersection Km0+500	10	3.2	15.8	18.2	30.8
The residential area at Km1+300 – Km1+500	10	3.2	15.8	18.2	30.8
The residential area at intersection No.2	5	4.4	17.0	19.4	32.0

Location where demolition of buildings may occur	Distance (*) (m)	Allowable maximum noise levels stated in QCVN26:2012/BTNMT: 70 dBA in daytime (6:00~21:00) 55 dBA in night-time (21:00~6:00)			
		Daytime		Night-time	
		Min 6-21h	Max 6-21h	Min 21-6h	Max 21-6h
The residential area at Km5+420 – Km5+940	10	3.2	15.8	18.2	30.8
The residential area at Km8+700 – Km8+850	10	3.2	15.8	18.2	30.8
The residential area at Km9+300 - Km9+500	10	3.2	15.8	18.2	30.8

(*) QCVN 26:2010/BTNMT

Assessment

Result of forecast shows that residents living near the sites of demolition of buildings may be affected by noise levels exceeding the allowable limit from 3.2dBA to 18.1 dBA in daytime, and particularly from 18.2dBA to 33.1dBA in night-time. Residents living in the blocks nearby the demolition sites may be severely affected by excessive noise. However, this impact is limited only during the time of demolition activities, and residents living behind the blocks nearby the demolition sites may not be severely affected by excessive noise since noise will be almost mitigated by the blocks located in front of the demolition sites.

3.1.2.4. Impacts to landscape

Wastes generated in the demolition of structures and houses along the route of the project in the preparation phase will not cause serious impact to the surrounding environment. However, if the wastes are not collected promptly and appropriately treated, these wastes can emit into the environment, polluting the environment and landscape and creating favorable conditions for development of harmful pests (rats, cockroaches ...).

3.1.2.5. Traffic accident, obstruct the movement of the local population

Operation of vehicles, machinery, etc., participated in demolition works and the preparation of construction sites will be able to cause more traffic jams, accidents, etc. on local roads, and obstruct the movement of the local population.

The impacts of the construction preparation phase are summarized in the following table:

Table 3.5. Summary of the impacts of the construction preparation phase

No.	Impacts	Location	Time	Degree of impact
I	***Impacts of land acquisition, relocation and resettlement***			
1	Disturbing life by occupancy of residential land	Residential area along the ring road No. 3	Long time	High
	Loss of income due to permanent appropriation of agricultural land	Along the route ounder the project, belonging to communes of Kenh Giang, Dông Son, Hoa Binh, An Lu, Trung Ha, Thuy Trieu, Ngu Lao, Phuc Le, Pha Le, Lap Le, Thuy Nguyen district	Long time	Medium
2	Loss of income due to temporary occupancy of agricultural land	Construction sites	Short time	Medium
3	Impact on poor HHs, vulnerable HHs due to acquisition of land and houses .	Communes of Dông Son, Hoa Binh, An Lu, Trung Ha, Thuy Trieu, Ngu Lao, Phuc Le, Pha Le, Lap Le, Thuy Nguyen district	Long time	Medium
4	Spiritual impacts on families having graves on the land	Along the route	Long time	Medium
5	Impact on local economic condition (employment, livelihood) due to land appropriation for the project implementation.	Along the route	Long time	Medium
6	Impact to land use, and local resources due to land appropriation for the project implementation.	Communes of Kenh Giang, Dong Son, Hoa Binh, An Lu, Trung Ha, Thuy Trieu, Ngu Lao, Phuc Le, Pha Le, Lap Le, Thuy Nguyen district	-	Medium
7	Impact to existing social infrastructure and service due to acquisition of existing infrastructure (Electric line, water drainage system, supply system…)	Along the route	Short time	Medium
8	Impact to eco-system (due to	Two banks of Ruot	Long	Medium

No.	Impacts	Location	Time	Degree of impact
	acquisition of land for mangrove forest)	Lon river and Ruot Lon bridge	time	
9	Misdistribution of benefit and damage	Residential areas at: Km0+000– Km0+500, Km1+300–Km1+500 Km5+420–Km5+940, Km8+700–Km8+850, Km9+300 - Km9+500	Long time	Medium
10	Community split	Ditto	Long time	Medium
11	Risk of explosion due to bombs/mines when acquiring land and water area for the implementation of the project.	The whole project	Short time	Medium
II	***Impacts of site clearance and preparation of construction yards***			
1	Air pollution due to dust from demolition activity and leveling work for preparation of the beam casting area in construction site	Residential areas at: Km0+000– Km0+500, Km1+300–Km1+500 Km5+420–Km5+940, Km8+700–Km8+850, Km9+300 - Km9+500	Short time	Low ~ Medium
2	Waste generated from demolition of houses and buildings and site clearance.	Along the route and construction sites	Short time	Low ~ Medium
3	Noise and vibration generated from demolition of houses and buildings, ground leveling.	Residential areas at: Km0+000– Km0+500, Km1+300–Km1+500 Km5+420–Km5+940, Km8+700–Km8+850, Km9+300 - Km9+500	Short time	Medium
4	Degradation of landscape due to waste and site clearance	Ditto	Short time ~ Long time	Medium
5	Traffic jam, accidents and obstruction to movement of local people.	NH10, PR359 and local roads connecting with the route of the project	Short time	Medium

3.2. Assessment of impacts from sources in construction phase

3.2.1. Impacts of exploitation and transportation of construction materials

The Project plans to procure construction materials from the borrow pits, quarries, and sand stockpiles which are under operation and have license for operation and usually provides construction materials for the large-scaled infrastructure development projects in Hai Phong City.

Transportation of construction materials would generate air pollutants (dust, exhaust gas), noise, etc., at the exploitation sites and on the transportation waterways/roads. Traffic jam and accidents may be increased on the roads to be used for transporting construction materials.

Assessment

Construction materials from the borrow pits, quarries, and sand stockpiles will be purchased from facilities which have the license of exploitation/operation, and usually provide construction materials for the large-scaled infrastructure development projects in Hai Phong City.

According to Decree No.18/2015/ND-CP (Annex II), the mining land (with a volume of over 100,000 m3 of soil exploitation in a year), or quarry, sand mine (with volume of over 50,000m3 of stone/sand exploited in a year) will have to be approved in term of environmental impact assessment as a prerequisite to obtain a license for exploitation operation. Thus, in the next phase of the project, in the process of selecting suppliers of construction materials, it is required to check if the vendor has a mining operation license or not

For the Project, thanks to Hoang Dieu port in the south, it will be very convenient for transportation of construction materials by river. The transportation by river will minimize impacts of pollution such as dust, noise and traffic accidents as well.

The borrow pits, quarries, and sand stockpiles expected to be suppliers for this project are the major sources that usually provide construction materials for the large-scaled infrastructure development projects in Hai Phong City. Names and locations of these mines, pits, quarries, sand stockpiles are presented in Table 3.6 and Figure 3.2.

Table 3.6. List of major borrow pits, quarries, sand stockpiles expected to supply construction materials for the project

No.	Name	Location	Quantity (million m^3)	Materials transport road	Distance
I	**Borrow pit**				
1	Dong Than 1	Minh Duc town, Thuy Nguyen District, Hai Phong city	0.1	Tan Duc road, NH No.10, PR No.359, Road No.9C, VSIP road, Bach Dang road	7km
2	Dong Than 1	Minh Duc town, Thuy Nguyen District, Hai Phong city	0.5	Tan Duc road, NH No.10, PR359, Road No.9C, VSIP road	
II	Quarry				
1	Ha Son	Minh Duc town, Thuy Nguyen District, Hai Phong city	0.8	Tan Duc road, NH10, PR359, Road No.9C, VSIP road	6km
2	Phuong Mai	Phuong Nam commune, Uong Bi town, Quang Ninh province (near Da Bac bridge)	1.0	• Waterway: Bach Dang river, Cam river • Road: NH10	River: 10km
III	**Sand Stockpile**				
1	Quan Toan	On the Cam river, at Quan Toan area, Hai Phong city	Big quantity	Waterway: Cam river	- Ruot Lon bridge: 14km

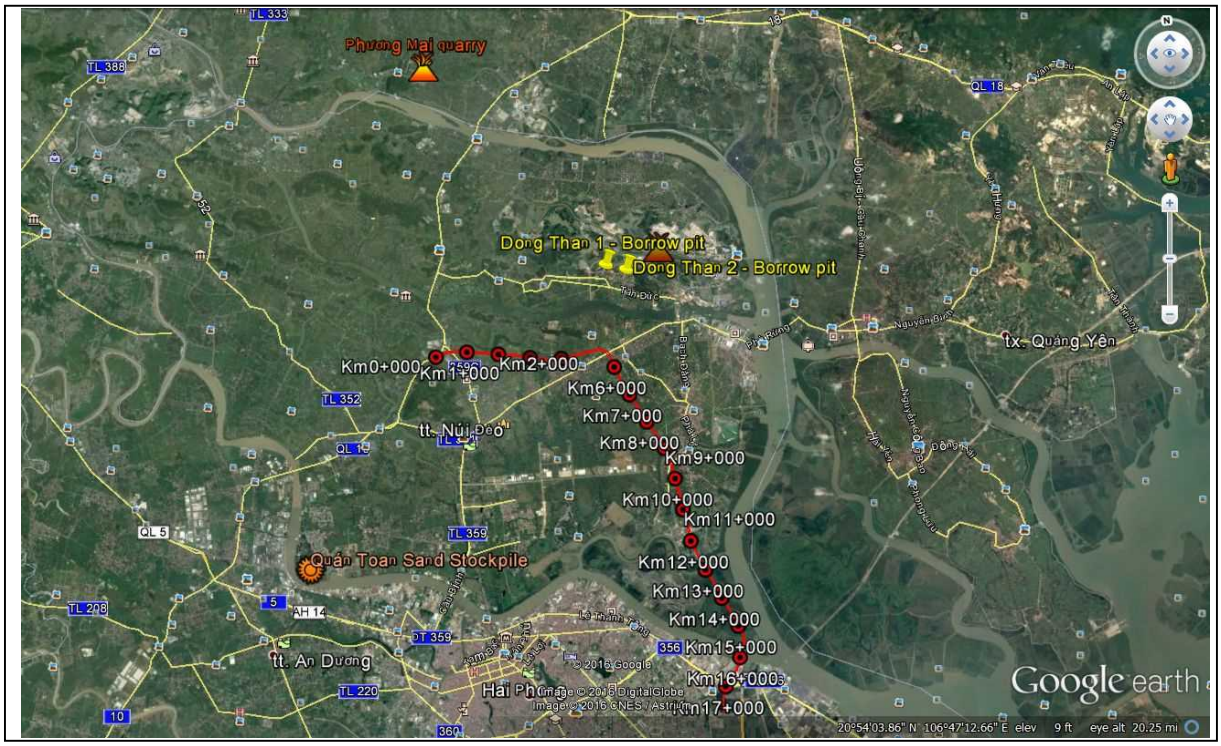


Figure 3.2. Location of expected material pits for the project

3.2.2. Environmental impacts from waste-related sources

3.2.2.1. Dust and emissions

a. Sources of dust and emissions

Activities generating dust and emissions include the followings:

- Excavation and embankment activities of foundation pit, abutments and bridge piers generating dust;
- Excavation and embankment activities of pavement, intersection;
- Related activities:
  - ✓ Operation of construction equipment generates dust and poisonous substance (NO_2, SO_2, CO and HC);
  - ✓ Transportation of redundant soil and stone by road generates dust and emissions (NO_2, SO_2, CO and HC);
  - ✓ Operation of concrete batching plant within the construction site generates dust.

b. Impact from dust and emissions

b1. Air pollution from dust generated from excavation and embankment activities:

Earthwork: The amount of dust generated from earthwork activities depends on components of excavated soil, humidity and weather condition. Prediction of the dust amount generated from earthwork activities bases on:

– Total amount of excavated and embanked soil (Table 3.7).

Table 3.7. Total volume of excavated and embanked soil

No.	Items	Volume (m^3)		
		Excavated Soil	Embanked Soil, sand	Total
-	Intersection bridge No.1	10,856	3,148	14,004
-	Intersection bridge No.2	8,685	2,519	11,203
-	Intersection bridge No.3	9,770	2,833	12,604
-	Ruot Lon Bridge	13,027	3,900	16,927
-	Road	8,055	975,062	983,117
	Intersection bridge No.1	**50,393**	**987,462**	**1,037,855**

– Dust generation coefficient during construction process of the World Health Organization (WHO) (Table 3.8).

Table 3.8. Dust Emission Coefficient from Construction Activities

No	Pollution Source	Dust Emission Coefficient
1	Dust from process of digging, road–bed embankment whirled by wind (sandy dust).	$1 \div 100 g/m^3$
2	Dust from process of loading, unloading building material (soil, stone, sand …).	$0.1 \div 1 g/m^3$
3	Vehicles transporting sand, soil scattered on road producing dust	$0.1 \div 1 g/m^3$

Source: Quick Assessment Document of WHO

Calculation results are presented in Table 3.9.

Table 3.9. Emission flow of dust from excavation and embankment activities

No.	Items	Amount of arising Dust (kg)		Scope (1)	Construction Period(2)	Amount of Dust (mg/ms)	
		Min	Max	m	month	Min	Max
-	Intersection bridge No.1	17	1,428	359	28	0.002	0.206
-	Intersection bridge No.2	13	1,143	279	28	0.002	0.212
-	Intersection bridge No.3	15	1,286	319	28	0.002	0.208
-	Ruot Lon Bridge	20	1,727	579	28	0.002	0.154
-	Road	17	1,475	200	2	0.061	5.335

Note: (1) The scope of construction including a 10m from abutments

(2) Digging and filling time is estimated as 2/3 of total construction time

b2. Air pollution from dust generated from construction activities

b.2.1. Construction across the route

Construction activities across the route regard to the operation of construction vehicles, equipment in site clearance area. Predict of total load and volume of dust and gases generated from the fuel combustion of construction equipment (across the route) based on:

– Oil consumption amount of the construction machinery (Table 3.10);

Table 3.10. Consumed Oil in Construction (Horizontal and Vertical Construction)

No.	Items	Forecast of Consumed Oil (ton diesel)		
		Horizontal Construction	Vertical Construction	Total
-	Intersection bridge No.1	82.2	15	**97.2**
-	Intersection bridge No.2	61.6	8.6	**70.2**
-	Intersection bridge No.3	71.7	11.6	**83.3**
-	Ruot Lon Bridge	442	7.2	**449.2**
-	Road	5,128.7	4,563	**9,691.7**

(*) The oil amount is determined bases on:

- *Circular No. 06/2005 dated 15/4/2005 guiding the method of elaborating construction machine and equipment shift prices.*
- *Norm of work construction cost estimate 2012 (construction sector), issued in conjunction with Decision No. 1091/ QD-BXD dated 26/12/2011 of Ministry of Construction.*

– Emission coefficients of the World Health Organization: 1 trucks of 3.5 to 16 tons will release into the atmosphere about 4.3kg of TSP; 20S kg of SO_2 (S is sulfur amount in diesel, according to QCVN 01: 2007/BKHCN S = 0.05%); 55kg of NO_2; 28kg of CO and 12kg of HC when consuming 1 ton of diesel.

– The construction scope and period of each work item (Table 3.11).

Table 3.11. Total Emission Flow of Dust and gas emission from the operation of construction machinery and equipment

No.	Items	Amount of Fuel (Ton diesel)	Scope *(m)*	Construction Period (*) *(months)*	Emission flow (mg/ms)				
					TSP	SO_2	NO_2	CO	HC
-	Intersection bridge No.1	82.2	359	28	0.051	0.001	0.065	0.331	0.142
-	Intersection bridge No.2	61.6	279	28	0.049	0.001	0.063	0.319	0.137
-	Intersection bridge No.3	71.7	319	28	0.05	0.001	0.064	0.325	0.139
-	Ruot Lon Bridge	442	579	28	0.17	0.001	0.217	1.104	0.473
-	Road	75.4	200	2	1.173	0.003	1.500	7.636	3.273

(*) Dust generated from construction across the route in earth-working time

Total dust load amount generated from earthwork and construction activities across the route: As many items will be constructed at the same time in the same area, the total load amount of dust and poisonous gas generated within each item of the Project shall be the total amount of dust and poisonous gas generated from each activity (table 3.12).

Table 3.12. Total Volume of Dust and Toxic Gases generated from the Construction

No.	Items	Emission flow (mg/ms)				
		TSP (*)	SO_2	NO_2	CO	HC
-	Intersection bridge No.1	0.257	0.001	0.065	0.331	0.142
-	Intersection bridge No.2	0.261	0.001	0.063	0.319	0.137
-	Intersection bridge No.3	0.258	0.001	0.064	0.325	0.139
-	Ruot Lon Bridge	0.324	0.001	0.217	1.104	0.473
-	Road	6.508	0.003	1.500	7.636	3.273

(*) Total dust emission is determined according to the maximum value of dust amount generated from earthwork activities (corresponding to the maximum emission coefficients of the World Health Organization) and dust amount generated from construction activities.

Basing on total amount of dust and gas emission generated from construction of each items, it is able to determine average amount at any point by using Sutton model.

Sutton diffusion model:

$$C = \frac{0.8E.\left\{\exp\left[\frac{-(z+h)^2}{2\sigma_z^2}\right] + \exp\left[\frac{-(z-h)^2}{2\sigma_z^2}\right]\right\}}{\sigma_z.u} \quad (mg/m^3)$$

In which:

- *C: concentration of pollutant in the air (mg/m^3).*
- *E: pollutant emission from waste source (mg/ms),*
- *In the case of the Project, prevailing wind direction in the dry season and the rainy season is the South East is the Northeast; angle between wind direction of 2 seasons and the route of the Project is 90^o (calculated for the case where pollutant content is the highest).*
- *z: the height of the calculation point (m); z = 1.5m.*
- *h: the height of road surface compared with the height of surrounding ground (m); h=2m.*
- *u: the average wind velocity in Project's area (m/s); wind velocity in dry and rainy season is $u_{average}$ =2.9m/s and 3.1m/s.*
- *σ_z: diffusion coefficient vertical direction z (m).*

Diffusion coefficient of σ_z in vertical direction z with the atmospheric stability in Project area is B determined by the following formula:

$$\sigma_z = 0.53.\ x^{0.73} \quad (m)$$

In which: x: distance from calculation point to the waste source, under wind direction, m.

The quantitative results of the concentrations of dust and poisonous gases generated from construction activities (excavation, embankment, Horizontal construction) and the spreading scope of these substances are presented in table 3.13.

Table 3.13. Forecast on dust and toxic gas dispersion from construction process (excavation, embankment and horizontal construction)

Unit: mg/m³

Items	Parama -ters	Season	Distribution of concentration with distance (*)					QCVN 05:2013 & 06:2009/BTNMT
			5m	10m	25m	50m	100m	
Intersection bridge No.1	TSP	Rainy	0.027	0.023	0.019	0.012	0.008	**0.2**
		Dry	0.029	0.025	0.020	0.013	0.008	
	SO_2	Rainy	<0.001	<0.001	<0.001	<0.001	<0.001	**0.125**
		Dry	<0.001	<0.001	<0.001	<0.001	<0.001	
	NO_2	Rainy	0.007	0.006	0.005	0.003	0.002	**0.1**
		Dry	0.007	0.006	0.005	0.003	0.002	
	CO	Rainy	0.035	0.030	0.024	0.015	0.010	**5**
		Dry	0.037	0.032	0.026	0.016	0.011	
	HC	Rainy	0.015	0.013	0.010	0.007	0.004	**1.5**
		Dry	0.016	0.014	0.011	0.007	0.005	
Intersection bridge No.2	TSP	Rainy	0.027	0.024	0.019	0.012	0.008	**0.2**
		Dry	0.029	0.025	0.020	0.013	0.009	
	SO_2	Rainy	<0.001	<0.001	<0.001	<0.001	<0.001	**0.125**
		Dry	<0.001	<0.001	<0.001	<0.001	<0.001	
	NO_2	Rainy	0.007	0.006	0.005	0.003	0.002	**0.1**
		Dry	0.007	0.006	0.005	0.003	0.002	
	CO	Rainy	0.033	0.029	0.023	0.015	0.010	**5**
		Dry	0.036	0.031	0.025	0.016	0.010	
	HC	Rainy	0.014	0.012	0.010	0.006	0.004	**1.5**
		Dry	0.015	0.013	0.011	0.007	0.005	
Intersection bridge No.3	TSP	Rainy	0.027	0.023	0.019	0.012	0.008	**0.2**
		Dry	0.029	0.025	0.020	0.013	0.008	
	SO_2	Rainy	<0.001	<0.001	<0.001	<0.001	<0.001	**0.125**
		Dry	<0.001	<0.001	<0.001	<0.001	<0.001	
	NO_2	Rainy	0.007	0.006	0.005	0.003	0.002	**0.1**
		Dry	0.007	0.006	0.005	0.003	0.002	
	CO	Rainy	0.034	0.030	0.024	0.015	0.010	**5**
		Dry	0.036	0.032	0.025	0.016	0.011	
	HC	Rainy	0.015	0.013	0.010	0.006	0.004	**1.5**
		Dry	0.016	0.014	0.011	0.007	0.005	
Ruot Lon bridge	TSP	Rainy	0.033	0.029	0.023	0.015	0.010	**0.2**
		Dry	0.035	0.031	0.025	0.016	0.011	
	SO_2	Rainy	<0.001	<0.001	<0.001	<0.001	<0.001	**0.125**
		Dry	<0.001	<0.001	<0.001	<0.001	<0.001	
	NO_2	Rainy	0.022	0.019	0.015	0.010	0.007	**0.1**
		Dry	0.024	0.021	0.016	0.011	0.007	
	CO	Rainy	0.112	0.098	0.078	0.051	0.034	**5**
		Dry	0.120	0.105	0.084	0.054	0.036	
	HC	Rainy	0.048	0.042	0.034	0.022	0.014	**1.5**
		Dry	0.051	0.045	0.036	0.023	0.015	

Items	Parama -ters	Season	Distribution of concentration with distance (*)					QCVN 05:2013 & 06:2009/BTNMT
			5m	10m	25m	50m	100m	
Road and intersection	TSP	Rainy	0.499	0.448	0.374	0.257	0.176	**0.2**
		Dry	0.534	0.479	0.400	0.275	0.188	
	SO_2	Rainy	<0.001	<0.001	<0.001	<0.001	<0.001	**0.125**
		Dry	<0.001	<0.001	<0.001	<0.001	<0.001	
	NO_2	Rainy	0.124	0.111	0.093	0.064	0.044	**0.1**
		Dry	0.132	0.119	0.099	0.068	0.047	
	CO	Rainy	0.629	0.564	0.471	0.324	0.222	**5**
		Dry	0.672	0.603	0.504	0.346	0.237	
	HC	Rainy	0.270	0.242	0.202	0.139	0.095	**1.5**
		Dry	0.288	0.259	0.216	0.148	0.102	

From forecast results for dust concentration and gas emissions generated from the excavation, embankment, cross construction and spread scope of these substances, it is easy to see that:

– *For the bridge at the intersections, Ruot Lon bridge:* When constructing the excavation and embankment foundation of the abutment, concentration of TSP and gas emissions is smaller than the allowable limit.

✓ *For the road and the intersection:* When constructing the approach road, concentration of TSP 5m far from the edge of the construction site is 2.5-2.7 times higher than the allowable limit, and only satisfy the allowable limit when being 28-33m far from the edge of construction. Concentration of other gas emissions is lower than the allowable limit.

Dust pollution affects not only human health (diseases related to eyes, respiratory system), but also socio-economic activities. With impacts beyond the cosntruction period, the above diseases are suffered by residents in residential areas along the construction site.

b.3. Dust pollution generated from the transportation of redundant soil and stone

Vertical Construction: Load amount of dust and emissions generated from the transportation of redundant soil and stone is calculated similar to the case of construction across the route (Table 3.14). Average transport distance is 10 km. Sutton diffusion model is used to predict the emission scope of dust and exhaust gases.

Table 3.14. Emission flow of dust and Toxic Gases from transport engine (Vertical construction)

Fuel demand	Transportation distance	Construction period (*)	Emission flow (mg/ms)				
(ton diesel)	*(km)*	*(month)*	**TSP**	**SO_2**	**NO_2**	**CO**	**HC**
4,605	10	28	0.027	<0.001	0.349	0.178	0.076

(*) Transport activities happens mainly in earthwork period.

Dust from road:

Dust load amount swept up by tires from the road is determined based on dust emission coefficient of the World Health Organization (Table 3.15) for the case of transporting via soil aggregate roads.

Table 3.15. Emission Coefficient of Dust Whirled from Road Surface

No	Type of road	Unit (U)	TSP (kg/U)
I	***Unpaved road***		
1	Gravel road	1,000 km	3,7f
2	Dirt road	1,000 km	21f
3	Crushed limestone road	1,000 km	7,1f
II	***Paved road***		
1	Local streets (width <10m, <500 vehicles/day)	1,000km	15
2	Collector streets (width >10m, 500 ~ 10.000 vehicles/day)	1,000km	10
3	Highways (>10.000 vehicles/day)	1,000km	4,4
4	Expressway (>50.000 vehicles/day)	1,000km	0,35

Note: WHO. 1993. Assessment of source of air, water and land pollution. A guide to rapid source inventory techniques and their use in formulating environmental control strategies. Part one: Rapid inventory techniques in environmental pollution.

Coefficient f can be determined by formula $f = S.(W^{0.7})(w^{0.5})$*, in which:*

- *S: the average vehicle speed in km/h (10 km/h);*
- *W: the average vehicle weight in ton (10 tons);*
- *w: average number of wheels per vehicle (6 wheel)*

Results are presented in Table 3.16.

Table 3.16. Emission Flow of Dust Whirled from Road Surface

Emission Coefficient (kg/1.000km.xe)	Transportation Number	Transportation period (month)	Emission Flow from road surface (mg/ms)
2,578	62,240	28	7,653

Emission flow of dust and Toxic Gases generated from transportation activities

As dust and toxic gases generated at the same time and area, total load amount of dust

and emission when operating vehicle on road is the total load amount of dust and poisonous gas generated from engine and dust swept from road (Table 3.17).

Table 3.17. Emission flow of dust and Toxic Gases generated from transportation activities

Items	Emission flow (mg/ms)				
	TSP	SO_2	NO_2	CO	HC
Transportation	7.68	<0.001	0.349	0.178	0.076

Sutton diffusion model is used to predict the diffusion range of emission from material transportation activities, which is similar to the predict of excavation and embankment activities and horizontal construction..

Table 3.18. Predict of the diffusion range of Dust and Toxic Gases from transportation activity

Items	Parama -ters	Season	Distribution of concentration with distance (*)					QCVN 05:2013 & 06:2009/BTNMT
			5m	10m	25m	50m	100m	
Transportation	TSP	Rainy	1.042	0.700	0.375	0.229	0.139	**0.2**
		Dry	0.975	0.655	0.351	0.214	0.130	
	SO_2	Rainy	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	**0.125**
		Dry	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	
	NO_2	Rainy	0.009	0.006	0.003	0.002	0.001	**0.1**
		Dry	0.009	0.006	0.003	0.002	0.001	
	CO	Rainy	0.024	0.016	0.009	0.005	0.003	**5**
		Dry	0.023	0.015	0.008	0.005	0.003	
	HC	Rainy	0.010	0.007	0.004	0.002	0.001	**1.5**
		Dry	0.010	0.006	0.003	0.002	0.001	

(*) Distance from the centerline of the transportation road, taking into account the direction of wind in perpendicular with the direction of transportation

Forecast results show that: at the distance of 5km from centerline of the transportation road, dust and gas emission concentration generated from the transportation is 4.9 times higher than allowable limit (in dry season) and up to 5.2 times higher than allowable limit (in rainy season); it only reaches the allowable limit when the distance from centerline of transportation road is over 55m (in dry season) to 60m (in rainy season).

However, when the redundant soil and stone are transported by roadway to Minh Duc dam area and transported by waterway via Bach Dang River to the dumping area, on a transportation length of 28km, it will cause insignificant impact on the water quality during the transportation process (see Figure 3.3).

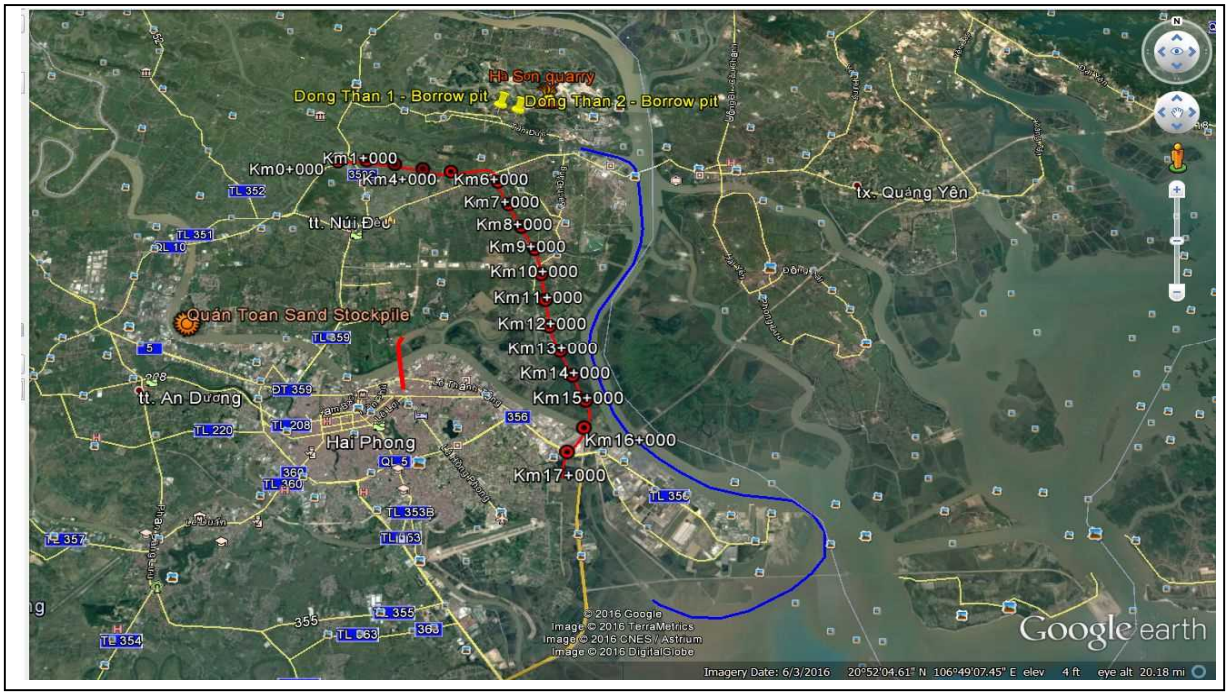


Figure 3.3. Expected waterway for transportation of redundant soil/stone and waste

b3. Dust generated from the concrete mixing plants

A considerable amount of dust would be generated from the operation of concrete mixing plants. If without proper management, this dust will cause degradation of ambient air quality of the surroudings.

b4. Dust pollution impacts on public health

Dust pollution affects not only human health (diseases related to eyes, respiratory system), but also socio-economic activities. With impacts beyond the cosntruction period, the above diseases are suffered by residents living in the residential areas along Km0 + 000 - Km0+ 500, Km1+300 – Km1+500, Km5 + 420 - Km5 + 940, Km8 + 700 - Km8 + 850, Km9 + 300 - Km9 + 500, and residents along the transport routes: national road No. 10, provincial road No. 359 and roads in the project area.

However, it is difficult to assess this impact, because it is varied depending on construction method, construction equipment, contractors' management capability, etc. Measures to mitigate this impact should be included in the environmental management plan (EMP) and environmental monitoring plan (EMoP). And contractors should be obligatory to carry out works in accordance with these EMP and EMoP.

3.2.2.2. Waste

1. Construction solid waste

a. Activities generating construction solid waste

Construction solid waste generated in the construction period includes:

- Rocks and soils from pavement excavation and bridges' lower part construction;

- Construction scrap and solid waste from construction activities.

Detailed information on categories and components of solid waste are shown in Table 3.19.

Table 3.19. Solid waste/scrap generated during construction period

No.	Activity	Solid waste generated	
		Composition	Location
1	Construction of bridge and approach road, intersection	Spoiled rocks and soils, paper, milled wood, concrete, bricks, steel, waste, etc.	Along the route of the project

b. Construction solid waste impact

– *Spoiled rock and soils:* Spoiled rocks and soils are generated from earthworks activities such as excavation is shown in the Table 3.7.

– *Construction solid waste:* This type of waste arises in each item of the project, including construction of road parts, intersections, bridge lower and upper parts and finishing, etc. The compositions of such waste vary from grinding sludge, milled wood, slag, mortar residues and surplus concrete, etc. It is almost impossible to forecast the amount of waste by each construction item due to different factors.

These wastes may not cause severe impact to environment, but if they are not promptly collected and appropriately removed, they can be scattered into the surrounding environment, and cause degradation of environment. Additionally, construction solid waste may cause some environmental problems such as:

– Dust dispersion during storage and transportation;

– Impacts to residents and transport in case of erosion and spillage at storage locations near residential areas and existing roads;

– Water pollution caused by TSS in case of disposal or spillage into the water

Solid wastes generated from the bridge upper part construction:

For Ruot Lon Bridge, the construction of bridge upper part may cause dropping solid wastes such as concrete, cement mortar, etc.

Once penetrating into the water of Cam River, floating objects like plastic bags, equipment wrapping paper and domestic waste will damage landscape beauty. Other solid objects accumulate on the surface of sediments, facilitating the growth of harmful organisms, degrading the ecological quality of water and sediments of Ruot Lon River.

It is very difficult to predict the amount of solid wastes dropping/scattering during the construction phase of bridge upper part. However, measures to prevent its impacts should be examined and implemented in the next stages of the Project.

Risk of water and sediment pollution caused by solid wastes not being collected after construction

For Ruot Lon Bridge, solid wastes include iron and steel of the abutment/pier surrounding cofferdams and materials of inshore temporary works during the bridge lower part construction. These materials not only cause permanent pollution to river sediments but also hinder waterway transport on Ruot Lon River at the bridge construction location. These risks will only disappear when the solid wastes are collected completely after completion of the bridge.

2. Domestic solid waste

a. Domestic solid waste generation activities

Domestic solid waste generated in the worker camps includes:

- Garbage disposed by workers;
- Waste from canteen of worker camps

Detailed information on categories and components of domestic solid waste are shown in Table 3.20.

Table 3.20. Domestic Solid waste

No.	Activity	Solid waste generated	
		Composition	Location
1	Workers' living activities	Bottles, cans, leftover food and organic matters, redundant paper, ink…	Worker camps and Construction offices

Construction site will be arranged near the expected location for construction of Ruot Lon Bridge and intersection bridges. About 100 workers may be required for each construction site for Ruot Lon bridge item and about 50 workers will be required for each intersection bridge.

On average, each day, 0.5 kg of solid waste is generated by each person so total domestic solid waste at each construction site generated by construction workers at the construction site of the intersection bridge is 25kg and construction site for Ruot Lon

Bridge is 50kg. This kind of waste consists of decomposable organic waste (leftover food) and other non-decomposable solid wastes such as cans, plastic bags, paper, etc. In addition, there can be solid waste like plastic, ink cartridge…from construction offices. They are generated daily during the construction period.

b. Domestic solid waste impact

If this waste is not collected quickly and appropriately, it will cause garbage pollution such as stench rising from decomposable organic waste, badly affecting aesthetics and facilitating the development of harmful species (rats, cockroaches, etc.). Additionally, waste from worker camps near Ruot Lon River can drop down or run-off with rainwater toward the river, causing water pollution.

3. Waste oil and oil-containing waste

a. Waste oil and oil-containing waste generation activities

Wastes from construction sites generally consist of engine oils, oily rags, chemicals, metal scrap, metal dust, lubricants, lubricant oils, solvents, paints, tires, wood, soil, etc. Notably, most of these wastes are classified as hazardous waste.

Waste oil and oil-containing waste are generated at the site from 3 source:

– *Waste oil from periodic oil changes*: Waste oil is estimated for amount of waste oil per vehicle (7 liters/one time of change) and cycle of change (117 work-shift of vehicles/one time of change). According to the results, with 271,248 work-shift of vehicles for construction of the project shall correspond with 16,225 liters of waste oil. This amount of waste oil will be contained in machine warehouses at the construction site.

– *Vehicle and machine maintenance water*: Vehicle and machine maintenance activity taking place in machine warehouses at the construction site will generate oil and TSS containing wastewater (Table 3.21).

Table 3.21. Wastewater and pollution level from machine maintenance activities

Type of Waste Water	Flow (m^3/ day)	Concentration of the Pollutants		
		COD (mg/l)	Oil (mg/l)	SS (mg/l)
From equipment maintenance	2	20 ÷ 30	–	50 ÷ 80
From equipment cleaning	5	50 ÷ 80	1.0 ÷ 2.0	150 ÷ 200
From equipment cooling	4	10 ÷ 20	0.5 ÷ 1.0	10 ÷ 50
Total	**11**	**30 ÷ 49**	**0.6 ÷ 1.3**	**81 ÷ 124**
QCVN 40:2011/BTNMT, column A		***C=50***	***C=5***	***C=50***
QCVN 40:2011/BTNMT, column B		***C=100***	***C=10***	***C=100***

Notes: Column A shows value C of pollutant parameter in industrial wastewater discharged into water

sources that are used for domestic water supply purpose; Column B shows value C of pollutant parameter in industrial wastewater discharged into water sources that are not used for domestic water supply purpose.

- *Oil-containing solid waste generated from operations of vehicles and machines and maintenance activities*: Oil-containing solid waste generated from oil changes of vehicles and machines and maintenance of equipment includes oil-containing cloths, machine covers, etc. However, this amount of waste is insignificant that can be collected. It is also hard to quantify this waste as their appearance depends on the amount of machines and equipment to be used, and the intention of the contractor whether to carry out maintenance or not, etc. This waste is generated daily at construction site.

b. Impacts of waste oil and oil-containing waste

- Waste oil can penetrate into environment through form of spill or washout by rain. Oil spill or washout depends on waste storage location and project management capability. Upon occurrence of spill or washout, before spreading on the ground, an amount of oil will be penetrated into the topsoil at the construction area causing soil pollution. Additionally, the construction sites are often located at bridge head, close to the surface water, waste oil and oil-containing waste from the site will penetrate into surface water of Ruot Lon River, causing pollution of this water sources.
- Oil from oil-containing waste (oil-containing cloths) creates oil scum on water surface and cause water pollution. Waste oil is also harmful to aquatic species, especially in the mangroves area on two banks of Ruot Lon River. Through the food chain, oil will accumulate in all types of organisms: from low-level ones (algae, plankton and phytoplankton) to high-level ones (aquatic species, fish, etc.). Water pollution by oil causes damage not only to adjacent farming systems but also to distant systems.
- Pollution status will remain during the construction period and even further if there is no measure to collect oil and oil-containing cloths when detecting them in water sources.

Poorly designed management plan for waste oil and oil-containing waste may cause contamination of the environment and risks to the people health and safety.

3.2.2.3 Water pollution

1. Domestic waste water

a. Domestic waste generation activities

One amount of polluted water will arise from workers' camps by worker's daily activities like cooking, bathing, washing ... This amount of wastewater must be treated before being discharged into the surrounding natural water sources.

Domestic wastewater from workers camps include wastewater generated from preparation of meals (V_{na}) and activities like bathing, washing and personal hygiene (V_{tg}). Based on water standard for workers at job-site under standard 20TCN 4474 - 87 "Water standard used for meal preparation" which is 25 liters/person/day and under standard 20TCN33 – 85 "water standard used for bathing and washing", which is 45 liters/person/day, together with 80% of these water volume discharged into the environment, the volume of wastewater at each site is 2.8m^3 (for area of 50 workers), and up to 5.6m3 (for area of 100 workers).

b. Impacts of wastewater

Based on the load factor of pollutants in urban sewage given by WHO, 1993. Part 1. "Rapid inventory techniques in environmental pollution", the pollutant load at each site with 100 workers (Table 3.22) and concentration of pollutants (Table 3.23) in domestic wastewater of workers are identified.

Table 3.22. Pollutants in domestic wastewater from workers' camps

No	Pollutant	Emission flow coefficient (g/person/day)	Wastewater flow (kg/day)	
			50 workers per day	100 workers per day
1	BOD_5	45 ÷ 54	2.3 ÷ 2.7	4.5 ÷ 5.4
2	Total solid (TS)	170 ÷220	3.5 ÷ 7.3	7 ÷ 14.5
3	Coliform	$10^6 \div 10^9$	$5*(10^7 \div 10^{10})$	$10^8 \div 10^{11}$

Table 3.23. Concentration of Pollutants in Domestic Wastewater

No.	Parameter	Concentration of Pollutants (mg/l) in non-treated domestic wastewater	Cmax (QCVN 14:2008/BTNMT)
1	BOD_5	281.2 ~ 337.5	60
2	TSS	437.5 ~ 906	120
3	Total Coliform (MNP/100ml)	$0.6x10^7 \sim 0.6x10^{10}$	6.000

Note: $C_{max} = C. K$

- C_{BOD} *= 50mg/l,* C_{TSS} *= 100mg/l (applied the column B, Table 1, QCVN 14:2009/BTNMT - water source not used for domestic water supply purpose)*
- *K = 1,2 - applied for production enterprises of under 500 persons.*

Content of pollutants in domestic wastewater from worker camps far exceeds the Cmax (under QCVN 14:2008/BTNMT with K = 1.2 for production facilities with less than 500 people) when being discharged into water source of Class B under QCVN 08:2008/BTNMT (table 3.23). Particularly, BOD_5 concentration is 4.5 times higher; and TSS - about 4 times higher. This type of wastewater generates daily from worker tents during the construction period.

Entry of this waste into the surface water in rivers and canals at the bridge construction location will cause organic pollution.

2. Wastewater from concrete mixing plant

a. Waste generation activities

Mixing plant with capacity of 50m^3/h is expected to be located at the site on both sides of Ruot Lon Bridge. According to the standard, with capacity of 50m^3/h, 87 m^3 and 10 m^3 of water shall be used for washing aggregate and for mixing concrete, respectively; 80% of water volume used to wash aggregate will be reused. Therefore, each batch will generate 20.88 m^3 of wastewater with high content of TSS

b. Impacts of wastewater from concrete mixing

Considering the demand for concrete of 21,680 m^3, amount of wastewater generated is 9,020 m^3.

When mixing concrete, apart from the amount of water for mixing, a large amount of water is also needed to wash aggregate that generates wastewater with TSS. Thus, without appropriate control, wastewater from mixing plant will enter the surface water source and increase the turbidity of river water by TSS.

3. Water pollution from polluted rainwater running off from construction yards

Particularly, during rainy season from May- October, rainwater running off every day through the construction yards where materials stockpiling, parking lot, worker tents, workshops, concrete mixing plant, beams mold yards… will contain many pollutants like oil, organic substances, heavy metal, solid waste... Without proper management method, this rainwater runoff from the construction yards may flows into Ruot Lon River and cause degradation of river water quality.

4. Wastewater from construction site

In Vietnam today, bored pile technology is often used for construction of pile foundation/abutments and the technology usually generate an amount of sludge containing bentonite which can pollute river water, causing harm to aquatic species and organisms. The project of constructing ring road No.3 intends to apply the technology of steel pipe sheet pile construction without using bentonite, thereby not causing serious pollution of river water, and less harmful to aquatic organisms.

Rainwater runoff on the embankment during the construction process will be able to take away land and sand, increasing the turbidity for surrounding catchment area of the river.

3.2.3. Impacts of sources unrelated to waste

3.2.3.1. Noise

a. Sources of Impacts/Generation Activities

During the construction phase, the main source of noise generation is the construction machinery and transport vehicles.

Some large and medium sized equipment and machinery will be used for the construction of road and bridge. Besides, trucks, grading, concrete batching plant with large sized, piling rigs, excavators ... as well as other construction machinery such as compressors, hammer ... will be used for construction. These machines will generate large noise level. Even though the noise impact will be temporary in the construction phase, it can also cause significant impact to the people in neighboring residential areas along the route of the project if there is no appropriate mitigation measures.

The level of noise generated from these activities is determined based on:

- The typical noise level of construction equipment;

- General formula for calculating noise (see the preparation stage of construction).

The levels of noise generated from construction equipment used in each works item were determined (Table 3.24).

Table 3.24. Estimated Results of Source Noise Level in Construction Phase

No	Items	Main used Equipment	Source Noise level (dBA)
I	*Route construction*		
-	Digging and soil moving	Bulldoze, backhoe, truck	85 ÷ 96.6
-	Grading and levelling	Grade and roller	80.8 ÷ 93.1
-	Paving	Paver, tamper, truck	87.9 ÷ 95
-	Landscaping and clean-up	Bulldoze, excavator, truck	80.6 ÷ 93.2
II	*Bridges construction*		
-	Executing structures	Cranes, welding machine, concrete-mixing equipment, concrete vibrator, truck	87.5 ÷ 96.3
-	Landscaping and clean-up	Bulldoze, excavator, truck	80.6 ÷ 93.2
III	*Related activities*		
-	Transporting material	Truck	83 ÷ 94
-	Mixing plant activities	Concrete-mixing equipment	90 ÷ 96

b. Impacts of noise

b1. Construction-period noise impacts on public health

Impacts of noise level on residential areas and other objects are determined based on:

– Calculation of noise attenuation by distance using the formula:

ΔL= 10 lg $(\frac{r_2}{r_1})^{1+a}(dB)$ (applied to noise sources from road)

In which:

– *ΔL: level of noise attenuation at a distance r2 from the source of noise*

– *r1: the distance from sound characterizing the noise source (r1 = 8m)*

– *a: Sound absorption coefficients of ground (a = 0,1 – ground for growing grass, without obstacle)*

– *Source: Pham Ngoc Dang 2003. Air environment. Science and Technics Publishing House 2003.*

– Noise attenuation level through green trees (see the preparation stage)

– Noise attenuation level through brick walls surrounding areas, especially the brick wall fence, which can reduce the noise by around 12dBA.

The result is shown in Table 3.25.

Table 3.25. Exceeded noise levels caused by construction activities

No.	Location of construction site	Distance (*) (m)	Exceeding maximum noise level stated in QCVN 26/2010/BTNMT (dBA)			
			Min (6-21h)	Max (6-21h)	Min (21-6h)	Max (22-6h)
-	The residential area at intersection Km0+500	10	13.7	22.5	28.7	37.5
-	The residential area at Km1+300 – Km1+500	10	7.6	19.2	22.6	34.2
-	The residential area at intersection No.2	5	14.7	23.5	29.7	38.5
-	The residence at section Km5+420 – Km5+940	10	7.6	19.2	22.6	34.2
-	The residence at section Km8+700 – Km8+850	10	7.6	19.2	22.6	34.2
-	The residence at section Km9+300 - Km9+500	10	7.6	19.2	22.6	34.2

(*)Distance to the edge of the road

Based on the sensitivity to noise, two kinds of impact are specified including:

– Common area: During the daytime, residential areas will be affected by the noise levels that exceed allowable limit by 7.6 dBA (when machines generating low-noise are used) and by 23.5 dBA (when machines generating high-level noise are used). At night-time, the noise levels exceed allowable limit by 22.65~ 38.5 dBA. Specifically, noise has significant impact on front block of residential houses, and back blocks suffer from noise of lower level.

Noise impact is not frequent, only when operating equipment and machines.

3.2.3.2. Vibration

a. Sources of Impacts/Generation Activities

The operation of construction machine and equipment will generally generate a certain extent of vibration. Because vibration is evaluated in separate cases not with average value, so the source vibration will be taken according to the highest vibration level of one of machinery/equipment involved in the construction. The vibration levels at source of several typical construction equipment are shown in Table 3.26. In which, the highest vibration level when constructing road pavement is generated by the roller (82dB) and the use of a tilt hammer for pile driving will generally generate a vibration level of 97.5 dB at source.

Table 3.26. Vibration levels at source of some typical construction equipment (10m distance)

No	Equipment	Vibration level (vertical direction, dB)
1	Excavator	80
2	Bulldozer	79
3	Truck	74
4	Roller	82
5	Air compressor	81
6	Tilt hammer*	97.5

(*)Using tilt hammer to construct stone-based, type 8 tons with energy close to 48kj, bond pile length from 7.5 to 15m, creating vibration level 12.9mm/s (97.5dB) at about 10m (vibration limit - DIN 4150 is 2mm / s for work construction).

b. mpacts of vibration

b1. Construction-period vibration impacts on public health

Forecast vibration attenuation with distance, using the formula:

$L = L_0 – 10\log (r/r_0) – 8,7a (r – r_0)$ *(dB)*

In which: *L - the vibration level in dB at a distance "r" meter to sources;*

L_0 - the vibration level in dB at a distance "r_0" meter from sources. Vibration level at a distance r_0 = 10m is generally recognized as vibration at source;

a - intrinsic reduction coefficients of vibration (a=0.5 for ground is clay)

Forecast vibration results are presented in Table 3.27.

Table 3.27. Vibration decrease by distance from the construction site

Items	Maximum vibration at source (r_0=10m) (dB)	Vibration at distance (*) (dB)			
		r=10m	r=12m	r=14m	r=16m
Roadbed construction	82	60.8	51.6	42.4	33.2
Pile driving by tilt hammer	97.5	69.4	60.6	51	41.9
QCVN 27:2010/BTNMT. for the common areas, the allowable maximum vibration level generated by construction activities is 75dB from 6-21h and the baseline level from 21h-6am.					

(*) Distance from edge of the road

Constructing bridges at intersections and constructing road base can cause vibration impacts to residential areas along the road. Construction machines such as tilt hammers are not used at this construction site. Depending on the method of construction foundations as well as the execution time of the day, the impact of vibration to the surrounding residential areas can be minimized significantly.

3.2.3.3. Impacts of Erosion and sedimentation

a. Sources of Impacts/Generation Activities

The construction activities with potential erosion and sedimentation include as follow:

- Excavation of foundation pit and driving of pile at bridges;
- Embankment of pavement talus;
- Temporary storage of materials and wastes;
- Transport of redundant soil and stone to dump site.

b. Assessment

b.1. Impacts from soil erosion and sedimention

During the construction process, the excavation locations, materials stockpiling sites and dumpling sites are adjacent to many different objects such as aquacultural farming ponds, rice paddy, residential areas and traffic roads, so the impacts of overspilled sludge on each object are different in the importance and level.

During the earth working process, if the ground and pavement have no asphalt; talus has not been covered with grass or marble and the soil dump is not covered for bridge abutment construction, they will be suffered from erosion in rains. Basing on the rainfall at the project area, slope and composition of soil and stone, the soil erosion level without grass for the excavated and embanked road without reinforcement is 2.5 cm/year and soil erosion level for the land dumped for construction of bridge abutment is 0.4% *(Nguyen Thi Ngoc An. Ecosystems and environment. Agriculture Publishing House, 1997*).

Foundation pit excavation and embankment activities shall cause the soil to be eroded

in piers, abutments. If the eroded soil resulting from rain in foundation pit excavation and embankment for Ruot Lon bridge if spilling into Ruot Lon River and aquaculture ponds…will degrade water quality due to the increasing levels of total suspended solids in the water. Eroded soil from excavated and embanked area for bridge foundation if overspilled on the existing road surface will cause risks of traffic accidents.

For construction of bridge piers, the project plans to apply the *steel pipe sheet pile method*. This method is considered as an environmental friendly method because the working area and construction period is suppressed to the minimum, and the volume of excavated soil is minimized. In addition, the high water-tightness of the earth retaining wall made by the steel pipe sheet piles will help efficiently prevent polluted water leaking from the construction sites to the river water. Consequently, impact of bottom sediment in the construction period is expected insignificant

b.2. Soil erosion at the materials stockpiling sites

If without proper management, the construction material stockpiling sites, the waste soil dumping sites, etc., may generate a certain amount of eroded soil and cause degradation of water quality of Ruot Lon river, Kenh Giang river and neighboring ponds for aquacultural purposes…

3.2.3.4. Impacts of Ecosystem

There is a part of mangrove vegetation along the banks of Ruot Lon River which can be affected by the construction of Ruot Lon Bridge. Therefore, it is required to consider mitigation measures for the impact on the mangrove ecosystem.

The water of Ruot Lon River may be degraded by the construction of the bridge's piers and operation of workers camps in the area. Erosions in wastewater discharged from the excavated areas, nutrients and biological contents in domestic sewage discharged from worker's camps, and oil and grease leaked from construction machineries, etc. may affect water quality of Ruot Lon River, and it may change the dominance and the composition of the plankton. Oil and toxic substances entering water source of Ruot Lon River may cause degradation of mangrove forest and then the wetland ecosystem in the river downstream area. Water pollution will reduce species numbers and relative abundances of populations. Construction materials stored near the watercourses, uncovered excavated soil, stone dumps, and construction wastes may be easily washed out and flow into the Ruot Lon river by rainfall, thus pollute the river water, change the water's pH value and deteriorate the aquatic animals' habitats. This can lead to the damage to plankton and benthos and aquatic biomass reduction in the river section adjacent to the downstream area of construction site.

However, at the present, water quality of Ruot Lon River is quite good and plankton, benthos systems can easily survive in water with relatively low requirement for water quality. Benthos can move to other habitats having similar characteristics. Therefore,

the impact on plankton and benthos is considered to be negligible.

3.2.3.5. Impacts of global warming

In general, in construction phase, construction activities can generate temporary impact and cause greenhouse effect due to emission of CO_2.

3.2.3.6. Operation of machinery, vehicles, occupation of traffic artery

a. Sources of Impacts/Generation Activities

The following activities generate an impact on road and waterways, including:

- Construction activities of piersin and adjacent to flow of Ruot Lon river;
- Construction activities at the intersection with the existing routes (NH10, PR 359, communal roads at intersection 1 and collector roads)
- Construction the embankment for the road pavement higher than the existing route.
- Transportation of redundant stone and soil by roads, particularly NH10, PR359, district roads and local roads;
- Operation of devices on site and along the route.

b. Assessment

b1. The risk of accidents for waterway transport means due to construction of the main bridge piers P6 and P7 in Ruot Lon's river flow

On the Ruot Lon river, only fishing vessels navigate, of which the clearance distance between two piers in the river (from P6 to P7) is 80m, so the construction of P6 and P7 piers will not affect much the circulation of vessels on Ruot Lon River. Details are shown in Figure 3.4. However, there is still risks of collisions, so it is required to implement and closely monitor measures to ensure safety for waterway transport means throughout the construction process.

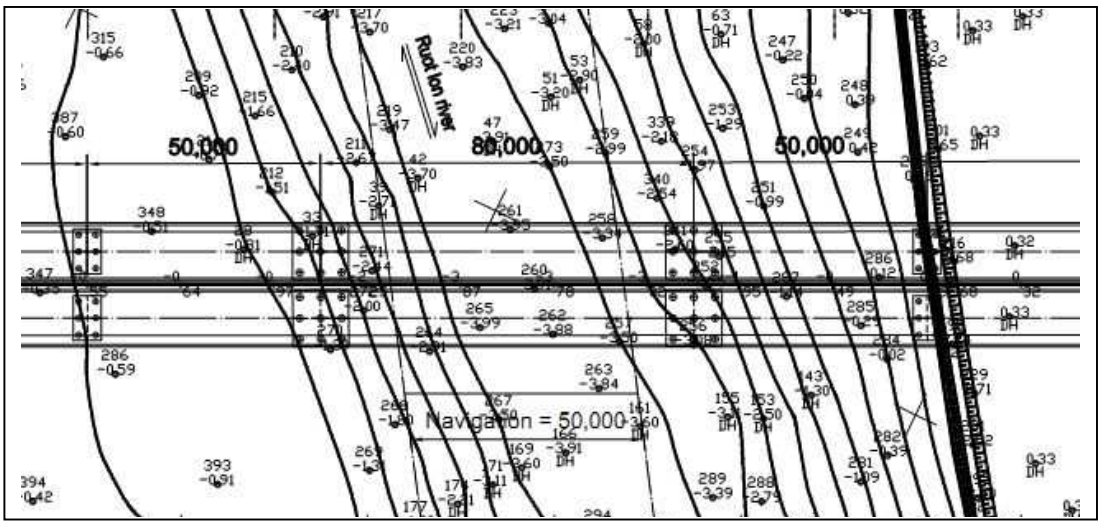


Figure 3.4. Layout of construction site of piers P6 and P7 on Ruot Lon river

Construction of intersection bridge no. 1 and No.2 will affect the transportation on district roads and provincial road No.359, construction of road in these section will affect people's lives at the locations where local roads intersect with the route of the project (See details in Figure 3.5).

Figure 3.5. Constructing the pier adjacent to edge of provincial road 359

b.2. Damage *to community facilities due to transportation on the low-level road*

While preparing investment projects, as inter-hamlet and inter-communal roads used to transport waste from the construction site to the dump site cannot be determined exactly, the impact on community facilities during transportation is just forecasts. Accordingly, if transporting on inter-communal and inter-hamlet roads to transport, the impact on the community facilities are mainly:

- Damage, deterioration of road in construction period;
- Damage of the whole road if it is not restored after construction.

Road damage affects to the local residents using the road daily. This inconvenience happens during construction and lasts longer if the road is not restored at least to the original state. In the case of transport by waterways, the impacts will be negligible.

3.2.3.7. Impacts of hydrological conditions

a. Sources of Impacts/Generation Activities

Construction of pile and pier on Ruot Lon River

b. Assessment

Ruot Lon Bridge has 2 piers of P6 and P7 located in the main flow of Ruot Lon River. Total water displacement of these piers is 3.2 x 4.1 + 3.2 x 4.86 = 28.67 equivalent to 4.27% of the area of cross section of Ruot Lon river bed (675m^2). According to the Japan's Guidance for management of river structures, construction works in the river flow will not change hydrological condition of the flow if its water displacement is smaller than 5% comparing with area of the river's cross section. For Ruot Lon Bridge,

this percentage is 4.27% so the construction of two piers under Ruot Lon River will not cause significant impact on hydrological condition of the river

3.2.3.8. Impacts related to the use of water

a. Sources of Impacts/Generation Activities

Piers construction on flow of Ruot Lon River.

b. Assessment

The downstream area of Ruot Lon River, particularly the section from construction location of Ruot Lon Bridge is used mainly for the purpose of navigation and one small part for aquaculture.

During the construction phase, aquaculture ponds at downstream of Ruot Lon bridge can be affected by water pollution caused by construction activities of the piers.

During the construction of piers, the machinery and the construction site area do not appropriate the navigable channel on the river, so the operation of navigation is not affected (this content has been mentioned in Section "3.2.3.6. Operating machinery, vehicles, appropriation of traffic artery ")

3.2.3.9. Worker concentration

a. Sources of Impacts/Generation Activities

During construction time (expected to be 42 months), the project will concentrate a great amount of workers on construction sites of the bridges.

The potential positive impact of the workers concentration includes opportunities for generating income for local people when they work for contractors or provide retail services like selling necessities to workers… However, the concentration of a large numbers of workers in the area can cause some socioeconomic problems

b. Assessment

The risk of disease transmission: The low sanitary conditions in temporary areas, tents in the construction site shall result in diseases such as petechial fever, eye disease, etc. to the workers and then spread to the surrounding residential area. In addition, there is the risk of the spread of infectious diseases such as HIV/AIDS between construction workers and local people. However, the construction sites are not so far from the urban centers where there are many entertainment places.

The risk of arising conflicts between workers and local people: If not being informed well, workers may breach local security and order. In addition, in the project area, the local residents with traditional village culture may conflict with worker, especially the

youth due to differences in lifestyle and culture. The conflicts and disputes of materials, property stealing of the residents and construction unit, the damage to materials, equipment and crops, etc. are the causes of conflict and disputes affecting to the local security and order.

Impacts in construction phase are summarized in following table:

Table 3.28. Summary of impacts in construction phase

No.	Impacts	Location	Time	Degree of impact
I	***Impacts related to waste***			
1	Air pollution by dust and impact on pubic health	– Along the route of project; – Along transportation road (NH10, PR359, VSIP road, local roads); – Near the cement mixing plant on construction site.	Short time	Low ~ Medium
2	Generation of construction solid waste, domestic solid waste, wast oil and oil-containing wastewater, wastewater from concrete mixing plant and rainwater runoff from construction site, degrading water quality and causing sedimentation	– Temporary dumping land for redundant soil, construction site of road and bridge – Worker camps, site offices at 3 construction sites for intersection bridges and 2 construction sites of Ruot Lon bridge. – Maintenance and washing stations for vehicles and machinery in 5 construction sites. – Cement mixing plant on construction site.	Short time ~ Long time	Low ~ Medium
II	***Non-waste related impacts***			
1	Noise	Residential areas at: Km0+000– Km0+500, Km1+300–Km1+500 Km5+420–Km5+940, Km8+700–Km8+850, Km9+300 - Km9+500	Short time	Medium
2	Vibration	Ditto	Short time	Medium
3	Erosion and sedimentation	– Embankment area; – Construction of piers in flow of Ruot Lon river – Construction material storage area	Short time	Nhỏ~ Medium

No.	Impacts	Location	Time	Degree of impact
4	Impact on ecosystem	– Construction of piers in flow of Ruot Lon river – Construction sites of Ruot Lon bridge	Short time	Medium
5	Impact on global warming	– Operation of machinery and equipement for the whole project area	Short time	Low ~ Medium
6	Impact from operation of machinery, equipment, occupancy of traffic artery in waterway and roadway	– Construction of pier P6 and P7 in the flow of Ruot Lon river; – Construction activities at the bridge locations of intersection; – Transportation of soil, stone, wastes by roads, especially local roads	Short time	Medium
7	Impact on hydrological condition	– Construction of piers in flow of Ruot Lon river	Short time	Low ~ Medium
8	Impact on water use	– Construction of pier P6 and P7 in the flow of Ruot Lon river;	Short time	Low ~ Medium
9	Impact due to worker concentration	5 construction sites	Short time	Medium

3.3. Impact Assessment in Operation Phase

3.3.1. Impact on the environment due to sources related impact of waste

3.3.1.1. Air pollution (Dust and exhaust)

a. Operations create dust and exhaust

In the operation stage, dust and exhaust (SO_2, NO_2, CO and HC) will be generated by:

- Fuel burning of vehicle will generate dust and exhaust;
- Operation of vehicle will generate dust from the tire rolling on the road.

b. Impact of dust and gas emissions

b.1. Air pollution from operation of vehicle affecting public health

Dust and exhaust from vehicle

The prediction of dust and exhaust (CO, NO_2, SO_2, HC*)* emission from fuel burning of vehicle from road is implemented based on:

- The figure of forecasted traffic volume in 2015 and 2040 (Table 3.29). In which traffic volume in the peak hour is estimated about 10% traffic volume total/day;

- Pollution coefficient of World Health Organization (WHO) (Table 3.30);
- National technical regulation on gasoline and diesel fuel (QCVN01:2007/BKHCN) regulation the content of Sulfur in the gasoline and diesel fuel in the transportation is S = 0.05%.

Table 3.29. The figure of forecasted traffic volume on ring road No. 3 in 2025 and 2040

Unit: (*)/day

No	Year	Section	MC (Motor-cycle)	Car	Mini Bus	Medium Large Bus	Pick up Truck	Rigid class Truck (2 axles	Rigid class Truck (3 axles)	Trailer (Separated)	Total	Speed at peak hour (*)
1	2025	(10) Km0+000 –Km3+160	7,572	3,802	169	327	63	921	301	1,222	**15,205**	65
	2040		10,950	5,734	391	758	135	1,977	646	2,623	**23,214**	65
2	2025	(9) Km3+160 – Km3+650	7,572	3,802	169	327	63	921	301	1,222	**15,205**	65
	2040		11,037	5,597	393	762	139	2,041	667	2,708	**23,344**	65
3	2025	(8) Km3+650 – Km4+500	7,440	3,646	168	326	59	868	284	1,152	**14,831**	65
	2040		9,933	5,020	393	762	117	1,723	563	2,286	**20,797**	65
4	2025	(7) Km4+500 – Km5+500	6,953	3,600	148	288	58	858	280	1,138	**14,180**	65
	2040		9,570	5,008	356	692	118	1,739	569	2,307	**20,359**	65
5	2025	(6) Km5+500 – Km9+700	7,807	4,948	118	229	63	928	303	1,232	**15,628**	65
	2040		10,083	7,204	437	849	132	1,943	635	2,579	**23,862**	65
6	2025	(5) Km9+700 – Km11+450	7,692	9,142	820	1,592	102	1,494	489	1,983	**23,314**	64
	2040		16,097	23,247	2,120	4,116	261	3,837	1,255	5,092	**56,025**	60
7	2025	(4) Km11+450 – Km12+500	7,692	9,142	820	1,592	102	1,494	489	1,983	**23,314**	64
	2040		16,097	23,247	2,120	4,116	261	3,837	1,255	5,092	**56,025**	60
8	2025	(3) Km12+500 - Km14+000	7,692	9,142	820	1,592	102	1,494	489	1,983	**23,314**	64
	2040		16,097	23,247	2,120	4,116	261	3,837	1,255	5,092	**56,025**	60

Note: (*) – is MC/Car/ Mini Bus/ Medium Large Bus/ Pick up Truck/ Rigid class Truck (2 axles)/ Rigid class /Truck (3 axles)/ Trailer

Source: The Project Description

Table 3.30. Air Pollution Coefficient for Transportation Means of WHO

Vehicle	Unit (U)	TSP (kg/U)	SO_2 (kg/U)	NO_x (kg/U)	CO (kg/U)	HC (kg/U)
1. Car (small car and pass. car)						
- Engine <1400 cc	1000km	0.07	1.74S	1.31	10.24	1.29
	ton diesel	0.80	20S	15.13	118.0	14.83
- Engine 1400-2000 cc	1000km	0.07	2.05S	1.33	6.46	0.60
	ton diesel	0.68	20S	10.97	62.9	5.85
- Engine >2000 cc	1000km	0.07	2.35S	1.33	6.46	0.60
	ton diesel	0.06	20S	9.56	54.9	5.1
Average	**1000 km**	**0.07**	**2.05S**	**1.19**	**7.72**	**0.83**
2. Truck						
- Gasoline running truck > 3.5 ton	1000km	0.4	4.5S	4.5	70	7
	ton diesel	3.5	20S	20	300	30
- Small truck (diesel) < 3.5 ton	1000km	0.2	1.16S	0.7	1	0.15
	ton diesel	3.5	20S	12	18	2.6
- Big diesel vehicle 3.5 -16 ton	1000km	0.9	4.29S	11.8	6.0	2.6
	ton oil	4.3	20S	55	28	2.6
- Very big truck (diesel)>16 ton	1000km	1.6	7.26S	18.2	7.3	5.8
	ton	4.3	20S	50	20	16
- Big Bus (diesel) >16 ton	oil	1.4	6.6S	16.5	6.6	5.3
	1000km	4.3	20S	50	20	16
	ton oil					
Average	**1000km**	**0.9**	**4.76S**	**10.3**	**18.2**	**4.2**
3. Motor bicycle	1000km	0.12	0.36S	0.05	10	6
- Engine <50cc. 2 stroke	ton diesel	6.7	20S	2.8	550	330
	1000km	0.12	0.6S	0.08	22	15
- Engine >50cc. 2 stroke	ton diesel	4.0	20S	2.7	730	500
	1000km		0.76S	0.30	20	3
- Engine >50cc. 4 stroke	ton diesel		20S	8	525	80
Average	**1000km**	**0.08**	**0.57S**	**0.14**	**16.7**	**8**

Source: WHO, 1993,

QCVN 1:2007/BKHCN – National regulation on gasoline and diesel regulates that content of sulfur in gasoline and diesel for transportation is S=0.05%.

Calculation results are presented in Table 3.31.

Table 3.31. Emission prediction results from vehicle in the peak hour on Ring road 3

No.	Year	Section	Dust and exhaust emission (mg/ms)				
			TSP	CO	NO_2	SO_2	HC
1	2025	(10)	0.110	6.505	0.229	0.040	2.219
	2040		0.221	11.011	0.477	0.076	3.538
2	2025	(9)	0.110	6.505	0.229	0.040	2.219
	2040		0.226	11.163	0.488	0.077	3.583
3	2025	(6)	0.109	6.858	0.228	0.043	2.286
	2040		0.223	10.86	0.488	0.08	3.378
4	2025	(5)	0.216	9.349	0.488	0.082	2.812
	2040		0.547	22.376	1.254	0.207	6.435
5	2025	(4)	0.216	9.349	0.488	0.082	2.812
	2040		0.547	22.376	1.254	0.207	6.435
6	2025	(3)	0.216	9.349	0.488	0.082	2.812
	2040		0.547	22.376	1.254	0.207	6.435

Dust generated from Operation of Vehicle Flow from road

Based on forecasted traffic volume (Table 3.29) and emission coefficient of dust swept from roads by the World Health Organization (table 3.30) determined load of dust from vehicles operation (tires rolling up from road surface), in the peak hour (Table 3.32).

Table 3.32 Emission Coefficient of Dust Swept from Roads

No	Type of road	Unit (U)	TSP (kg/U)
	Paved roads		
1	Urban roads (width <10m. Vehicle flow <500 units/day)	1000 km	15
2	Urban roads (width> 10 m. Vehicle flow 500 ~ 10,000 units/day)	1000 km	10
3	Highway (Vehicle flow > 10,000 units/day)	1000 km	4.4
4	Expressway (Vehicle flow > 50,000 units/day)	1000 km	0.35

Source: WHO, 1993.

Table 3.33. Dust load Generated from Operation of Vehicle Flow from road at peak hour on Ring road 3

Year	Traffic flow at peak hour (car/h)	Section	Traffic flow at peak hour (car/h)	Emission coefficient (kg/1000km.car)	Load of dust (mg/ms)
1	2025	(10)	1,437	4.4	1.756
	2040		2,322	4.4	2.838
2	2025	(9)	1,437	4.4	1.756
	2040		2,335	4.4	2.854
3	2025	(6)	1,563	4.4	1.91
	2040		2,386	4.4	2.916
4	2025	(5)	2,331	4.4	2.849
	2040		5,602	0.35	0.544
5	2025	(4)	2,331	4.4	2.849
	2040		5,602	0.35	0.544
6	2025	(3)	2,331	4.4	2.849
	2040		5,602	0.35	0.544

The total of dust and exhaust emission generated from vehicle operation

Because dust and exhaust generated concurrently in the same scope, the total of dust and exhaust emission will be the total of dust and exhaust emission generated form vehicle and dust from the tire rolling on the road (Table 3.34).

Table 3.34. The total of dust and exhaust emission generated from vehicle operation at peak hour on Ring road 3

Unit: (mg/m.s)

No.	Year	Section	TSP	CO	NO_2	SO_2	HC
1	2025	(10)	1.866	6.505	0.229	0.040	2.219
	2040		3.059	11.011	0.477	0.076	3.538
2	2025	(9)	1.866	6.505	0.229	0.040	2.219
	2040		3.08	11.163	0.488	0.077	3.583
3	2025	(6)	2.019	6.858	0.228	0.043	2.286
	2040		3.139	10.86	0.488	0.08	3.378
4	2025	(5)	3.065	9.349	0.488	0.082	2.812
	2040		1.091	22.376	1.254	0.207	6.435
5	2025	(4)	3.065	9.349	0.488	0.082	2.812
	2040		1.091	22.376	1.254	0.207	6.435
6	2025	(3)	3.065	9.349	0.488	0.082	2.812
	2040		1.091	22.376	1.254	0.207	6.435

Basing on total amount of dust and gas emission generated from construction of each

items, it is able to determine average amount at any point by using Sutton model.

- Sutton diffusion model:

$$C = \frac{0,8E.\left\{\exp\left[\frac{-(z+h)^2}{2\sigma_z^2}\right] + \exp\left[\frac{-(z-h)^2}{2\sigma_z^2}\right]\right\}}{\sigma_z.u} \quad (mg/m^3)$$

In which:

- *C: concentration of pollutant in the air (mg/m^3).*
- *E: pollutant emission from waste source (mg/ms). In the case of the Project. prevailing wind direction in the dry season and the rainy season is the South East is the Northeast; corner by between wind direction of 2 seasons and the route of the Project is 90 degrees.*
- *z: the height of the calculation point (m); z = 1.5m.*
- *h: the height of road surface compared with the height of surrounding ground (m); h=2m.*
- *u: the average wind velocity in Project's area (m/s); wind velocity in dry and rainy season is $u_{average}$ =2.9m/s and 3.1m/s.*
- *σ_z: diffusion coefficient vertical direction z (m).*

Diffusion coefficient of σ_z in vertical direction z with the atmospheric stability in Project area is B determined by the following formula:

$$\sigma_z = 0.53.\ x^{0.73} \qquad (m)$$

In which: x: distance from calculation point to the waste source under wind direction. m.

Parameters of meteorological input factors which are typical for Project are shown in Table 3.35.

Table 3.35. Forecast of dust and gas emissions from operation of vehicles by 2025 and 2040 at peak hours on Ring road 3

Unit: mg/m³

Item	Parameters	Season	Distribution of Pollutants acording to distance (*) (mg/m³)					QCVN 05:2013 & 06:2009
			5m	10m	20m	50m	100m	
	Section (10)							
2025	TSP	Rainy	0.474	0.384	0.279	0.157	0.097	0.3
		Dry	0.507	0.410	0.298	0.168	0.104	
	SO2	Rainy	0.013	0.011	0.008	0.004	0.003	0.35
		Dry	0.014	0.011	0.008	0.005	0.003	
	NO2	Rainy	0.079	0.064	0.047	0.026	0.016	0.2
		Dry	0.085	0.068	0.050	0.028	0.017	
	CO	Rainy	1.436	1.162	0.845	0.476	0.294	30
		Dry	1.535	1.242	0.903	0.509	0.314	
	HC	Rainy	0.418	0.338	0.246	0.139	0.086	5
		Dry	0.447	0.362	0.263	0.148	0.091	
2040	TSP	Rainy	0.498	0.403	0.293	0.165	0.102	0.3
		Dry	0.533	0.431	0.314	0.177	0.109	
	SO2	Rainy	0.012	0.010	0.007	0.004	0.003	0.35
		Dry	0.013	0.011	0.008	0.004	0.003	
	NO2	Rainy	0.078	0.063	0.046	0.026	0.016	0.2
		Dry	0.083	0.067	0.049	0.028	0.017	
	CO	Rainy	1.794	1.452	1.056	0.595	0.367	30
		Dry	1.918	1.552	1.129	0.636	0.392	
	HC	Rainy	0.576	0.466	0.339	0.191	0.118	5
		Dry	0.616	0.499	0.363	0.204	0.126	
	Section (9)							
2025	TSP	Rainy	0.474	0.384	0.279	0.157	0.097	0.3
		Dry	0.507	0.410	0.298	0.168	0.104	
	SO2	Rainy	0.013	0.011	0.008	0.004	0.003	0.35
		Dry	0.014	0.011	0.008	0.005	0.003	
	NO2	Rainy	0.079	0.064	0.047	0.026	0.016	0.2
		Dry	0.085	0.068	0.050	0.028	0.017	
	CO	Rainy	1.436	1.162	0.845	0.476	0.294	30
		Dry	1.535	1.242	0.903	0.509	0.314	
	HC	Rainy	0.418	0.338	0.246	0.139	0.086	5
		Dry	0.447	0.362	0.263	0.148	0.091	
2040	TSP	Rainy	0.502	0.406	0.295	0.166	0.103	0.3
		Dry	0.536	0.434	0.316	0.178	0.110	
	SO2	Rainy	0.013	0.010	0.007	0.004	0.003	0.35
		Dry	0.013	0.011	0.008	0.004	0.003	
	NO2	Rainy	0.080	0.064	0.047	0.026	0.016	0.2
		Dry	0.085	0.069	0.050	0.028	0.017	
	CO	Rainy	1.819	1.472	1.070	0.603	0.372	30
		Dry	1.944	1.573	1.144	0.645	0.398	

Item	Parameters	Season	Distribution of Pollutants acording to distance (*) (mg/m^3)					QCVN 05:2013 & 06:2009
			5m	10m	20m	50m	100m	
	HC	Rainy	0.584	0.472	0.344	0.194	0.119	5
		Dry	0.624	0.505	0.367	0.207	0.128	
	Section (8)							
2025	TSP	Rainy	0.295	0.239	0.174	0.098	0.060	0.3
		Dry	0.315	0.255	0.186	0.105	0.064	
	SO2	Rainy	0.006	0.005	0.004	0.002	0.001	0.35
		Dry	0.007	0.005	0.004	0.002	0.001	
	NO2	Rainy	0.036	0.029	0.021	0.012	0.007	0.2
		Dry	0.038	0.031	0.022	0.013	0.008	
	CO	Rainy	1.026	0.830	0.604	0.340	0.210	30
		Dry	1.097	0.888	0.646	0.364	0.224	
	HC	Rainy	0.353	0.285	0.207	0.117	0.072	5
		Dry	0.377	0.305	0.222	0.125	0.077	
2040	TSP	Rainy	0.446	0.361	0.263	0.148	0.091	0.3
		Dry	0.477	0.386	0.281	0.158	0.098	
	SO2	Rainy	0.011	0.009	0.007	0.004	0.002	0.35
		Dry	0.012	0.010	0.007	0.004	0.002	
	NO2	Rainy	0.069	0.056	0.041	0.023	0.014	0.2
		Dry	0.074	0.060	0.044	0.025	0.015	
	CO	Rainy	1.596	1.292	0.939	0.529	0.326	30
		Dry	1.706	1.381	1.004	0.566	0.349	
	HC	Rainy	0.519	0.420	0.305	0.172	0.106	5
		Dry	0.555	0.449	0.326	0.184	0.113	
	Section (7)							
2025	TSP	Rainy	0.282	0.228	0.166	0.094	0.058	0.3
		Dry	0.300	0.244	0.177	0.100	0.062	
	SO2	Rainy	0.006	0.005	0.004	0.002	0.001	0.35
		Dry	0.007	0.005	0.004	0.002	0.001	
	NO2	Rainy	0.035	0.028	0.020	0.011	0.007	0.2
		Dry	0.037	0.030	0.022	0.012	0.008	
	CO	Rainy	0.982	0.795	0.578	0.326	0.201	30
		Dry	1.050	0.850	0.618	0.348	0.215	
	HC	Rainy	0.333	0.269	0.196	0.110	0.068	5
		Dry	0.356	0.288	0.210	0.118	0.073	
2040	TSP	Rainy	0.437	0.354	0.257	0.145	0.089	0.3
		Dry	0.468	0.378	0.275	0.155	0.096	
	SO2	Rainy	0.011	0.009	0.006	0.004	0.002	0.35
		Dry	0.012	0.009	0.007	0.004	0.002	
	NO2	Rainy	0.069	0.056	0.040	0.023	0.014	0.2
		Dry	0.073	0.059	0.043	0.024	0.015	
	CO	Rainy	1.573	1.273	0.926	0.522	0.322	30
		Dry	1.682	1.361	0.990	0.557	0.344	
	HC	Rainy	0.505	0.409	0.297	0.168	0.103	5
		Dry	0.540	0.437	0.318	0.179	0.110	

Item	Parameters	Season	Distribution of Pollutants acording to distance (*) (mg/m^3)					QCVN 05:2013 & 06:2009
			5m	10m	20m	50m	100m	
	Section (6)							
2025	TSP	Rainy	0.329	0.266	0.194	0.109	0.067	0.3
		Dry	0.352	0.285	0.207	0.117	0.072	
	SO2	Rainy	0.007	0.006	0.004	0.002	0.001	0.35
		Dry	0.007	0.006	0.004	0.002	0.002	
	NO2	Rainy	0.037	0.030	0.022	0.012	0.008	0.2
		Dry	0.040	0.032	0.023	0.013	0.008	
	CO	Rainy	1.117	0.904	0.658	0.370	0.229	30
		Dry	1.194	0.967	0.703	0.396	0.244	
	HC	Rainy	0.372	0.301	0.219	0.123	0.076	5
		Dry	0.398	0.322	0.234	0.132	0.081	
2040	TSP	Rainy	0.511	0.414	0.301	0.170	0.105	0.3
		Dry	0.547	0.442	0.322	0.181	0.112	
	SO2	Rainy	0.013	0.011	0.008	0.004	0.003	0.35
		Dry	0.014	0.011	0.008	0.005	0.003	
	NO2	Rainy	0.080	0.064	0.047	0.026	0.016	0.2
		Dry	0.085	0.069	0.050	0.028	0.017	
	CO	Rainy	1.769	1.432	1.041	0.587	0.362	30
		Dry	1.891	1.531	1.113	0.627	0.387	
	HC	Rainy	0.550	0.445	0.324	0.182	0.113	5
		Dry	0.588	0.476	0.346	0.195	0.120	
	Section (3), (4) and (5)							
2025	TSP	Rainy	0.499	0.404	0.294	0.166	0.102	0.3
		Dry	0.534	0.432	0.314	0.177	0.109	
	SO2	Rainy	0.013	0.011	0.008	0.004	0.003	0.35
		Dry	0.014	0.012	0.008	0.005	0.003	
	NO2	Rainy	0.080	0.064	0.047	0.026	0.016	0.2
		Dry	0.085	0.069	0.050	0.028	0.017	
	CO	Rainy	1.523	1.233	0.896	0.505	0.312	30
		Dry	1.628	1.318	0.958	0.540	0.333	
	HC	Rainy	0.458	0.371	0.270	0.152	0.094	5
		Dry	0.490	0.396	0.288	0.162	0.100	
2040	TSP	Rainy	0.178	0.144	0.105	0.059	0.036	0.3
		Dry	0.190	0.154	0.112	0.063	0.039	
	SO2	Rainy	0.034	0.027	0.020	0.011	0.007	0.35
		Dry	0.036	0.029	0.021	0.012	0.007	
	NO2	Rainy	0.204	0.165	0.120	0.068	0.042	0.2
		Dry	0.218	0.177	0.129	0.072	0.045	
	CO	Rainy	3.646	2.950	2.146	1.209	0.746	30
		Dry	3.897	3.154	2.294	1.292	0.797	
	HC	Rainy	1.048	0.848	0.617	0.348	0.214	5
		Dry	1.121	0.907	0.660	0.372	0.229	

Note: (*) – Distance from centerline of the road

Comparing the results predicted of toxic gas concentration with maximum allowable limit in QCVN 05:2013/BTNMT and QCVN06 /2009: BTNMT, it is found that:

In 2025: On the centerline of the road, concentrations of dust generated from operation of vehicle flow will be 1.05-1.7 times higher than the allowable Limit in QCVN 05:2013/BTNMT for section (3), (4), (5), (6), (8), (9) and (10). Concentration of toxis gas generated by vehicles will be lower than allowable limit in QCVN06/2009: BTNMT

In 2040: On the centerline of the road, concentrations of dust generated from operation of vehicle flow will be lower than allowable limit in QCVN 05:2013/BTNMT, except for Section (6), (7), (8), (9) and (10) which exceed allowable limit in QCVN 05:2013/BTNMT from 1.7-3.1 times. Concentration of toxic gas generated from operation of vehicle flow will be smaller than allowable Limit of QCVN06/2009:BTNMT.

3.3.1.2. Water pollution

During the operational phase, the appearance the piers of Ruot Lon bridge in Ruot Lon River will degrade water quality due to changes in the sediment environment of the river.

With the increase of the annual traffic volume, tailpipe emissions from motorcycles, automobiles, oil and other hazardous substances falling on the road and bridge surface will accumulate over the years. When the contaminants are washed away by rainwater runoff in to the river, aquaculture ponds and rice fields, they will cause a certain impact on water quality and affect the aquatic ecosystem. Moreover, the participation of the transportation of hazardous materials in vehicles on the bridge can cause the accident risk on the bridge and penetration of hazardous substances into Ruot Lon River.

3.3.1.3 Waste

During the operational phase, the waste will arise on the surface of the road and bridges from operation vehicle and maintenance activities of the road and bridges such as paints, solvents, paint box, solvent box. The waste must be collected and handled in accordance with regulations.

3.3.1.4. Climate change/greenhouse gases

a. Sources of greenhouse gas

In the operation phase, greenhouse gases are generated mainly from the fuel combustion of vehicle engines causing dust and emissions. Total greenhouse gases will increase due to increase in the number of vehicles operating in the city.

The public transportation project itself does not cause increase in greenhouse gases but

the fuel burning from vehicles generate gas emissions in the project area. With or without the project, the vehicle flow through the region will still continue to increase over time. On the other hand, without the project, people have to use roundabout ways leading to traffic jams on these roads, increasing emissions causing the greenhouse effect

b. Preliminary assessment on impacts of greenhouse gases generated within the Project

b1. Climate change impacts

The forecasting of CO_2 amount generated from fuel combustion of vehicles running on the road was done on the basis of:

- Forecasted vehicle flow data in 2025 and 2040.
- CO_2 emission coefficient under IPCC 2006 "Guidelines for Statistics on Greenhouse Gas for Countries" (Table 3.36).

Table 3.36. Coefficient of CO_2 emissions from vehicle engines running on the road

Types of vehicles	CO_2 emission rate (kg/km)
MC (Motorcycle)	0.06310
Car	0.15849
Bus	0.49564
Truck	2.06112

The results are presented in Table 3.37.

Table 3.37. Forecast results of CO_2 emissions from vehicle engines

Year	Distance (km)	CO_2 emission (tons/year)
2025	13.6	46,608
2040	13.6	104,757

From the forecast results, it is found that CO_2 emissions from vehicles running along the entire Project road is 46,608 tons/year in 2025 and 104,757 tons/year in 2040. Unlike other gases with direct impacts on the air environment and the residential areas along the length of the Project road, greenhouse gases do not cause direct impacts to these areas, but accumulate together with greenhouse gases from other sources of emissions to contribute to climate change, thereby indirectly affecting the lives of the people in this region and other regions worldwide

3.3.2. Impact Sources not related to Waste

3.3.2.1. Noise

a. Sources of Impacts/Generation Activities

Forecasted traffic volumes during peak hours in operation phase are presented in Table 3.23.

b. The impact due to noise

In operation phase, noise level caused by traffic flow is normally unstable (quickly change with time) and depends heavily on many factors such as traffic volume, types of vehicles, features of roads, topography, etc. Therefore, in general, the equivalent steady sound level of a noise energy-averaged over a period of time is used to examine and assess noise level caused by traffic flow in the peak hours.

Model ASJ 2003 is used to predict the equivalent sound level Leq averaged in one hour (dBA) at sensitive receptors along the road. This model is developed by "Acoustic Society of Japan" (ASJ) and is being widely used in Japan. Calculation method of ASJ Model 2003 is presented below.

– Prediction method and calculation formula:

Noise level caused by a moving vehicle is calculated by the following formula:

$$L_{AE} = 10 \lg\left(\frac{1}{T}\sum_{i=1}^{n} 10^{0.1L_1} \Delta t_i\right)$$

In which:

- L_{AE}: sound exposure level at a certain time
- Δti: a certain period of time set to calculate L_{AE}
- Li: source noise level in a period of time Δti

The average equivalent noise level of vehicle flows can be calculated by the following formula:

$Leq = L_{AE}-10 +10 \lg N \lg (T / t_{0})$

In which:

- N: traffic volume;
- Leq: average equivalent noise level, dBA;
- T, t_0: time interval in second (t_0 = 1 second).

Calculation process has been programmed.

Noise levels at source are calculated by the following formula, applied for continuous vehicle flow:

L_{WA}= 46.7 + 30$\log_{10}$V (for small vehicles as passenger car, motorcycle, small truck, car);

L_{WA}= 53.2 + 30$\log_{10}$V (for big vehicles as bus, heavy truck).

V: vehicle's speed.

– Input of Model

+ Vehicle flow in 2025 and 2040 in rush hour. In which traffic volume in the peak hour is estimated about 10% traffic volume total/day and night.
+ Vehicle flow's speed at peak hour

Results of noise predicted from the operation of vehicles from the Project in 2025 and 2040 are presented in Table 3.38. Predicted results were compared with QCVN 26:2010/BTNMT (allowable limit of noise in day time of the project area is generally 70dBA)

The illustrations of noise prediction from vehicle flow are presented in Figure 3.7~ Figure 3.8

Table 3.38. Prediction of noise levels from the traffic flow in peak hour in 2025 and 2040 on ring road 3

Unit: dBA

No.	year	Sections	Height (2) (m)	Noise levels by distance (1) (m)					
				0	5	10	25	50	100
1	2025	(10)	4.5	68.7	68	67.3	65.8	64.1	62.0
			3	68.8	68	67.3	65.8	64.1	62.0
			1.5	68.8	68	67.4	65.8	64.1	62.0
			0	68.8	68	67.4	65.9	64.1	62.0
	2040		4.5	71.6	70.8	70.2	68.7	67.0	64.8
			3	71.6	70.9	70.2	68.7	67.0	64.8
			1.5	71.7	70.9	70.2	68.7	67.0	64.8
			0	71.7	70.9	70.2	68.7	67.0	64.8
2	2025	(9)	4.5	68.7	68	67.3	65.8	64.1	62.0
			3	68.8	68	67.3	65.8	64.1	62.0
			1.5	68.8	68	67.4	65.8	64.1	62.0
			0	68.8	68	67.4	65.9	64.1	62.0
	2040		4.5	71.7	70.9	70.3	68.8	67.0	64.9
			3	71.7	70.9	70.3	68.8	67.1	64.9
			1.5	71.7	70.9	70.3	68.8	67.1	64.9
			0	71.7	70.9	70.3	68.8	67.1	64.9
3	2025	(8)	4.5	68.5	67.8	67.1	65.6	63.9	61.8
			3	68.6	67.8	67.1	65.6	63.9	61.8
			1.5	68.6	67.8	67.2	65.6	63.9	61.8

No.	year	Sections	Height [2] (m)	Noise levels by distance [1] (m)					
				0	5	10	25	50	100
			0	68.6	67.8	67.2	65.7	63.9	61.8
	2040		4.5	71.1	70.3	69.7	68.2	66.5	64.3
			3	71.1	70.4	69.7	68.2	66.5	64.3
			1.5	71.2	70.4	69.7	68.2	66.5	64.3
			0m	71.2	70.4	69.7	68.2	66.5	64.3
4	2025	(7)	4.5	68.4	67.6	67	65.5	63.8	61.6
			3	68.4	67.7	67	65.5	63.8	61.6
			1.5	68.5	67.7	67	65.5	63.8	61.6
			0	68.5	67.7	67	65.5	63.8	61.6
	2040		4.5	71.0	70.3	69.6	68.1	66.4	64.3
			3	71.1	70.3	69.7	68.2	66.4	64.3
			1.5	71.1	70.3	69.7	68.2	66.4	64.3
			0	71.1	70.3	69.7	68.2	66.4	64.3
5	2025	(6)	4.5	68.9	68.1	67.5	66	64.3	62.1
			3	68.9	68.1	67.5	66	64.3	62.1
			1.5	68.9	68.2	67.5	66	64.3	62.1
			0	69.0	68.2	67.5	66	64.3	62.1
	2040		4.5	71.7	70.9	70.3	68.8	67.1	64.9
			3	71.7	71.0	70.3	68.8	67.1	64.9
			1.5	71.8	71.0	70.3	68.8	67.1	64.9
			0	71.8	71.0	70.3	68.8	67.1	64.9
6	2025	(5) and (4)	4.5	71.6	70.8	70.2	68.7	67.0	64.8
			3	71.6	70.9	70.2	68.7	67.0	64.8
			1.5	71.7	70.9	70.2	68.7	67.0	64.8
			0	71.7	70.9	70.2	68.7	67.0	64.8
	2040		4.5	75.1	74.3	73.7	72.2	70.5	68.3
			3	75.1	74.3	73.7	72.2	70.5	68.3
			1.5	75.1	74.3	73.7	72.2	70.5	68.3
			0	75.1	74.4	73.7	72.2	70.5	68.3
7	2025	(3)	4.5	72.5	71.5	70.8	69.1	67.3	65
			3	72.5	71.6	70.8	69.1	67.3	65
			1.5	72.6	71.6	70.8	69.1	67.3	65
			0	72.6	71.6	70.8	69.1	67.3	65
	2040		4.5	75.9	75	74.2	72.6	70.7	68.4
			3	76	75	74.3	72.6	70.7	68.4
			1.5	76	75	74.3	72.6	70.7	68.4
			0	76	75.1	74.3	72.6	70.7	68.4

No.	year	Sections	Height (2) (m)	Noise levels by distance (1) (m)					
				0	5	10	25	50	100
8	2025	(2) and (1)	4.5	72.4	71.5	70.7	69	67.2	64.9
			3	72.4	71.5	70.7	69	67.2	64.9
			1.5	72.5	71.5	70.8	69	67.2	64.9
			0	72.5	71.5	70.8	69.1	67.2	64.9
	2040		4.5	75.7	74.8	74	72.3	70.5	68.2
			3	75.7	74.8	74	72.3	70.5	68.2
			1.5	75.8	74.8	74	72.3	70.5	68.2
			0	75.8	74.8	74	72.3	70.5	68.2

Note: (1) Distance from the boundary of site clearance

(2) Height from the earth surface

Cell with gray highlight: noise level exceeds the allowable limit according to QCVN 26:2010/BTNMT (70dBA).

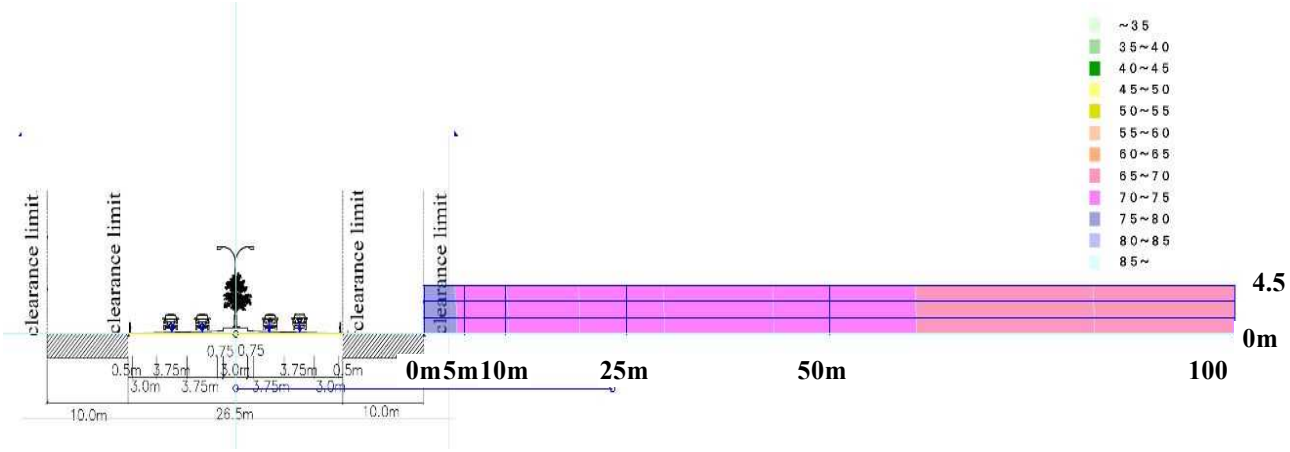


Figure 3.6. Predicted noise levels at Section (1), (2) on ring road 3 by 2025

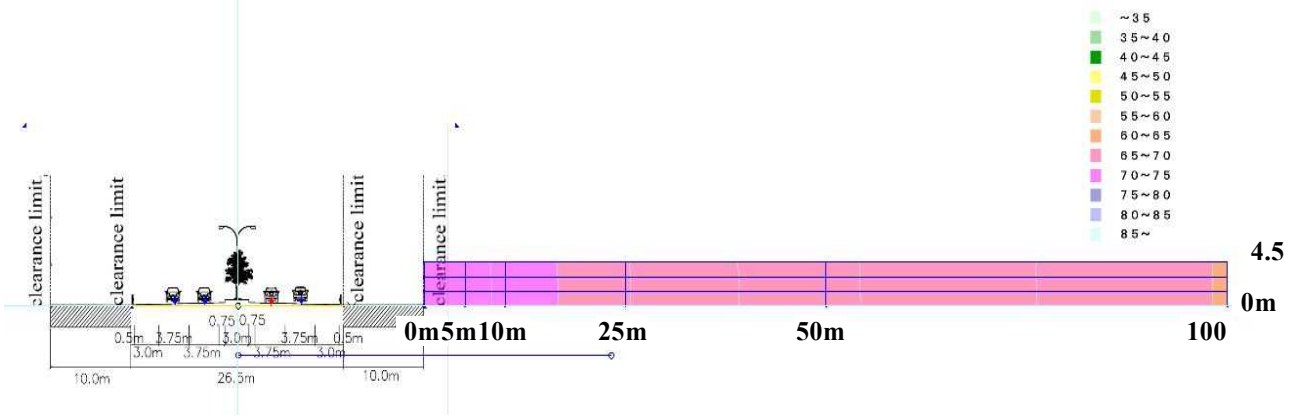


Figure 3.7. Predicted noise levels at Section (1), (2) on ring road 3 by 2040

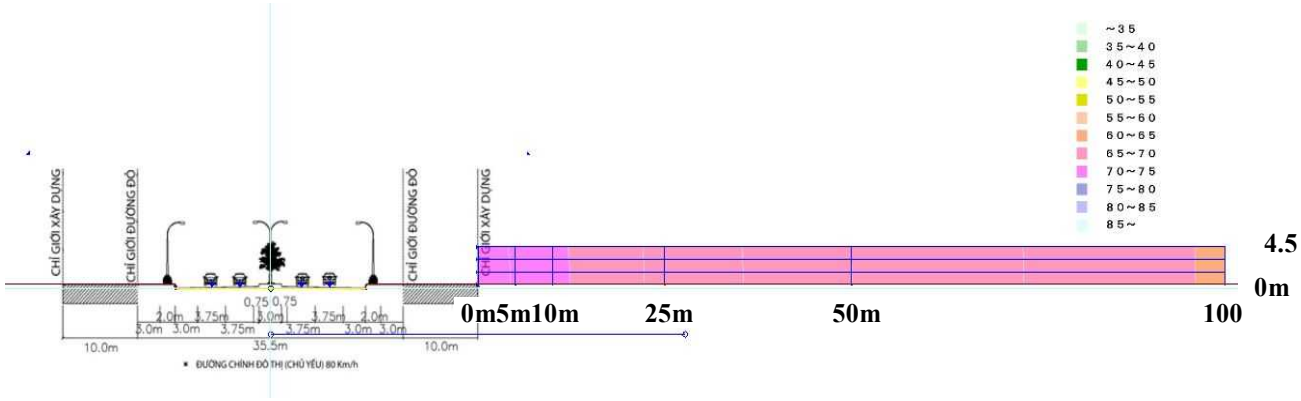


Figure 3.8. Predicted noise levels at Section (3) on ring road 3 by 2025

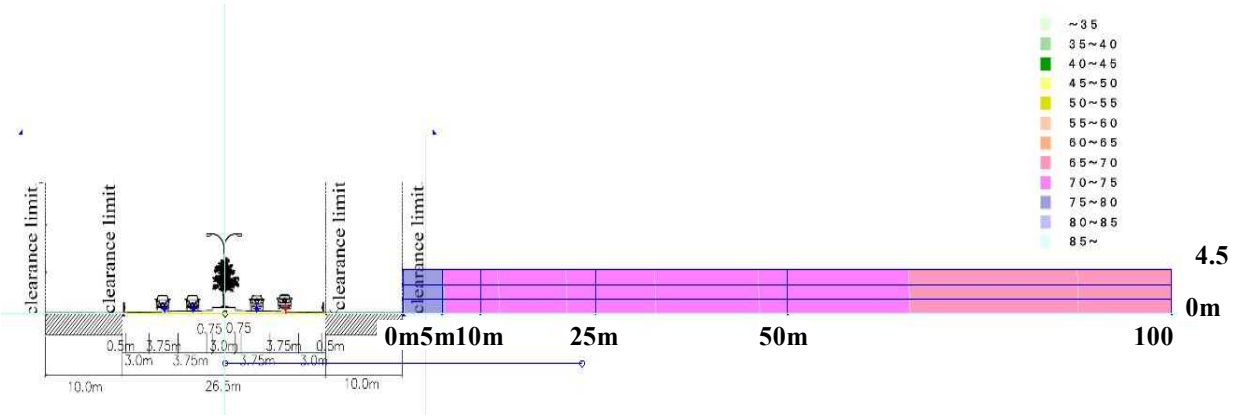


Figure 3.9. Predicted noise levels at Section (3) on ring road 3 by 2040

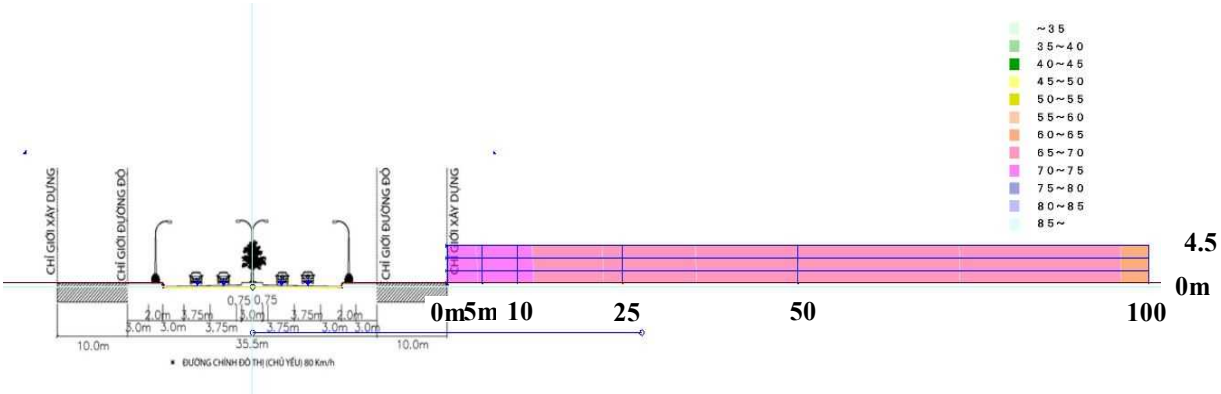


Figure 3.10. Predicted noise levels at Section (4) (5) on ring road 3 by 2025

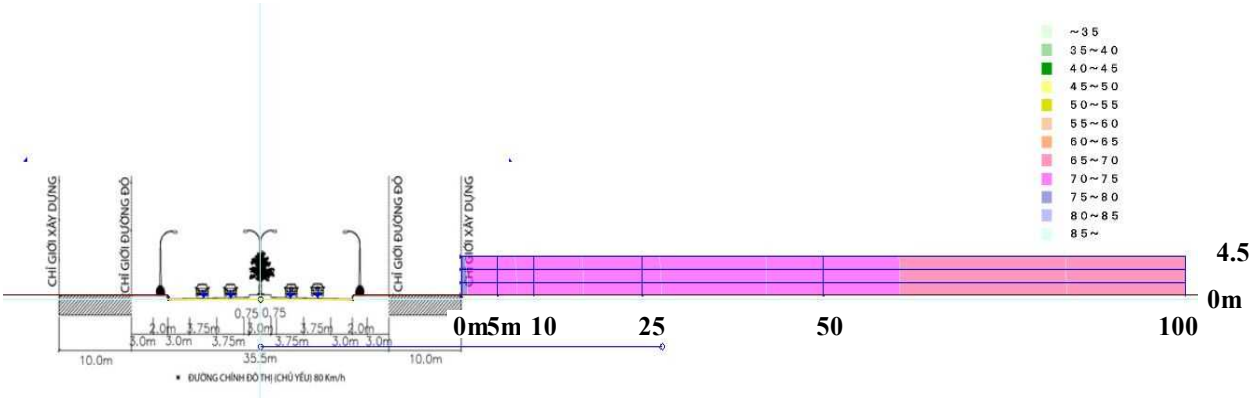


Figure 3.11. Predicted noise levels at Section (4) (5) on ring road 3 by 2040

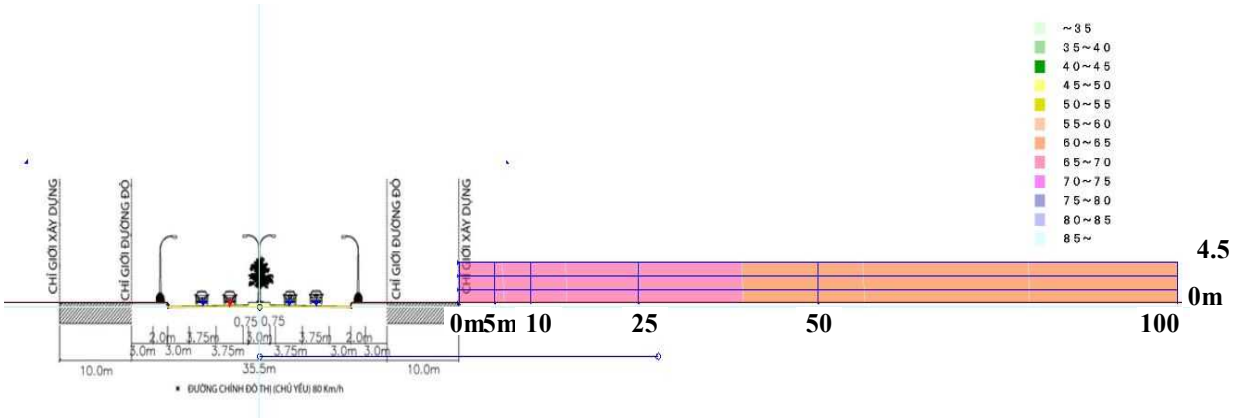


Figure 3.12. Predicted noise levels at Section (6) on ring road 3 by 2025

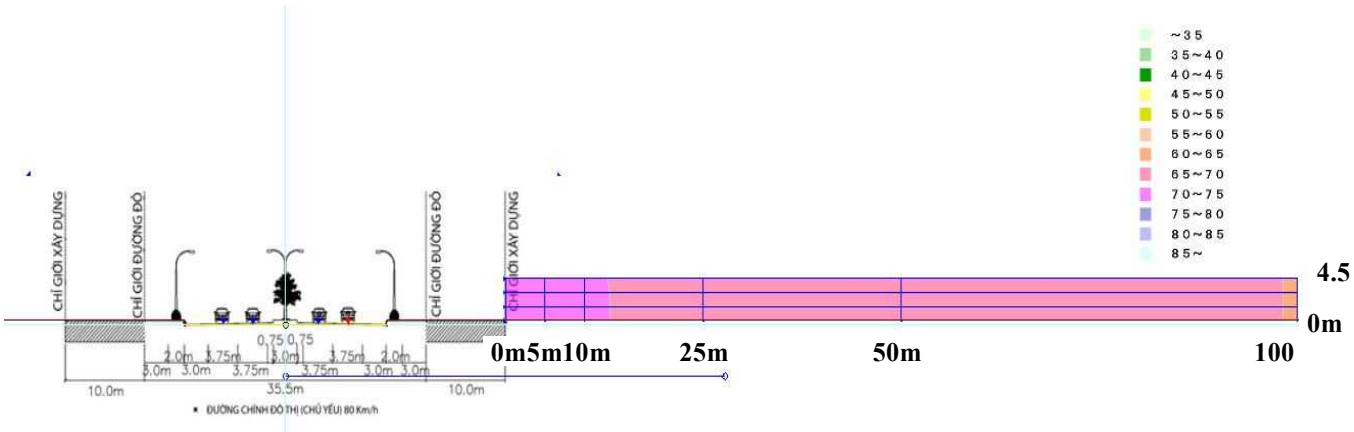


Figure 3.13. Predicted noise levels at Section (6) on ring road 3 by 2040

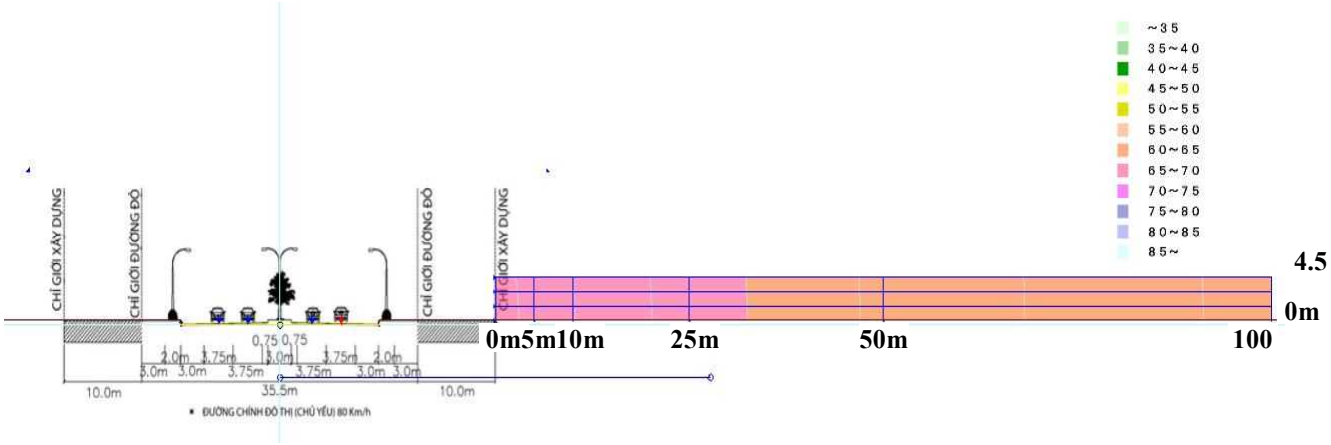


Figure 3.14. Predicted noise levels at Section (7) on ring road 3 by 2025

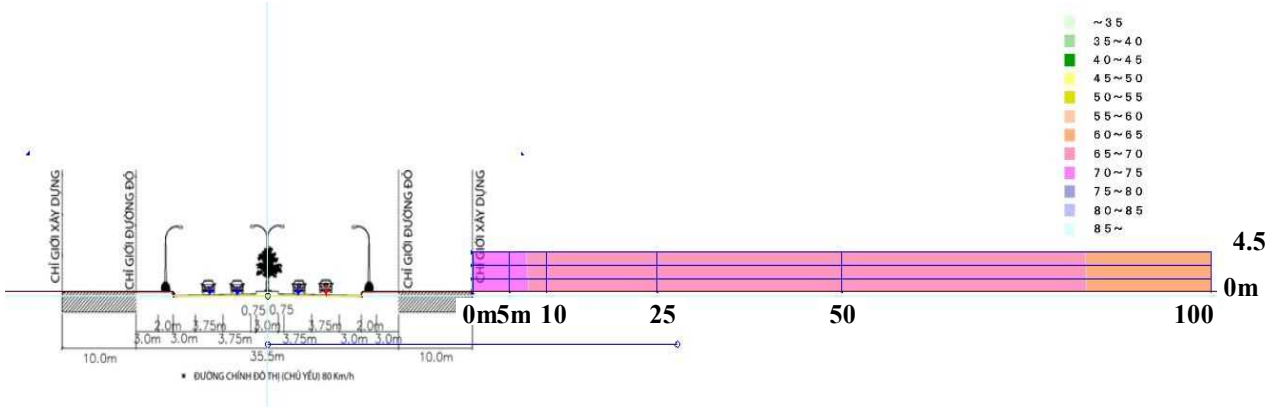


Figure 3.15. Predicted noise levels at Section (7) on ring road 3 by 2040

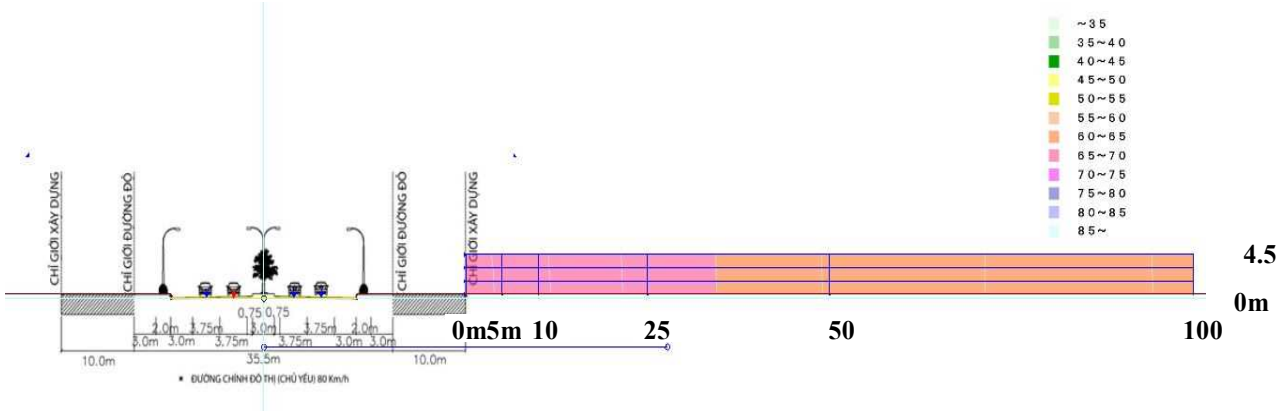


Figure 3.16. Predicted noise levels at Section (8) on ring road 3 by 2025

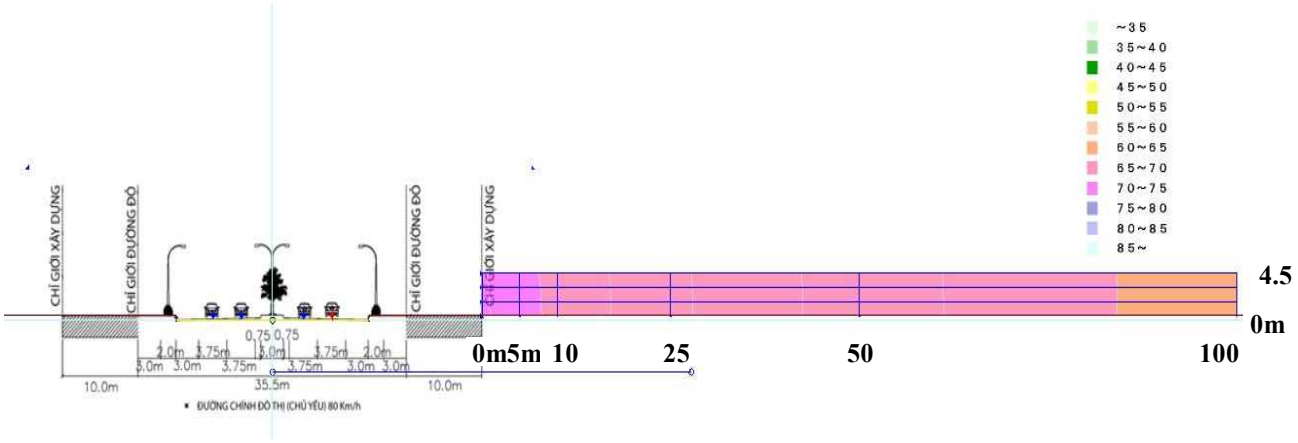


Figure 3.17. Predicted noise levels at Section (8) on ring road 3 by 2040

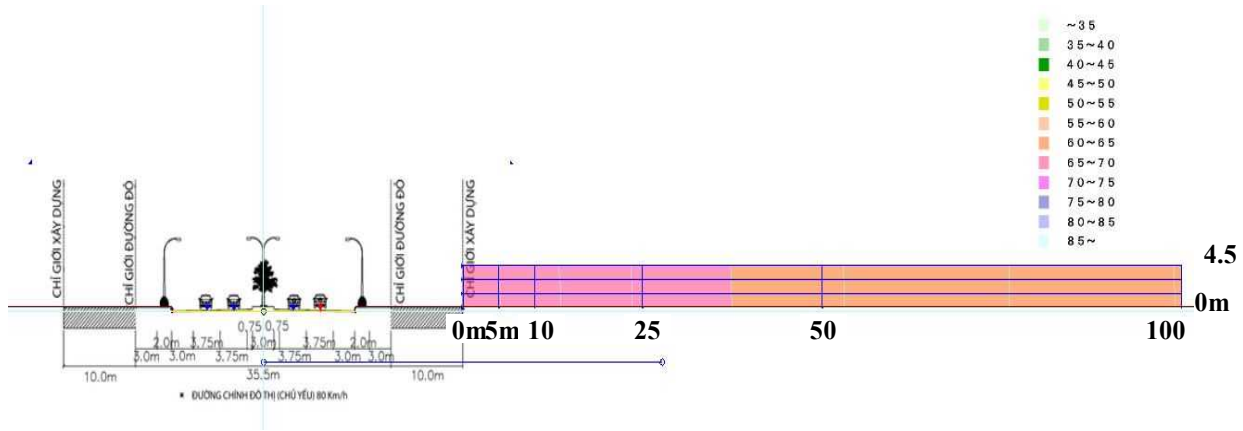


Figure 3.18. Predicted noise levels at Section (9) on ring road 3 by 2025

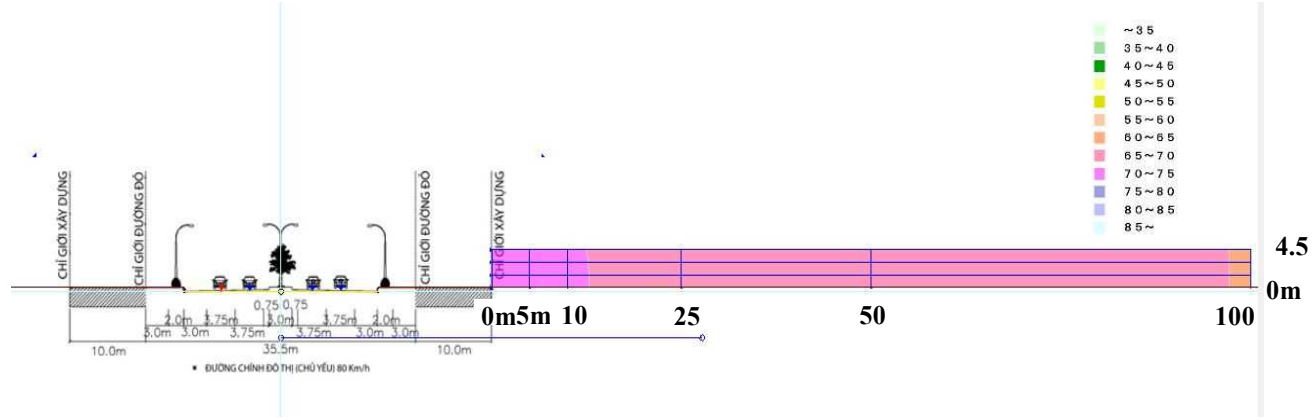


Figure 3.19. Predicted noise levels at Section (9) on ring road 3 by 2040

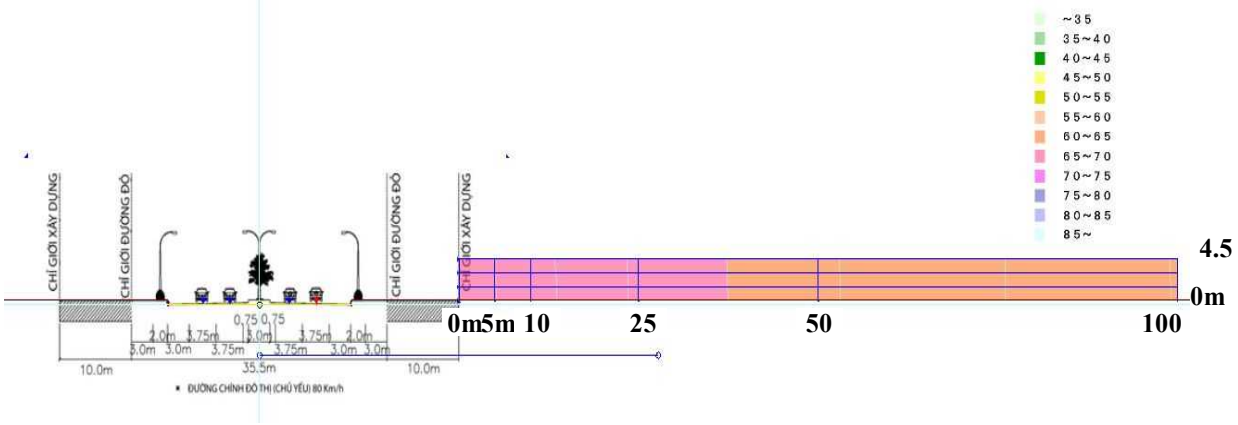


Figure 3.20. Predicted noise levels at Section (10) on ring road 3 by 2025

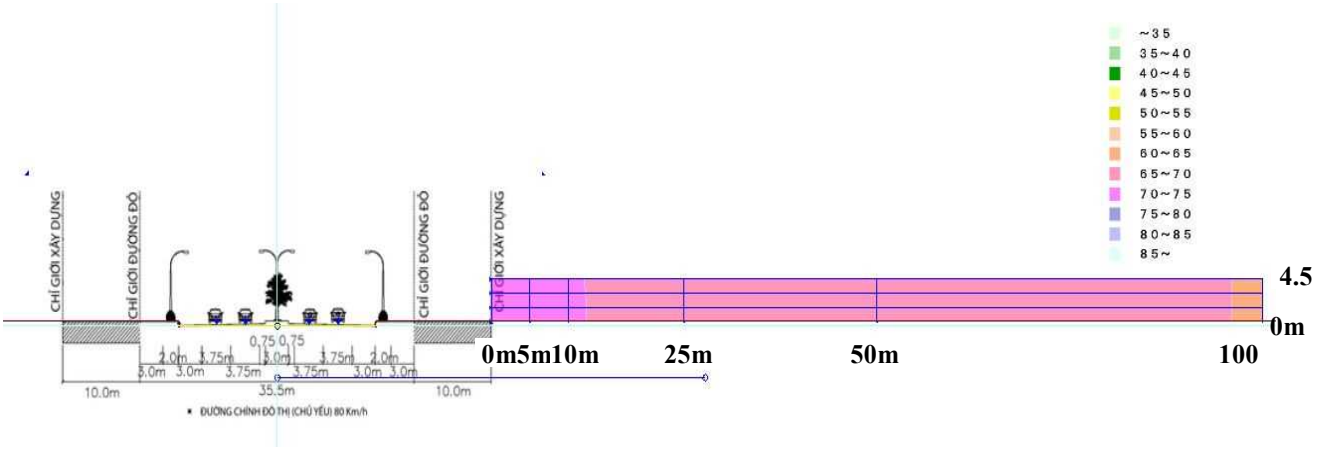


Figure 3.21. Predicted noise levels at Section (10) on ring road 3 by 2040

c. Assessment

Noise levels impact on each specific object is presented in Table 3.39.

Table 3.39. Noise level impact on the objects in 2025 and 2040 at ring road 3

No	Object	Distance [(1)] (m)	Noise affected (dBA)	Note
1	**Section (5)**			
a	*Year 2025*			
	Residential area (Km9+300 ~ Km9+500)	10	70.2	
-	Medical station in Lap Le commune (Km9+500) [(2)]	90	-	Located one block of building far from the construction site so it will not be affected by noise.
-	Residential area (Km8+700 ~ Km8+850)	10	70.2	
b	*Year 2040*			
	Residential area (Km9+300 ~ Km9+500)	10	73.7	
-	Medical station in Lap Le commune (Km9+500) [(2)]	90	-	Located one block of building far from the construction site so it will not be affected by noise.
-	Residential area (Km8+700 ~ Km8+850)	10	73.7	
2	**Section (6)**			
a	*Year 2025*			
-	Residential area (Km5+500 ~ Km5+940)	5	68.2	
b	*Year 2040*			
-	Residential area (Km5+500 ~ Km5+940)	5	71	
3	**Section (7)**			
a	*Năm2025*			
-	Residential area Ngu Lao commune (Km5+420 ~ Km5+500)	5	67.7	
b	*Year 2040*			
-	Residential area Ngu Lao commune (Km5+420 ~ Km5+500)	5	70.3	

No	Object	Distance (1) (m)	Noise affected (dBA)	Note
4	**Section (9)**			
a	*Year 2025*			
-	Residential area Ha Luan hamlet (Km1+400 – Km1+500)	10	67.3	
b	*Year 2040*			
-	Residential area Ha Luan hamlet (Km1+400 – Km1+500)	10	70.3	
5	**Section (10)**			
a	*Year 2040*			
-	Residential area (Km0+500)	10	67.4	
-	Residential area Ha Luan hamlet (Km1+300 – Km1+500)	10	67.4	
b	*Year 2040*			
-	Residential area (Km0+500)	10	70.2	
-	Residential area Ha Luan hamlet (Km1+300 – Km1+500)	10	70.2	

Note: (1) Distance from the construction boundaries (10m from ROW)

(2) Special area according to QCVN 26:2010

Cells with grey highlight: noise level exceeds the allowable limit according to QCVN 26:2010/BTNMT

Compare forecast results with Allowable Limit of QCVN 26/2010/BTNMT (70dBA during the day), found that.

– In 2025 *(*in the peak hours):

- The special areas won't be affected by noise;
- Impact noise level on resident areas that is located in the pavement is less than or approximately Allowable Limit according to QCVN 26:2010 (70dBA).

– In 2040 (in peak hours)

- The special areas won't be affected by noise;
- Impact noise level on the resident areas that is located in the pavement in excess of Allowable Limit according to QCVN 26:2010 (70dBA) isn't large (0.2 ÷ 3.7dBA). The level of this impact is negligible in compared with the benefits of street-front houses.

3.3.2.2. Vibration

a. Impact sourcess / Source generation activities

During the operational phase, vibration is caused by vehicle operation.

b. Impacts of vibration

The measurement results in the survey of environmental quality in August 2015 has showed that at the L_{10} vibration level at the start point of the Project intersecting with the National Road No. 10 is 62.0 dB. According to the design standard, the National Road No.10 is the grade-3 plain road with the designed speed of 80 kilometers/hour, equivalent to the designed speed of the project components. In addition, in the cross section of the Project components, there are 10-meter wide collector roads on two sides; otherwise, there should have 10-meter wide spaces to the permitted construction areas for residents. Therefore, during the project road operation, the vibration level is lower than the permissible limit as specified in the National Technical Regulation TCVN 7210:2002 on vibration generated by road vehicles (70 dB).

3.3.2.3. Deposition and erosion

For embankment: During the operation, if not reinforced embankment talus appropriate, soil erosion may occur from the embankment and could cause sediment to water bodies, the fields which are located adjacent.

For bridges crossing the river: Theoretically, the arrangement of abutments in the natural flow may create changes in hydrological and hydraulic regimes and riverbank erosion. However, piers of bridge design will be studied accordingly, ensuring easy flow of the river flow. Therefore, river bank erosion is expected to be negligible.

3.3.2.4. Landscape

Construction area along the ring road No.3 has no special landscape, so the appearance of Ring road No.3 will not have a negative impact on the landscape.

3.3.2.5. Impact of Ecosystem

During the operational phase, partly mangrove area of the riverbank under Ruot Lon Bridge will be affected by air pollution and shade by the Ruot Lon Bridge.

3.3.2.6. Impact of hydrology

Ruot Lon Bridge is designed with two piers of P6 and P7 located under the flow of Ruot Lon River. The designing work has studied to construct the pier with smallest displacement area, with cylindrical shape optimum for the flow direction. Therefore, the dynamics of the rivers flow will not change. However, during the operation phase, the river bed around the piers of the bridges will be eroded, but with no great depth.

3.3.2.7. Impact of Water usage

Presently, downstream of Ruot Lon River from the location for constructing Ruot Lon Bridge is used for water transportation and only one small portion is for aquaculture.

The appearance of Ruot Lon bridge will not affect water transport activities because piers of the bridge's main span far from with navigable clearance of 80m, ensuring navigation for fishing boats go in and out Mat Rong port.

The appearance of Ruot Lon bridge will also not affect much the water quality of river for aquaculture at downstream of this bridge.

3.3.3. Social impacts

3.3.3.1. Social capital and local organizations

Along the ring road No.3 of the project, people on the two sides of the road need to cross the road to access to headquarter of Commune People's Committee (CPC), cultural houses, ... to participate in community activities or solving personal issues. In addition, children also need to cross the road daily to get to school.

During the operational phase, the Ring Road No. 3 of the Project will facility movement of local people in a large area in the region. However, when ring road no.3 being completed, it will be higher with width of 45.5m-68m leading to faster speed of vehicles on the road. Local people living on roadside will have trouble crossing the road to get to the public utility facilities, shops, etc. particularly students daily crossing the road to get to their schools.

Therefore, it is required to arrange crosswalks with pedestrian markings for students go to school, as well as for local people in approaching public utility establishments, shops.

3.3.3.2. Local economic condition

In the operation phase, local economy and industry are expected to be developed due to the reduction in travel time, convenience trade between the two banks of the Cam River in the area of the project when the project is completed together with Vu Yen bridge project.

3.3.3.3. Poor households

Project-affected vulnerable households including the poors would face difficulty in restoring their living and livelihood after relocation. Therefore, the need is to monitor the effectiveness of policies to support, restoration of livelihood for these households,

during the beginning of the operational phase of the project.

3.3.3.4. Children's rights

In the operational phase, traffic volume will increase, and the speed of the vehicle will be faster, the risk of traffic accidents will increase. Children in the Project area will encounter more difficulties when going to school.

Impacts in operation phase are summarized in following table

Table 3.40. Summary of impacts in operation phase

No.	Impact	Location	Time	Degree of impact
I	***Impacts related to waste***			
1	Air pollution by dust and gas emission	– Along road and bridge of the Project	Long time	Low ~ Medium
2	Water polltion due to penetration of hazardous substance dropping onto the river or via rainwater runoff	– Along road and bridge of the Project	Long time	Low ~ Medium
3	Impact from waste	Along road and bridge of the Project	Long time	Medium
4	Impact on climate change/greenhouse gas	– The whole project area	Long time	Low ~ Medium
II	***Non-waste related impacts***			
1	Impact on public health by noise	Residential areas at: Km0+000– Km0+500, Km1+300–Km1+500 Km5+420–Km5+940, Km8+700–Km8+850, Km9+300 - Km9+500	Long time	Low ~ Medium
2	Impact on public health by vibration	– Ditto	Long time	Low ~ Medium
3	Impact on erosion. sedimentation	– Embankment road – Ruot Lon river	Long time	Low
4	Impact on landscape	– Surrounding area of the project	Long time	Positive
5	Impact on ecosystem	– Mangrove forest area near the approach road of Ruot Lon bridge	Long time	Low ~ Medium
6	Impact on hydrology	– Downstream area of Ruot Lon bridge on Ruot Lon river	Long time	Low

No.	Impact	Location	Time	Degree of impact
7	Impact on water use	– Water transport on Ruot Lon river – Irrigation capacity for the downstream area of Ruot Lon bridgen	Long time	Low
III	***Social impacts***			
1	Impact on social capital, local organizations	– Along the route of project	Long time	Medium
2	Impact on local economy	– Project area	Long time	Positive
3	Impact on the poor	– Relocated households	Long time	Medium
4	Impact on children's rights	– Schools in 9 communes of Dong Son, Hoa Binh, An Lu, Trung Ha, Thuy Trieu, Ngu Lao, Phuc Le, Pha Le, Lap Le of Thuy Nguyen district	Long time	Medium

3.4. Environmental incidents

3.4.1. Environmental incidents during construction phase

1. Technical incidents

The construction of the structure on the bridges at the height of more than 10 meters high will potentially cause technical incidents, leading to the works collapse, especially in the installation of scaffolds and construction of the piers of Ruot Lon Bridge in the river and the piers of bridges at intersection No. 1 and No.2. Once happening, technical incidents will be disasters, not only threatening the lives of the construction teams but also causing serious consequences for waterway transport means under the bridges on Ruot Lon River, and the road (commune road, PR No. 359).

2. Risks of fires and explosions

During the construction phase, oil and gas will be used for the operation of construction equipment. Oil and gasoline with the main composition of hydrogen carbide compounds (96 ~ 99%) are capable of evaporating quickly on the clear surfaces, thus easily causing explosions, especially when they are mixed with air and touch sparks.

3. Labor safety incidents

Labor accidents may occur during any activity in the construction process with use of workers if labor safety procedures are not followed.

The main causes of labor accidents are below:

- Mistakes in design of technological measures: Mistakes in design of technological measures such as formwork support measures and cantilever construction, etc. may result in works collapse, causing labor accidents;
- Mistakes in construction organization: such as inappropriate shift arrangement, improper and overlapping work arrangement, use of unqualified materials, omission of construction procedures and so on;
- Technical mistakes: incomplete or broken machinery, vehicle and instruments such as lack of safe mechanisms, shields and preventive signaling systems, etc.;
- Violations of safety technical procedures and regulations;
- Risk-related causes: accidents caused by transportation vehicles, slipping and falling down from scaffolds, electrical accidents and so on. On rainy days, the risks of occupational accidents increase due to possible land-slip, power incidents and subsidence.

4. Incidents of natural disasters (storms and heavy rain)

Such natural disasters all may result in incidents on site like:

- Increasing the probability of occupational accidents in case of the upper bridge construction, particularly threatening the lives of construction workers with lightning;
- Causing threats to the stability of the sky structures, especially pulling over newly built structures in case of thunderstorms;
- Causing risks of flooding on site as well as moving contaminants on the works surface to another location.

5. Incidents of vessel impact with the work

For Ruot Lon bridge, the distance between pier P6 and pier P7 in Ruot Lon river is 80m, and main transport means on the river are fishing boats. However, in the construction process, due to unexpected factors, there may be incidents of collision or impact between boats and the machinery for pier construction on the river. This incident will cause damage not only to people, boats, but also to the pier which is one important item of the project.

3.4.2. Environmental incidents during the operation phase

3.4.2.1. Vessel incidents

As stated in the impacts, although the presence of pier in the river flow will not generate significant changes in hydrological and hydraulic regimes, flow and erosion of the river sections where the bridges are expected to be built, the flow cross-sectional surface will be narrowed. Therefore, this is the cause of vessel accidents in the operation phase, to specify:

- In the dry season, when the vessel flow section is limited, the presence of abutments will increase the likelihood of incidents and collisions among vessels together;
- In the flood season, large flow velocities produce thrusts, increasing the likelihood of collisions between vehicles and abutments while they pass the bridges.

Vessel accidents not only cause damages to people, possessions and goods, but also affect the stability of the bridges (in case of collisions with the piers).

3.4.2.2. Risks of traffic accidents

Road traffic accidents can happen during the transportation of people and vehicles, not only cause damage to people and vehicles but also damage to auxiliary works of the bridges.

3.5. Comments on detail degree and reliability of assessment

3.5.1. Detail of the assessment

The identification of the project's impacts has been developed on the basis of considering each project's activities in three phases of preparation, construction and operation in the environment of receiving the Project with specific features of natural conditions, natural resources and socio-economic conditions of the region. If the Project is executed. There will appear the impacts of permanent land and infrastructure acquisition, impacts of erosion due to intervention to creation, impacts on transport. Impacts of bombs and mines and impacts on environmental quality, etc. Otherwise, such impacts will not occur, but the socio-economic growth of communes within the project will be limited.

The detail degree was also reflected in the calculations of emissions based on source data of facilities, machinery and materials to be used; technologies to be applied; personnel to be employed and in accordance with standards, regulations and norms specified in the legal documents issued by the State of Vietnam, international organizations and from construction experience of construction associations

3.5.2. Reliability of assessment

3.5.2.1. Forecasting methods

Emission sources were forecasted on the basis of facilities. machinery and materials to be used; technologies to be applied and personnel to be employed in line with the norms of the State of Vietnam and international organizations as well as summarized experience. The forecast results could be reliable.

Forecasting the impacts and scale of the impacts was determined based on the sensitivity of recipients and the size of emission sources. The assessment on the pollution levels was performed according to the method of comparison between the forecast results with the National Standard on environment in 1998 and those in 2008 ~ 2015 as well as international standards applicable to developing countries. The methodology was reasonable

However, due to possible small changes in the contractor's performance and weather fluctuations, etc., together with quick calculation quantitative and semi-quantitative methods applied to the report, the quantitative accuracy was not high. Therefore, unanticipated impacts and adjustments to provided ones will be added through the supervision from the construction preparation and during the construction.

3.5.2.2. Calculation Methods

a. Prediction of air pollutant concentration

Using model Gausse applied for road source to forecast pollution level based on the forecast of waste emission flow of dust and toxic gases specific for transportation projects in meteorological conditions of Project area in both construction and operation stages is a traditional method. This model is programmed on language C++.

The results of forecast of toxic gas emission from vehicle flow's engine in 2025, 2040 are found reliable. However, some input parameters as meteorological conditions are taken by annual average values, the forecast results are relative. The observation of air quality in operation stage corresponding with vehicle flow in reality shall help to adjust the forecast results.

b. Prediction of noise pollution

b.1. Pre-Construction and Construction phase

The forecasting method noise source and the noise attenuation with distance is applied in the curriculum "Air Environment" by PhD. Dr. Pham Ngoc Dang – Scientific Publishing house 2003. These are the trusted, accepted and widely used in Vietnam.

However, according to this method many inputs were taken in standard conditions. Many factors affect the noise level as cross of road, surrounding topographic ... are not included in the model so accuracy is not high

b.2. Operation phase

ASJ–Model 2003 was used to forecast noise level generated from the traffic flow on the road of the Project. The ASJ Model–2003 allows to predict noise level for various types of noise source, as well as noise levels at sensitive receptors along the alignment (residential areas, schools). The model is considered providing highly reliable results.

The ASJ Model 2003 was developed mainly by "the Acoustic Society of Japan" based on many complex formula according to A-method (A-method is also called "Precision Method"), and B-theory of acoustic diffusion (B-method is also called "engineering method"), in which process of description and calculation of noise intensity is based on a sequence of fixed sound frequency per unit of time, changing in the range of 1 minute to 30 minutes. The process of sound wave dispersion calculation in ASJ Model 2003 is described and separated on the basis of process of sound echo with regression equations. The input parameters of vehicle flow are separated by various lanes and that flow is considered unchanged in number of regular vehicles on the road.

Basic calculation equation is based on division of each vehicle flow into different sections, at one of which the total sound intensity is calculated with receptors and each of vehicle. Total sound intensity is divided and calculated for one meter area of road

surface on the basis of matching pursuit algorithm. Calculation is reasonable and reliable. However, the noise forecast excludes features of topography and sample vehicle, so it is necessary to verify in practice.

CHAPTER IV. MEASURES FOR PREVENTION & MITIGATION OF NEGATIVE IMPACTS AND PREVENTION OF & RESPONSE TO ENVIRONMENTAL INCIDENTS

4.1. Measures for prevention & mitigation of the project's negative impacts on the environment in the pre-construction phase

4.1.1. Measures for mitigation of negative impacts of land acquisition, relocation and resettlement

4.1.1.1. Mitigation of impacts due to permanent land occupation

a. Description of mitigation measures

Measures to mitigate impacts of land acquisition, involuntary resettlement are described in the separately-prepared Resettlement Action Plan (RAP) and livelihood restoration plan.

The RAP has contents in conformity with Vietnamese laws and regulations as well as the JICA Guidelines on environmental and social considerations (April 2010), and was reviewed by both JICA and Vietnamese side. The RAP was submitted to Hai Phong City PC for approval and will be used as a basis to prepare the Resettlement Policy Framework (RPF) as well as other plans which aim to mitigate impacts of land acquisition and resettlement.

The local people will be informed about this plan, and will be encouraged to participate into the project as from the FS formation stage via public consultation meetings. Based on these meetings, people's expectation will be grasped, then a consensus will be obtained during the project implementation process. Public hearings, etc. are organized in order to provide project information as well as forecasted environmental impacts and proposed mitigation measures, etc. Via these meetings, the project stakeholders will update opinions of the local people and authorities on the above mentioned issues.

The project owner will provide sufficient and timely necessary information and documents about the project, and budget for compensation, support and resettlement.

Compensation and Support: Households are not able to recovery livelihood and business if compensation for damages is only made at the replacing price of acquired farmland. Measures to support stable production and income restoration plans will be developed and implemented to ensure that the livelihood of people losing agricultural land will be restored at least at the level as before. Measures to support relocation of houses and life stability for people losing houses and resettled will be prepared and implemented in order to quickly stabilize life of these households.

Recruitment: For some simple jobs with low skill requirements, the contractor will be encouraged by the Project Owner to recruit local labors, among which people with

acquired farmland will be preferential to be employed with respect to their wishes and eligibility.

b. Objects and Implementation time

– *Applicable objects:*

+ Households with occupied residential land and houses

+ Households with permanently occupied agricultural land.

– *Time*: Completed before construction.

4.1.1.2. For impact of temporary acquisition of land

a. Description of mitigation measures

- A part of land area (currently cultivation land and aquacultural ponds) will be rehired to prepare for construction sites of bridges at interchanges and Ruot Lon bridge.

- Implement mitigation measures of temporary land acquisition impacts as proposed in the RAP and livelihood restoration plan, namely as follows:

1) Compensation for all damaged or lost assets, including trees, crops, works at full replacement cost and under agreement with owners of the temporarily acquired lands.

2) Rental in cash for the land temporarily occupied at a rate which will be not less than the net income that would have been derived from the affected property during disruption in case of not expropriation.

3) Restoration of the land within 3 months after use: The contractor is expected to return the land in its original condition within 3 months after the termination of the civil works.

b. Objects and Implementation Time

– *Objects*: Owners of temporary occupied land

Time: Completed before site leveling.

4.1.1.3. For impacts on vulnerable households including poor households

a. Description of mitigation measures

Vulnerable households consist of social policy households and female-headed households, etc. affected by the project. Mitigation measures of impacts on vulnerable households are presented in The RAP and livelihood restoration plan, namely as follows:

+ For vulnerable households to be relocated, the project will apply a separate policy to assure they may relocate and stabilize their live at new place.

+ For vulnerable households to be relocated with more than 20% of production land affected, or whose affected land area is less than 20% of production land area but the remaining area is not viable, they will receive a special support according to regulations of Hai Phong City People's Committee.

+ Other support policies.

b. Objects and implementation time

- *Applicable objects:* vulnerable group consisting of social policy households and female headed households.
- *Implementation time*: To be completed before construction.

4.1.1.4. For impacts of grave relocation

a. Description of mitigation measures

For the purposes of limiting social impacts from grave relocation, the following measures shall be taken:

- *Early announcement*: It is necessary to announce early the land clearance time to the graves' relatives for implementing necessary rituals.
- *Compensation and support*: Reasonable compensation and support will be done for the relocation, transportation and burial of new graves.

b. Objects and implementation time

- *Objects:* Relatives of relocated graves
- *Time:* Completed before construction

4.1.1.5. For impacts on local economy (employment, livelihood)

a. Description of mitigation measures

- Implement measures to mitigate impacts on employment, production, business of local people as proposed in the RAP and livelihood restoration plan.

- Implement the project on schedule, select reasonable construction method and time of each item to minimize the impacts.

- Contractor will be encouraged to recruit people affected by the project and people from other locality to do common jobs.

b. Objects and implementation time

- *Applicable objects:* Production and business households related to the project.
- *Implementation time*: During preparation and construction stage.

4.1.1.6. For use of land and natural resources of the locality

a. Description of mitigation measures

- Implement the project in compliance with the City's master plans.

- Compensation and support policies for households losing land must be implemented according to the RAP and approved by competent authorities.

- When prepare livelihood restoration plan for project affected households, take into account efficient use of existing resources of the locality.

b. Objects and implementation time

– *Applicable objects:* Households losing land of communes related to the project.

– *Implementation time*: During preparation phase.

4.1.1.7. For impacts of relocating utilities (irrigation ditches, electricity poles)

a. Description of mitigation measures

- Diversion plan of utilities like electricity lines, irrigation ditches, etc., will be developed in details and implemented properly, so that relocation of these works will be completed before construction and will not interrupt daily life and production activities of the people in a long time.

- Steps in reinstatement of these utilities are as follows: (1) Construction and finalization of new systems; (2) Trial run; (3) Operate new systems and demolish old systems.

- Assure sufficient budget and pay on time relocation costs of electricity lines, irrigation ditches, etc. (relocation costs were included in the project total investment cost).

b. Objects and implementation time

– *Applicable objects:* Electricity lines and irrigation ditches along the project route.

– *Implementation time*: Before construction of road and bridge.

c. Assessment of effectiveness of mitigation measures

Mitigation measures for impacts on utilities are feasible and in compliance with construction sequence, not interrupt daily life and production activities of the people; costs for this work has been prepared and included in the project total investment cost.

4.1.1.8. For impacts on ecosystem (mangrove forest)

a. Description of mitigation measures

- Compensation plants for occupied mangrove forest area of 1.02ha.

- Location of compensation plants must comply with "Forest protection and development program of Hai Phong City People's Committee to 2020" (Decision No. 1600/QD-UBND announced on 21/8/2013). According to this program, Hai Phong

plans to expand forestation area from 4,800ha to 8,000ha in 2020. Mangrove forest mostly locates along Bach Dang, Cam and Ruot Lon rivers.

- Combine the project's forestation plan with the plan under implementation by Vingroup to develop eco-parks in the East of Vu Yen island.

b. Objects and implementation time

– *Applicable objects:* Mangrove forests.

– *Implementation time*: During pre-construction and construction phases.

4.1.1.9. For impacts by unequal benefit and damage sharing

- Compensation and support for affected households are implemented as mentioned in Section 4.1.1.1.

4.1.1.10. For impacts of community separation

a. Description of mitigation measures

- Study the project alignment to avoid residential areas

- Arrange traffic safety assurance devices to facilitate accessibility of peoples on two sides of roads.

b. Objects and implementation time

– *Applicable objects:* sections through residential areas at Km0+000 – Km0+500, Km1+300 – Km1+500, Km5+420 – Km5+940, Km8+700 – Km8+850, Km9+300 - Km9+500.

– *Implementation time*: During preparation phase

4.1.1.11. For bombs and mines

a. Description of mitigation measures

The following measures will be taken to prevent incidents caused by bomb and mine explosion:

- An entity specialized in explosive clearance under Ministry of National Defense will implement bomb and mine clearance in the land acquisition area of the project.

- Inform the local authorities and communities before the bomb and mine clearance entity to implement this work.

- Investigate and clear explosives in accordance with regulations.

- Provide sufficient fund.

b. Objects and implementation time

– *Applicable objects:* within land acquisition area of the project

– *Implementation time*: before construction

4.1.1.12. Assessment of effectiveness of mitigation measures

It is experienced that the land acquisition usually creates long-term social impacts, especially when it needs to relocate and resettle a number of affected households, even it is a small-scaled land acquisition, and its aim is to contribute to the national and public interests, and the compensation is done in accordance with the compensation, support and resettlement plan agreed by the affected people. Practical experience indicates that social disputes are mostly be settled, if the RAP and the mitigation measures are well prepared and implemented.

In case of the Project, the proposed measures to mitigate impacts of land acquisition and resettlement are considered feasible due to the following reasons:

- The RAP was carefully prepared in line with Vietnamese laws and regulations on land acquisition and JICA Environmental Guidelines (2010), and had taken into considerations opinions of affected people collected during the consultation meetings and group discussions in the project-affected communes.
- The local land fund is available, therefore it is able to provide affected households with appropriate land for resettlement in place as their expectations, and the arrangement of suitable resettlement sites is feasible.
- Information on the project implementation progress, construction schedule, compensation, support and resettlement policy and plans, etc., were appropriately dismissed to localities and affected households;
- Compensation to the temporarily-acquired agricultural land will be done under agreement and satisfied by both the Project Owner and affected people. After completion of construction, the contractors will be obligated to clean-up and restored the land to its original as stipulated by law.

4.1.2. Measures for mitigation of negative impacts of site clearance and preparation

4.1.2.1. Mitigation measures of air pollution (dust)

(1) Control of dust generated during house demolition

a. Description of measures

- *Watering for moisture:* in case of demolishing on windy, dry days;
- *Covering with canvas:* Canvas covers demolition areas to prevent dust from dispersing into the surrounding areas;
- *Waste transportation:* Waste that is not recycled will be treated, disposed under contracts with competent environmental companies.

b. Locations and implementation time

- *Locations:* in residential areas at Km0+000 – Km0+500, Km1+300 – Km1+500, Km5+420 – Km5+940, Km8+700 – Km8+850, Km9+300 - Km9+500.
- *Implementation time*: 2 weeks during preparation phase.

(2) Control of dust generated during site leveling

a. Description of measures

- *Watering:* Measures would be implemented to control dust emissions, such as the use of water carts, sprinklers, sprays and dust screens. The frequency of use would be modified in response to weather conditions. Spraying water is taken from rivers, canals and water sources near the work sites.

b. Locations and implementation time

- *Location:* At the leveling location of the construction site.
- *Implementation*: 3 months

c. Assessment on effectiveness of mitigation measures

The mitigation measures achieve high efficiency and feasibility due to simple techniques, no possibility of dust emissions.

4.1.2.2. Mitigation of impacts of waste

a. Description of measures

- *Classify and process properly*: demolition waste such as, iron sheet, steel, wood will be classified to reuse for backfilling the site or burning, etc.
- *Collect and choose temporary storage area*: generated waste will be collected and gathered at defined locations on the site.
- Not burning waste, construction waste or trees on the construction site.
- Contractors of demolition works must sign a contract with Hai Phong City urban environment company to collect, transport and process waste from demolition works.

b. Locations and implementation time

- *Locations* : house demolition areas at the sections Km0+000 – Km0+500, Km1+300 – Km1+500, Km5+420 – Km5+940, Km8+700 – Km8+850, Km9+300 - Km9+500; construction site.
- *Implementation:* During demolition period (2 weeks) and construction site preparation period (1-2 months).

c. Assessment on effectiveness of mitigation measures

That people reuse demolition waste and the project reuses soil and broken bricks not only solve the demand of construction materials for works in the areas lacking construction materials but also limit waste at disposal site. Waste collection measures are reasonable and solid waste treatment measures are in compliance with the Decree No. 59/2007/ND-CP and the Decree No. 38/2015/ND-CP dated 24/4/2015 of the Government on management of wastes and discarded materials. The proposed measures are feasible and efficient.

4.1.2.3 Mitigation of noise impacts

a. Description of measures

The following measures shall be implemented to mitigate noise impacts:

- Not demolishing, leveling and transporting at night: from 22.00 pm to 6.00 a.m.
- Maintaining the equipment to ensure smooth operation, thereby reducing the noise source;
- Restricting to operate many devices simultaneously.
- Combine manual and machinery demolition.

b. Location and implementation time

- *Location:* Residential areas at the sections Km0+000 – Km0+500, Km1+300 – Km1+500, Km5+420 – Km5+940, Km8+700 – Km8+850, Km9+300 - Km9+500.
- *Applicable time*: 2 weeks for each demolition location.

c. Assessment on effectiveness of mitigation measures

Not constructing at night except when eliminating noise arising at source. These measures are completely feasible when the contractor has specific regulations and raise awareness of workers.

4.1.2.4. Mitigation of impacts on landscape

a. Description of mitigation measures

- Classify, collect and process construction wastes generated from demolition of houses and structures, then transport to the disposal site on daily basis.

b. Object and implementation time

- *Applicable object:* construction wastes generated from demolition of houses and structures.
- *Implementation time:* preparation phase

4.1.2.5. Mitigation of traffic accidents and obstruction on traffic of local people

a. Description of mitigation measures

- Set up the fence isolating the demolition area with surrounding areas.
- Arrange warning signs of demolition areas
- Equipment, machines used for house demolition and site levelling near crowded areas must be managed properly to prevent traffic accidents and obstruction of local people's travelling.
- Do not transport construction waste in peak hours.
- Construction waste must be transported by special vehicles with covered body to avoid waste scattering on the roads.

b. Objects and implementation time

- *Applicable object:* Where houses to be demolished and on construction sites of bridges at interchanges.
- *Implementation time*: during pre-construction phase

c. Assessment on effectiveness of mitigation measures

The mitigation measures are feasible and economic. If these measures are strictly applied impacts of traffic accidents and obstruction of people's travelling will be mitigated effectively.

4.2. Prevention and mitigation measures of adverse impacts on environment during construction phase

4.2.1. Mitigation of impacts by exploitation and transportation of construction materials

- Construction materials are supplied from pits which are granted with exploitation license and operated under a good environmental management.

- When transporting materials by waterway, the following measures shall be applied:
+ Equip shield panels surrounding materials to avoid material scattering on river.
+ Fine materials prone to spread in wind must be covered with canvas during transportation.

+ Prohibit to transport materials exceeding the load of vessels and boats.

+ Only use boats/barges in compliance with waterway transport standards.

+ At transit location from boats/barges to trucks, apply measures to mitigate impacts of dust and soil erosion as explained in Sections 4.2.2.1 and 4.2.3.3.

- When transporting materials by roadway, the mitigation measures include:

+ The contractor shall not store soil, rock, sand in public land or private land area.

+ Regularly spray water on the transportation route, material storage area and areas prone to dust emission.

+ Body of trucks used to transport materials prone to dust emission must be installed with partition and tails as regulated. Materials prone to dust emission must not be higher than the partition and tail cover, and must be covered with tarpaulin cloth in good conditions. The covering cloth must meet requirements on quality and must cover beyond the truck sides and tail at least 300 mm.

+ Trucks used for transporting construction materials must comply with the standard on permissible emission (stipulated in the Decision No. 249/2005/QD-TTg dated 01/10/2005), and must be covered carefully.

- Transportation routes will be determined in the technical design phase, and mitigation measures of impacts of material transportation will be further studied.

4.2.2. Mitigation of impacts on sources related to waste

4.2.2.1. Prevention of dust emission

(1) Dust emitted from earthworks and related activities

a. Description of mitigation measures

The following measures will be applied in order to prevent and minimize quantity of dust emitted from earthworks:

- Train workers to raise awareness and responsibility in air quality control.

- Implement monitoring program during construction time, including daily checking issues related to weather, meteorology and dust emission on construction site (as in dry weather and strong wind).

- Construction activities can be changed, reduced or controlled in strong wind condition if strong wind can cause more dust emission on site.

- Promptly stabilize surface of construction site to prevent or minimize dust emission by wind blow.

– *Moistening dust emission areas*: Spraying water taken from surface water sources in rivers, canals and irrigation ditches near the construction sites to avoid dust emission.

Proposed technical solutions:

1. *Use of water carts, sprinklers, sprays. The frequency of use would be modified in response to weather conditions.*
2. *Use standardized nozzles for water spraying to ensure that the surface is moistened evenly without any water stagnation. Instead of bulk water usage, the surface should be sprayed for many times.*

– *Ngăn ngừa phát tán bụi tại các bãi chứa tạm*: Các bãi chứa đất tạm thời có thể tích lớn sẽ được quây quanh để tránh phát tán bụi.

Proposed technical solutions:

1. *The enclosing sheet is made of thick nylon fabric preventing dust from being emitted into sensitive subjects (residential areas, schools, etc.).*
2. *The sheet is about 30 cm higher than the surface of the yard.*
3. *The sheet should be fixed with piles driven deeply into ground*

– Excavation and backfilling areas will be stabilized as soon as possible to prevent or minimize dust emission by wind.
– Temporary soil storage area with large volume will be covered with canvas to avoid dust emission.
– Equip tools such as wire meshing, wheel washing equipment, etc. to clean vehicle wheels before leave the construction site, to keep roads outside the construction site clean.
– Clean the construction site and adjacent roads when necessary.
– Set up speed limit signs and monitor speed of construction vehicles on the site.
– Trucks and equipment must turn off when stop working for more than 15 minutes.
– Construction vehicles and equipment must meet emission standards: under the

"Decision No. 249/2005/QD-TTg dated October 10, 2005 made by the Prime Minister prescribing the emission standard applied to road motor vehicles".

- Vehicles are only allowed to move within the stipulated construction scope (site clearance scope)..
- Construction vehicles and equipment must be maintained in accordance with manufacturer's instruction to assure vehicles work well.

b. Location and Implementation time

- *Location:* pavement, foundation pit, abutment/pier construction sections, temporary material and waste soil storage yards, and sensitive objects along the project including residential area at the sections Km0+000 – Km0+500, Km1+300 – Km1+500, Km5+420 – Km5+940, Km8+700 – Km8+850, Km9+300 - Km9+500.
- *Time:* during construction phase

(2) Dust emitted from waste soil transport activities

a. Description of mitigation measures

The following measures will be applied in order to minimize air pollution due to TSP generated from transport vehicles containing redundant soils and stones.:

- Train workers to raise awareness and responsibility in air quality control.
- The transport vehicles taking redundant soils and stones from the project area to site leveling location must meet all requirements of emission standards under "the Decision No 249/2005/QD-TTg dated October 10, 2005 made by the Prime Minister prescribing the emission standard applied to road motor vehicles".
- The soil, stone or sand transport vehicles must have body lid or canvas that will be tightly tied to the vehicles.
- Do not transport waste soil in peak hours and public holidays.
- Soil scattering on roads while transportation must be collected, and the road will be regularly cleaned.
- Plan to transport a major part or all waste soil by waterway.

b. Location and Implementation time

- *Location:* On transport routes from the construction site to disposal sites.
- *Implementation time:* During construction phase.

(3) Dust emitted from concrete mixing plants

a. Description of mitigation measures

- *Prevention of dust emission in mixed materials storage areas*: In order to avoid dust emission, the material stockyards shall be shielded by enclosing canvas sheet,

except for one side for moving materials onto belt conveyor. The sheet is tightly fixed into ground;

- *Prevention of dust emission from material pouring activities:* When pouring materials down from trucks, it is necessary to spray water in case of dust emission;
- *Prevention of dust emission from stone crushing activities*: Stone shall not be crushed at the construction site. Standard stone or gravel for mixing concrete will be purchased from licensed utilities and supplier;
- *Prevention of dust emission from belt conveyor*: Materials used to mix concrete (sand and gravel) will be moistened before being taken onto the belt conveyor leading to mixer.
- *Prevention of dust emission from silo*: According to design, dust filters are installed inside the silo of concrete mixing plant. Fabric dust filter sleeve or steam spray device should be used depending on capacity and technical characteristics. These equipment has dust filtration capacity of over 90%. During the construction period, the equipment should be regularly maintained by the contractor.

b Location and time for implementation

- *Location*: Cement mixing plant at the construction site;
- *Time:* During the construction period.

(4) Assessment of effectiveness of mitigation measures

The proposed measures are based on the principle of minimizing dust emission from sources that not only brings high efficiency, but also reduces dust pollution level (if any) in residential areas as a basis for operation regulation. The proposed measures are feasible and highly effective. To increase the feasibility of the proposed measures, implementation costs will be included in the total investment capital of the Project; besides, implementation contents for contractor as well as supervision contents for consultant shall also be included in terms; under terms of economic contract. Project's inspection methods shall be applied to ensure that contractor and supervision consultant shall comply with the contract**.**

4.2.2.2. Mitigation of waste impacts

- *Development of waste management plan*: The Project Owner shall manage materials and waste generated during the construction period under a waste management plan (WMP) which consists of the following main contents:
  + Assign person in charge of waste management on site.
  + Set up objectives for WMP.

+ Estimate types of wastes and volume of relevant wastes.
+ Set up criteria to reduce volume of disposal waste.
+ Describe recycle/reuse method for each kind of waste.
+ Determine disposal site and removal method including materials to be classified on site for reuse and recycle.
+ Method to monitor waste treatment process.
+ Describe special measures for material use and processing
+ Description of measures of dissemination and training to encourage workers involvement on site.

– WMP is made for ordinary waste (construction waste, domestic waste) and hazardous waste (oil-containing wastes, toxic chemical containing wastes. During the construction period, WMP will be applied by construction units as a construction document so as to specify management procedures and report on waste generated and materials transported to the construction site. WMP is one of the subjects for inspection as mentioned in environmental monitoring program.

– *Management and treatment of waste*: Measures for management and treatment of domestic solid waste, construction solid waste, wastewater, waste oil and oil-containing waste as described as below.

(1) Construction solid waste

a. Description of mitigation measures

- Quantity of raw materials to be used will be calculated at the beginning of each construction activity to avoid exceeding storage capacity and wasteful use on site.

- Waste must be stored and treated in dedicated areas isolating with surrounding areas to avoid loss or scattering and future pollution. Temporary waste storage area must situate far from sensitive areas such as residential areas, surface/ground water sources. The waste storage area must be maintained in good and clean condition.

- Do not burn waste, construction waste and trees on site.

- The contractor must classify construction waste on site to facilitate reuse and recycle by modern and feasible technology, namely as follows:

+ Construction waste, according to the Engineer, reasonable for backfilling: The Contractor shall contact with the Hai Phong urban environment company to determine suitable location for reuse (for example: filling sunken areas like ponds, lakes, fields, garden, etc., or for construction works). Reuse of this waste will not cause impacts on environment.

+ Construction waste, according to the Engineer, unreasonable for backfilling: The

contractor shall classify construction waste on site and store in dedicated areas for each kind of waste such as wood, metal and plastic to facilitate transportation to disposal site and treatment.

- Discarded materials and wastes generated from bridge construction must not be discharged directly into rivers. Arrange grid below the bridge at construction site to collect solid waste and prevent them from scattering into rivers and roads.

- After complete bridge construction, all scaffoldings and temporary facilities used for bridge construction must be removed and river bed must be cleaned from any discard materials or wastes, etc.

- Waste soil generated from embankment and works construction will be utilized for backfilling low areas along two sides of roads and locations as agreed by local authorities or land owners in writing. The remaining soil will be removed at the defined disposal location.

- During technical design, disposal locations of the project will be determined and impacts potentially caused by disposal activities will be investigated and evaluated in details.

b. Location and Implementation time

– *Location*: the entire project
– *Applicable time:* During construction phase.

(2) *Management of domestic solid waste*

a. Description of mitigation measures

The following measures shall be taken in order to minimize impacts of domestic solid waste from workers tents:

– Domestic solid waste will be handled gradually. Firstly, solid waste will be collected and classified by sorting out the reusable type. The non-reusable waste and waste from are not reused and waste from portable toilets will be transported and discharged to solid waste treatment area of Hai Phong city under the economic contract signed with urban environment company in Hai Phong city, etc.
– All solid waste from workers tents will be collected in containers with capacity of 100 ÷ 240 liters dedicated for each kind of waste to facilitate reuse and recycle.
– Leftover food and vegetables can be used by residents as animal feed. Reusable waste such as plastic bags, cardboard, cans, bottles can be sold to scrap dealers to be recycled.
– Un-reusable waste will be removed to temporary storage area which is designed with wall and roof for weatherproofing.
– Under the economic contract, the Project Owner will require the contractor to

handle all kinds of domestic waste in accordance with the Decree No. 59/2007/ND-CP dated April 09, 2007 and the Decree No. 38/2015/ND-CP on solid waste management and in accordance with local practice.

b. Location and Implementation time

- *Location*: at construction site of the project.
- *Applicable time:* During construction phase.

(3) *Management of redundant oil and oil contaminated waste*

a. Description of mitigation measures

The following measures shall be taken in order to prevent the spread of oil, causing environmental pollution:

- Classify and temporarily store all redundant oil in separate containers with red labels and stored in the area with tight floor and roof.
- Registration of waste generator: As the project generates over 600kg of redundant oil/ year, the project owner shall register as waste generator with Department of Natural Resources and Environment (DONRE) of Hai Phong city.
- Prepare annual hazardous waste management report and submit DONRE before January 31st of the following year.
- Under the economic contract, the Employer shall require the contractor to report on hazardous wastes arising from the project activities.
- A contract on transportation and treatment of hazardous waste shall be signed according to Circular No. 36/2015/TT-BTNMT dated June 30th, 2015 of the Ministry of Natural Resources and Environment defining on hazardous waste management.

b. Location and Implementation time

- *Location*: on construction site.
- *Implementation time:* During construction phase.

4.2.2.3. Mitigation of impacts on water sources

(1) *Management and treatment of domestic waste water*

a. Description of mitigation measures

The following measures shall be taken in order to prevent the risk of polluting organic substances in rivers, canals and pollution due to domestic waste from the tents inside the construction site:

- *Wastewater from washing:* Wastewater from washing shall be reused to moisten the surface of construction sites or dust generating area in the construction site.

- *Treatment of domestic wastewater:* At each site, in addition to washing wastewater, the wastewater from the canteen will be pre-treated to prevent organic substances in natural water sources from being polluted due to the decomposition process of leftovers. The wastewater from canteen will be led into shallow sand pit (about 70cm depth), approximately 10m2 width, to retain dirt after going through manhole with mesh to collect garbage. After penetrating in sand, the water shall flow into the site drainage system before dissolving into the flow. The sand is replaced weekly. The amount of 3m3 replaced sand can be regarded as waste after washing and handling preliminarily like redundant soil and stone.
- *Using mobile toilets:* Arrange fixed toilets with 3 compartment septic tanks at worker camps, site offices. Where the site is far from the fixed toilets, use mobile toilets. Waste from mobile toilets will be collected under an economic contract with district Urban Environmental Company.

b. Location and Implementation time

- *Location*: worker camps, site offices of the project.
- *Applicable time:* During construction phase.

(2) Management and treatment of waste water from concrete mixing plants

a. Description of mitigation measures

The following measures shall be applied to control polluted water source from concrete mixing plants:

- Treatment of waste water from concrete mixing plants: The entire amount of aggregate washing water will be reused to moisten the surface of construction sites or dust generating areas in the construction site.

- Aggregate washing water shall be directed into scale pit with at least 2 compartments; each compartment's capacity must be large enough so that the contaminants can sediment for the amount of water discharged from one batch of concrete. Wire meshing partition is placed in front of sedimentation tank to collect garbage. The water sedimented in the tank will be reused. The contaminants will be collected and handled like construction waste.

- Sedimentation tanks and drains are located inside the site and prepared concurrently with the preparation of construction and maintained to operate well during the construction period.

- The partitions shall be regularly cleaned and maintened to ensure that garbage, stone, and sand will be retained and only water can flow out the sedimentation tank.

- Collected garbage and sand will be handled like construction solid waste as described in the section "Management of construction solid waste".

- After completion of construction, the ditches and pits must be filled before handed over to the owner.

b. Location and Implementation time

– *Location*: Concrete mixing plants.

– *Applicable time:* During construction phase.

(3) Management and treatment of rain-water spilled over the construction site

a. Description of mitigation measures

The following measures shall be applied to control polluted rainwater spilled over from the construction site to rivers:

- The construction site shall be designed with a suitable rainwater drainage system including culverts, ditches, manholes, pits, grass of low areas, etc., to prevent rail water spilling over the construction site and flowing with contaminants into surrounding flows.

- Rainwater is collected and led to the canals through manholes with partition for waste collection.

- *Clean up of the surface:* Collecting the contaminants on the ground to prevent the surrounding water sources from being polluted.

- The construction ground is covered with a crush stone layer which reduces dust emission in dry season and reduces contaminants flowing in spilled rainwater in rainy season.

b. Location and Implementation time

– *Location*: at construction site.

– *Applicable time:* During construction phase.

(4) Management and treatment of wastewater from construction area

a. Description of mitigation measures

The following measures shall be applied to control surface water contaminated by wastewater in the construction area:

- Prepare water quality and soil erosion management plan with the following contents :

+ Legal requirements related to water quality.

+ Issues of erosion, sedimentation, water quality caused by the project.

+ Water quality management measures during construction process.

+ Role and responsibility of people participating into construction and implementation of water quality and soil erosion management terms and conditions.

+ Mechanism of monitoring, supervision and report to evaluate effectiveness of the

implemented control measures.

- Apply environmental friendly technology such as steel pipe sheet pile driving method instead of bored piling method to minimize water pollution caused by bridge abutment/pier foundation construction because no bentonite is generated

- Apply construction methods which use water effectively to save water, and with water reuse, treatment measures.

- Devices such as garbage, mud collectors will be regularly checked to prevent contaminated water spilling out.

- A surface water quality monitoring program will be implemented during construction phase to monitor water quality at upstream and downstream of Ruot Lon bridge. The monitoring program shall start before construction.

b. Location and Implementation time

– *Location*: the entire project area.
– *Applicable time:* During construction phase.

(5) Assessment on effectiveness of mitigation measures and residual impacts of waste treatment and management

The preparatory and implementation of waste management plans is the project's commitments and regulations on work safety, environmental hygiene in a transportation project. Therefore, the project owner shall comply with the commitments with the State authorities on environment management at each locality and the implement content with contractors, as well as the supervising content of the consultant shall be stated in bidding terms. According to the economic contract, the project owner shall implement inspection measures to require the contractor as well as supervising consultants to comply with the contract. Therefore, the feasibility of the proposed measures is guaranteed.

4.2.3. Mitigation of impacts of sources irrelevant to waste

4.2.3.1. Mitigation of noise impacts on residents

1. Mitigation measure of noise impacts

(1) General provisions

The provision is aim to provide compulsory contents for construction activities in compliance with legal requirements on environmental protection in construction activities; as well as ensure that the measure can reduce noise effectively without additional costs.

– *Requirements on applicable standards*: the maximum permissible limit of noise in daytime (6:00~21:00) at 55dBA in special zones including schools, etc., and

70dBA in normal zones including residential areas, etc. according to QCVN 26:2010/BTNMT - National Technical Regulation on Noise is applied to control the noise level generated from the construction activities.

- *Compliance with the regulations on construction:*
  - Instruct and train staff and workers of the contractors about responsibility for activities generating noise.
  - The machines, devices generating noise must be located at a suitable position so that the noise in daytime spreading to residential areas is no greater than 70dBA and to schools not greater than 55dBA.
  - All vehicles parked at site must turn off the engine;
  - All equipment and machines outside the site shall be regularly inspected on noise levels, repaired and calibrated to ensure the safety and noise generation within standard level under the guidance of U.S Environmental Protection Committee- Noise from construction equipment and machinery NJID, 300.1, 31-12 - 1971;
  - Machines and vehicles with low noise generation shall be prioritized to operate when constructing near the area sensitive to noise;
  - The drivers shall be trained to perform properly such as turning off the vehicles when possible and avoid causing unnecessary noise like using the horn unnecessarily while driving;
  - The fixed equipment such as generator is usually placed away from residential areas; otherwise, it shall be placed in a close box to reduce noise (The box is recommended to be made of brick).

(2) For activities generating noise in construction

a. Description of mitigation measures

- *Compliance with the above general provisions.*
- *Control the noise at source including*:
  - Prepare noise management plan with the following contents:
    + Determine zones sensitive to noise such as residential areas, etc.
    + Describe permissible date and time for construction.
    + Describe and identify all construction activities, including construction site, equipment and time.
    + Describe general and specific work rules to be applied to mitigate noise according to Vietnamese standard (QCVN 26: 2010/BTNMT).
    + Procedure recording claims and handling claims regarding noise.

+ Noise supervision procedures.

+ Overview about public consultation meetings when construction activities generating big noise are implemented.

- Select equipment and machines generating less noise when constructing near residential areas;
- Set up suitable and feasible construction time frame.
- On principle, construction activities are only implemented in allowed date and time. Construction near residential areas is only allowed in nighttime (22:00pm~06:00am) if generated noise does not exceed the permissible level according to Vietnamese standard (QCVN 26:2010/BTNMT).
- Activities generating big noise such as pile driving, road construction, concrete drilling, etc. will be arranged in time frame which allows high base noise.
- Transportation of materials and waste soil will be implemented in date and time allowed for construction, when feasible and reasonable.
- Prepare construction plan and suitable noise mitigation measures to assure relaxation time of residents. Such measures consist of limiting the number of hours for big noise generating construction activities like pile driving, or other suitable measures as agreed between contractors and residents.
- Select construction method such as using hydraulic machines or electric energy equipment/machines instead of diesel oil machines. This measure shall be considered and implemented at suitable and feasible locations.
- Construction site, entrance of construction site shall be arranged as far as possible from objects sensitive to noise.
- Use temporary noise barriers at ancillary construction works near residential areas.
- Restrict the speed (5km/h) of transport vehicles in areas under construction. Besides, the contractor shall regularly remind drivers to comply with speed regulations on construction means operating on roads outside the construction site.

b. Location and Implementation time

- *Location*: Construction site near sensitive areas such as residential areas at the sections Km0+000 – Km0+500, Km1+300 – Km1+500, Km5+420 – Km5+940, Km8+700 – Km8+850, Km9+300 - Km9+500.
- Implementation time: During construction phase.

(3) Assessment on effectiveness of mitigation measures

Noise reduction effectiveness in sensitive areas was considerable due to the implementation of the general regulations as well as noise reduction measures at

source. To ensure the feasibility of the proposed measures, the implementation contents of the proposed measures for contractor as well as the supervision content for the consultant shall be stated in bidding provisions; under the terms of the economic contract, the project owner shall implement inspection measures to require contractor and supervising consultants to comply with the contract.

4.2.3.2 Mitigation of vibration impacts on residents

a. Description of mitigation measures

- *Control the vibration at source includes*:
  - Prepare vibration management plan during pre-construction and construction phases with the following issues:
    + Determine zones sensitive to vibration such as residential areas, etc.
    + Describe permissible date and time for construction.
    + Describe and identify all construction activities generating vibration, including construction site, equipment and time.
    + Describe general and specific work rules to be applied to minimize vibration.
    + Procedure recording claims and handling claims regarding vibration.
    + Vibration supervision procedures.
    + Procedures of public consultation when construction activities generating big vibration are implemented.
  - Set up suitable and feasible construction time frame.
  - On principle, construction activities are only implemented in allowed date and time. Construction near residential areas is only allowed in nighttime (22:00pm~06:00am) if generated vibration does not exceed the permissible level according to Vietnamese standard (QCVN 27:2010/BTNMT).
  - Activities generating big vibration such as pile driving, compacting will not carried out within rest hours of residents, especially in nighttime.

b. Location and Implementation time

- *Location*: Construction site near sensitive areas such as residential areas at the sections Km0+000 – Km0+500, Km1+300 – Km1+500, Km5+420 – Km5+940, Km8+700 – Km8+850, Km9+300 - Km9+500.
- Implementation time: During construction phase.

c. Assessment on effectiveness of mitigation measures

Vibration reduction effectiveness in sensitive areas was considerable due to the implementation of the general regulations as well as vibration reduction measures at source. To ensure the feasibility of the proposed measures, the implementation

contents of the proposed measures for contractor as well as the supervision content for the consultant shall be stated in bidding provisions; under the terms of the economic contract, the project owner shall implement inspection measures to require contractor and supervising consultants to comply with the contract.

4.2.3.3. Mitigation of impacts by erosion and sediment

1. Soil erosion at construction site

a. Description of mitigation measures

- Instruct, guide and train all workers including contractors' workers on the need and responsibility for controlling erosion and sediment.

- The contractor shall prepare construction plan so as to reduce excavation works in rainy season from May ~ October.

- Prepare the construction plan so as to minimize level and time of disturbing the vegetation cover.

- Apply environmental friendly technology such as steel pipe sheet pile method to minimize soil erosion from construction of bridge foundation.

- Regularly raise precaution in stormy season. The contractor shall prepare action procedures for forecast or upcoming stormy rains as well as action procedure during or after stormy rains. Special attention shall be paid to rainwater flow in stormy condition, especially at construction location with high slope.

- In rainy season, rainwater drainage system must be constructed before road foundation construction. Before constructing embankment, construction of rainwater pits and ditches must be completed.

- Prepare the construction plan so as to avoid construction of high backfilling, bridge pier/abutment footing, etc., in rainy season. If impossible, drainage system will be improved to drain rainwater quickly and easily.

- All exposed areas must be reinforced and/or covered with grass as soon as possible after excavation works complete. Especially in rainy season, the ground shall be compacted to avoid erosion by rains. If signs of erosion appear, contractors must reinforce them.

- The slope of the works and construction areas must be kept at the minimal level to reduce the possibility of erosion by rainwater flow.

- Ditches, soil bank, mesh, canvas, sand bags, etc., are measures used on the construction site to mitigate erosion. Erosion and sediment control will be maintained until ground structure is stable and reaches the required compactness.

b. Location and Implementation time

– *Location*: embankment sections of the project route, Ruot Lon bridge

– Implementation time: During construction phase.

2. Soil erosion at material storage yard

a. Description of mitigation measures

- Areas for temporary storing construction materials like gravel, sand and filling and waste soil must be established before construction activities.

- Discarded organic soil will be stored temporarily at yards in land clearance area, and shall be removed as soon as possible for levelling locations as agreed with the local authorities.

- Arrange material/waste soil stockpile yards far from surface water sources and areas prone to spilled rainwater. Do not arrange storage yards in residential and business areas at the level lower than that of material/waste soil storage yards.

- Loose materials must be bagged or covered with geotextile fabric. Dig ditches surrounding the storage yards to prevent penetration of wastewater into surrounding areas.

- Material/waste soil stockpile yards without protection wall of more than $50m^3$ shall be covered by canvas or the likes in case of stormy rains. Measures shall be taken to prevent the washing away of construction materials, soil into any drainage system. The mud collecting partition shall be placed surrounding the construction site to retain sedimented mud to not flow to outside area. The partition is made of geotextile garment, buried deep into the ground and reinforced for stability. The mud retained in the partitions will be collected to stop the mud from spillage and drain easily. This type of mud is not used for roadbed and is handled like redundant soil. In rainy period, the partitions will be maintained regularly for at least every two days. After completion of a road section, partitions will be removed and cleaned up to reuse for following sections.

- Particularly, in rainy period from May to October, redundant soil must be removed immediately to the disposal site according to regulations. The leftover will be covered to avoid washing away by rainwater.

b. Location and Implementation time

– *Location*: Material/waste soil stockpile yards.

– Implementation time: During construction phase.

4.2.3.4. Mitigation of impacts on ecosystem

a. Description of mitigation measures

- Environmental friendly technology such as steel pipe sheet pile driving method will be used to minimize water pollution caused by bridge pier foundation construction.

- Do not clear up vegetation covers outside land acquisition area of the project.

- Arrange fences surrounding construction site and material storage yards, etc., to avoid unnecessary damages on surrounding trees and landscape.

- All trees within the project area will be protected if they grow outside the construction site and not obstructing construction or operation of the project.

- Embankment and slope shall be stabilized by planting grass to mitigate erosion; and, the best way is to use hydraulic seeding machines.

b. Location and Implementation time

– *Location*: Ruot Lon bridge and approaches.

– Implementation time: During construction phase.

4.2.3.5. Mitigate impacts of global warming

a. Description of mitigation measures

- Consider material transportation routes while supplying materials.

- Redundant materials such as gravel from construction of road foundation, road surface, etc., shall be recycled if possible.

-While selecting construction machines and equipment, take into account their fuel consumption.

- Prepare the project plans so as to minimize repeated treatment of materials, avoiding material/waste soil transportation in a long distance, and avoiding to use additional fuel.

- Maximize usage of electricity driven construction machines and equipment.

- Use domestic goods and services, especially local ones to reduce gas emission from fuel burning when transportation.

- If potential incidents maybe occurred during construction of a work item, the contractor can propose to change the design, technical parameters or construction method so as to mitigate impacts of global warming.

b. Location and Implementation time

– *Location*: the entire project

– Implementation time: during pre-construction and construction phases.

4.2.3.6. Mitigate impacts by operation of equipment, machines occupying traffic corridor

1. Traffic congestion and obstruction on roads surrounding the construction site

a. Description of mitigation measures

The following measures shall be applied to prevent and reduce road traffic interrupt

during construction:

- *Comply with general provisions:*
  - Construction method and sequence, etc. must be designed so as to minimize occupation time of public roads, not discontinue traffic surrounding the construction site for a long time.
  - Schedule the construction activities so as work items which may obstruct local traffic seriously will be implemented when the traffic flow is low.
  - If local roads are blocked for construction, bypass routes will be opened or other measures will be taken to facilitate residents' access to their houses, business or production establishments.
  - Construction machines, equipment and vehicles of the Project shall not be gathered on existing roads.
  - Temporary storage yards of materials, soils and stones shall be located within Project's site clearance scope. In case of soil sediment or soil scattering on the existing road, it is necessary to collected and cleaned.
  - During the construction of interchanges, surface of National Highway 10 and Provincial Road 359 near the interchanges will be cleaned daily. The length of the sections to be cleaned will be shown by supervision engineers on the base of dirty caused by the project's vehicles.
  - Vehicle drivers and workers must understand and comply with regulations on traffic safety and must not drink alcohol and use illegal drug.
  - Coordinating with local traffic police to control the traffic on roads in the interchange area.
  - Limit transportation in peak hours from 6 ~ 8h and 16 ~ 18h;
  - Use trucks with cover or canvas to prevent scattering into roads.
  - Scattering materials will be collected and roads will be cleaned to avoid slippery in rains.
- *Organizing construction in a reasonable way:* activities like erection of approaching bridge beam crossing the Provincial Road 359 will not be carried out at peak hours so as not to affect the traffic on the road.
- *Placing warning signs:* warning signs shall be placed at both sides of existing roads and at least 150m away from the construction site. The signs should be firmly installed on normal days as well as on windy days with fluorescent property at night. After completion of construction, all warning signs will be removed.
- *Installing pickets and alarm lamps:* Pickets are installed during construction period to determine the construction scope. All pickets are at least 75cm high having wide base which will not be damaged by means of transport. They are white with

fluorescent property during the day and at night. They shall be firmly installed on normal days as well as on windy days. Pickets equipped with flash lights of type A (low frequency) or type B (high frequency) will be instructed by the supervision engineer based on actual conditions before being used.

- *Traffic control:* During the construction time at intersections, workers holding warning flags shall be arranged to control the traffic. During the beam installation, means of transport on the road will guided to suitable bypass roads.

b. Location and time for implementation

- *Location*: Bridges at interchanges
- Implementation time: Construction phase

2. Road damages due to transport of materials or redundant soils and stones

a. Description of mitigation measures

To mitigate risks of damages to local roads caused by transport of materials or redundant soils and stones.

- *For provincial roads and national roads:*
  - *Not to exceed the allowable limit and load*: Transport vehicles must follow regulated speed and not carry overload.
- *During transport on inter-village and inter-communal roads*
  - *Reaching agreements with local authorities:* Obtaining written consent from local authorities on temporarily using inter-village and inter-communal roads for transportation purposes only;
  - *Carrying out transport reasonably*: Materials and redundant soils and stones shall not be transported during the time when many vehicles are on the roads and on holidays. The project owner shall define this time and undertake before each local authority not to transport at this time;
  - *Taking sanitation measures and recovering initiate state of the roads*: ensuring sanitation and safety while using roads; performing maintenance of roads; recovering initiate state of the roads before handing over to local authorities.

b. Location and time for implementation

- Location: At transport routes, namely National Highway No. 10, Provincial Road No. 359, and inter-village roads, inter-communal roads etc.
- Implementation time: During construction period.

4.2.3.7. Mitigation of impacts on hydrological conditions

a. Description of mitigation measures

- Ruot Lon bridge is designed with only two piers P6, P7 in the main flow of Ruot Lon river to mitigate impacts on the flow. The piers are in parallel with the direction of the main flow; therefore, water occupation area is minimal. Shape of the piers is designed to facilitate the river flow.

- Select construction technology, time and method for piers P6, P7 so as to minimize the water occupation area of Ruot Lon River, especially in flood season.

b. Location and Implementation time

- *Location*: Ruot Lon bridge
- Implementation time: Pre-construction and construction phases.

4.2.3.8. Mitigation of impacts on water usage in downstream of the river

a. Description of mitigation measures

- Implement mitigation measures for impacts of water pollutions as in Section 4.2.2.3.

- Implement mitigation measures for impacts on waterway transport as in Section 4.4.2.1.

b. Location and Implementation time

- *Location:* Downstream of Ruot Lon bridge
- *Implementation time:* During construction phase

4.2.3.9. Mitigation of impacts related to workers

a. Description of mitigation measures

- *Management of employees*: Workers tents, water and electricity will be supplied to ensure good health condition for workers living at construction site. Temporary residence shall be registered for workers; Workers are required to respect local culture, religion, belief, not to drink alcohol while working. A timetable (working hours and break time) is also determined for workers.
- *Coordinating with local community:*
  - Coordinating with local authorities of wards/communes, including the Committee of the Vietnam Fatherland Front and the Women's Union to equip workers with knowledge about social evils, prostitution, HIV and epidemic in the area, etc.
  - Closely coordinating with the local community in order to ensure public sanitation in case of occurrence of epidemics in the area;
  - Coordinating with local authorities in order to prevent and cope with social evils.

– *Hiring local people*: Hiring unskilled local workers (both women and men) to perform simple works. For some works requiring qualified performers, the contractor will choose among the local workers and equip them with new skills so that they can meet job's requirements.

b. Location and Implementation time

– *Location:* at worker camps and construction site

– *Implementation time:* During construction phase

c. Assessment on effectiveness of mitigation measures

Being considered the Project's regulations on safety and environment sanitation during construction period, the said mitigation measures should be included in bidding contract. This legally binding regulation shall facilitate the full implementation of the proposed measures.

4.2.3.10. Safe working environment protection measures

- Equipping workers with all necessary protective equipment such as labor helmets, anti-noise devices, safety shoes, etc.

- Organize training courses on assurance measures for safety of local people, especially students.

- Provide workers with good living conditions and health care services during construction.

- Install indicative signs and alarm lights, etc. at locations where accidents may occur.

- Install fences surrounding the dangerous areas to prevent residents from accidental access. Provide lighting in night time where local people frequently pass by.

- Arrange staff who direct and assure safety at locations with high traffic flow.

4.3. Measures for prevention and mitigation of negative impacts of the Project on environment in operation period

4.3.1. Mitigation of impacts related to waste

4.3.1.1. Mitigation of air pollution impacts

a. Description of mitigation measures

Implement the following measures to mitigate impacts of air pollution caused by transport vehicles during operation:

- Regularly maintain road and bridge surface.

- Regularly spray water to clean road surface.

- Monitor air quality in the areas adjacent to the project in a certain time when operation phase starts. If concentration of pollutants exceeds the anticipated level, consider to take additional feasible measures.

b. Location and Implementation time

– *Location:* at the sections (3), (4), (5), (6), (8), (9) và (10)

– *Implementation time:* during operation phase

4.3.1.2. Mitigation of water source pollution impacts

a. Description of mitigation measures

The following measures shall be taken to mitigate water pollution caused by traffic vehicles, bridge maintenance works, etc.:

- Before operation phase, prepare procedures to timely response to incidents, traffic accidents on the bridge that causes spillage of pollutants into river.

- Road surface must be cleaned up periodically, especially before rains to collect garbage and minimize pollutants flowing from road surface to river.

- Equip sufficient devices to collect, transport and treat waste generated from maintenance works such as redundant paint, solvent, paint boxes, solvent and painting devices, etc.

- Regularly check and maintain drainage systems.

b. Location and Implementation time

– *Location:* in the entire project

– *Implementation time:* During operation phase

4.3.1.3. Mitigation of impacts by waste

a. Description of mitigation measures

- Regularly collect waste generated from operation of vehicles on roads.

- Waste generated from bridge maintenance will be collected, transported and treated according to regulations.

- Regularly disseminate, raise awareness of environmental protection and waste management for workers of bridge maintenance entity.

- Provide sufficient waste collection devices.

b. Location and Implementation time

– *Location:* in the entire project

– *Implementation time:* During operation phase

4.3.1.4. Mitigation of impacts related to climate change/ green house effects

a. Description of mitigation measures

- Strictly comply with road surface and ancillary structure maintenance regime to slow down degradation of materials.

4.3.2. Mitigation of impacts irrelevant to waste

4.3.2.1. Mitigation of noise impacts

a. Description of mitigation measures

Implement the following measures to mitigate impacts of noise caused by operation of vehicles during operation phase:

- Plant and care trees on sidewalks of collector roads;

- Install speed limit signs on road sections near residential areas;

- Regularly maintain road surface to assure the quality of road and bridge surface.

b. Location and Implementation time

– *Location*: Along the route through residential areas.

– Implementation time: operation phase.

4.3.2.2. Mitigation of sediment and erosion impacts

a. Description of mitigation measures

- Regularly maintain slopes of embankment to prevent erosion.

- Plant grass, reinforce two sides of embankment talus.

b. Location and Implementation time

– *Location*: embankment slope and talus

– Implementation time: operation phase.

4.3.2.3. Mitigation of impacts on ecosystem

a. Description of mitigation measures

- Prepare and implement flora ecosystem protection plan including determination of impacts and mitigation measures of impacts on trees, management/protection measures for plants and vegetation cover of mangrove forest surrounding the project area.

- Care for urban trees in the project area.

b. Location and Implementation time

– *Location*: the project area

– Implementation time: Operation phase.

4.3.2.4. Mitigation of impacts on water usage

a. Description of mitigation measures

- Arrange buoys, waterway signs in Ruot Lon bridge area in accordance with regulations of waterway traffic.

b. Location and Implementation time

– *Location*: section of Ruot Lon river in the area of Ruot Lon bridge

– *Implementation time:* operation phase.

4.3.3. Mitigation measures of social impacts

4.3.3.1. Mitigation measures of impacts on social infrastructures, existing social services of the locality, children rights, social capital, etc.

a. Description of mitigation measures

- Regularly maintain works to assure safety for pedestrians such as damper, traffic lights, signs, etc., where many pedestrians need to cross the roads

- Regularly maintain zebra road markings for pedestrians and facilitate local people go from/to houses, schools, public areas, etc., in the opposite side of the road.

b. Location and Implementation time

– *Location*: in the entire project area

– Implementation time: operation phase.

4.3.3.2. Mitigation of impacts on vulnerable households

a. Description of mitigation measures

- Further implement, if necessary, mitigation measures of impacts on vulnerable households including poor households as proposed in the RAP and livelihood restoration plan.

- Continue monitoring program for livelihood restoration for vulnerable households.

b. Location and Implementation time

- *Location*: in the entire project
- Implementation time: operation phase.

4.4. Measures for prevention and response to natural incidents and accidents

4.4.1. Construction phase

4.4.1.1. Prevention and response to technical incidents

a. Description of measures

The following measures shall be applied to prevent and response to technical incidents occurred during construction phase:

- Strictly comply with quality control procedures including survey works before construction, construction plan, construction drawings, etc.
- Comply with occupational safety assurance plan;
- Prepare incident response and rescue plan: the contractor shall prepare occupational accident rescue and response plan, establish rescue team, specific response procedures including person in charge of rescue team, implementation procedures, and determine contact addresses in emergency cases such as health centers, hospitals, etc. within/near construction site area, and hospitals in Hai Phong City.

b. Location and implementation time

- *Location:* in the entire project.
- *Implementation time:* During construction phase.

4.4.1.2. Fire and explosion incidents prevention and response

a. Description of measures

The following measures shall be taken to prevent and response to fire and explosion incidents in construction stage of the Project:

- Regulations on storage of flammable materials: Petrol, gasoline and gas used for construction equipment will be stored in separate depots, away from potential sources of ignition. These depots are equipped with temperature monitoring equipment and fire alarm system;
- Equipping the construction site with firefighting and prevention equipment: fire extinguishers and fire water tanks shall be prepared for the construction site and petroleum depots. Fire prevention and protection vehicles and equipment will be regularly checked and maintained;
- Fire drills training: Providing workers with training courses to improve capabilities and raise awareness of fire safety, firefighting and prevention;

b. Location and implementation time

- *Location:* construction site.
- *Implementation time:* during construction phase.

4.4.1.3. Occupational accidents prevention

a. Description of measures

The following measures shall be taken in order to prevent occupational accidents in construction stage

- Complying with all regulations on occupational safety:
  - The contractor will establish the regulations on occupational safety in the construction process;
  - Establishing and following periodic check-up programs for staff and workers;
  - Providing training courses and information on sanitation and occupational safety;
  - Equipping workers with all necessary protective equipment;
  - Establishing appropriate communication systems to ensure occupational safety during the construction period.
- Making rescue plan in case of accidents: The contractor will make a rescue and response plan in case of occupational accidents, establish rescue teams, make concrete plan (leadership, implementation procedure) and identify locations in emergency situation such as clinics and hospitals in or near the construction site, and hospitals of Hai Phong city.

b. Location and implementation time

- *Location:* in the entire project.
- *Implementation time:* during construction phase.

4.4.1.4. Prevention for natural incidents (storms, heavy rains)

a. Description of measures

- Assign a team dedicated in monitoring weather conditions, especially in stormy rain season to elaborate natural incident prevention and response plans for the construction site.

- Schedule construction activities so as to complete construction of pile foundation, underwater pier footing.

- In stormy rain season, it requires to strengthen scaffoldings, ensure their stability in case of heavy rain and strong wind.

- Establish lightning protection systems.

- Elaborate a plan to remove construction materials, machines and equipment to safe location in case of heavy rains, storms and floods.

- Elaborate incident response plan: when an incident occurs, actively rescue as per procedures. On the other hand, contact with other agencies in the area such as Hai Phong City rescue and flood and storm prevention steering committee to rescue on time. In addition, obtain an agreement with health stations of wards/communes along the project route to use these stations for first aids. Arrangement of facilities for emergency cases must be approved by the supervision engineer.

b. Location and implementation time

– *Location:* in the entire project.

– *Implementation time:* during construction phase.

4.4.2. Prevention for traffic accidents on river and roads during construction and operation phases

4.4.2.1 Prevention for accidents on rivers during construction phase

a. Description of measures

- The contractor must prepare inland waterway traffic assurance plan and submit the Inland waterway traffic management agency for approval. The documents consist the followings:

  + A letter requesting for approval on the inland waterway traffic assurance plan;
  + Construction method;
  + Inland waterway traffic assurance solution in the construction area of the project.

- *Complying with all regulations on inland waterway traffic:* strict comply with all regulations on inland waterway traffic; not to exceed the allowable load and speed limit; equip with safety equipment, including sirens, lights, lifebuoys.

- *Placing signs:* warning signs shall be placed at lease 300m away from the construction site and at locations easy for vehicle drivers to see. The signs should be firmly installed on normal days as well as on windy days with fluorescent property at night. After completion of construction, all warning signs will be removed.

- *Installing buoys and alarm lamps:* Buoys are installed during construction period to limit the construction scope. All buoys are red, white and visible both during day and at night. Buoys are equipped with flash lights of type A (low frequency) or type B (high frequency). Place scanning lights in the construction area in night time.

- *Traffic control:* The contractor must hire a river traffic safety management company to guide, regulate vessels and boats circulating in upstream and downstream of the bridge location.

During the time of using floating system to install steel sheet piles, erect supporting frames and the time of using floating mixing plants, workers holding warning flags shall be arranged to control the traffic.

- Instruct ship and boat owners related to construction of the project regarding the manner to inform relevant authorities to timely response to incidents. Hot lines of these relevant authorities like Hai Phong City rescue and flood and storm prevention steering committee, People's Committees of wards and communes along two sides of the river, etc. will be provided. These hot lines are also shown at construction site and site offices at visible locations.

- Establish rescue procedures for traffic accidents on the river including how to move victims to health stations of the nearest wards/communes for first aids, or to the nearest hospital, or call ambulance of the city.

b. Location and implementation time

– *Location:* Bridge pier construction area.
– *Implementation time:* During construction phase.

4.4.2.2. Prevention for accidents on rivers during operation phase

a. Description of measures

- Install sufficient alarm lamps, buoys, and signs according to regulations of inland waterway traffic.

- Closely cooperate with Inland waterway traffic management agency to assure traffic safety on the river.

- Instruct ship and boat owners frequently passing by the bridge location regarding the manner to inform relevant authorities to timely response to incidents. Hot lines of these relevant authorities like Hai Phong City rescue and flood and storm prevention steering committee, People's Committees of wards and communes along two sides of the river, etc. will be provided. These hot lines are also shown on ships and boats at visible locations

- Establish rescue procedures for traffic accidents on the river including how to move victims to health stations of the nearest wards/communes or the nearest hospitals for first aids, or call ambulance of the city

- Devices for alarm, traffic safety assurance such as alarm signs, buoys, lights, etc., must be regularly checked and maintained.

b. Location and implementation time

– *Location*: Ruot Lon river in Ruot Lon bridge area.
– *Implementation time*: Operation phase.

4.4.2.3. Prevention for roadway traffic accidents during operation phase

a. Description of measures

- Regularly maintain traffic safety assurance devices on roads surrounding the bridge such as traffic lights, speed warning signs, damper lines, etc., where many pedestrians cross the roads.

- Regularly maintain zebra road markings for pedestrians and facilitate local people access schools, public areas, etc., in the opposite side of the road.

b. Location and implementation time

- *Location*: in the entire project.
- *Implementation time*: Operation phase.

CHAPTER V. ENVIRONMENTAL MONITORING AND MANAGEMENT PROGRAM

5.1. Environmental Management Program

5.1.1. Objectives

The objective of the Project's environmental management program is to propose a program to manage environmental protection issues during pre-construction, construction and operation phases of the project, namely as follows:

- To make a plan to manage the implementation of measures for environmental impact mitigation approved by the environmental management authority and specified in the terms of the Project's technical instructions;
- To ensure proper waste management and a rapid response mechanism to environmental issues and incidents and emergency handling of environmental incidents;
- To continuously gather information on environmental quality changes during the Project implementation for promptly detecting additional adverse impacts on the environment and proposing measures for environmental pollution prevention and reduction under the National Technical Regulations from 2008 to present.
- The information obtained in the course of the Project's environmental management shall ensure the following key attributes:
  - Data accuracy: The observation data accuracy is assessed in terms of the similarity between data and reality;
  - Data specificity: The data collected at an observation location represents a certain space;
  - Data uniformity: The data gathered at different locations at different times within the Project area is comparable with each other. The comparability of data is called the data uniformity;
  - Continuous monitoring capability over time: As per environmental observation plan defined during the Project implementation;
  - Data synchronization: The data include sufficiently large information about elements themselves and related elements.

5.1.2. Summary of Environmental Management Plan

The Environment Management Plan of the Project is summarized in Table 5.1.

Table 5.1. Summary of Environmental Management Plan

Project activities	Environmental Impacts	Impact mitigation measures	Financial sources	Period of Implementation	Responsible entity	Supervision Agency
1. In preparation phase						
1.1. Involuntary – Impacts from land acquisition, relocation and resettlement						
1.1.1 Permanent land acquisition	Impact of land acquisition, relocation and resettlement: - Relocation and resettlement, loss neighborhood, trading places, advantage infrastructure, - Loss production land incomes, …	- Measures to mitigate impacts are described in the separately-prepared Resettlement Action Plan (RAP) and Livelihood Restoration Plan. - The contents of RAP would be accordance with the Law and the Decrees of Vietnam as well as JICA's Environmental Guidelines (2010), and reviewed by both JICA and Vietnam. RAP has been submitted to Hai Phong People's Committee for approval and considered as basis to prepare a Plan for compensation, support and resettlement as well as other plans in order to minimize the land acquisition and resettlement. - The local residents would be informed about this plan, and encouraged to participate in Project's formation from an early stage through notice meeting/discussion in order to capture demands of local people and create a consensus with the project. Consultation meetings, conferences ... would be organized with the aim to disseminate information about project, forecast impacts, propose mitigation measures ... and collect opinions of local residents and the competent authorities of the above issues - Project owner shall ensure to provide properly and timely information, necessary documents of project, budget for compensation, support and resettlement.	Counterpart funds of Vietnamese Government	Before construction	Compensation and Site clearance Committee at district level	Hai Phong Bridge Projects Management Department
1.1.2 Temporary land acquisition	Loss of incomes Interrupt business activities	- A part of land area (currently cultivation land and aquacultural ponds) will be rehired to prepare for construction sites of bridges at interchanges and Ruot Lon bridge. - Measures to mitigate impacts of temporary land acquisition are included in the separately-prepared Resettlement Action Plan (RAP) and Livelihood Restoration Plan - The properties are lost or damaged including trees, crops will be	Counterpart funds of Vietnamese Government	Before construction	Hai Phong Bridge Projects Management Department	Hai Phong Bridge Projects Management Department

Project activities	Environmental Impacts	Impact mitigation measures	Financial sources	Period of Implementation	Responsible entity	Supervision Agency
		compensated at full replacement price level and in accordance with consent of the owners of temporary land acquisition. - Rental price of temporarily occupied land will not less than the net income that farmers can obtain if their land was not occupied. - The Contractor shall reinstate land area as original status within 3 months after completion of construction.				
1.1.3 Permanent land acquisition, resettlement.	Impact on poor household (difficulty in restoring livelihoods after relocation, resettlement)	- Measures to mitigate the impact on vulnerable households (poor households, female headed households, and policy households) affected by the project are described in a separate RAP report and Livelihood Restoration Program. - Policies for specially assist to vulnerable households are as follows: Regarding vulnerable households to be relocated, Project shall provide special assistance to ensure that they will be able to move to and re-stabilize their life at their new place. - Vulnerable households to be relocated who have more than 20% of affected productive land area or who have affected land area is less than 20% but the remaining land not enough for cultivation, will be supported specially under provisions of the People's Committee of Hai Phong city	Counterpart funds of Vietnamese Government	Before construction	- Compensation and Site clearance Committee at district level - Labor, Invalids, and Social Department of Thuy Nguyen District	Labor, Invalids, and Social Department of Thuy Nguyen Districts.
1.1.4 For impacts of grave relocation	Impact on spirit of relatives of relocated graves	- Early announcement: It is necessary to announce early the land clearance time to the graves' relatives for implementing necessary rituals. - Compensation and support: Reasonable compensation and support will be done for the relocation, transportation and burial of new graves.	Counterpart funds of Vietnamese Government	Before construction	Compensation and Site clearance Committee at district level	Hai Phong Bridge Projects Management Department
1.1.5 Permanent land acquisition, Demolitions for site clearance,	Impact on local economy such as employment, business of households affected by land acquisition, site	- Measures to mitigate impacts on employments and livelihood of relocated residents are described in separate RAP report and Livelihood Restoration Program. - Implement the project on schedule, select proper construction method and time of each items so as to mitigate the impacts. - In construction period, the contractors would be encouraged to employ project-affected residents and other local residents to work as construction	Counterpart funds of Vietnamese Government	Before construction	Compensation and Site clearance Committee at district level	Hai Phong Bridge Projects Management Department

Project activities	Environmental Impacts	Impact mitigation measures	Financial sources	Period of Implementation	Responsible entity	Supervision Agency
prepare for construction sites	clearance, v.v.	worker...				
1.1.6 Permanent land acquisition	Impact on usage of local natural resources (loss living land an production lands)	- Properly compensate and support for affected households whose land is lost by Project. - When making livelihood restoration plan for affected households, using effectively land and existing natural resources of local should be taken into consideration.	Counterpart funds of Vietnamese Government	Before construction	Compensation and Site clearance Committee at district level	Hai Phong Bridge Projects Management Department
1.1.7 Relocating utilities (irrigation ditches, electricity poles)	Interrupt water supply and power supply, affecting the daily life and production activities of local residents	- Relocation plan of utilities systems (electricity lines, irrigation ditches...) would be established in detail and carried out properly, so that this removal would be completed before starting construction and shall not make long-term disruption to daily life and production of local residents. - It is ensured an adequate budget and timely payment for relocation expenses of electricity system (this cost was included in the total investment of the project).	Construction costs	Before construction	Construction Contractor	Hai Phong Bridge Projects Management Department
1.1.8 Land acquisition	Degrade Ecosystem (loss a part of area of mangroves forest)	- Reforestation plan of about 1.02ha of area of mangrove forests lost by the project should be prepared in detail. - Reforestation to compensate to the mangrove forests shall be in compliance with the "Forest Development and Protection Program of the People's Committee of Hai Phong city up to 2020" (Decision No. 1600/QD-UBND published on 21.08.2013). According to this plan the City has plans to expand the existing forest area of the city from 4.800ha up to 8,000 ha in 2020. Mangrove forests are mainly along Bach Dang River, Cam River and Ruot Lon River. - Combine the project's forestation plan with the plan under implementation by Vingroup to develop eco-parks in the East of Vu Yen island.	Construction costs	In construction period	Forest Planting Company under contract with Hai Phong Bridge Projects Management Department	- Hai Phong Bridge Projects Management Department - Consultant of Forest Development and Protection Center

Project activities	Environmental Impacts	Impact mitigation measures	Financial sources	Period of Implementation	Responsible entity	Supervision Agency
1.1.9 Land acquisition, demolition activities	Unfair between benefit and loss (households do not get the same benefit or damages)	- Properly compensate and support for affected households are described in RAP report and Livelihoods Restoration Program.	Counterpart funds of Vietnamese Government	Completion before construction stage	Compensation and Site clearance Committee at district level	Hai Phong Bridge Projects Management Department
1.10 Construction and operation of bridge and road	Existing properties of the society, social organizations on the locality (community separation)	- At location near schools, public areas, the design will include traffic safety assurance devices to facilitate accessibility of peoples on two sides of roads.	Construction costs	Pre-construction and construction phase	Construction contractor	Hai Phong Bridge Projects Management Department.
1.1.11 Demolition works, construction works	Accidents may happen due to explosion of unexploded ordnances remaining after war	- A professional unit of demining explosive from Ministry of Defense shall carry out demining bomb and mines in the Project site area. - Before demining explosives, the local authority and public community should be informed before investigation of explosive ordnances. - Investigation, identification and treatment of explosive ordnances should be carried out in accordance with procedures. - Sufficient budget should be provided	Construction costs	Before starting construction	Contractor of Ministry of Defense under contract with Project owner	- Hai Phong Bridge Projects Management Department. - Supervision Consultant
1.2.	**Impacts due to site clearance and preparation of construction site**					
1.2.1 Demolition, clearing surface and preparation of construction sites	Air pollution (affecting people's health, trading activities, …)	- Spray water to control dust arising from demolition activities. Frequency of spraying depends on weather conditions. Water taken from rivers, canals, and water sources near where demolition. - Use canvas to cover demolition areas to prevent dust dispersing into surrounding environment.	Construction costs	2 weeks for demolition; 1- 2 months for construction site preparation	Contractor under the contract with Project owner	- Hai Phong Bridge Projects Management Department - Supervision Consultant
1.2.2 Demolition,	Discharge wastes causing	- Wastes from demolition work would be classified for reuse. Construction scraps (concrete, brick,…) may be reused for levelling ground of	Construction costs	2 weeks for demolition; 1- 2	Contractor under the	- Hai Phong Bridge Projects

Project activities	Environmental Impacts	Impact mitigation measures	Financial sources	Period of Implementation	Responsible entity	Supervision Agency
clearing surface and preparation of construction sites	environmental pollution (affecting health of local people damage the landscape, make environmental sanitation problems more serious).	construction site or other civil works; metals (iron, steels) can be used for civil works, and woods (doors, trees ,…) can be used for other civil works or fuels for burn… - Wastes will be collected and gathered on appropriate areas at site as regulated. - No burning of debris, construction wastes or vegetation shall be allowed on-site. - The demolition contractors shall sign a contract with Urban Environmental Company of Hai Phong city for collection, transportation and disposal of domestic wastes (waste water from septic tanks...) and wastes from demolition activities.		months for construction site preparation	contract with Project owner	Management Department - Supervision Consultant
1.2.3 Demolition, clearing surface and preparation of construction sites	Noise and vibration (affecting people's health)	- Do not carry out demolition, levelling and transportation at night time: from 10p.m to 6a.m. - Maintenance of equipment to ensure smoothly operate, so reduce noise. - Operation of all equipment at the same time should be limited. - Manual manner and machinery manner would be combined.	Construction costs	2 weeks for demolition; 1- 2 months for construction site preparation	Contractor under the contract with Project owner	- Hai Phong Bridge Projects Management Department. - Supervision Consultant
1.2.4 Land occupation, construction of new road	Impacts on landscape	- Classify, collect and process construction wastes generated from demolition of houses and structures, then transport to the disposal site on daily basis.	Construction costs	Before construction and in completion of the project	Contractor under the contract with Project owner	- Hai Phong Bridge Projects Management Department. - Supervision Consultant
1.2.5 Demolition, clearing surface and preparation of construction	Traffic accidents, impact on travelling of local persons	- Install barriers at boundary between demolished areas and surrounding areas. - Arrange warning signs at demolition places - The equipment, machines used for demolition of buildings and leveling works near densely residential areas should be managed properly to prevent traffic accidents and affecting traveling of local persons.	Construction costs	In construction preparation stage	Contractor under the contract with Project owner	- Hai Phong Bridge Projects Management Department. - Supervision Consultant

Project activities	Environmental Impacts	Impact mitigation measures	Financial sources	Period of Implementation	Responsible entity	Supervision Agency
sites		- Do not transport construction wastes on the peak hours. - Trucks for carrying construction wastes should be a dedicated one, with covered wagon body to avoid drop wastes into the roadway.				
2. Construction stage						
2.1. Impacts from exploitation and transportation of materials						
2.1. Construction material supply	Impacts from exploitation and transportation of construction materials including air pollution, water pollution, noise pollution, damage the existing roads, causing traffic accidents.	- Materials for construction would only be provided from licensed mines, operated under good environmental management. - In case materials would be transported by waterway, the following measures should be applied: Equip protective plate around materials to prevent them from falling down the river. + Cover dedicated canvas for dispersible fine materials during transportation. + Prohibit to transport overload exceeding load of ships and boats. + Only use the vessel comply with standards for waterway traffic. + At places where materials are moved from barges on shore, it is necessary to implement mitigation measures to reduce dust and landslides as proposed in Item 2.2.1. and 2.3.3. - In case materials are transported by roadway, the mitigation measures will include: + Spray water frequently on soil-roads along transportation route, at material storage areas and areas potentially arising dust. + Trucks used to transport materials which potentially generate dust must follow formality for body and tail cap. Materials potentially generate dust will not be discharged higher than the tail cap, and be covered by tarpaulin canvas in good condition. Tarpaulins canvas must be guaranteed the right quality and over thrust down the side and the rear at least 300 mm. + Trucks used to transport construction materials must meet standards about allowable exhaust emissions (as stipulated in Decision 249/2005/QD-TTg dated October 1, 2005).	Construction costs	During construction period	Construction Contractor under the contract with Project owner	- Hai Phong Bridge Projects Management Department. - Construction Supervision Consultant (CSC) - Environmental Supervision Consultant(EMC) - Safety and Environmental Officer of Contractors (SEO)

Project activities	Environmental Impacts	Impact mitigation measures	Financial sources	Period of Implementation	Responsible entity	Supervision Agency
		- Road routes for transportation of materials will be determined in detail in technical design stage, and mitigation measures to reduce impacts of material transportation will be studied in detail.				
2.2. Impacts from resources relating disposals						
2.2.1. Air pollution						
2.2.1-1 Excavation or backfilling and other construction activities	Air pollution generated from excavation or backfilling and construction activities (degrading air quality, affecting local people's health, business, production activities)	- Site training would be provided to make construction workers aware of air quality control practices and responsibilities. - Implement a monitoring program during construction, including daily checking information related to the weather forecast, meteorological and dust generated at sites (such as dry weather, strong winds). - Construction activities would be modified, reduced or controlled during high or unfavorable wind conditions if they would potentially increase off-site dust emissions. - Measures would be implemented to control dust emissions, such as: use the water carts, sprinklers, sprays and dust screens. Implementation frequency would be suitable with specific conditions of weather. - Excavation or backfilling areas would be stabilized as soon as practicable (by compacting, covering, planting grass) to prevent or minimize windblown dust. - Temporary massive land dump will be gathered around by canvas to avoid dust generation. - It is equipped by needed tools to clean trucks' wheels before leaving sites to the road (like grille, wheel washing facilities, etc.) to limit making dirty road outside the sites. - Construction areas and surrounding public roads would be cleaned, as required. - Speed limits would be posted and observed by all construction vehicles on the construction site. - Trucks and equipment would be switched off when not in operation for periods of greater than 15 minutes	Construction costs	During construction period	Construction Contractor under the contract with Project owner	- Hai Phong Bridge Projects Management Department. - Construction Supervision Consultant (CSC) - Environmental Supervision Consultant(EMC) - Safety and Environmental Officer of Contractors (SEO)

Project activities	Environmental Impacts	Impact mitigation measures	Financial sources	Period of Implementation	Responsible entity	Supervision Agency
		- Construction equipment and machinery must meet the emission requirements under Decision No. 249/2005/QD-TTg. - Construction equipment would not be allowed to operate outside the construction area. - Construction equipment and vehicles have to be maintained in accordance with guidelines of Manufacturer in order to work in good condition.				
2.2.1-2 Transport waste rock, soils	Arising dust from material transportation (degrade air quality, especially dust, affecting heath of local people, business activities...)	- Vehicles delivering waste soil, rock should have to meet the requirements of emission standards under the "Decision No. 249/2005/QD-TTg dated 10/10/2005 - The vehicles used to transport soil, rock or sand must have lids. In the case of vehicles without cover, tarpaulin will be used to cover materials, the canvas will be tied to ensure that it cannot fly away. - Waste rocks would not be transported at peak hours and on holidays. - Land spillage during transport on the road have to be collected, and transportation routes of waste soil have to be regularly cleaned. - Make plan to transport majority or the entire volume of waste soil by waterway.	Construction costs	During construction period	Construction Contractor under the contract with Project owner	- Hai Phong Bridge Projects Management Department. - Construction Supervision Consultant (CSC) - Environmental Supervision Consultant(EMC) - Safety and Environmental Officer of Contractors (SEO)
2.2.1-3 Cement mixing plant	Dusts come from mixing plant causing degrading air quality	- The material stockyards shall be shielded by enclosing canvas sheets, except for one side for moving materials onto belt conveyor. Canvas sheets will be fixed on ground. - Spray water when pouring materials down from trucks to avoid dust generation; - Rocks should not be crushed at site. Rocks and gravels for concrete mixing shall be purchased from licensed suppliers. - Moisten materials for concrete (sand and gravel) before pouring onto the	Construction costs	During construction period	Construction Contractor under the contract with Project owner	- Hai Phong Bridge Projects Management Department. - Construction Supervision Consultant (CSC) - Environmental

Project activities	Environmental Impacts	Impact mitigation measures	Financial sources	Period of Implementation	Responsible entity	Supervision Agency
		belt conveyor leading to the mixer. - Fabric dust filter shall be installed inside the silo of concrete mixing plant and regularly maintained.				Supervision Consultant(EMC) - Safety and Environmental Officer of Contractors (SEO)
2.2.2. Wastes						
2.2.2-1 Construction activities	Generation of solid wastes from construction, including waste soils, excess construction materials, will affect living, traffic of adjacent residents; degrade air quality (dust), degrade water quality by TSS,	- The waste management plan covering the following things should be developed: + Specify person in charge of managing waste on site + Establish objectives of waste management plan. + Estimate the waste types and amounts involved. + Set targets for reducing the amount of each waste sent to landfill. + Describe recycling/reuse methods for each material + Identify the waste destinations and transport modes, including what materials are being segregated on site for reuse or recycling. + Identify monitoring modes of waste processing progress. + Describe special measures for material use and handling. + Describe communication and training to support and encourage participation from everyone on site - Raw material requirements shall be planned at the outset of each construction activity to avoid excess material storage and wastage on-site. - Wastes shall be stored and handled in dedicated areas with bounded sides such a way as to avoid loss or leakage and subsequent pollution. Temporary waste storages should locate far from sensitive areas such as: resident areas, surface water/ground-table water sources. Waste storages shall be well maintained and frequently be cleaned. - No burning of debris, construction wastes or vegetation shall be allowed on-site.	Construction costs	During construction period	Construction Contractor under the contract with Project owner	- Hai Phong Bridge Projects Management Department. - Construction Supervision Consultant (CSC) - Environmental Supervision Consultant(EMC) - Safety and Environmental Officer of Contractors (SEO)

Project activities	Environmental Impacts	Impact mitigation measures	Financial sources	Period of Implementation	Responsible entity	Supervision Agency
		- The Contractor shall segregate construction waste materials on-site to facilitate re-use, recycling and waste disposal practice in accordance with the best feasible and modern technology: + Construction waste has been identified as suitable for soil improvement or ground formation: The contractor will contact the Urban Environmental Company in Hai Phong city find suitable place for reuse (e.g. to backfill the hollows such as ponds, lakes, fields, gardens ... or constructions). The re-use will not cause more environmental impact. + For wastes was identified as unsuitable for improvement and ground formation: The contractor would classify waste in place in dedicated areas for each type, including but not limited to wood, metal, plastic - Scraps and wastes generated from bridge construction should not be discharged into the river. A grid would be laid on river surface for collecting solid wastes, prevent them from falling into the river. - After completion of bridge construction, all the scaffolding and other temporary facilities used for bridge construction should be removed, and the river should be cleaned, do not let any scraps or garbage fall down into the river,... - Waste soils generated from embankment items should be reused as much as possible for backfilling of lower areas along two sides of road route, and levelling land lots were approved in writing by local authorities and land owners. Unusable soils shall be moved to prescribe dumps. - In technical design stage, positions of dumps would be defined clearly and impacts arising from disposal activities shall be surveyed and accessed in detail.				
2.2.2-2. Activities of Workers (at Worker Camps)	Generation of living solid wastes causing environmental unsanitary,	- Domestic solid waste would be processed gradually. Firstly collecting solid wastes, classifying them and segregating solid wastes can be reused. Transport wastes which cannot be reused and from portable toilets to treatment area of Hai Phong city for disposal under contract signed with Hai Phong Urban Environmental Company.	Construction costs	During construction period	Construction Contractor under the contract with Project owner	- Hai Phong Bridge Projects Management Department. - Construction

Project activities	Environmental Impacts	Impact mitigation measures	Financial sources	Period of Implementation	Responsible entity	Supervision Agency
	water pollution, affecting health, living environment of local residents	- All solid wastes from worker camps would be collected into separated tanks with capacity of 100 ~ 240 liters, and then, would be classified and segregated the wastes can recycle and reuse. - Food scraps, vegetables would be used for animal feed. Wastes can be reused like plastic, cardboard, cans, bottles can be sold for recycle. - Wastes cannot be reused shall be moved to temporary properly designed storages with walls and cover. - Under an economic contract, Project Owner shall request contractor to treat the domestic solid wastes according to Decree 59/2007/ND-CP dated 09/04/2007 and Decree 38/2015/ND-CP about management of solid wastes and matching with realistic at the locality.				Supervision Consultant (CSC) - Environmental Supervision Consultant(EMC) - Safety and Environmental Officer of Contractors (SEO)
2.2.2-3 Construction activities; Maintenance of construction equipment, machinery	Generation of waste oils and wastes containing oil, solvents causing degrading surface water quality, soil quality	- Classify and temporarily store all of waste oils in dedicated tanks labeled by red mark and stored at area with tight-reinforced base and covered. - Waste generator registration: As prescribed, if the project generates over 600kg of waste oil/year shall have to register to be Waste Generator to Department of Natural Resources and Environment of Hai Phong city. - Report on hazardous waste management shall be prepared annually and submit to Department of Natural Resources and Environment prior to 31st January of the next year. - Through the economic contracts, the Project owner shall request the contractor to synthesize and report on hazardous wastes arising from operations of the Project. - Sign contract with one specialized company to transport and handle hazardous waste according to Circular No.36/2015/TT-BTNMT dated 06.30.2015 of the Ministry of Natural Resources and Environment regulated on hazardous waste management.	Construction costs	During construction period	Construction Contractor under the contract with Project owner	- Hai Phong Bridge Projects Management Department. - Construction Supervision Consultant (CSC) - Environmental Supervision Consultant(EMC) - Safety and Environmental Officer of Contractors (SEO)
2.2.3. Water pollution						
2.2.3-1	Generation of	- Wastewater from bath would be reused to moisten surface of the road or	Construction	During	Construction	- Hai Phong

Project activities	Environmental Impacts	Impact mitigation measures	Financial sources	Period of Implementation	Responsible entity	Supervision Agency
Workers' activities	domestic waste water causing degrading surface water quality	places can emit dust during construction work. - At each construction site, apart from above reused bath- waste water, wastewater from canteens would be preliminarily treated to avoid discharge any organic polluted sources into the natural water sources because of decomposing food scraps. Wastewater from canteens will discharge into sand pit with dimensions (width x 70cm depth of about 10m2) to retain dirt after going through screened manholes with to collect garbage. Water, after seeps through the sand, flows into the drainage system of the site before entering the flow. Sand in the pit shall be replaced every week. 3m3 of replaced sand per week can be considered as wastes after preliminarily washing and handling similar as waste soils. - Arrange permanent 3-compartment septic tank for worker camps and site offices. At the sites where far from permanent toilets, mobile toilets would be used. Wastes from portable toilets would be collected under an economic contract with Urban Environmental Company at district level.	costs	construction period	Contractor under the contract with Project owner	Bridge Projects Management Department. - Construction Supervision Consultant (CSC) - Environmental Supervision Consultant(EMC) - Safety and Environmental Officer of Contractors (SEO)
2.2.3- 2. Activities of concrete, cement mixing plant	Generation of waste water causing degrading quality of surface water	- Treatment of waste washing water from concrete mixing plant: The whole aggregate-washed water would be reused to moisten the surface of the construction sites or dust areas. - Waste washing water discharge directed into clarifier with at least 2 compartments; capacity of each compartment must be large enough to contain sediment in the water. Install screens in front of clarifier to collect garbage. Deposited water would be reused. Sediment would be collected and treated as a construction waste. - Sediment tanks and culverts are located inside the construction site and would be built simultaneously preparation works of construction sites and should be maintained as in good condition during construction period. - Sediment tanks shall be cleaned regularly and ensure retain all garbage, rocks, sand and only the water can flow out of the sediment tank. - Deposited garbage and sand, stone would be handled as construction waste as described in the "Management of construction solid wastes."	Construction costs	During construction period	Construction Contractor under the contract with Project owner	- Hai Phong Bridge Projects Management Department. - Construction Supervision Consultant (CSC) - Environmental Supervision Consultant(EMC) - Safety and Environmental Officer of Contractors (SEO)

Project activities	Environmental Impacts	Impact mitigation measures	Financial sources	Period of Implementation	Responsible entity	Supervision Agency
		- After completion of project construction, culverts and clarifier should be leveled before handover to the owner.				
2.2.3- 3. Activities of construction sites	Overflow of rainy-water from construction sites entrains pollutants causing degrading surface water quality	- The construction site is designed with suitable rainwater drainage system (including culvert, ditches, manholes, deposit pits, lower lawn area, etc.) to prevent overflow of rainy-water on construction sites entraining pollutants to flows surrounding. - Rainwater is collected by system of drains, ditches with manholes for waste collection and deposition of sediment. - Clean the surface: Contaminants on construction sites must be collected regularly in order to prevent from contaminating water flows surrounding after heavy rains. - Surface of construction site would be laid by crushed stone to reduce emissions of dust in the dry season and pollutants in the water entrained with storm water overflow during the rainy season.	Construction costs	During construction period	Construction Contractor under the contract with Project owner	- Hai Phong Bridge Projects Management Department. - Construction Supervision Consultant (CSC) - Environmental Supervision Consultant(EMC) - Safety and Environmental Officer of Contractors (SEO)
2.2.3- 4 Construction activities	Increase waste water causing degrading quality of surface water	- Make plan for water quality and soil erosion management covering the following issues in order to manage the impacts on surface water quality during construction process of the project: + Legal requirements related to water quality. + Problems of erosion, sedimentation, water quality likely arising from the project. + Management measures of water quality and soil erosion during construction period. + Roles and responsibilities of involved persons in the development and implementation of quality management terms on water and soil erosion. + Monitoring mechanism, monitoring and reporting to assess the effectiveness of taken control measures. - Apply technology to build a friendly environmental technology such as	Construction costs	During construction period	Construction Contractor under the contract with Project owner	- Hai Phong Bridge Projects Management Department. - Construction Supervision Consultant (CSC) - Environmental Supervision Consultant(EMC) - Safety and Environmental Officer of

Project activities	Environmental Impacts	Impact mitigation measures	Financial sources	Period of Implementation	Responsible entity	Supervision Agency
		using steel pipe sheet pile instead of bored-piles to minimize polluted water from the construction of bridge piers /abutments because it will not arising bentonite. - Apply the construction methods that use efficiency of water, saving the amount of water used, under means of reprocessing and reuse of water. - Check regularly garbage screens, sediment deposition to prevent overflow of water with pollutants to outside. - Develop a monitoring program of surface water quality during the construction process to monitor the water quality at upstream and downstream of Ruot Lon bridge. The monitoring program will start before construction.				Contractors (SEO)
2.3. Impacts from sources not related to waste						
2.3.1 Construction activities	Generate noises affecting heath of local people	- A Construction Noise Management Plan would be prepared and would include the following: + Identification of nearby residences and other sensitive land uses. + Description of approved hours of work. + Description and identification of all construction activities, including work areas, equipment and duration. + Description of what work practices (generic and specific) would be applied to minimize noise according to Vietnamese Standards about Noise (QCVN 26:2010/BTNMT). + A complaints handling process. + Noise monitoring procedures. + Overview of community consultation required for identified high impact works. - Induction and training would be provided to relevant staffs and workers of contractors outlining their responsibilities with regard to noise. - Equipment would be regularly inspected and maintained to ensure it is in good working order. - The machinery with low sound level shall be priority to use when	Construction costs	During construction period	Construction Contractor under the contract with Project owner	- Hai Phong Bridge Projects Management Department. - Construction Supervision Consultant (CSC) - Environmental Supervision Consultant(EMC) - Safety and Environmental Officer of Contractors (SEO)

Project activities	Environmental Impacts	Impact mitigation measures	Financial sources	Period of Implementation	Responsible entity	Supervision Agency
		construction work is undertaken near noise sensitive areas. - Noisy equipment would be orientated away from residential areas and would not be concentrated in a narrow space. - All vehicles stay on site must be switch off. - In principle, construction work only be allowed to implement within allowable time-frame. Construction works near resident areas would be allowed only in night time (22:00pm~06:00am) under provided that noises are not exceeding allowable level according to Vietnamese standard (QCVN 26:2010/BTNMT). - Noisy operations such as piling, road-making, drilling concrete ... would be implemented in time frame match with high background noise levels. - Transportation of waste materials, soil would only be conducted during permitted construction time-frame, when feasible and appropriate. - A protocol would be developed to identify the need for and provision of respite measures for residential areas. Respite measures may include the restriction to the hours of construction activities resulting in impulsive or tonal noise (such as pile driving), or other appropriate measures agreed between the contractor and residents. - Select construction measures such as the use of hydraulic machines or electrical machines/devices instead of diesel machines. This measure would be considered and implemented at feasible and appropriate positions. - Construction sites and access roads should be located at far as possible from noise sensitive objectives. - Use temporary noise barrier at the auxiliary construction locations where quite close to residential areas. - Limit speeds for transportation vehicles in areas under construction (5km/h). In addition, drivers should be regularly reminded by contractor to comply with the speed regulations for construction vehicles operating on the roads outside the construction area.				

Project activities	Environmental Impacts	Impact mitigation measures	Financial sources	Period of Implementation	Responsible entity	Supervision Agency
2.3.2 Construction activities	Generate vibrations affecting heath of local people	- Vibration Management Plan would be prepared and would include the following: + Identification of vibration sensitive areas. + Description of approved hours of work. + Description and identification of all construction activities, including work areas, equipment and duration. + Description of what work practices (generic and specific) would be applied to minimize vibration. +A complaints handling process. + Vibration monitoring procedures. + Public consultation progress where there are demands for carrying out construction activities under high vibrations. - Induction and training would be provided to relevant staffs and workers of contractors outlining their responsibilities with regard to vibrations. - In principle, construction work only be allowed to implement within allowable time-frame. - Construction works near resident areas would be allowed only in night time (22:00pm~06:00am) under provided that vibrations are not exceeding allowable level according to Vietnamese standard (QCVN 27:2010/BTNMT)	Construction costs	During construction period	Construction Contractor under the contract with Project owner	- Hai Phong Bridge Projects Management Department. - Construction Supervision Consultant (CSC) - Environmental Supervision Consultant(EMC) - Safety and Environmental Officer of Contractors (SEO)
2.3.3-1 Excavation, embankment works for bridge abutment/piers foundations	Soil erosion, arising sediment causing degrading water quality by TSS	- All the workers (including sub-contractors' workers) shall seriously follow instructions, guidelines, practices, etc., at construction sites about their responsibilities in regard of soil erosion and sediment control. - The Contractor shall plan his works to minimize surface excavation works during the rainy season (from May ~ October). - The plan shall be made to minimize the extent and duration of disturbing the vegetation. - Environmental-friendly construction method such as steel pipe sheet pile should be applied to the extent possible to minimized polluted water from the construction of bridge piers.	Construction costs	During construction period	Construction Contractor under the contract with Project owner	- Hai Phong Bridge Projects Management Department. - Construction Supervision Consultant (CSC) - Environmental Supervision Consultant(EMC)

Project activities	Environmental Impacts	Impact mitigation measures	Financial sources	Period of Implementation	Responsible entity	Supervision Agency
		- Particular attention shall be paid during storm season. The Contractor shall prepare action plan incase storm and rain is forecasted, and action processes during or after rainstorms. Special attention shall be paid to control storm water runoff during storms, especially in construction locations with high slopes. - In rainy season, rainy drainage system should be built before construction of wall foundation. And reservoirs containing rainy water and drainage ditch system should be built before embankment of road base. - Construction plan should be arranged to avoid carry out items like embankment, bridge pier/abutment construction, etc., in rainy season. If impossible, rainy drainage system should be improved to ensure water would discharge easily and fast. - All exposed earth areas shall be completed and revegetated as soon as possible after earthworks have been completed. Specially, in rainy season, ground must be compacted to avoid erosion by rain. The Contractor shall continue reinforcement if any erosive sign is found. - The overall slope of the works areas and construction yards shall be kept to a minimum to reduce the erosive potential of surface water flows. - Channels, earth bunds, netting, tarpaulin and or sand bag barriers shall be used on site to manage surface water runoff and minimize erosion. Soil erosion and sediment control shall be maintained until soil structure reaches stability and required cohesive rate.				- Safety and Environmental Officer of Contractors (SEO)
2.3.3-2 Storage, transportation of materials, waste soils	Soil erosion, sediment arising causing degrading water quality by TSS	- Temporary store yards of construction materials (e.g.: rock, gravel, sand and backfilling soil) and waste soil should be arranged before any construction activities. - Organic soil and wastes which can reuse would be stored in dedicated dump included in scope of site clearance, and would be transported for leveling at places as agreed with local authorities. - Waste material/ soil stored location would be arranged in scope of site clearance and far from surface water sources and storm water runoff areas.	Construction costs	During construction period	Construction Contractor under the contract with Project owner	- Hai Phong Bridge Projects Management Department. - Construction Supervision Consultant (CSC) - Environmental

Project activities	Environmental Impacts	Impact mitigation measures	Financial sources	Period of Implementation	Responsible entity	Supervision Agency
		Do not arrange storage location in the residential, business areas where elevation lower than waste material/soil stored areas. - Bulk materials should be packed off or covered by geotextile. Digging ditches around the storage area to prevent sewage from entering. - Construction material/waste soil storages over 50m3 without enclosure wall should be covered with tarpaulin or similar fabric during rainstorms. Appropriate measures should be implemented to prevent washout of materials, waste soils into any drainage system. Place muddy screens around the site to keep sediment/soil not flow out. Muddy screens are made of geotextile, buried deep into the ground and reinforced to ensure stability. Remove all the dirt blocked by the screen, keeping mud from spilling out and water can drain easily. This kind of muddy soil shall not be reused but as waste soil. In the rainy season, muddy screens should be regularly maintained for at least every two days. After completion of construction of one road segment, remove screens, clean them and reuse for the next segment. - In particular, during the rainy season, from May to October, waste rocks and soils should be immediately moved to the prescribed dumps. Amount of rock, soils which unable to transport punctually should be covered to prevent from runoff by rain water.				Supervision Consultant(EMC) - Safety and Environmental Officer of Contractors (SEO)
2.3.4 Construction activities of Ruot Lon bridge; Activities of construction sites of Ruot Lon bridge	Discharge waste causing water impairment affecting ecosystems of mangrove forest	- Environmental-friendly construction method such as steel pipe sheet pile should be applied to minimized polluted water from the construction of bridge piers' foundations - No clear vegetation outside Project site clearance area. - Site fencing shall be erected around construction sites, storage areas, etc. to avoid unnecessary damages to vegetation, trees and landscape, etc. - All trees within the works boundaries shall be preserved if they are outside the permanent works areas and do not interfere with construction or operation of the Project. - Embankments and slopes shall be stabilized by grass planting, ideally by	Construction costs	During construction period	Construction Contractor under the contract with Project owner	- Hai Phong Bridge Projects Management Department. - Construction Supervision Consultant (CSC) - Environmental Supervision Consultant(EMC)

Project activities	Environmental Impacts	Impact mitigation measures	Financial sources	Period of Implementation	Responsible entity	Supervision Agency
		hydro-seeding, to minimize erosion.				- Safety and Environmental Officer of Contractors (SEO)
2.3.5 Equipment, machinery operated by diesel, petrol	Emission of CO2, causing global heat increasing	- Material transportation distance would be considered for material supply process. - Excess material like gravel left from the road foundation construction activities, road surface, etc. would be reused if possible. - Fuel efficiency of the machines and devices would be considered when selection. - Project Plan shall be made thoroughly to be able to minimize duplication of materials, avoiding transporting materials in a long way and using additional fuel. - Use as maximum as possible powered construction machinery and equipment. - Use domestic goods and services, especially at the locality to reduce emissions of exhaust air from transportation. - The contractor may propose changes to the design, specifications, or methods of construction if finding any dangerous incident when building a certain work items, in order to mitigate the impact of climate change.	Construction costs	During construction period	Construction Contractor under the contract with Project owner	- Hai Phong Bridge Projects Management Department. - Construction Supervision Consultant (CSC) - Environmental Supervision Consultant(EMC) - Safety and Environmental Officer of Contractors (SEO)
2.3.6-1 Operate machine, vehicles … .	Impacts generated from operations of machines, vehicles, encroaching on road traffic	- Obey the general regulations: + Construction methods and sequence, etc. should be designed to minimize block-out duration of public road, do not interrupt traffic around construction area. + Construction items potentially caused a major obstacle for local traffic should be scheduled to implement in less traffic density time. + In the case block-out of local roads is necessary during construction progress, an access roads should be opened or should have other	Construction costs	During construction period	Construction Contractor under the contract with Project owner	- Hai Phong Bridge Projects Management Department. - Construction Supervision Consultant (CSC) - Environmental

Project activities	Environmental Impacts	Impact mitigation measures	Financial sources	Period of Implementation	Responsible entity	Supervision Agency
		appropriate measures to help local residents can access their homes, business and manufacture every day. + Do not concentrate construction equipment, vehicles of Project on the existing roads. + During construction of intersections, surface of National Highway 10 and Provincial Road 359 near intersection point should be cleaned every day. The length of the sections to be cleaned will be shown by supervision engineers on the base of dirty caused by the project's vehicles. + Drivers and construction workers should be aware and comply with traffic safety regulations and should not drink alcohol and use drugs. + Coordinate with the local traffic police to regulate traffic at intersection area. + Limit travelling during peak hours from 6 ~ 8 and 16 ~ 18h. - Reasonable construction organization: girder erecting of access bridge crossing Provincial Road 359 would not carry out during peak hours, in order to not affect road traffic. - Warning signs: Warning signs at construction areas would be placed at two sides of the existing road at visible places that drivers observe easily and at least 150m from the site. - Marker post and indicating lights: Marker posts would be placed to border the scope of the construction during pavement of the existing road surface. Lights above maker post are flashing lights type A (less blinking lights), or Type B (more blinking lights) should be approved by supervision engineer prior to use depending on actual conditions. - Traffic Guide: Guiding to ensure traffic during construction period at the intersection location. Flagman should be assigned to regulate the traffic.				Supervision Consultant (EMC) - Safety and Environmental Officer of Contractors (SEO)
2.3.6-2 Operate vehicles and equipment	Damage the local roads which used for delivery for	- Regarding to Provincial Roads and National Roads: + Do not transport over speed, over load: the trucks shall go with right speed and shall not carry overload - Transport on inter-communal and inter-village roads:	Construction cost	During construction period	Construction Contractor under the contract with	- Hai Phong Bridge Projects Management Department.

Project activities	Environmental Impacts	Impact mitigation measures	Financial sources	Period of Implementation	Responsible entity	Supervision Agency
	material, waste soil	+ Agreement with local authority: it should obtain consent in writing from the local authority for use of temporary inter-village, inter-communal roads for transportation with right purposes; + Reasonable delivery organization: materials and waste soil would not be transported on roads when crowded and on the holidays. The Project shall be responsible for getting information about such time-frame and commitment to avoid transporting at the time-frame with each local region; + Implement sanitary measures and reinstatement: Keep roads hygiene and safety when use and maintenance, to ensure normal, safety travel of the people and reinstatement of road before handing over to the locality.			Project owner	- Construction Supervision Consultant (CSC) - Environmental Supervision Consultant(EMC) - Safety and Environmental Officer of Contractors (SEO)
2.3.7 Construction of bridge piers	Make hydrological conditions changing, erosion under the bridge	- Select technology, construction duration, organization method for the construction of piers P6, P7 in the direction of reduced displacement area of water flow of Ruot Lon river, especially in the rainy season	Construction cost	During construction period	Construction Contractor under the contract with Project owner	- Hai Phong Bridge Projects Management Department. - Construction Supervision Consultant (CSC) - Environmental Supervision Consultant(EMC) - Safety and Environmental Officer of Contractors (SEO)
2.3.8 Construction of bridge piers	Impact on water use at downstream of	- Implement measures to minimize the impact of water pollution (Section 4.2.2.3). - Implement measures to minimize impacts to waterway (Section 4.4.2.1)	Construction cost	During construction period	Construction Contractor under the	- Hai Phong Bridge Projects Management

Project activities	Environmental Impacts	Impact mitigation measures	Financial sources	Period of Implementation	Responsible entity	Supervision Agency
under Ruot Lon River	Ruot Lon River because of water pollution. Obstructing traffic on Ruot Lon River				contract with Project owner	Department. - Construction Supervision Consultant (CSC) - Environmental Supervision Consultant(EMC) - Safety and Environmental Officer of Contractors (SEO)
2.3.9 Concentration of workers	The risk of spreading disease; the risk of arising conflicts between the workers and the local people	- Accommodation, water and electricity would be fully provided for worker camps to ensure good health conditions for the workers. - Registration of temporary residence should be conducted for the workers coming from other places. - Workers shall be trained to respect culture and beliefs of the local people. Workers are prohibited from drinking alcohol in working time and gambling at the site. - Prepare working schedule (working hours and time-breaks) for workers. - Coordinate with local organizations such as the Fatherland Front, Women's Union ... to promote awareness of workers and prevent social evils, prostitution, infectious diseases, etc. - Coordinate and cooperate closely with local communities to prevent the social crimes and disease arising in the region. - Employ local people (both men and women) for unskilled works is priority. For some jobs requiring technical capability, the contractor will recruit among the local workers and equip them with the skills to be able to meet the requirements of the job.	Construction costs	During construction period	Construction Contractor under the contract with Project owner	- Hai Phong Bridge Projects Management Department. - Construction Supervision Consultant (CSC) - Environmental Supervision Consultant(EMC) - Safety and Environmental Officer of Contractors (SEO)
2.3.10	Safety	- Workers would be provided adequately personal protective equipment	Construction	During	Construction	- Hai Phong

Project activities	Environmental Impacts	Impact mitigation measures	Financial sources	Period of Implementation	Responsible entity	Supervision Agency
Activities of worker, construction activities	environment for work	such as helmets, anti-noise device, safety shoes, etc. - Organize training for workers on safety measures to protect the local people, especially the students. - Provide workers good living conditions and health care services during construction process. - Install of instruction signs, indication lights, Etc. at positions potentially occurring accident. - Erect temporary fencing surrounding positions potentially occurring accident to prevent people inadvertently coming in. Install lights at night at areas having frequent travelling of the locals. - Arrange person for guidance and keeping safety at/near position concentrating construction vehicles.	costs	construction period	Contractor under the contract with Project owner	Bridge Projects Management Department. - Construction Supervision Consultant (CSC) - Environmental Supervision Consultant(EMC) - Safety and Environmental Officer of Contractors (SEO)
3. Operation phase						
3.1. Effect sources related to wastes						
3.1.1 Activities of vehicles	Arising dust and emissions of CO2, NOx, SO2, and HC causing degrade surrounding air quality, affecting people's health	- Conduct regularly maintenance of access road to bridge. - Conduct regularly maintenance of roads surface and bridges. - Spray water regularly for cleaning road surface. - Implement environmental monitoring of air quality near the project area in a certain period at the start of operation stage of the project. Supplement feasible and appropriate mitigation measures if concentration of pollutants greater than forecasted level.	Annual budget of Hai Phong City	Operation period of Project	Road and Bridge Maintenance Company under contract with Hai Phong Department of Transportation	Hai Phong Department of Transportation (DOT)

Project activities	Environmental Impacts	Impact mitigation measures	Financial sources	Period of Implementation	Responsible entity	Supervision Agency
3.1.2 Activities of vehicles; Maintenance activities of bridge and road	Generating wastes, resulting degrading water quality because garbage, dust gone with water flow to river	- Prior operation stage of Project, the response procedures should be established to response in time to incidents, traffic accidents on bridge, overflowing pollutants to the river. - The road surface should be cleaned periodically, especially before a rainstorm to collect garbage, reduce pollutants flowing into the river from the road surface. - Fully equip devices to collect, transport and treat waste disposal from iron arch bridge maintenance (paint sludge, excess solvents, paint boxes, solvents and equipment for painting, ...)	Annual budget of Hai Phong City	Operation period of Project	Road and Bridge Maintenance Company under contract with Hai Phong Department of Transportation	Hai Phong Department of Transportation (DOT)
		- Checking regularly and maintaining drainage system.			Urban Environmental Company	Hai Phong Department of Natural Resources and Environment
3.1.3 Activities of vehicles; Maintenance activities of bridge and road; Easily discharge garbage in unregulated way	Waste generation; degrade water quality; sanitation, environmental degradation; affecting people's health.	- Collect frequently wastes arising from activities of vehicles on bridges, roads. - Waste arising from bridge maintenance would be collected, transported and handled in accordance with procedures. - Disseminate and foster frequently awareness of environmental protection, waste management to employees of Bridge Maintenance Company. - Provide adequate equipment for waste collection.	Annual budget of Hai Phong City	Operation period of Project	Road and Bridge Maintenance Company under contract with Hai Phong Department of Transportation	Hai Phong Department of Transportation (DOT)
3.1.4 Activities of	CO2 emission may change the	- Strictly implement maintenance mode for roads and auxiliary infrastructure aiming at slowing the degradation of materials.	Annual budget of Hai	Operation period of Project	Road and Bridge Maintenance	Hai Phong Department of

Project activities	Environmental Impacts	Impact mitigation measures	Financial sources	Period of Implementation	Responsible entity	Supervision Agency
vehicles.	climate/ greenhouse effect		Phong City		Company under contract with Hai Phong Department of Transportation	Transportation (DOT)
3.2. Impacts do not relating to waste sources						
3.2.1 Activities of vehicles on road	Generation of noise affecting health of local people. Affect production and business activities	- Planting and take care of trees on the sidewalk along the frontage roads	Annual budget of Hai Phong City	Operation period of Project	Hai Phong Green Park Co., Ltd.	Hai Phong Department of Construction
		- Install speed limit signs at locations near residential areas. - Regular maintenance of roads surface, and bridges.			Road and Bridge Maintenance Company under contract with Hai Phong Department of Transportation	Hai Phong Department of Transportation
3.2.2 Operation of bridge and road	Sediment and erosion make degrading water quality (TSS)	- Regularly perform maintenance of the embankment slope to prevent erosion. - Plant grass or reinforce two sides of embankment slopes	Annual budget of Hai Phong City	Operation period of Project	Road and Bridge Maintenance Company under contract with Hai Phong Department of Transportation	Hai Phong Department of Transportation
3.2.3 Vehicles run on bridge; Operate bridge and road	Degrade ecosystems of mangroves due to river water pollution, dust and air from the bridge	- Prepare and implement a plan to protect the ecosystem of plants, including identification of impacts and impact mitigation measures for trees, method for management/protection of trees, vegetation and mangroves forest around the project area	Annual budget of Hai Phong City	Operation period of Project	Center for development and protection of mangrove forests;	Center for development and protection of mangrove forests. Hai Phong Department of

Project activities	Environmental Impacts	Impact mitigation measures	Financial sources	Period of Implementation	Responsible entity	Supervision Agency
						Agriculture and Rural Development
		- Take care of Project's plants.			Hai Phong Green Park Co., Ltd.	Hai Phong Department of Construction
3.2.4 Appearance of bridge piers in the flow of Ruot Lon river	Obstruction of waterway traffic on Ruot Lon river	- Arrange buoys, waterway signs in Ruot Lon bridge area in accordance with regulations of waterway traffic.	Annual budget of Hai Phong City	Operation period of Project	Road and Bridge Maintenance Company under contract with Hai Phong Department of Transportation	Hai Phong Department of Transportation
3.3. Social impacts						
3.3.1 Vehicles travelling when putting road and bridge into operation	Affect the infrastructure, current social services of the local, children's rights, social capital funds, etc. .	- Regular maintenance of Works to ensure safety for pedestrians, such as speed damper, traffic lights, signage, etc. at locations where there are amount of pedestrians need to cross the street. - Careful maintenance of crosswalks (with painted markings) for pedestrians should be conducted, to help local people easily come to/from houses, schools, public facilities, etc. in the other side of the road.	Annual budget of Hai Phong City	Operation period of Project	Road and Bridge Maintenance Company under contract with Hai Phong Department of Transportation	Hai Phong Department of Transportation
3.3.2 Site clearance, relocation, resettlement	Affect the poor, vulnerable households who face difficulties to restore the life after relocation	Continue to implement (if necessary) measures to mitigate the impact on vulnerable households (including the poor) as proposed in the Resettlement Action Plan (RAP) and Livelihood Restoration Program. - Continue to implement a monitoring program to livelihoods restoration of vulnerable households.	Annual budget of Hai Phong City	Operation stage of project	Department of Labor, Invalids and Social Affairs of Hai Phong; City Compensation Council of Thuy	Department of Labor, Invalids and Social Affairs of Hai Phong; City Compensation Council of Thuy

Project activities	Environmental Impacts	Impact mitigation measures	Financial sources	Period of Implementation	Responsible entity	Supervision Agency
					Nguyen district	Nguyen district
4. Natural disasters, labor accidents, traffic accidents						
4.1. The incident occurred in the construction phase						
4.1.1 Bridge , road construction activities	Technical problems	- Strictly comply with quality control procedures, including survey work before construction, construction plan, construction drawings, etc. - Comply with the labor safety plan. - Emergency response plan: The contractor shall prepare an emergency response plan to cope with labor accidents, set up a rescue team, establish specific emergency response procedures (such as in charge person of the rescue team, the process of implementation), and shall identify where to contact in an emergency situation such as medical centers, hospitals, etc. in/near the construction site, and hospitals in Hai Phong City.	Construction costs	In construction process	Construction Contractor under contract with Project Owner	- Hai Phong Bridge Projects Management Department. - Construction Supervision Consultant (CSC) - Environmental Supervision Consultant(EMC) - Safety and Environmental Officer of Contractors (SEO)
4.1.2 Activities at construction site	Fire incidents causing human mortal and damage equipment and machinery	- The provisions on storage of flammable materials: Oil, gas used for construction machinery should have to be stored in a dedicated warehouse, far away from inflammable sources. The warehouse must be equipped with temperature monitoring equipment and fire alarm systems. - The sites should be equipped by fire protection equipment: Fire extinguishers and fire-fighting water tank would be prepared at site and at the petroleum storage. Prevention and fire-fighting vehicles and equipment would be checked and maintained regularly. - Fire Prevention Training: Training, advocacy should be held to improve workers' capacity and awareness of safety and fire prevention.	Construction costs	In construction process	Construction Contractor under contract with Project Owner	- Hai Phong Bridge Projects Management Department. - Construction Supervision Consultant (CSC) - Environmental Supervision

Project activities	Environmental Impacts	Impact mitigation measures	Financial sources	Period of Implementation	Responsible entity	Supervision Agency
						Consultant(EMC) - Safety and Environmental Officer of Contractors (SEO)
4.1.3 Construction activities, operation of machinery, equipment and delivery	Labor accident causing human mortal and damage equipment and machinery	- Comply with all the regulations on labor safety: The contractor shall establish regulations on labor safety in the construction process. Establish periodical health checks programs for employees and workers. Organizing training courses and dissemination of hygiene and labor safety. Fully equipped for workers the necessary protective equipment. Establish communication systems to ensure safety during construction – Make rescue plan when accident happened: The contractor shall develop an emergency response plan to incidents of labor accidents, founded rescue teams, rescue establish a specific process (e.g. people responsible for rescue, the process of implementation), and to identify where to contact in an emergency situation such as medical centers, hospitals, etc. in / near the construction site range, and hospitals in the city of Hai Phong.	Construction costs	In construction process	Construction Contractor under contract with Project Owner	- Hai Phong Bridge Projects Management Department. - Construction Supervision Consultant (CSC) - Environmental Supervision Consultant(EMC) - Safety and Environmental Officer of Contractors (SEO)
4.1.4 Construction activities on river, on the height in storm season	Disaster like storm, flood, heavy rain causing human mortal and damage	- One team would be assigned for monitoring the weather situation in the public media, particularly in the rainy season in order to prepare prevention plans for natural disasters on the construction site. - Make construction plan how to complete items such as pile foundation, underwater bearings before the typhoon season. - In storm season, the scaffolding system should be reinforced to ensure	Construction costs	In construction process	Construction Contractor under contract with Project Owner	- Hai Phong Bridge Projects Management Department. - Construction Supervision

Project activities	Environmental Impacts	Impact mitigation measures	Financial sources	Period of Implementation	Responsible entity	Supervision Agency
	equipment and machinery	stability when heavy rain, high winds. - Install lightning system. - Make relocation plan for vehicles, machinery, construction materials when heavy rains and storms, floods occur. - Make emergency response in regard with incidents occur: When incidents occur, project will proactively rescue the incident, on the other hand will contact the other units in the area for in time rescue (Committee for the prevention of floods, storms and search and rescue of Hai Phong city). Besides, the project will deal with health centers in wards/communes along the project route to use this room as first aid stations. Arrangement of rescues equipment for emergency should be approved by the supervision engineer.				Consultant (CSC) - Environmental Supervision Consultant(EMC) - Safety and Environmental Officer of Contractors (SEO)
4.2. Traffic accidents (on the river and on the road, in the construction phase and operation phase)						
4.2.1 Construction activities of P6 and P7 piers on Ruot Lon River	The accident on the river due to collisions between boats and construction equipment, construction works	Accident on River in construction period - The Contractor shall prepare security plans for inland waterway transport and submitted to the Inland Waterways Regulatory Agency for approval. The profile shall include: A request letter asking for approval of the plan to ensure the safety of inland waterway transport; Construction method; Method for ensuring safety of inland waterway transport in the area of construction; - Comply with the provisions on inland water transport: strict implementation of the regulations on inland waterway transport; Do not carry excessive amounts as regulated. Do not operate the over speed allowed; equip with safety equipment, including sirens, lights, life buoy. - Traffic signs: Signs warning of construction areas on a minimum distance of 300m, where all drivers can easily observe. Traffic signs should be stable in normal traffic conditions as well as when there are strong winds with light reflectors for easy recognition at night. After	Construction costs	In construction process	Construction Contractor under contract with Project Owner; Inland Waterway Traffic Management Agency	- Hai Phong Bridge Projects Management Department. - Construction Supervision Consultant (CSC) - Environmental Supervision Consultant(EMC) - Safety and Environmental Officer of Contractors (SEO)

Project activities	Environmental Impacts	Impact mitigation measures	Financial sources	Period of Implementation	Responsible entity	Supervision Agency
		completion of construction, all these signs would be removed. - Spar buoys and lights: Install spar buoys to determine limit of construction area in construction time. All buoys are red, white and ensure visibility both day and night. Lights on the buoys may be Type A blinking lights (less blinking lights), Type B (more blinking lights); metering lights construction site. - Traffic guide: the Contractors should hire one Waterway Safety Traffic Management Company r to guide and coordinate boats traffic at upstream, downstream areas and at bridge construction locations. As far as using floating system for construction of bridge's piers, support system, flagman should be arranged to keep watch and regulate traffic at construction area. - Guide the ship owners in line with the construction of project how to notify the relevant authorities to respond promptly when incidents occur. The hotline phone number of the relevant authorities such as Committee for the prevention of floods, storms and search and rescue of Hai Phong city. People's Committee of wards, communes along river banks ... should be provided. These phone numbers should be pasted at the most easily observed location at construction sites and the site office. - Establish salvage procedures when the accident occurred on the river, including carry the victims to the medical bases of wards/communes along two sides of Ruot Lon river to use this room as first-aid station or bring the victims to the nearest hospital or call the city's ambulances.				
4.2.2 Piers appear on the main streamline of Ruot Lon river	Risk of increasing collision of boats, causing loss of people, vehicles, especially age	Accident on river in operation stage - Fully install of signal lights, buoys and signs as prescribed by the inland waterway transport - Working closely with the Inland Waterway Traffic Management Agency to ensure traffic safety on the river. - Guide the ship owners who frequently pass through bridge construction area how to notify the relevant authorities to respond promptly when	Budget of Hai Phong City	Operation stage	Inland Waterway Traffic Management Agency Control Steering Committee for the prevention of	People's Committee of Hai Phong City People's Committee of Thuy Nguyen Rural district

Project activities	Environmental Impacts	Impact mitigation measures	Financial sources	Period of Implementation	Responsible entity	Supervision Agency
	of Ruot Lon Bridge	incidents occur. The hotline phone number of the relevant authorities such as Committee for the prevention of floods, storms and search and rescue of Hai Phong city. People's Committee of wards, communes along river banks ... should be provided. These phone numbers should be pasted at the most easily observed location on boats and ships. - Carry the victims to the medical bases of wards/communes along two sides of the river to use this room as first-aid station or bring the victims to the nearest hospital or call the city's ambulances. - Alerts devices, traffic safety protection on the river such as Signs, buoys, lights, etc. should be regularly checked and maintained.			floods, storms and search and rescue of Hai Phong city People's Committee of Lap Le, Thuy Trieu, Nam Hai communes	and Hai An district
4.2.3 Road traffic in operation stage	Risk of increasing traffic accidents on bridge and roads.	- Regular maintenance of vehicles should be conducted to ensure traffic safety on the roads around bridge, such as traffic lights, speed warning signs, speed humps, etc. in locations were many pedestrians need to cross the street. - Regular maintenance of crosswalks for pedestrians should be conducted, to help local residents easily access to schools, public facilities, etc. in the other side of the street.	Budget of Hai Phong City	Operation stage	Road Maintenance Company under contract with Hai Phong Department of Transportation	Hai Phong Department of Transportation

5.1.3. Implementation of Environmental Management Plan (EMP)

5.1.3.1. Implementation of Environmental Management Plan (EMP) in preparation and construction phase of the Project

The following relevant organizations and parties with different roles and responsibilities should attend the Environmental Management Plan in preparation and construction phase of the Project:

- Sponsor: Japan International Cooperation Agency (JICA) (at the proposal of Hani Phong People's Committee)
- Project Owner: Hai Phong City Bridge Projects Management Department
- Agency approving the EIA Report: Ministry of Natural Resources and Environment (MONRE);
- Hai Phong Department of Natural Resources and Environment (DONRE) and relevant agencies;
- Construction supervision consultant(CSC)/ Environmental Supervisor (ES);
- Environmental Monitoring Consultant (EMC);
- Construction Contractor;
- Contractor's Safety & Environmental Officer (SEO);
- Community Supervision Board.

The relationship between the parties involved in environmental management of the project in preparation and construction phase is shown in the following figure.

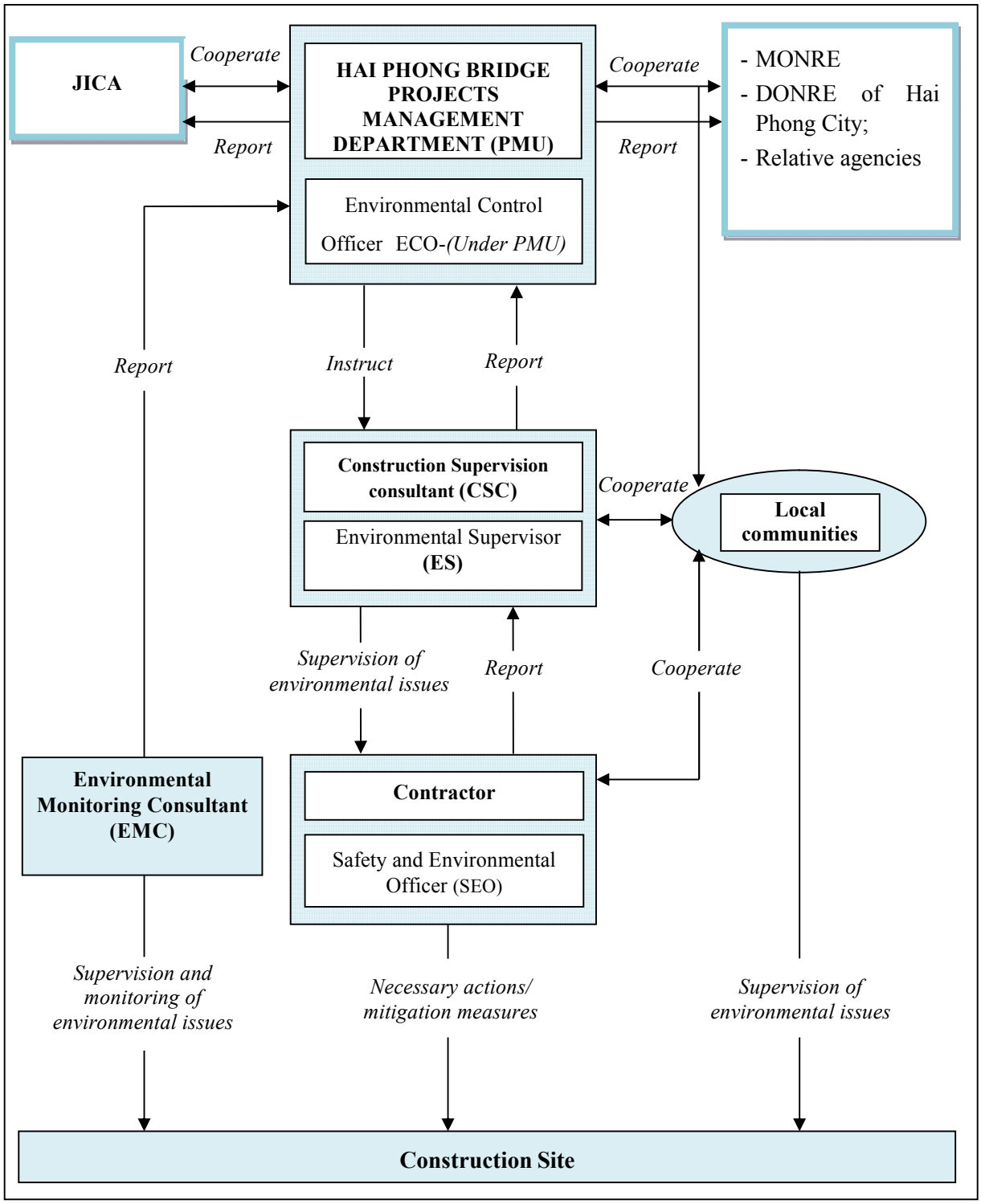


Figure 5.1. Organization Chart of Environmental Management in Pre-construction and Construction Stages of the Project

Table 5.2. Roles and Responsibilities of Stakeholders in Pre-construction and Construction Stages of the Project

Roles	Responsibilities regarding Environment matters
Hai Phong Bridge Projects Management Department (PMU)	As the Project implementation management organization, the Project Owner, Hai Phong Bridge Projects Management Department is responsible for overall monitoring of the implementation of project, including compliance with requirements on environment. Hai Phong Bridge Projects Management Department shall take the major responsibility for environmental activities in all phases of the Project as stipulated in the Circular No. 32/2015/TT-BGTVT dated July 24, 2015 issued by the Ministry of Transport on environmental protection in traffic infrastructure development. Specifically, Hai Phong Bridge Projects Management Department shall: - Include environmental protection commitments, waste treatment measures, measures to minimize adverse impacts on environment in the EIA report approved by competent authorities to bidding documents and contract with construction contractors. - Be responsible for organization and management of environmental protection in construction activities and shall perform the following tasks: o Preparing and approving Project EMP, and then submitting to communal people's committee which has given their opinions in EIA process for publicly issuing the EMP before commencing the construction o Giving guidance and instruction to Contractor's staff and employees on contents of EMP, waste treatment measures, and measures to minimize adverse impacts on environment with regards to the bidding package undertaken by the Contractor o Organizing, supervising, urging contractor to implement methods of management, collection and treatment of waste (especially hazardous waste); measures to minimize dust, noise, vibration; measures to cope with incidents; occupational safety methods; Making weekly assessment of environmental compliance made by contractor; preparing and saving the assessment record under the form specified in Annex 3 – Circular No. 32/2015/TT-BGTVT. o Performing periodic environmental monitoring; summarizing, evaluating and making report on compliance with the environmental protection contents of the project according to construction schedule; submitting the report to relevant environmental protection agency under Provincial PPCs and the agency approving EIA report. o Immediately taking remedy and informing the agency approving the decision on investment in project and Communal/Distric PPC or the Department of Natural Resources and Environment at the project

Roles	Responsibilities regarding Environment matters
	location in case of suspension of construction activities due to environmental incidents, o Keeping environmental protection records with regards to the projects; coordinating with, providing the State management agency for environmental protection with relevant information for purpose of inspecting. o Handling violations of construction contractor with regards to environmental protection in the bidding package under the terms of the contract signed.
Environmental Control Officer (ECO) - *(under Hai Phong Bridge Projects Management Department)*	To achieve effectiveness in the implementation process, the Hai Phong Bridge Projects Management Department shall appoint an ECO to address environmental issues of the Project. This ECO is responsible for helping the Hai Phong Bridge Projects Management Department to perform the following tasks: - Considering EIA and EMP conducted by consultant; - Integrating EMP in detailed engineering design documentation and in contract documents and tender; - Including the responsibility for monitoring and supervision of EMP in the outline, contract documents and tender for Environmental Supervisor (ES); - Providing relevant data in the process of selecting consultant; - Reviewing reports submitted by the Environmental Supervisor; - Directly monitoring the management, supervision and monitoring; - Inspecting construction activities to ensure that construction units perform all obligations as defined in job description relating to environmental impact mitigation measures. In cases any provision is not followed, the Environmental Supervisor shall report directly to the Hai Phong Bridge Projects Management Department to suspend the work of the construction unit. - Giving advice to the Director of Hai Phong Bridge Projects Management Department on resolutions for environmental issues of the Project
Construction supervision consultant (CSC)/ Environmental Supervisor (ES)	- Supporting Hai Phong Bridge Projects Management Department in establishing and operating the environmental management system; making recommendations on adjustment and enhancement of relevant parties' capacity in the process of implementation and monitoring the implementation of EMP of contractor. - CSC will be responsible for general supervision of construction activities and ensure that the Contractor complies with contractual requirements and specifications. ES belonging to CSC group will be responsible for supervising and monitoring construction activities in terms of environmental aspect and ensure that the Contractor satisfies

Roles	Responsibilities regarding Environment matters
	with requirements specified in the contract signed with the project owner, in approved EIA report, as well as in EMP. - ES includes Environmental Engineers with adequate knowledge in the field of environmental protection who are responsible for fulfilling obligations and monitoring the environmental issues in construction activities of the Contractor. - Directly notifying construction units of any potential environmental issues that may hinder the progress of the Project. - Monitoring the implementation of mitigation measures by the contractor, promptly proposing and implementing additional interventions so as to complete the said mitigation measures amd meet requirements on environmental protection. - Making plan to prevent and respond to environmental issues, emergency situations that may occur during construction. - Requesting Hai Phong Bridge Projects Management Department to suspend the construction partly or wholly in case the contractor fails to meet requirements on occupational safety and environmental protection as agreed or stated in the contract. - Reporting periodically on environmental monitoring results to Hai Phong Bridge Projects Management Department. - Organize training courses to enhance capability on environment if required.
Environmental Monitoring Consultant (EMC)	- Conduct periodic environmental monitoring. - Reporting periodically on monitoring results to Hai Phong Bridge Projects Management Department. - Perform additional measurements upon request.
Construction contractor	The Contractor shall comply with all provisions on environmental protection as stipulated in the Circular No. 32/2015/TT-BGTVT dated July 24, 2015, specifically: - Construction Contractor shall comply with all provisions of law on environmental protection, standards, environmental technical specifications and satisfy requirements on environmental protection as specified in the contract signed with Hai Phong Bridge Projects Management Department. - During construction, the construction contractor shall perform the following basic tasks: o Implementing requirements in EMP of the project, taking waste treatment measures, and measures to minimize adverse impacts on environment with regards to the bidding package undertaken by the Contractor. o Regularly monitoring and urging officials and employees to comply with requirements on environmental protection with regards to the

Roles	Responsibilities regarding Environment matters
	bidding package in construction process; raising awareness and consciousness of environmental protection in employees. o Collecting, storing, transporting, treating or disposing solid waste (such as mud, excavated soil, refused materials, construction waste, etc.) in the right place, method and volume. o Collecting and storing household waste and hiring local environmental sanitation unit to transport and treat; or treating waste in accordance with regulations. o Collecting and storing hazardous waste and hiring licenced hazardous waste management unit to transport and treat. o Preparing toilet, waste collector and container, temporary sewage treatment works on construction sites, construction administration office and worker camps. o Taking measures to reduce dust, noise, vibration, drainage measures, and local anti-flooding measures; designing and implementing emergency response plans; ensuring traffic safety during the construction process. o Managing and maintaining technical state of construction vehicles, equipment and machines in accordance with regulations on quality, technical safety and environmental protection; complying with regulations on vehicle load; covering materials and waste, preventing them from leakage that causes environmental pollution while transporting during the construction process. o Recovering the initial environmental state, cleaning the construction site, making clearance of river and channel beds after completing the construction. o Providing the State management agency for environmental protection with relevant information for purpose of inspecting. - Being subject to the management of ES, adjusting or strengthening measures when being required by the ES or ECO.
Owners of other project concerned	Vingroup JSC: - Cooperating with Hai Phong Bridge Projects Management Department in replanting mangrove trees affected by the Project in the area planned for developing the ecological park. - Conserving the mangrove forest remaining in the eastern area of Vu Yen Island. VSIP: - Conserving the mangrove forest remaining in the southern area of VSIP Industrial Park along the north bank of Cam River.
Local community (government, Non-governmental	Community investment monitoring is a voluntary activity performed by the residents in commune/ward under the Decision No 80/2005/QD-TTg and other relevant legal provisions, for the purpose of:

Roles	Responsibilities regarding Environment matters
organizations, etc.)	- Monitoring and assessing the compliance with regulations on investment management of competent investment decision authority, project owner, PMU, contractors and construction unit during the investment process (including environmental aspect); - Detecting and reporting to state competent authority on any violation of regulations on investment management (including environmental aspect) so as to promptly prevent and handle the violation, avoiding waste and loss of state capital and assets, as well as bad effect on interests of the community.

5.1.3.2. EMP Implementing Organization in Operation Stage

EMP implementing organization in operation stage (guarantee period of the works) is presented in Figure 5.2.

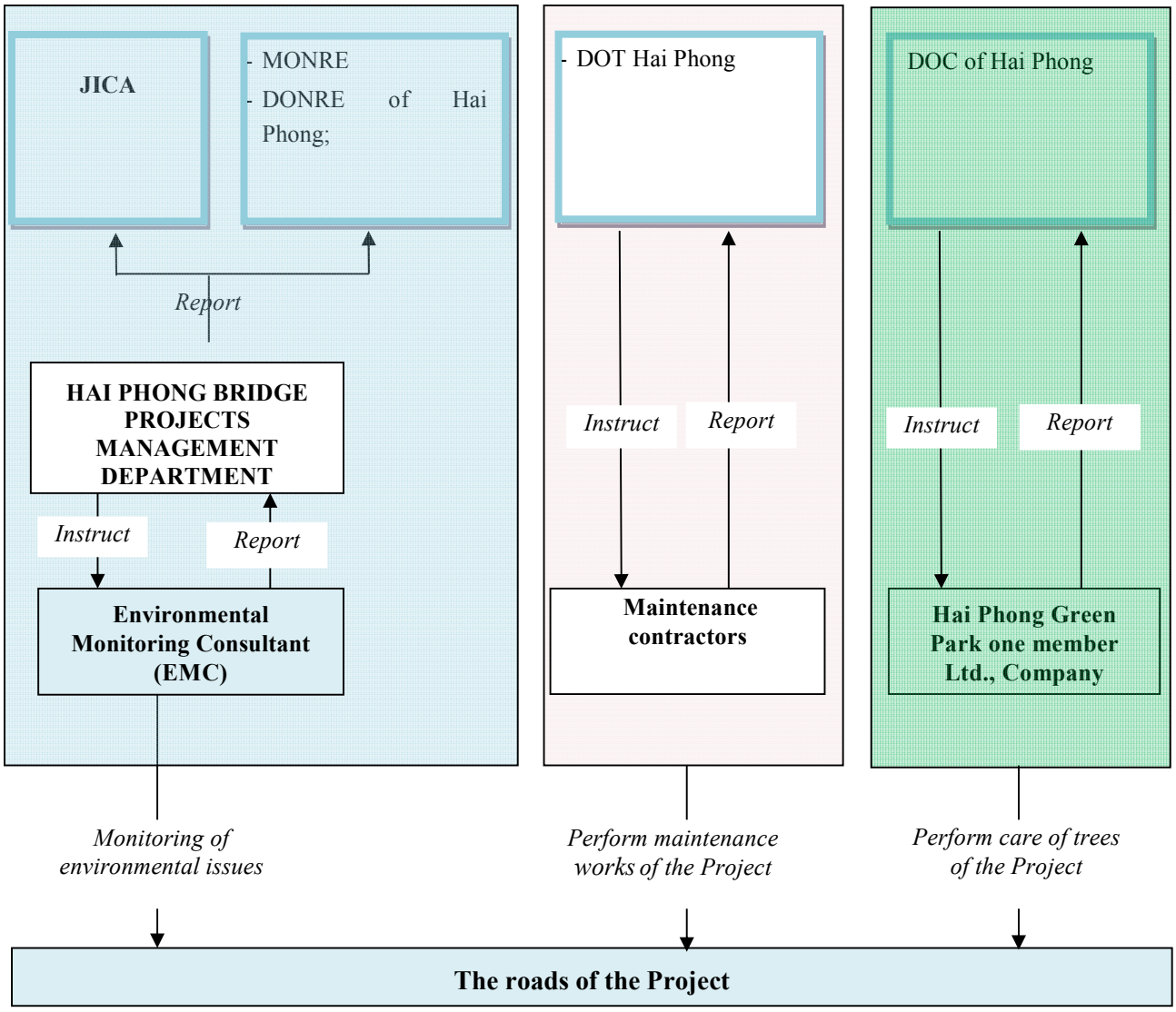


Figure 5.2. Organization Chart of Environmental Management in Operation Stages

Table 5.3. Roles and responsibilities of environmental management organizations in operation stage of the Project

Organization	Responsibilities (environmental aspect)
JICA	If the Project is implemented under JICA's cooperation, JICA shall follow up the implementation of environmental protection measures of the Project, and discuss with Hai Phong People's Committee (HPPC) when it needs to carry out additional cooperation for the same purpose.
MONRE and Hai Phong DONRE	Means the environmental management functional agency which manages and monitors the implementation of environmental protection measures as specified in the Decision on Approval of EIA report of the Project
Department of Transport	- Means the state management agency which manages, inspects, and develops traffic works maintenance plans of the project in operation stage after being handed over by the Hai Phong Bridge Projects Management Department - The other responsibility is to select maintenance contractor and monitor maintenance activities of traffic works of the project
Department of Construction	- Means the State management agency which organizes and supervises the works of planting and caring for public trees including those planted on traffic works.
Hai Phong Bridge Projects Management Department (PMU)	- Hai Phong Bridge Projects Management Department – Project Owner is the agency which manages the implementation of the Project, monitors and provides 24-month warranty service, including environment monitoring of the Project in operation stage
Environmental Monitoring Consultant (EMC)	- Periodically monitor environmental factors - Periodically report the monitoring results to Hai Phong Bridge Projects Management Department
Maintenance Contractors	- Provide warranty services at his own cost with regards to works done by him upon receipt of request for maintenance from the project owner in case any damage arises during the warranty period.
Haiphong Green Park One Member Limited Company	- Means the unit which plants and cares for public trees on traffic works of the city

5.2. Environmental Monitoring Plan

5.2.1. Objectives

Environmental monitoring plan are used to ensure that all project impacts including impacts predicted in chapter III and the additional impacts identified during construction will be controlled, feasibility of the mitigation measures to be strengthened and any opinion of the community comment will be resolved efficiently. Objectives of the plan include:

- Determine the actual extent of the impacts;
- Control impacts which are generated from construction process and mentioned in EIA report;
- Check environmental pollution standards applied to the project during construction;
- Check and supervise implementation of environmental protection solutions during construction based on EIA report.
- Suggest mitigation measures in case of unexpected impacts;
- Suggest to the Project Owner to coordinate with central and local environmental organizations to solve pending issues relating to environmental protection under the scope of the Subproject;
- Assess the effect of mitigation measures in pre-construction, construction and operation stages.

5.2.2. Content of Environmental Monitoring Plan

5.2.2.1. Waste Monitoring

Monitoring of waste will be carried out periodically and regularly in the construction stage by the Environmental Monitoring Officer (ES). Waste monitoring plan are presented in the following table.

Table 5.4. Waste Monitoring Plan in Construction Stage

No	Items		Construction Stage
I	**Construction Solid Waste**		
1		Monitoring parameter	The volume of construction solid waste are generated; The storage, collection, transportation and disposal of waste soil and rock; demolition materials and building materials. Dumping sites for construction solid waste: Monitoring of soil dumping at the prescribed place (the positions that are received agreement with the local authorities) and environmental management at the dumping sites.
2		Location	At the temporary storage for waste soil and rock; demolition materials and building materials. At the dumping sites for construction solid waste
3		Monitoring frequency	Regular monitoring by ES
4		Monitoring method	Check daily work records of the waste collectors; Conduct on-site observation on the performance of waste collection and treatment
5		Standard for comparison/ Regulation	Decree No.38/2015/ND-CP dated April 04th, 2015
II	**Domestic Solid Waste**		
1		Monitoring parameter	The volume of domestic solid waste are generated Schedule of domestic solid waste collection; The quantity and quality of the garbage bins.
2		Location	At the construction sites (estimated 05 construction sites)
3		Monitoring frequency	Regular monitoring by ES
4		Monitoring method	Check daily work records of the waste collectors; Conduct on-site observation on the performance of waste collection and treatment
5		Standard for comparison/ Regulation	Decree No.38/2015/ND-CP dated April 04th, 2015

No	Items		Construction Stage
III	**Hazardous waste**		
1		Monitoring parameter	The volume of hazardous waste are generated Schedule of hazardous waste collection; The quantity and quality of the hazardous waste containers.
2		Location	At the construction sites (estimated 05 construction sites)
3		Monitoring frequency	Regular monitoring by ES
4		Monitoring method	Check of daily work records of the hazardous waste collectors Conduct on-site observation on the performance of hazardous waste collection and treatment
5		Standard for comparison/ Regulation	QCVN 07:2009/BTNMT and Circular No.36/2015/TT-BTNMT dated June 06th, 2015
IV	**Wastewater**		
1		Monitoring parameter	Domestic wastewater (*):domestic wastewater collection, total volume of wastewater and monitoring parameters (including BOD_5, total coliform, SS); Construction wastewater: Total volume of wastewater from maintenance activity of machine and monitoring parameters (oil).
2		Location	Domestic wastewater: will be monitored at the output of the septic tank in the construction sites. Construction wastewater: will be monitored at the output of the machinery maintenance station in the construction sites.
3		Monitoring frequency	Regular monitoring on the collection and treatment of wastewater by ES Monthly wastewater sampling and analysis by ES
4		Monitoring method	Check record of works of domestic wastewater collectors; Wastewater sampling and analysis of wastewater quality
5		Standard for comparison/ Regulation	QCVN 14:2008/BTNMT and QCVN 40:2011/BTNMT

Notes: (*) In case of using mobile toilets are not required to monitor the parameters of domestic waste water (including BOD_5, total coliform)

5.2.2.2. Ambient Environment Monitoring

Ambient environment monitoring will be carried out periodically by EMC (hired by project owner). Ambient environment monitoring plan is presented in the following table. The locations of ambient environment monitoring are shown in Figure 5.4.

Table 5.5. Ambient Environment Monitoring Plan

No	Items		Stage		
			Pre-construction	**Construction**	**Operation**
I	**Air quality**				
1		Monitoring parameter	TSP, PM10, NO_2, SO_2, CO and microclimate (Temperature, humidity, speed, wind direction), atmospheric pressure.		
2		Location	- RR-KK1: Start point of RR3(intersecting with NH10) – Coordinates: 20°56'37" N; 106°40'20" E - RR-KK2: RR3 intersecting with Provincial Road 359 – Coordinates: 20°56'17" N; 106°43'11" E RR-KK3: RR3 intersecting with level crossing (Km9+500) – Coordinates: 20°54'20" N; 106°44'10" E		
3		Monitoring frequency	Once prior to construction. For every point, monitoring continuous 24 hours, every 2 hours/ time.	Once every three months. For every point, monitoring continuous 16 hours, every 2 hours/ time.	Once every six months (in first 24 months – under warranty period). For every point, monitoring continuous 24 hours, every 2 hours/ time.
4		Monitoring method	Air sampling and analysis of air quality Check complaints raised by local residents Regular observation at construction sites during the construction period		
5		Standard for comparison	QCVN 05:2013/ BTNMT		
II	**Noise, Vibration**				
1		Monitoring parameter	Noise (Leq), Vibration (Laeq)		
2		Location	Similar to location for air quality		
3		Monitoring frequency	Once prior to construction. For every point, monitoring	Once every three months. For every point, monitoring continuous	Once every six months (in first 24 months – under warranty).

No	Items		Stage		
			Pre-construction	**Construction**	**Operation**
			continuous 24 hours, every 2 hours/ time.	24 hours, every 2 hours/ time.	For every point, monitoring continuous 16 hours, every 2 hours/ time.
4		Monitoring method	Measurement of noise levels at the designated sites Check complaints raised by local residents Regular observation at construction sites during the construction period		
5		Standard for comparison	QCVN 26:2010/ BTNMT (for noise) and QCVN27:2010/BTNMT (for vibration)		
III	**Surface Water**				
1		Monitoring parameter	Temperature, pH, DO, SS, BOD_5, COD, Coliform		
2		Location	- RR-Nm1: Kenh Giang river – Coordinate: 20°56'32"N; 106°40'8"E - RR-Nm2: small river at Km2+600 – Coordinate: 20°56'20"N; 106°41'39"E - RR-Nm3: small river at Km6+900 – Coordinate: 20°55'34"N; 106°43'32"E - RR- Nm4: Upstream of Ruot Lon bridge 300m – Coordinate: 20°52'30"N; 106°44'29"E RR- Nm5: Downstream of Ruot Lon bridge 300m – Coordinate: 20°52'42"N; 106°44'48"E		
3		Monitoring frequency	-Once prior to construction. -For Ruot Lon bridge: Taking two samples/ one point on ebb-tide and flood-tide. -For other rivers or channels, taking once every point.	-Once every three months. -For Ruot Lon bridge: Taking two samples/ one point on ebb-tide and flood-tide. -For other rivers or channels, taking once every point.	-Once every six months. -For Ruot Lon bridge: Taking two samples/ one point on ebb-tide and flood-tide. -For other rivers or channels, taking once every point.
4		Monitoring method	Take samples of water at the monitoring sites described above, and analysis its quality. Check complaints raised by local residents Regular observation at the water bodies near the construction sites during the construction period		

No	Items		Stage		
			Pre-construction	Construction	Operation
			Periodic observation at the specified water bodies which are sensitive to water pollution, including the monitoring sites described above.		
5		Standard for comparison	QCVN 08-MT:2015/BTNMT		

5.2.2.3. Other Monitoring

In addition to the monitoring of waste, monitoring ambient monitoring also include monitoring of erosion, subsidence, drainage capacity of the horizontal culvert system and inundation condition, etc. Environmental supervisor (ES) under the construction supervision consultant team building does this work regularly. Other monitoring plan is presented in the following table.

Table 5.6. Other Monitoring Plan

No	Item Monitoring	Construction Stage	Operation Stage
1	Waste	1) Monitoring location As described in Table 5-4 2) Monitoring frequency As described in Table 5-4 3) Monitoring method As described in Table 5-4	1) Monitoring location Around approaches and RR3 2) Monitoring frequency Every month by Hai Phong DOT 3) Monitoring method -Check monthly work reports submitted by the road maintenance contractors -Conduct on-site observation to confirm the performance of waste collection and treatment done by the road maintenance contractors. -Check complaints raised by local residents.
2	Bottom sediment	1) Monitoring location River beds of Ruot Lon River, other rivers or channels in Thuy Nguyen district 2) Monitoring frequency Regular monitoring by Environmental Supervisor 3) Monitoring method -Check reports on construction works prepared by contractors -Check records of complaints raised by local residents -Conduct observation on construction sites	1) Monitoring location River beds of Ruot Lon River, other rivers or channels in Thuy Nguyen district 2) Monitoring frequency Every 3 months by DOT 3) Monitoring method -Check complaints raised by local residents
3	Eco-system	1) Monitoring location Mangrove forests and wetlands along Ruot Lon River Street trees along Nguyen Trai Street	1) Monitoring location Mangrove forests and wetlands along Ruot Lon River Street trees along Nguyen Trai

No	Item Monitoring	Construction Stage	Operation Stage
		2) Monitoring frequency Regular monitoring by Environmental Supervisor 3) Monitoring method -Check reports on construction works prepared by contractors -Check reports on progress of reforestation prepared by DARD -Check reports on the works to remove and replant trees along Nguyen Trai Street, and confirm on-site the progress of these works.	Street 2) Monitoring frequency Every 3 months by DARD (Forest Protection and Development Division) for mangrove forests. Hai Phong Green Park Company for street trees. 3) Monitoring method -Check complaints raised by local residents. -Conduct on-site observation to confirm the performance of the works to protect and develop the mangrove forests
4	Hydrological conditions	1) Monitoring location Ruot Lon River, other rivers or channels in Thuy Nguyen district 2) Monitoring frequency Regular monitoring by Environmental Supervisor 3) Monitoring method -Check reports on construction works prepared by contractors -Check complaints raised by local residents -Conduct on-site observation at the waterbodies around the construction sites	1) Monitoring location Ruot Lon River, other rivers or channels in Thuy Nguyen district 2) Monitoring frequency Regular monitoring by Hai Phong DOT 3) Monitoring method -Check reports on construction works prepared by contractors -Check complaints raised by local residents -Conduct on-site observation at the waterbodies around the construction sites
5	Involuntary resettlement	As described in the monitoring plan of RAP	-
6	Poor households	As described in the monitoring plan of RAP	As described in the monitoring plan of RAP
7	Local economy	As described in the monitoring plan of RAP	As described in the monitoring plan of RAP
8	Land use and utilization of local resources	As described in the monitoring plan of RAP	-
9	Water usage	1) Monitoring location As described in the monitoring plan for surface water quality in Table 5.5 2) Monitoring frequency As described in the monitoring plan for surface water quality in Table 5.5 3) Monitoring method As described in the monitoring plan for surface water quality in Table 5.5	1) Monitoring location As described in the monitoring plan for surface water quality in Table 5.5 2) Monitoring frequency As described in the monitoring plan for surface water quality in Table 5.5 3) Monitoring method As described in the monitoring plan for surface water quality in Table 5.5
10	Existing social infrastructure and service	1) Monitoring location Relocation sites of electric cables, communication cables, water supply pipes, ditches, gutters, etc. 2) Monitoring frequency Regular monitoring by PMU during the	1) Monitoring location Traffic signs, traffic safety facilities, road drainage ditches, etc. 2) Monitoring frequency Every month by DOT

No	Item Monitoring	Construction Stage	Operation Stage
		pre-construction phase 3) Monitoring method -Check reports on the works to relocate public facilities prepared by contractors -Conduct on-site observation on the relocation works.	3) Monitoring method -Check monthly work reports submitted by the road, bridge maintenance contractors -Check complaints raised by local residents -Conduct on-site observation to check the conditions and performance of the road auxiliaries.
11	Social capital, local organizations	1) Monitoring location Sites planned for pedestrian crossings 2) Monitoring frequency Regular monitoring by Environmental Supervisor 3) Monitoring method -Check reports on construction works prepared by contractors -Check complaints raised by local residents -Conduct on-site observation at the construction sites	1) Monitoring location Pedestrian crossings 2) Monitoring frequency Every month by DOT 3) Monitoring method -Check monthly work reports submitted by the road, bridge maintenance contractors -Check complaints raised by local residents -Conduct on-site observation to check the conditions and performance of the pedestrian crossings.
12	Unequal distribution of benefits and damage	As described in the monitoring plan prepared for RAP	
13	Landscape	1) Monitoring location All vegetation covers along the bridge approach roads and RR3 2) Monitoring frequency Regular monitoring by Environmental Supervisor 3) Monitoring method -Check reports on construction works prepared by contractors -Check complaints raised by local residents -Conduct on-site observation at the construction sites	1) Monitoring location All vegetation covers along the bridge approach roads and RR3 2) Monitoring frequency Every month by DOT 3) Monitoring method -Check monthly work reports submitted by the Green Park Linited Company -Check complaints raised by local residents -Conduct on-site observation to check the conditions of the street trees and vegetation along the roads.
14	Children's rights	1) Monitoring location At design location of unauthorized level crossings 2) Monitoring frequency Regular monitoring by Environmental Supervisor 3) Monitoring method Check reports on construction works prepared by contractors Check complaints raised by local residents Conduct on-site observation at the	1) Monitoring location At design location of unauthorized level crossings, traffic safety facilities, etc. 2) Monitoring frequency Every month by DOT 3) Monitoring method Check monthly work reports submitted by the road maintenance contractors Check complaints raised by local residents

No	Item Monitoring	Construction Stage	Operation Stage
		construction sites	Conduct on-site observation to check the conditions and performance of the pedestrian crossings, road auxiliaries, etc.
15	Working environment	1) Monitoring location All construction sites and worker camps 2) Monitoring frequency Regular monitoring by Environmental Supervision consultant 3) Monitoring method -Check reports on construction site management prepared by contractors -Conduct on-site observation at the worker camps	-
16	Incidents	1) Monitoring location All construction sites and along the roads used to transport materials and waste 2) Monitoring frequency Regular monitoring by Environmental Supervisor 3) Monitoring method Check reports on working safety management prepared by contractors Conduct on-site observation at the waterbodies around the construction sites	1) Monitoring location Traffic signs, signals, safety facilities, etc., along the bridge, approaches, RR3 2) Monitoring frequency Every month by DOT 3) Monitoring method Check monthly work reports submitted by the road maintenance contractors Check complaints raised by local residents Conduct on-site observation to check the conditions and performance of the road auxiliaries.
17	Transboundary impacts, global warming	1) Monitoring location All construction sites and along the roads used to transport materials and wastes 2) Monitoring frequency Regular monitoring by Environmental Supervisor 3) Monitoring method Check reports on construction work management prepared by contractors Conduct on-site observation at the construction sites	1) Monitoring location Road surface, structures of RR3 2) Monitoring frequency Every month by DOT 3) Monitoring method Check monthly work reports submitted by the road maintenance contractors Check complaints raised by local residents Conduct on-site observation to check the conditions and performance of the road surface, road auxiliaries, etc.

5.3. Training plan for improving capability with regards to environmental issues

The success of EMP partly depends on organization of training plan to improve capabilities of all personnel involved in EMP, including some environmental control officers of the PMU, construction supervision consultant (CSC), local government, community supervision board, environmental & safety officer of the construction contractor, all all workers of the contractor.

The said people shall be trained in the field of environment issues and their responsibilities in EMP approved by PMU. After the training programs, they will understand their obligations so as to appropriately carry out environmental management plants in stages of the project.

Training programs records should be kept at site, including information on trainees ; training time; name of the trainer; and a general description of the training contents, in order to provide evidence for the purposes of audit / inspection.

The following training programs will be considered for each organization.

Table 5.7. Trainees and training contents

No.	Trainees	Trainer	Training contents
1	Environmental Control Officer in Hai Phong Bridge Projects Management Department	Environmental Supervision Consultant	- Environmental Management Process in the overall project. - Improving awareness of the central role of environmental management system (EMS). - Supplementing new knowledge / legislation related to environment and handling of environmental violations. - Supplementing solutions to issues arising at site.
2	Officers in group of Construction Supervision Consultant	Environmental Supervision Consultant	- Fundamentals of Environmental Management. - EMP Supervision content approved by Hai Phong Bridge Projects Management Department. - Assessment of compliance, monitoring and tracking of environmental protection activities of the Project. - Improving awareness and response process with environmental incidents. - Monitoring of environmental protection activities during the construction, etc.
3	Representative of local government	Environmental Supervision Consultant	- Updating new regulations on environment in contents related to the monitoring and supervision implemented by ward/communal units in collaboration with local projects. - Providing construction content and environmental protection measures in EMP of the project. - Notifying project's divisions of the mechanisms for monitoring, exchange of information and address in collaboration with local government.

No.	Trainees	Trainer	Training contents
4	Representative of Community Supervision Board	Environmental Supervision Consultant	- Improving awareness of rights and responsibilities of community with regards to EMP (as prescribed by law). - Providing environmental impact mitigation measures of the project as well as environmental management plan that will be applied to the project. - Notifying and providing the address for receiving feedback from the community and project settlement process, and giving reply to the community.
5	Environmental & Safety Officer of Construction Contractor	Environmental Supervision Consultant	- Providing contents in EMP of the project approved by the Hai Phong Bridge Projects Management Department as the basis for making EMP of the contractor. - Updating new regulations on environment, focusing on contents related to the role of local units and of community supervision. - Notifying the monitoring procedures, information exchange mechanism within the project. - Notifying the environmental monitoring form, keeping information and documents, etc.
6	Workers of Construction Contractor	Environmental & Safety Officer of Construction Contractor	- Policies and regulations on occupational safety, environmental hygiene; - An overview of contractor's work and equipment under strict requirements on occupational safety and environmental hygiene - Environmental protection measures of the contractor applied to the project - Mechanism for testing, giving information and feedback on the implementation of environmental protection measures by contractor - Rules on occupational safety, environmental hygiene when working or operating equipment; - The process of handling environmental situations and accidents, first aid for occupational accidents.

Table 5.8. Plan to strengthen the capacity of environmental management

TT	Subject to be trained	Number of trainees	Times	Unit to organize	Source of cost
1	Officers of Hai Phong Bridge Projects Management Department	3 persons	01 time before construction and 01 quarter/ time during construction	Hai Phong Bridge Projects Management Department and Environmental Supervisors	− Hai Phong Bridge Projects Management Department − This cost is included in the contract with ES.
2	Engineers of Construction Supervision Consultant	2 persons	- ditto -	- ditto -	- ditto -
3	Representatives of local government	1 person/ commune About 10 per in total	- ditto -	- ditto -	- ditto -
4	Representative of Community Supervision Board	1 person/ commune About 10 per in total	- ditto -	- ditto -	- ditto -
5	Heath, Safety and Environmental Officer (SEO) of the contractor	About 2 per in total	- ditto -	- ditto -	- ditto -
6	Workers of Contractors	All	- nt-	Contractor and Heath, Safety and Environmental Officer (SEO) of the contractor	− Contractors

5.4. Estimated Budget for EMP Implementation

5.4.1. Basis of Estimated Budget

The regulation documents are applied to estimate preliminary budget for EMP implementation including:

- Circular No. 05/2016/TT-BXD dated on March 10, 2015 of Ministry of Construction on guidelines for determination of the unit labour cost in the management of the construction cost;
- Circular No. 33/2007/TT-BTC dated on April 9th, 2007 issued by Ministry of Finance on guidelines for the implementing of value-added tax law and law amending and readjusting some treaties of Value-added tax law;
- Circular No. 06/2016/TT - BXD dated on March 10, 2010 issued by Ministry of Construction on guidelines for establishing and expenses management of work construction investment project;
- Circular No. 02/2015/TT-BLDTBXH dated on January 12th, 2015 of the Ministry of Labour, War Invalids and Social Affairs, providing for levels of salary of domestic consultants to be taken as the basis for estimating consultancy service provision packages applying the form of time-based contract funded by the State budget.
- Decision No. 3230/QD-BGTVT dated on August 25th, 2014 of MOT promulgating the temporary decision on increasing the responsibility for maintaining road infrastructure under the investment decision made by the ministry of transport
- Circular No. 32/2015/TT-BGTVT dated on July, 24th, 2015 of the MOT regulating on environmental protection in developing transport infrastructure.
- Other current documents of State, Ministry of Construction and related Ministries.

5.4.2. Estimated Budget for Monitoring

5.4.2.1. Budget for Monitoring EMP Implementation

Monitoring EMP implementation of the contractor (management and monitoring of compliance with environmental protection measures of Contractor) will be carried out by the Environmental Officer (ES). This cost should be included in the contract signed with construction supervision consultant (CSC).

Table 5.9. Estimated Budget for Monitoring EMP

No,	Item	Unit	Quantity	Unit price (VND)	Amount	
					VND	USD
I	**Construction phase**				**1,862,000,000**	**82,756**
1	Monitor compliance with environmental management plan					
-	01 person supervises continuously in 42 months for RR3	month	42	30,000,000	1,260,000,000	56.000
2	**Other costs**					
-	Per diem					
	42 months x 4 weeks x 5 days/week	day	840	150,000	126,000,000	5,600
-	Accommodation	day	840	250,000	210,000,000	9,333
-	Car rental	day	840	300,000	252,000,000	11,200
-	Take a photograph, printing, photocopy (once every three months)	time	14	1,000,000	14,000,000	622
II	**Operation phase**					
1	Monitoring the quality of engineering structures and trees		Management expenditure (from state budget) is allocated to monthly salary of staff in local units			

Notes:

- Costs for monitoring EMP implementation are included in the project management costs which is regulated in paragraph b, Clause 1, Article 3 of Circular no.06/2016/TT-BXD dated on March 10th, 2016 issued by Ministry of Construction

- Exchange Rate on January 11, 2016 of Vietcom Bank: 1USD = 22,500 VND

5.4.2.2. Budget for Monitoring Parameters of Wastewater

Monitoring ambient environmental Quality will be carried out periodically in construction stage by EMC. This budget should be included in the contract signed with CSC or EMC.

Based on the above-mentioned monitoring wastewater program, the estimated budget for implementing this program is presented in the following table.

Table 5.10. Budget for Monitoring Parameters of Wastewater

No	Items	Construction Stage		
		Location	Amount	
			VND	USD
1	Domestic wastewater	2	145,901,000	6,484
2	Construction wastewater	2	54,245,000	2,411
3	Other cost		82,196,000	3,653
	Total		**282,342,000**	**12,549**

Note: - Other costs include taxable income, VAT tax, printing etc.
- Exchange Rate dated on January 11, 2016 of Vietcom Bank: 1USD = 22,500 VND

5.4.2.3. Budget for Monitoring Ambient Environmental Quality

Monitoring ambient environmental Quality will be carried out periodically by EMC. This budget should be included in the contract signed with CSC or EMC.

Based on the above-mentioned monitoring ambient environmental program, the estimated budget for implementing this program is presented in the following table.

Table 5.11. Budget for Monitoring Ambient Environmental Quality

No	Items	Stage						Amount	
		Pre-construction		Construction		Operation			
		Location	Cost (VND)	Location	Cost (VND)	Location	Cost (VND)	VND	USD
1	Air quality	3	49,927,000	3	465,987,000	3	199,709,000	715,623,000	31,805
2	Noise and vibration	3	8,310,000	3	108,035,000	3	33,242,000	149,587,000	6,648
3	Surface water quality	3	7,433,000	3	104,057,000	3	29,730,652	141,220,652	6,276
4	Other cost		23,727,000		421,551,000		71,589,000	516,867,000	22,972
	Total		**89,397,000**		**1,099,630,000**		**334,270,652**	**1,523,297,652**	**67,702**

Note:

- Other costs include making report, taxable income, VAT tax, printing etc.

- Exchange Rate dated on January 11, 2016 of Vietcom Bank: 1USD = 22,500 VND

5.4.3. Budget for Preparing and Disclosing the EMP

Responding to the request specified in Article 16 of Decree 18/2015 / ND-CP of the Government dated February14th, 2015 on environmental protection planning, strategic environmental assessment, environmental impact assessment and environmental protection plan, after the report on environmental impact assessment is approved, the project owner shall make environmental management plan of the project on the basis of environmental monitoring and management plan proposed in the environmental impact assessment report and disclose the EMP at the headquarters of the People's Committees of communes where were conducted the consultations during the implementation of environmental impact assessment.

Table 5.12. Budget for Preparing and Disclosing the EMP

No	Items	Amount	
		VND	USD
1	Preparing EMP and Disclosing EMP	78,329,000	3,481
2	Others cost	21,165,000	941
	Total	**99,494,000**	**4,422**

Note:

- Other costs include taxable income, VAT tax, printing etc.

- Exchange Rate dated on October January 11, 2016 of Vietcom Bank: 1USD = 22,500 VND

5.4.4. Budget for Implementation of Capacity Building and Training Program

Budget for implementation of capacity building and training is presented in the following table:

Table 5. 13. Budget for Implementation of Capacity Building and Training

No	Subject to be trained	Number of trainees	Amount	Source of cost
1	Officer of Hai Phong Bridge Projects Management Department	2 persons	2 persons x 12 times x 1,500,000 VND / person = 36,000,000 VND	- Project Owner - Hai Phong Bridge Projects Management Department (PMU) - This cost is included in the Contract with ES
2	Engineer Supervisors	2 persons	2 persons x 12 times x 1,500,000 VND / person = 36,000,000 VND	
3	Representatives of local government	10 persons	10 persons x 12 times x 1,500,000 VND / person = 180,000,000 VND	
4	Representatives of Community Supervision Board	10persons	10 persons x 12 times x 1,500,000 VND / person = 180,000,000 VND	
5	Heath, Safety and Environmental Officer (SEO) of the contractor	2 persons	2 persons x 12 times x 1,500,000 VND / person = 36,000,000 VND	
	Total (1+2+3+4+5)		**= 468,000.000 VND**	**(=20,800 USD)**

Note:

- Exchange Rate dated on January 11, 2016 of Vietcom Bank: 1USD = 22,500 VND

5.4.5. Total budget for EMP implementation

In addition to the costs already included in the relevant packages/contracts, one more budget will be required for EMP as follows:

Table 5.14. Total budget for EMP implementation

No	Items	Amount		Note
		VND	USD	
1	Monitoring EMP implementation	1,862,000,000	82,756	Table 5.9
2	Monitoring wastewater	282,342,000	12,549	Table 5.10
3	Ambient environmental quality monitoring	1,523,297,652	67,702	Table 5.11
4	Preparation and disclosure of the EMP	99,494,000	4,422	Table 5.12
5	Capacity building and training program	468,000,000	20,800	Table 5.13
	Sub-total (1-5)	**4,235,133,652**	**188,228**	
6	Contingency (10%)	423,513,365	18,823	
	Total (1-6)	**4,658,647,017**	**207,051**	

Note:

- Exchange Rate dated on January 11, 2016 of Vietcom Bank: 1USD = 22,500 VND

Total Estimated Budget for EMP Implementation is **4,658,647,017 VND (≈ 207,051 USD).**

The above cost rate is estimated based on current unit price and Consultant's experiences (including VAT). Because the project will be implemented several years, price fluctuation will be unavoidable. A contingency amount should be prepared for any unavoidable price or cost increase during project implementation.

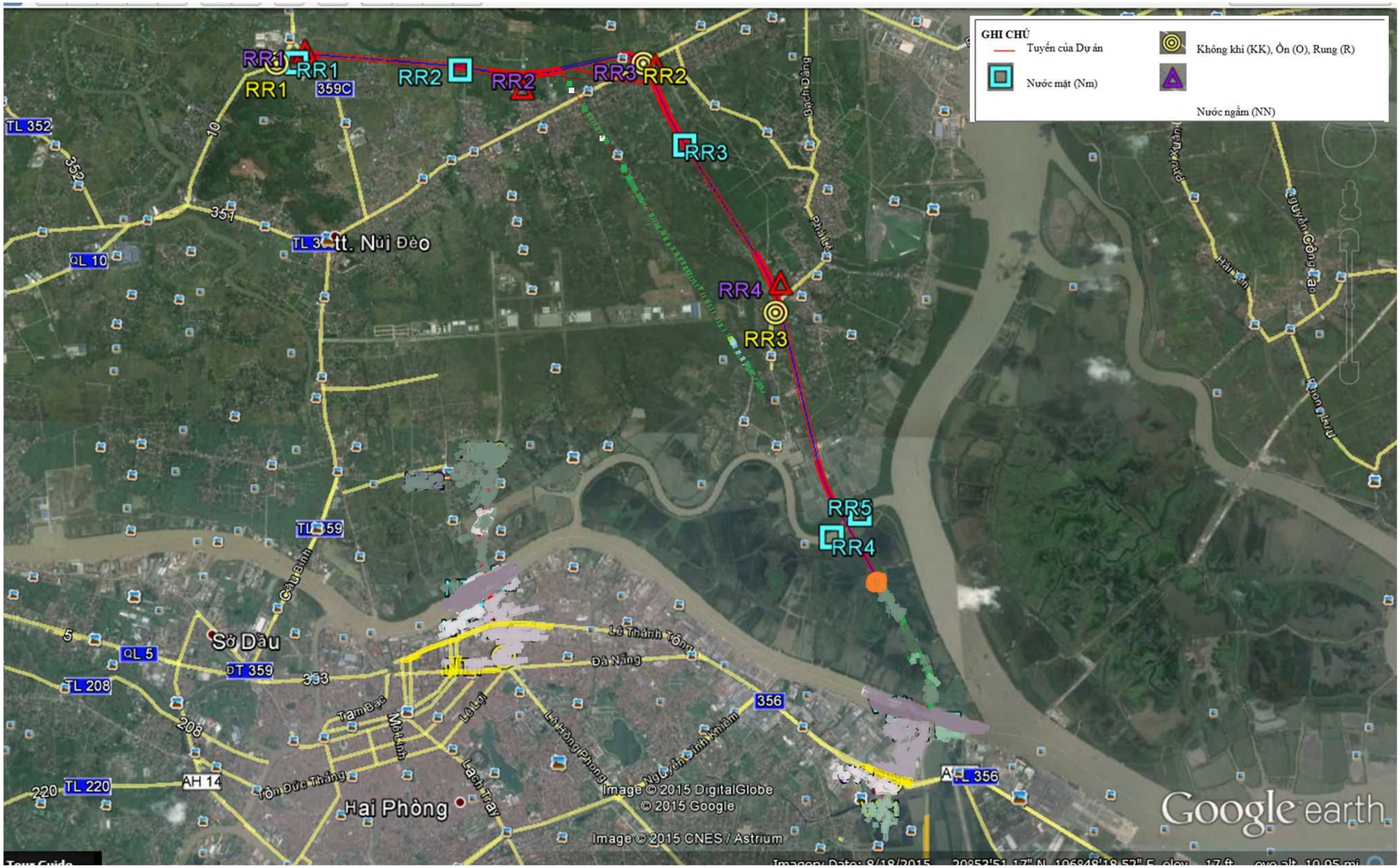


Figure 5.3. Environmental Quality Monitoring Locations

CHAPTER VI. PUBLIC CONSULTATION

6.1. Public Consultation – Stage 1 (April-May, 2015)

6.1.1. Objectives

In accordance with Vietnamese regulations on environment protection and JICA's requirements, Hai Phong Urban Construction and Development Works Management Unit has directed the Environmental Consultant in coordination with the local authorities to hold the public consultation meetings regarding the Project.

The main objective of these public consultation meetings are:

- To provide the affected people and local communities with basic information about the Project.
- To collect opinions of the affected people and local communities about the Project plans, particularly the impacts and measures to mitigate the environmental impacts.
- To answer inquiries of the affected people and local community regarding the environmental impacts as well as and the measures to mitigate them; To call for the active opinion contribution of the affected people and local communities, etc. to the Project.

6.1.2. Contents of public consultation meetings

Phase 1 include the main contents as follows: (i) disseminating information about the Project (context, needs for the Project, etc.); (ii) explaining alternatives and forecasted impacts; (iii) collecting participants' opinions/proposals on the Project and matters regarding the environment, site clearance and resettlement; and (iv) promoting cooperation and participation of the affected people and local communities in the project implementation plans.

6.1.3. Venues and times of public consultation meetings

Public consultation meetings were held by each ward/commune at different venues and times with the participation of the local authorities, relevant organizations and affected people, including:

- Affected households/organizations by the Project;
- Representatives of ward/communal People's Committees;
- Representatives of locally social and political organizations;

The meetings will be organized at venues and times as follows (Table 6.1)

Table 6.1. Location and time of public consultation meetings 1st

No.	Location	Time	Remarks
1	Kenh Giang commune – Thuy Nguyen district	04/6/2015	
2	Hoa Binh commune – Thuy Nguyen district	20/4/2015	
3	An Lu commune – Thuy Nguyen district	22/4/2015	
4	Trung Ha commune – Thuy Nguyen district	15/4/2015	
5	Thuy Trieu commune – Thuy Nguyen district	18/4/2015	
6	Ngu Lao commune – Thuy Nguyen district	21/4/2015	
7	Phuc Le commune - Thuy Nguyen district	16/4/2015	
8	Pha Le commune - Thuy Nguyen district	21/4/2015	
9	Lap Le commune - Thuy Nguyen district	20/4/2015	
10	Dong Hai 2 Ward – Hai An district	29/5/2015	

Table 6.2. Some images at the 1st public consultation meetings

No.	Images	Remarks
1		Project staff are welcoming and guiding participants
2		**Project introduction:** The Consultant's representative is giving an overview of the Project and environmental impacts.

No.	Images	Remarks
3		A resident is raising her opinions.

6.1.4. Results of public consultation - Phase 1

The results of public consultation - Phase 1 is provided in Table 6.3. For detailed contents and meeting lists, refer to Appendix of Public Consultations.

Table 6.3. Synthesis of public consultations with residents directly affected by the project

No.	Public Consultations		Answers by representatives of the Project Owner & the Consultant
	Residents' concerns about the Project	Proposals to the Project Owner	
	Dong Hai No.2 Ward		
1	Acquisition of land from enterprises: – Hoang Cau Trading JSC: The enterprise is trading yards and foreign goods services. The project will affect the enterprise since its land part will be acquired while the remaining is not enough or difficult for business activities. – VNT Logistics Company: The Project's land acquisition affects the company's production and workers' lives.	The Project Owner must take measures to compensate and facilitate production stabilization for enterprises.	
	Kenh Giang Commune		
2	Selection of route alternatives: Two alternative were presented.	Most local government and community representatives proposed to select the first alternative to reduce the level of impacts on people.	The project is in the research phase and the scope of the project is at the relative level. In the next steps, more detailed designs will be provided. The project route matter will be

No.	Public Consultations		Answers by representatives of the Project Owner & the Consultant
	Residents' concerns about the Project	Proposals to the Project Owner	
			further studied in consideration of opinions of the authorities and local communities to make the most appropriate plan for ensuring the technical and social welfare issues.
	Hoa Binh and An Lu Communes		
3	Land acquisition and site clearance: Like for the above-mentioned localities, the Project will occupy the residents' farmland and aquaculture land, causing them to lose their livelihood and production tools, affecting their daily lives.	The Project Owner should prepare the compensation and resettlement project for residents in a transparent and fair manner so that people feel secure and stable in life; Also, the Project Owner should create jobs for people who lose their jobs. The location of resettlement will be discussed with and notified to residents. Also, the selection of the route alternative must be carefully studied to minimize the degree of influence.	The opinions of the local authority and residents were received. We are considering the land acquisition. We promise to select the optimal alternative to reduce damages and influence on the residents. The compensation policy will be developed in compliance with the regulations of the State and the sponsor - JICA.
	Trung Ha Commune		
4	Infrastructure occupancy: During the execution of the project, a number of canals, power towers and roads for duties, site or yard will be occupied	It was suggested that temporarily occupied works should be reverted into their original after the construction completion.	For public utility occupancy, mitigation measures, specific environmental impact assessment and supervision programs will be done during the project implementation.
	Thuy Trieu Commune		
5	The affected enterprise is Vu Khang JSC: If the 1st alternative is chosen, the project will be across the whole housing complex,	The Project Owner was recommended to choose the second alternative to reduce	Currently, the Project is in the research phase; therefore the project

No.	Public Consultations		Answers by representatives of the Project Owner & the Consultant
	Residents' concerns about the Project	Proposals to the Project Owner	
	residential land, communal domestic water supply factory and family graves with a total area of 4,000 m2, which will cause huge losses for the enterprise, affecting the incomes of 40-50 workers working in the enterprise and the water supply to the whole commune.	the damages to the enterprise, limit the impacts on the lives of the enterprise's workers and not to interrupt the water supply for the local people.	scope is merely at the relative level. Detailed design will be provided in the next steps. Regarding the route matter occupying the land of Vu Khang JSC, the Project Owner got ideas and promised to further study in the project design steps.
	Ngu Lao Commune		
6	Community separation: The completed road will hinder agricultural production, cause village split and farmland fragmentation, and directly affect the large family shrines in the village.	The Project Owner should choose the second alternative to limit the extent of influence.	Currently, the Project is in the research phase; therefore the project scope is merely at the relative level. Detailed design will be provided in the next steps.
	Phuc Le Commune		
7	Sanitation and labor safety: during the project construction, dust, noise, waste water and waste will be generated, affecting the environment and people's lives.	The Project Owner should take measures to minimize environmental pollution and ensure labor safety during the construction.	The measures to minimize the impacts of dust, noise, sewage and waste and those to ensure labor safety will be presented in details in the Project's EIA report, which will be publicly posted at the locality for people to know and supervise during the construction after approved.
	Pha Le Commune		
8	Large number of workers coming to the locality: During the project construction, there will mobilize a large number of workers from other places, easily causing insecurity and in order at the locality and conflicts between workers and locals.	The Project Owner should closely coordinate with the local authority to ensure the security and order there.	– The Project Owner shall be responsible for implementing the following measures: – To employ the local workers as many as

No.	Public Consultations		Answers by representatives of the Project Owner & the Consultant
	Residents' concerns about the Project	Proposals to the Project Owner	
			possible to minimize the number of external workers coming to the project site. - To educate workers on the relationships with the local community. - To fulfill temporary residence registration for workers at the local public security. - To educate workers on ethical behaviors and styles in work and health, closely managing the workforce to prevent evils like alcoholism, gambling and fights among workers and between workers and local people. -
	Lap Le Commune		
9	Project duration: Residents worried that the lasting project may affect their living, production and business activities.	The Project Owner should publicly provide the detailed implementation plan, and promptly notify people of any abnormal changes in the project's scope and progress.	The implementation period and plan will be studied, adjusted and notified to the local authority as well as residents.
10	There will have conflicts between residents and construction units regarding irrigation, travelling and daily activities ...	The construction units must comply with the rules of the units and the locality.	The Project Owner was committed to complying with the mitigation measures given in the EIA report, including the construction schedule.

6.2.1. Summary of Implementation of Public Consultation

After receiving the comments in the 1st public consultations, the project owner studied and provided the project design solutions accordingly. At the request of JICA, the project owner will carry out the 2nd public consultation for explanation of the measures to implement the comments gained from the 1st one and also to answer and clarify the communities' requests.

The implementation of the 2nd public consultation is done in integration with the consultations with the communal/ward governments as required by the Vietnamese party. Implementing the Environmental Protection Law 2014, the Project Owner's Representative – (Hai Phong City) Urban Construction and Development Work Management Unit sent the Dispatch No. 167/BQLPTDT-QLCL dated December 1, 2015 on the consultation in the preparation of the environmental impact assessment report of Hai Phong City Main Road Investment Construction Project to the People's Committees of communes/wards/towns and the communities/organizations subject to direct impacts of the project (in conjunction with the project's environmental impact assessment report).

The consultation on communities directly affected by the Project was conducted in the form of community meetings jointly chaired by the Project Owner - Hai Phong City) Urban Construction and Development Work Management Unit and the respective communal People's Committees (CPC). The CPCs convened the meeting participants who are representatives from the Communal Fatherland Front and the socio-political organizations, social professional organizations, urban groups and hamlets with a notice of the meeting purposes, time and place. The opinions of the meeting participants were expressed fully in the minutes of the meetings. The written responses and the minutes of the meetings are attached as the Appendix No. 5 - Public Consultation.

6.2.1.1. Summary of Implementation of Consultation of CPCs and Organizations Directly Affected by the Project

During the public consultation taking place from December 01, 2015 to December 10, 2015 in the communes/wards/towns located along the (Hai Phong City) Urban Main Road, the Environmental Centre - Transport Engineering Design Inc. as the environmental consultant, directly delivered, on behalf of the Project Owner, the Dispatch No. 167/BQLPTDT-QLCL dated December 1, 2015 and directly worked with the People's Committees of Communes/Wards and organizations directly affected by the Project. The Project Owner received written responses from localities with details as follows:

Table 6.4. List of Consulted People's Committees at Commune Level and Organizations Directly Affected by the Project

No.	Ward/Commune/ Organization	District	Time of consultation	Local representative	Position	Written response
1	Kenh Giang	Thuy Nguyen	09/12/2015	Luong Van Minh	Chairman	57/CV-UB
2	Dong Son	Thuy Nguyen	04/12/2015	Ta Thi Lien	Chairwoman	57/CV-UB
3	Hoa Binh	Thuy Nguyen	04/12/2015	Nguyen Duy Tuyen	Vice Chairman	65/CV-UB
4	An Lu	Thuy Nguyen	01/12/2015	Tran The Manh	Vice Chairman	48/CV-UB
5	Trung Ha	Thuy Nguyen	10/12/2015	Nguyen Duy Manh	Vice Chairman	71/CV-UB
6	Thuy Trieu	Thuy Nguyen	03/12/2015	Nguyen Thi Thinh	Chairwoman	86/CV-UB
7	Ngu Lao	Thuy Nguyen	10/12/2015	Do Van Hoang	Chairman	62/CV-UB
8	Phuc Le	Thuy Nguyen	09/12/2015	Pham Van Mai	Chairman	61/CV-UB
9	Pha Le	Thuy Nguyen	02/12/2015	Vu Van Thang	Chairman	51/CV-UB
10	Lap Le	Thuy Nguyen	02/12/2015	Vu Thi Ngot	Vice Chairwoman	66/CV-UB
11	Dong Hai 2	Hai An	08/12/2015	Nguyen Van Quan	Chairman	110/CV-UB

6.2.1.2. Summary of Implementation of Consultation of Communities Directly Affected by the Project

To meet the requirements of the sponsor - JICA, and the Government of Vietnam, the Project Owner conducted consultation meetings in communities on the same day of working with authorities of communes/wards/towns.

Meeting participants: (i) local government representatives; (ii) community representatives; (iii) Project Owner's representative (Detailed list of meeting participants is attached in the appendix).

The public consultation meetings were conducted in the following order:

- The local government representatives declared the purposes of the meetings and introduced the Project Owner and the environmental consultants chairing the meetings.
- The environmental consultant briefly presented the draft environmental impact assessment report of the project stating the project's activities, expected impacts and proposed mitigation measures of the Project.

- The workshop was conducted and comments, suggestions and questions of government representatives, community representatives and residents participating in the meetings were solved.

6.2.2. Results of the second public consultation

6.2.2.1. Feedback of PCPs and organization directly affected by the Project

The People's Committees of communes and wards within the scope of the Project received the Dispatch No. 167/BQLPTDT-QLCL dated December 01, 2015 from (Hai Phong City) Urban Construction and Development Work Management Unit accompanied by the Project's environmental impact assessment. The representatives of the local People's Committees had feedback in writing to the Project Owner. The summary of feedback from the local People's Committees is presented in Table 6.5.

Table 6.5. Summary Table of Public Consultations of PCPs

No.	Commune/ ward/ town	Public Consultations		
		On negative impacts of the project	**On measures to minimize the negative impacts**	**Recommendations for the Project owner**
1	Kenh Giang	Assessments on negative environmental impacts of the Project stated in the report should be agreed upon	To agree upon measures to reduce negative environmental impacts of the Project stated in the report	- To strictly implement commitments raised by the Employer in the report. - To work closely with local authorities to handle all problems and difficulties during the implementation of the project.
2	Dong Son	To approve the assessments on negative environmental impacts of the Project stated in the report. To focus on impacts of land clearance on residential area, impacts of air and noise pollution during the construction	To approve the measures to reduce negative impacts stated in the report; the implementation should be monitored.	- To give maximum support to residents losing land and house. To support local area in construction and renovation of affected infrastructure works and traffic roads in the local area. - Specific plans must be notified to the local authorities.

No.	Commune/ ward/ town	Public Consultations		
		On negative impacts of the project	On measures to minimize the negative impacts	Recommendations for the Project owner
3	Hoa Binh	Socio-economic and environmental impacts have been relatively adequately reviewed and evaluated.	The mitigation measures are effective in reducing environmental pollution and stabilizing residents' life. The implementation should be strictly monitored during the project construction.	-To give maximum support to residents losing land and house. To support local area in construction and renovation of infrastructure works in the local area. − To closely coordinate with the local area during the implementation of the Project
4	An Lu	The impacts relatively fully described and anticipated the environmental impacts during the Project implementation	The mitigation measures have been proposed in detail which should be taken strictly during the Project implementation	− To make and apply mechanisms and policies of best compensation and support for residents losing land and house. − To closely coordinate with local area during the Project implementation − To recover the initial state of local infrastructure works if they are damaged due to operation of the project.
5	Trung Ha	Attention should be paid to noise, vibration and dust impact during the construction	To take specific measures to minimize noise, vibration and dust impact on residential areas within the Project area	- To commence and complete the project as soon as possible. - To work closely with local authorities to handle all problems and difficulties during the construction of the project. - To implement the commitments raised by the Employer in the report.
6	Thuy Trieu	Socio-economic and environmental impacts have been	The feasible mitigation measures are to reduce	- To strictly implement the proposed mitigation

No.	Commune/ ward/ town	Public Consultations		
		On negative impacts of the project	**On measures to minimize the negative impacts**	**Recommendations for the Project owner**
		reviewed and evaluated. During next stages, any issues arising should be resolved immediately.	environmental pollution. The implementation of these measures should be monitored.	measures. To accelerate the project's progress in order to soon recover initial state of residential areas. - To support the local area in building traffic roads connecting to project's road so as to facilitate the production.
7	Ngu Lao	Assessments on negative impacts of the Project on the environment stated in the report should be agreed upon.	To agree upon measures to reduce negative impacts on the environment stated in the report	- To commence rapidly and on schedule - To support the local area in building additional infrastructure works. - To work closely with local authorities in implementing the next steps.
8	Phuc Le	Residents' agricultural land recovery have biggest impact on local area.	The proposed measures are feasible and effective	- To develop best support policies in favor of the residents losing land and house. - To support the local area in building additional infrastructure works. - To work closely with local authorities during the implementation of the project.
9	Pha Le	Socio-economic and environmental impacts have been reviewed and evaluated. During next stages, any issues arising should be resolved immediately	The proposed mitigation measures are feasible which could be applied during the implementation of the project	- To take best support measures in favor of the affected residents. - To strictly implement the proposed mitigation measures. - To work closely with local authorities during the implementation of the project.

No.	Commune/ ward/ town	Public Consultations		
		On negative impacts of the project	On measures to minimize the negative impacts	Recommendations for the Project owner
10	Lap Le	Socio-economic and environmental impacts have been relatively adequately reviewed and evaluated. Impacts due to residents' lands and properties should be researched in more detail.	The proposed mitigation measures are feasible which could be applied during the implementation of the project. It is necessary to develop measures to support residents losing land and house	- To work closely with local authorities and early notify them of any plans during the implementation of the project, - Any affected local infrastructure works should be rebuilt. It is necessary to help residents relocate and stabilize their life.
11	Dong Hai 2	Agreed on assessment of the project's adverse impacts on the environment as described in the report.	Agreed on mitigation measures of adverse impacts on the environment as described in the report.	− Early implement and complete the project in order to stabilize daily lives of residents and develop the social economy of the locality. − Comply with commitments that the project owner stated in the report.

6.2.2.2. Feedback from representatives of communities directly affected by the Project

At the public consultation meeting, most residents agreed with the project's purposes and development. There were many suggestions for the Project.

The feedback from residents affected in each locality is shown in the following table:

Table 6.6. Summary Table of Public Consultations of Communities Directly Affected by the Project

No.	Public Consultations	
	Residents' concerns regarding the Project	Recommendations for the Project Owner
1	*Site clearance and resettlement:* - The project shall occupy residential, agricultural and aquaculture farming land, affecting the resident's income due to production and farming land loss, relocation and resettlement. This is the most concern of the majority. They were doubted whether the compensation policy would be	- The Project owner was required to comply with the provisions of law, ensure fairness and transparency for residents. They would like to be compensated for site clearance at the market prices. People whose aquaculture

No.	Public Consultations	
	Residents' concerns regarding the Project	**Recommendations for the Project Owner**
	satisfying, whether the project would be delayed, preventing them from carrying out new construction, renovation of buildings or investment in land, etc. -Whether the resettlement area could ensure living conditions for people with the advantage of living and trading. The resettlement locations should be consulted by local residents. For example, the households in Dong Son Commune desired to resettle at the locality (at Hamlet 5, adjacent to the National Highway No.10 with the gardening area of about 7000m2), etc.	ponds are subjected to recovery, recommended that if the remaining area is not qualified for continuance of production, the plan of recovering the remaining area or transferring the production model should be provided. - The Project owner was required to early announce before compensation and land clearance for the better preparation of residents as well as people's engagement in the compensation and site clearance process. -The resettlement area should be located near the existing areas, or in the same hamlet/commune as people have been familiar with the local customs and practices. They desired to be consulted in the process of development of policies and compensation price.
2	*Drainage, irrigation ditch improvement*: the project shall pass through many irrigation ditch systems which causes some passing fields to receive water difficultly from the temporary occupied ditches, affecting agricultural production due to loss of irrigation water or localized flooding.	- The Project owner was required to overcome the above situation and avoid affecting the production activities of people. The temporarily occupied work should be reconverted to the original state.
3	*Environmental pollution (air, dust, noise or vibration)*: The excavation activities in hot, dry and windy weather may generate dust, affecting people living along the roadsides. The transportation of redundant sand and soil as well as construction waste may cause much dust. The operation of construction machinery and transportation vehicle is also a source of noise and vibration, affecting to households near the construction location.	- The project owner should provide an operation schedule for these vehicles as well as implement measures to minimize dust. - The construction should be avoided during peak hours; meanwhile, the construction machineries and vehicles should be inspected carefully to ensure proper technical standards.

No.	Public Consultations	
	Residents' concerns regarding the Project	**Recommendations for the Project Owner**
4	*Worker concentration*: The project is predicted to gather a large number of workers from different places, easily causing epidemics and conflicts to the local residents.	- The project owner must implement worker's temporary residence registration at the localities and regular health check as well as promulgate specific rules and regulations to them. - The local residents should be prioritized to implement the simple tasks.
5	*Spiritual issue*: The Project will cross several ancient graves on the field (at Hamlet 10- Hoa Binh, Lap Le and Pha Le Commune), areas with places of worship (at My Dong village - Ngu Lao Commune), near the temples, shrines and Khuong Pagoda, etc. During the construction process, the demolition, leveling activities may affect these works.	- Some residents at Hamlet 8- Ngu Lao Commune required the project owner to implement the plan of avoiding passing their places of worship. -The project owner must provide land for relocating the graves in compliance with their customs and worship activities.
6	*Local traffic and works:* The local roads will be used to transport materials and waste for the project, possibly affecting the structure of roads, dams and resulting to settlement and cracks of houses along the roadsides due to the passing of large trucks.	- The oversized and overloaded vehicles should be prohibited from passing through the communal roads. - The damaged road during construction process should be timely repaired. - Residents at Lap Le Commune required the Project owner to implement safety measures for the dams under the supervision of representatives of the local governments and residents.

6.2.3. Feedback and commitments of the Project Owner on suggestions, recommendations and requests of consulted authorities, organizations and communities

After reviewing comments from the localities, the Project Owner has feedback and commitments as follow:

No.	Residents' concerns regarding the Project	Feedback and commitments of the Project Owner
1	Land Clearance and Resettlement	The scope of land clearance, the volume of land clearance and the implementation plan were concerned and stated in detail in Chapter 1 of the EIA report by the Project Owner. The Project Owner is committed to adequately compensating for affected households, creating jobs for people losing their jobs due to lost residential land, arable land and aquaculture land, etc. For households to relocate: The plan of compensation, support and resettlement will be conducted as prescribed by the Law and is publicly posted locally. The Project Owner shall consider aspirations of households to relocate in order to arrange resettlement areas near the former residence or pecuniary compensation for households to self-relocate. Details are presented in Chapter 4 of the EIA report.
2	Environmental hygiene	The measures to reduce dust pollution in periods are detailed in Chapter 4 of the EIA report of the project. For those sensitive areas, the Project shall arrange specific measures for each affected one. The EIA report of the Project after being approved by the Ministry of Environment and Natural Resources will be publicly posted locally. The Project Owner is committed to fully implementing measures to reduce impacts of dust and noise pollution presented in the report.
3	Temporary occupancy of canal systems and roads	- For road transport: it is committed to reverting to the original state. - For drainage systems, sewers will be constructed in the old ditch. After completion of sewers, the water will be turn to the initial channel and the land for the temporary ditch will be reverted to the original state.
4	Drainage, Flooding	The Project Owner would like to receive the feedback and directed the design consultant to design in accordance with standards; approaches will be designed with full drainage system, avoiding floods during the construction.
5	Worker concentration	The Project Owner and contractors have their own rules to manage workers, and will coordinate with the localities to propaganda workers on social evils, prostitution, epidemics, HIV in the region, etc. in order to limit arising social evils.

No.	Residents' concerns regarding the Project	Feedback and commitments of the Project Owner
		The registration process of temporary residence, temporary absence for workers from other areas will be also conducted. Local workers are preferred.
6	Spiritual matters	- The issue of occupying land of graves along the Project: The Project Owner will coordinate with the local government and families who have graves to be relocated in accordance with their customs. Compensate will be agreed to ensure no damage for residents. - Desires of households from Hamlet 8- Ngu Lao Commune to change the alignment to avoid relocating places of worship of their family. During the public consultation meetings, the environmental consultant, on behalf of the Project Owner, proposed plans for moving the route in Hamlet 9, but the vast majority of villagers in Hamlet 9 disagreed. Therefore, the project owner will coordinate with the local government and residents to compensate adequately when relocating. Details are presented in chapter 4 of the EIA report.
7	Traffic safety, public works in the localities	At the crossing positions, there will be arranged intersections, signs and signal lights. The loading of material and waste when transporting on hamlet/communal roads must ensure the right size and load. The current road system and other works will be reverted as origin after completing the project. There will be commitment and adequate compensation agreement with residents and the local governments if there is any damage to buildings, architecture. Details are presented in Chapter 4 of the EIA report.

The Project Owner is committed to complying with environmental mitigation measures recommended in the EIA report of the Project and also conducting to publicize information about the Project, the Decision on approval of the EIA report and the plan of environmental management to the authorities as prescribed.

CONCLUSIONS, RECOMMENDATIONS AND COMMITMENTS

I. Conclusions

1. The impacts of each activity in the operational phases of the project has been completely identified. The assessment on the impacts on each subject according to causes arising from the activities has been quantified at maximum. The extent of the scale of the impacts caused by the Project's activities on the environment is as follows:

   - The impacts of land acquisition, especially permanent residential land acquisition are strong, directly affecting the lives of the households (relocation, resettlement, income).
   - The impacts on water environment: construction of the bridge over Ruot Lon river and the operation of construction site are main elements affecting water, sediment, wetland ecosystems, mangroves, irrigation capacity of rivers, canals, ditches and aquaculture ponds in the project area.
   - The impacts on road traffic due to (i) occupancy of construction vehicles (ii) land accretion in earthworks and material spillage during transportation, causing marshy conditions, affecting traffic safety;
   - The impacts on water transport on Ruot Lon river due to the construction of the piers of the main span bridge abutments in the flow of Ruot Lon river, and material transportation by waterway.
   - The impacts on residents due to air pollution, noise and due to spillage of materials during excavation and backfilling affecting the health and the lives of communities the project area.

   These impacts have been analyzed in detail for appropriate mitigation measures. However, there have remained impacts impossible to be determined precisely on the extent and scale of space and time due to unclear information and only overall analysis in the assessment such as locations of temporary material and waste soil and stone storage fields and the storage time, etc.

2. The proposed mitigation measures for impacts such as impacts due to land acquisition, impacts on water environment; impacts on residents, impacts on traffic, etc., have the high feasibility and efficiency. However, to ensure acceptable residual impacts, the construction will be monitored to promptly take the appropriate corrective measures. The environmental management and monitoring will be carried out upon the project implementation. The Project Owner is responsible for the environmental management and monitoring, provision of adequate and timely funding for this activity. The funding for environmental

protection have been included in the total investment of the Project.

3. The public consultation has been done according to the requirements of the Environmental Protection Law 2014 and the requirements of JICA. The components consulted consist of governments of communes/wards (People's Committees and Fatherland Front) and communities directly or indirectly affected related to the scope of the Project.
4. After the Project's EIA report is approved by the Ministry of Natural Resources and Environment and JICA, the Project Owner will develop environmental management plans and environmental technical instructions in the detailed design as the basis for implementing the environmental management plan of the construction entities.

II. Recommendations

The cooperation and support of Hai Phong City Department of Natural Resources and Environment as well as the People's Committees and Fatherland Front of the communes/wards passed through by the Project, along with the relevant local sectors are necessary for the deployment of the environmental protection plan during the Project implementation.

III. Commitments

1. The environmental management and monitoring program proposed in Chapter IV, including measures to mitigate adverse impacts, prevent and response to environmental incidents and environmental treatment facilities and the environmental monitoring upon the approval on the Project's EIA report from the Ministry of Natural Resources and environment and JICA shall be performed.

   During the construction, the national and international standards and regulations on the environment shall be followed. The air and surface water quality and noise or vibration, etc shall be ensured to meet the national and international standards, including:

   a. Decree No. 18/2015/ND-CP dated 14/02/2015 approved by the Government on the strategic environmental assessment, environmental impact assessment and environmental protection commitments;
   b. Decree No. 19/2015/ND-CP dated 14/02/2015 approved by the Government detailing the implementation of the environmental protection law;
   c. Decree No. 59/2007/ND-CP dated 09/04/2007 on management of solid waste;
   d. Decree No. 38/2015/ND-CP dated 24/04/2015 approved by the Government on the management of waste and scrap;
   e. Circular No. 27/2015/TT-BTNMT dated 29/05/2015 approved by the Ministry

of Natural Resources and Environment on the strategic environmental assessment, environmental impact assessment and environmental protection plans;

f. Circular No.36/2015/TT-BTNMT dated 30/06/2015 approved by the Ministry of Natural Resources and Environment on the hazardous waste management.

g. Standards and codes of Vietnam on the environment as mentioned in the introduction;

h. Standards for measurement and analysis methods as mentioned in the introduction;

i. Industry standard for design.

2. Commitments to community

a. To coordinate with the land acquisition council and the People's Committee of districts and communes involved in the Project to solve the issues of land acquisition, relocation and resettlement and public utility occupancy and relocation in accordance the powers and responsibilities;

b. To respect the values of the local communities and continue to conduct exchanges and consultations with local residents on matters affecting the environment of the Project area;

c. To continuously improve and upgrade measures to reduce pollution through surveillance, monitoring, audit and review; Strictly comply with the communications and reporting on the implementation of the contents of the approved EIA report and the requirements of the approval decision in accordance with the Decree No. 18/2015/ND-CP dated 14/02/2015 approved by the Government on the strategic environmental assessment, environmental impact assessment and environmental protection commitments and the Circular No. 27/2015/TT-BTNMT dated 29/05/2015 approved by the Ministry of Natural Resources and Environment on the strategic environmental assessment, environmental impact assessment and environmental protection plans as requested by JICA;

d. To manage generated waste in a good manner;

e. To work with the local authorities on issues of employment, health protection and preservation of order and security within the scope of the project;

f. To ensure no interruption of irrigation water source, power supply and domestic water supply that disrupt economic activities of the locality;

g. To strictly following Hai Phong City’s regulations on environmental management and protection;

h. To work with local authorities in order to obtain agreements in writing on disposal sites before construction.

3. Commitment to compliance with general regulations on environmental protection related to the Project phases, including:

   a. To allocate sufficient funds for the project's environmental protection and compensation in case of incidents causing environmental pollution by the project;

   b. To take environmental protection solutions and measures in the construction preparation, construction and operation as presented in Chapter IV;

   c. The Project Owner commits to addressing complaints from the community about the Project's environmental issues in accordance with the law on complaints and denunciations and the provisions in Chapter XIV "Inspections and handling of violations and settlement of complaints and denunciations and compensation for damages to the environment" of the Environmental Protection Law 2014; and make compensation for incidents and issues related to the land clearance.

   d. To make compensation, conduct rehabilitation and return land, roads and irrigation ditches in case of temporarily acquired by the Project.