

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)  
NGUYEN TRAI BRIDGE**

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**  
NGUYEN TRAI BRIDGE CONSTRUCTION PROJECT



**Hai Phong, November 2016**



HAI PHONG CITY PEOPLE'S COMMITTEE  
HAI PHONG BRIDGE PROJECTS MANAGEMENT DEPARTMENT  
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**report on  
environmental impact assessment**

NGUYEN TRAI BRIDGE 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**



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## INTRODUCTION

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### 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, etc. Construction of Nguyen Trai Bridge from Le Hong Phong - Nguyen Trai axis, crossing Cam River to Thuy Nguyen is vital, meeting the general development of the City and the areas at two banks of Cam River and Thuy Nguyen District, attract investment and development of Hai Phong urban area toward the North bank of Cam River.

Construction of Nguyen Trai Bridge not only meets transport demand between the City center and new urban areas in the North of Cam River, connecting industrial zones, but also connect the region. It creates new connection between Hai Phong and Northern provinces through National Highway 10, National Highway 18 and Ring Road 3 of the City. Besides, the project also gathers outstanding advantages of transport and landscape on Cam River, decorate for architectural space, culture, landscape of Hai Phong City.

#### b. Background of the Project

With over a century of construction and development, Hai Phong has contributed greatly into the fight for independence, construction and protection of the country. Hai Phong is now focusing on construction and development in the orientation of a green, civilized, modern port city, a big service and industrial center with high competitiveness, a major marine economic area of the country in accordance with the policies of the Central Party and the State.

Hai Phong City has determined one of three breakthrough development directions of the city is the North integrated with development of the urban system along two sides of Cam River to create a breakthrough appearance of the city center, a new urban center with typical characteristics of Hai Phong urban area. Construction of Nguyen Trai Bridge will take an important role in connecting the old political administrative center area in Hong Bang District with the new one to be built in North Cam River urban area, concurrently, linking Cat Bi airport with Northern development area of the City, VSIP Haiphong Township, Industrial & Service Park. This is also a vital route of passenger transport in North – South direction of the City.

Construction of Nguyen Trai Bridge is an important part in establishment of ring road system of Hai Phong City and in main route as determined in the Decision No. 1448/QD-TTg dated 16/9/2009 of the Prime Minister approving the adjustment of the Hai Phong urban construction master plan to 2025 and in vision to 2050: “...*new construction of Vat Cach, Ben Lam, Nguyen Trai, Hoang Van Thu Bridges, road tunnel from Nguyen Binh Khiem to Vu Yen island, road tunnels on the coastal expressway*”. Hai Phong is under urban space and socio-economic development; therefore, consideration in constructing bridges is necessary, which helps improving the transport network, upgrading the urban landscape, and effectively develop logistics, etc. Nguyen Trai Bridge not only takes part in transport infrastructure development of the city and the region but also connect with China’s transportation.

Nguyen Trai and Vu Yen Bridges construction project is of great interest of Japan International Cooperation Agency (JICA); therefore, a preparatory survey team with Chodai Co., Ltd. as leading company has been assigned to carry out surveys including preparation of EIA report for Hai Phong arterial trunk road construction project, aiming at ODA project formation (SAPROF). The JICA study team has 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). MPI has registered the Nguyen Trai Bridge construction project in the list of 10 ODA projects funded with 2016 fiscal year loans of the Japanese Government as in the letter No. 3592/BKHDT-KTDN dated 13/5/2016 regarding proposed projects for using Japanese Government’s ODA loans of 2016 fiscal year.

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 Department to be the project owner of Nguyen Trai Bridge construction project. All procedures related to change of the project owner from the urban development construction project management board to Hai Phong Bridge Projects Management Department will be 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***

Nguyen Trai Bridge 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 XIII<sup>th</sup> National Assembly at the 7<sup>th</sup> 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 Vision to 2030 approved by HPPC at the Resolution No.32/2014/NQ-HDND dated on December 11<sup>th</sup> 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 7<sup>th</sup> of the VIII<sup>th</sup> National Assembly on June 23<sup>rd</sup>, 2014, and became effective from January 1, 2015;
  - Decree No. 18/2015/ND-CP dated on February, 14<sup>th</sup> 2015 issued by the Central Government on environmental protection assessment, strategic environmental assessment, environmental impact assessment and environmental protection plans;
  - Circular No.27/2015/TT-BTNMT dated on May, 29<sup>th</sup> 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 XIII<sup>th</sup> National Assembly of Socialist Republic of Vietnam in the sixth session on November 29<sup>th</sup>, 2013;
  - National Law on Water Resource No. 17/2012/QH13 adopted by the XIII<sup>th</sup> National Assembly of Socialist Republic of Vietnam in the 3<sup>rd</sup> 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 13<sup>th</sup>, 2008;
  - Decree No.38/2015/ND-CP dated on April, 24<sup>th</sup> 2015 of Central Government on management of waste and discarded materials;
  - Decree No.03/2015/ND-CP dated January, 6<sup>th</sup> 2015 of Central Government on determination damages to the environment;
  - Decree No.42/2012/ND-CP dated November 5<sup>th</sup> 2012 of Central Government

- on management and use of rice-farming land;
- Decree No.179/2013/ND-CP dated December 31<sup>st</sup> 2013 of Central Government on the sanction of administrative violations in the domain of environmental protection;
  - Decree No.43/2014/ND-CP date May 15<sup>th</sup> 2014 of Central Government on detailing a number of articles of the Land Law;
  - Decree No.47/2014/ND-CP dated May 15<sup>th</sup> 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 24<sup>th</sup> 2015 of MOT on regulations on environmental protection in traffic infrastructure development;
  - Circular No.36/2015/TT-BTNMT dated June 30<sup>th</sup> 2015 of MONRE on management of hazardous wastes;
  - Circular No.28/2011/TT-BTNMT dated August 1<sup>st</sup> 2011 of MONRE on providing guidelines on technical process of surrounding air environment monitoring and noise;
  - Circular No.29/2011/TT-BTNMT dated August 1<sup>st</sup> 2011 of MONRE on regulations on continental water surface environment monitoring;
  - Circular No.30/2011/TT-BTNMT dated August 1<sup>st</sup> 2011 of MONRE on regulations on technical process of underground water environment monitoring;
  - Circular No.33/2011/TT-BTNMT dated August 1<sup>st</sup> 2011 of MONRE on regulations on technical process of soil environment monitoring;
  - Circular No.39/2011/TT-BGTVT dated May 18<sup>th</sup> 2011 of MOT on guiding a number of articles of the Government's Decree No. 11/2010/ND-CP of February 24<sup>th</sup> 2010 on the management and protection of road infrastructure facilities.
  - Circular No. 37/2014/TT-BTNMT dated June 30<sup>th</sup> 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 seven<sup>th</sup> session of the XIII<sup>th</sup> National Assembly on June 18<sup>th</sup> 2014 and became effective from January 1, 2015;
- Road Traffic Law adopted on 13<sup>th</sup> November, 2008 at the 4<sup>th</sup> session of the XII<sup>th</sup> National Assembly;
- National Law on Dike No. 79/2006/QH11 adopted on November 29<sup>th</sup> 2006 at the ten<sup>th</sup> session of the XI<sup>th</sup> 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 17<sup>th</sup> 2014 at the seven<sup>th</sup> session of the XIII<sup>th</sup> National Assembly;
- National Law on Inland Waterway Transport No.23/2004/QH11 adopted on June 15<sup>th</sup> 2004 at the fif<sup>th</sup> sessions of the XI<sup>th</sup> National Assembly and became effective

from January 1, 2005.

- Decree No.46/2015/ND-CP dated May 12<sup>th</sup> 2015 of Central Government on quality control and maintenance of construction works;
- Decree No.100/2013/ND-CP dated on September 3<sup>rd</sup> 2013 of Central Government on amending and supplementing a number of articles of the government Decree no. 11/2010/ND-CP dated February 24<sup>th</sup> 2010 of Government regulations on management and protection of road infrastructure facilities;
- Decree No.11/2010/ND-CP dated February 24<sup>th</sup> 2010 of Central Government regulations on management and protection of road infrastructure facilities;
- Decree No.32/2015/ND-CP dated March 25<sup>th</sup> 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;
- Document No. 850/VP-GT dated 19/02/2016 of the City’s People’s Committee on listing Nguyen Trai Bridge construction project in the short list of Japanese ODA projects in the 2016 fiscal year;
- Document No. 250/UBND-GT dated 07/3/2016 of Hai Phong City’s People’s Committee on listing Hai Phong City Nguyen Trai Bridge construction project in the short list of ODA funded projects of the fiscal year 2016;
- 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 02 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 Department for implementation in accordance with the Notice No. 391/TB-UBND dated 25/10/2016 of Hai Phong City's People's Committee 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 Department
  - o Representative: Mr. Do Tuan Anh; Position: General Director;
  - o Address: No. 14, Minh Khai Street –Hong Bang District – Hai Phong.
  - o 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

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- 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
<b>A Member of the Project Owner</b>					
1	Mr Dao Ngoc Sy	Vice Director		Overall management	
3	Mr. Dinh Phu Hieu	Manger of Technical Department		Coordination	
<b>B List of EIA and EIA report preparation participants</b>					
2	Mr. Nguyen Thanh Chinh	Director of Environment 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.:	- Chief of EIA - Generally in charge of EIA report quality - In charge of Chapter 3, Chapter 4 and Conclusion	

**Environmental Impact Assessment Report**

<b>No.</b>	<b>Full name</b>	<b>Position/ Organization</b>	<b>Academic title and major of training</b>	<b>In charge of</b>	<b>Signature of EIA participants</b>
			KS-04-03085-A)		
4	Mr. Nguyen Dinh	Expert (TEDI-ENVICO)	Master of Science, Environmental Science	- Calculation and forecast of noise and vibration impacts	
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	Expert (TEDI-	Environmental engineering	- In charge of Chapter 6 and table of contents,	

<b>No.</b>	<b>Full name</b>	<b>Position/ Organization</b>	<b>Academic title and major of training</b>	<b>In charge of</b>	<b>Signature of EIA participants</b>
	Thi Thanh Hoa	ENVICO)	technology engineer	appendixes - Implement administrative procedures	
12	Mr Phan Van Mach	Institute of Ecology and living being resources	Biology Bachelor	In charge of conditions 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

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### 1.1. Name of the Project

Nguyen Trai Bridge construction project.

### 1.2. Project Owner

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

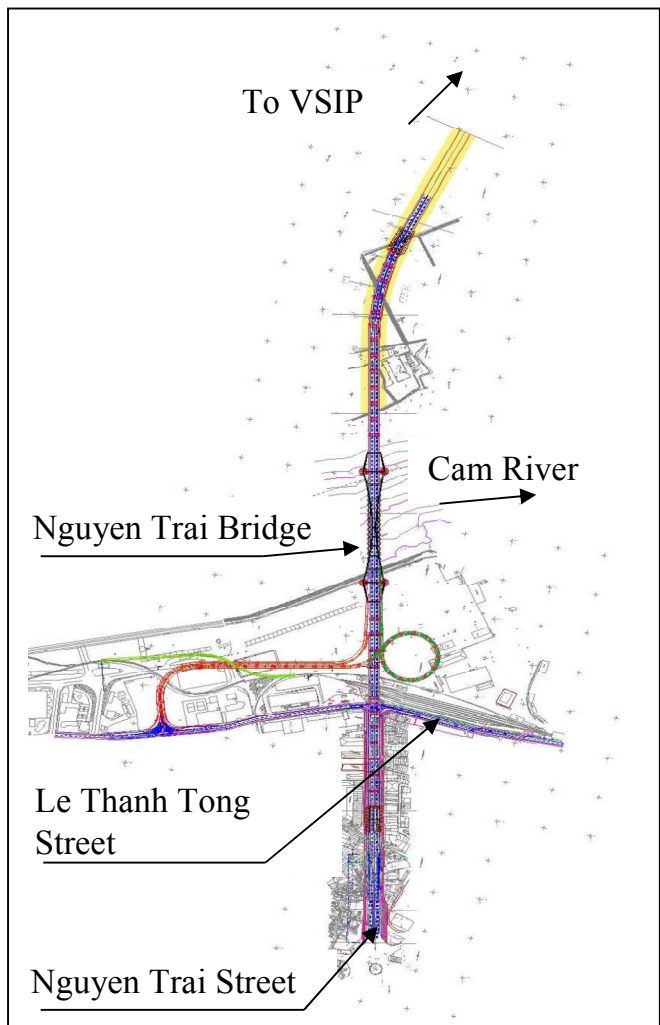
### 1.3. Geographical location

#### 1.3.1. Construction Investment Scale of the Project

##### *a. Scope of the Project*

Nguyen Trai Bridge construction project locates in May To Ward, Ngo Quyen District and Duong Quan Commune, Thuy Nguyen Rural District.

Figure 1.1. Site map of the project



1-2

### 1.3.2. Geographical Location of the Project

The Project is located in 02 communes of two districts of Ngo Quyen and Thuy Nguyen.

Natural and socio-economic factors around the Project area are as followings:

- *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 are relatively heavy.
- *River system and waterway transport:* The bridge planned by the Project will cross over the Cam River, this is sources of surface water for irrigation activities in the project area. On the right bank of the Cam River where Nguyen Trai Bridge is planned, there is Hoang Dieu Port.

Waterway transport on Cam River to Hoang Dieu port (in Nguyen bridge area) and Hai Phong port is featured with operation of vessels from 5,000 DWT to 40,000 DWT. The number of vessels from 5,000 DWT to 40,000 DWT calculated in years is shown in table 1.1 and figure 1.2.

The flow of vessels of more than 4,000 DWT running from Hoang Dieu port to Kien Bridge is shown in table 1.2 and figure 1.2.

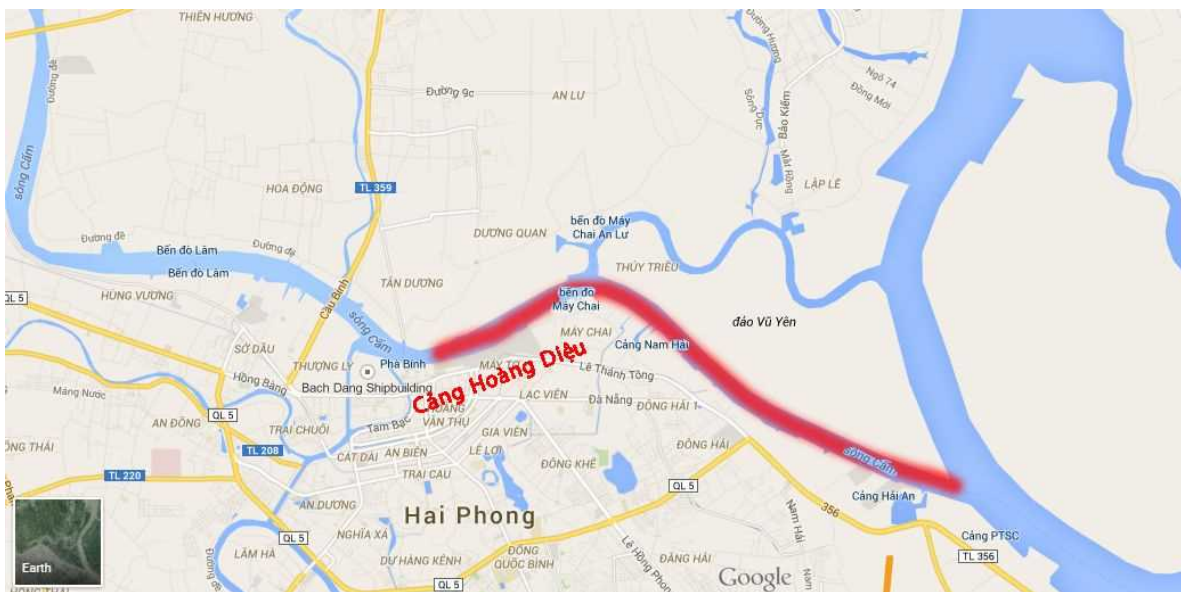


Figure 1.2. Vessels circulating from Hoang Dieu port to river mouth



**Table 1.1. Statistical table of number of vessels unloading in Hoang Dieu port and Hai Phong port from 2010 to 2014**

Year	Number of vessel trips			
	To 5,000 DWT	From 5,000 DWT to 7,000 DWT	From 7,000 DWT to 15,000 DWT	From 15,000 DWT to 40,000 DWT
2010	544	232	459	48
2011	467	205	465	64
2012	370	149	415	58
2013 (to end of October 2013)	267	109	351	62
2014	250	95	256	64

Source: The project

The number of vessels of more than 4,000DWT to Nam Ninh, Vat Cach and Quynh Cu ports under the section from Hoang Dieu port to Kien Bridge in 2014 is 52 trips (figure 1.3).



**Figure 1.3. Vessels circulating on the section from Hoang Dieu port to Kien Bridge**

- *Residents and economic activities:* on the South bank of Cam river in the project area, residents mostly live along 2 sides of Nguyen Trai and Le Thanh Tong streets with economic activities, beside Hoang Dieu port locating from the North of Le Thanh Tong street to Cam river banks. In the North bank of Cam River are aquaculture areas and fields with main agricultural activities.
- *Cultural, history and other structures:* Einstein High School (Le Loi High School) locates on Nguyen Trai Street, near Nguyen Trai – Le Thanh Tong crossroad.

Figure 1.4 shows the geographical location map of the Project and the outstanding spots observed around the project area.

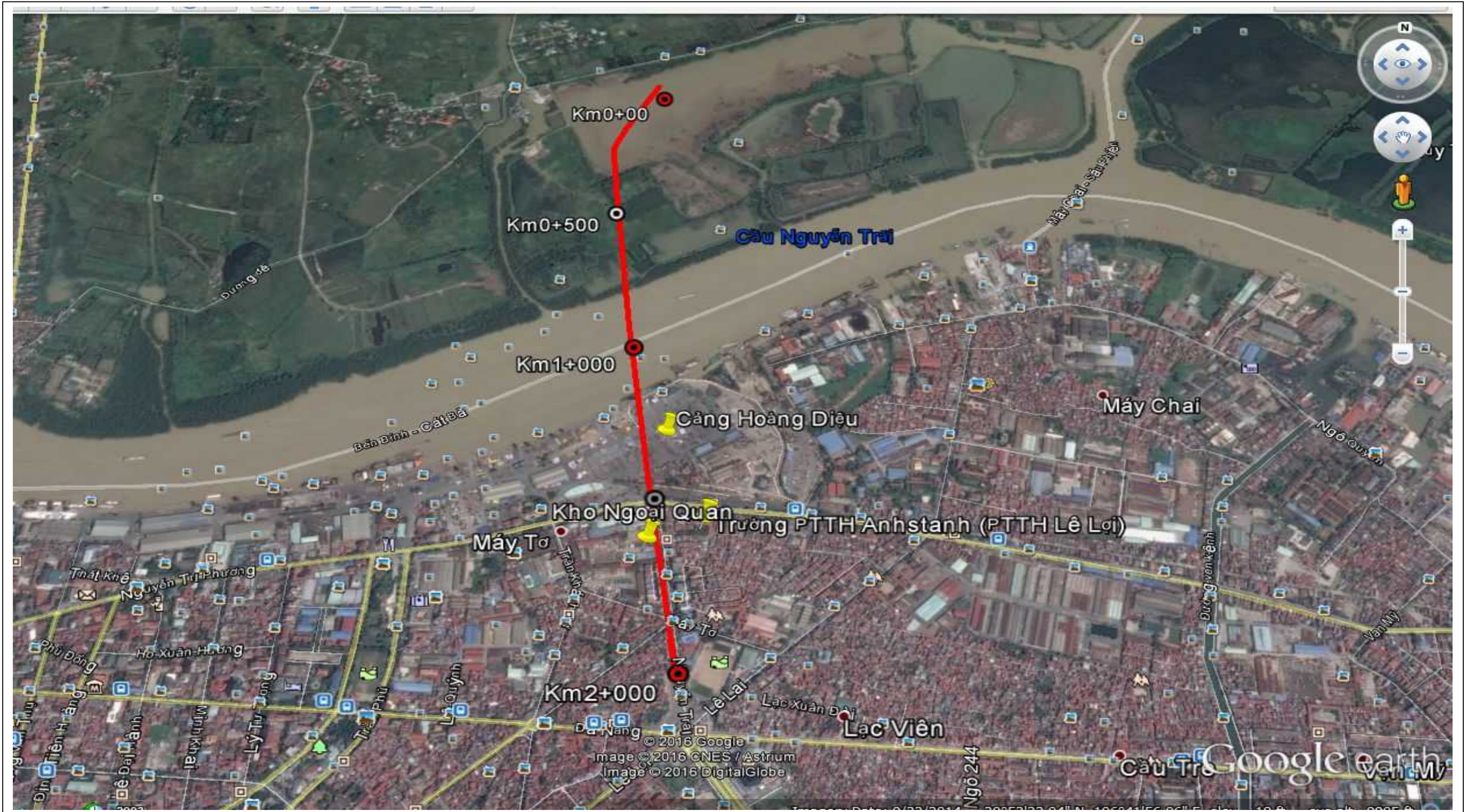
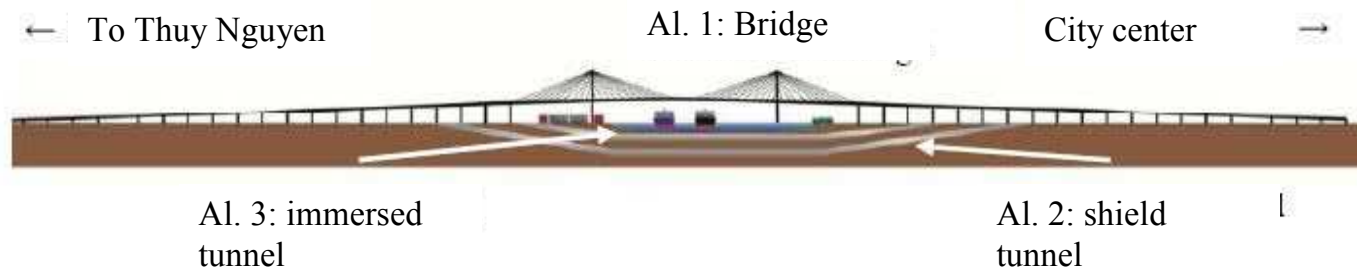


Figure 1.4. Location of outstanding spots in the project area

– *Comparison of alternatives of crossing over Cam river:*

As shown in Figure 1.5, there are three alternatives for crossing the Cam River at the location where the Nguyen Trai Bridge is planned: 1 alternative to build a bridge, 2 alternatives to build a tunnel.



**Figure 1.5. Alternatives of crossing Cam river at Nguyen Trai bridge location**

Comparison and evaluation of alternatives of crossing Cam river at Nguyen Trai bridge are presented in table 1.2.

**Table 1.2. Comparison and evaluation of alternatives of crossing Cam river at Nguyen Trai bridge**

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

Alternative	Alternative 0: No structure	Alternative 1: Bridge	Alternative 2: Shield tunnel	Alternative 3: Immersed tube tunnel
Summary and aim	Status quo, no construction (no environmental or social impact).	Alternative 1 involves the construction of a new bridge over the Cam River to cope with increased traffic associated with the development of new residential and industrial areas on the north river side and the opening of Lach Huyen Port. (Main structure: 600m bridge)	Alternative 2 involves the construction of a shield tunnel under the Cam River to cope with increased traffic associated with the development of new residential and industrial areas on the north river side and the opening of Lach Huyen Port.	Alternative 3 involves the construction of an immersed tube tunnel under the Cam River to cope with increased traffic associated with the development of new residential and industrial areas on the north river side and the opening of Lach Huyen Port.
Social impact	⊙ No relocation of residents or houses, and no new land acquisition required.	○ The total length of the proposed bridge with access roads is approximately 1,350m. This requires the relocation of around 160 houses and the acquisition of around 1,360m <sup>2</sup> of land on the south river side. On the north river side, no houses have to be relocated, but the acquisition of around 5,000m <sup>2</sup> of land including aquaculture facilities and agricultural land is needed. Alternative 1 requires the least land acquisition and relocation, and has a social impact similar to Alternative 3 and less than Alternative 2.	× The total length of the proposed shield tunnel with access roads is approximately 2,180m which is the longest of all alternatives. The land acquisition and relocation needs on both river sides are expected to be higher than for Alternative 1 and Alternative 3. Dozens of houses along the extended access roads and around the excavation sites and tunnel openings are expected to be affected. On some sections, the use of underground areas requires surface rights to be considered. However, the present functions of the port can be kept unchanged.	△ The total length of the proposed immersed tube with access roads is approximately 1,260m. This requires the relocation of around 160 houses on the south river side, as well as the acquisition of around 8,400m <sup>2</sup> of land including aquaculture facilities and agricultural land on both river sides. The social impact is less than for Alternative 2 and similar to that for Alternative 1. On some sections, the use of underground areas requires surface rights to be considered. However, the present functions of the port can be kept unchanged.

Alternative	Alternative 0 : No structure	Alternative 1 : Bridge	Alternative 2 : Shield tunnel	Alternative 3 : Immersed tube tunnel
Impact on Mangrove and wetland	⊙ Status quo, no impact.	○ Since the bridge structure will be “transparent” after completion, the impact on surface currents and groundwater flow which may affect the wetlands and mangrove forests on the north side of Cam river is expected insignificant.	△ After completion, a 250m area around the tunnel opening and the adjoining earthwork section will obstruct the surface currents and groundwater flow, which negatively affects the wetlands and mangrove forests.	△ After completion, a 250m area around the tunnel opening and the adjoining earthwork section will obstruct the surface currents and groundwater flow, which negatively affects the wetlands and mangrove forests.
Impact on living environment / pollution	× 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. Houses along the roadside will also suffer from more noise pollution.	⊙ Although more regional traffic is expected to increase roadside air pollution, noise and vibration, such emissions and noise are diffused and the impact on the living environment is therefore less than for Alternative 2 and Alternative 3.	○ Since a ventilation tower with a concentrated ventilation system will be employed, it is unlikely that there will be high concentrations of emissions in the areas near the tunnel openings. Regarding noise around the tunnel openings, a noise absorption system should be employed to satisfy Vietnamese noise regulations. However, the noise level at the tunnel openings will be higher compared with Alternative 1: Bridge.	○ Since a ventilation tower with a concentrated ventilation system will be employed, it is unlikely that there will be high concentrations of emissions in the areas near the tunnel openings. Regarding noise around the tunnel openings, a noise absorption system should be employed to satisfy Vietnamese noise regulations. However, the noise level at the tunnel openings will be higher compared with Alternative 1: Bridge.

Alternative	Alternative 0 : No structure	Alternative 1 : Bridge	Alternative 2 : Shield tunnel	Alternative 3 : Immersed tube tunnel
Impact on water environment	⊙ Status quo, no impact.	○ The steel pipe sheet pile methods which is environmental friendly method will be used as a pier foundation. A working area and construction period is suppressed to the minimum, and an amount of discharged soil is small. The earth retaining wall has also high water-tightness, and the impact on the water environment containing a water quality, an ecosystem, a flood, etc. is very small. And the bridge structure will be “transparent” after completion, the impact on surface currents and groundwater flow which affect the wetlands and mangrove forests is limited.	○ Status quo, no impact.	× Since immersed tunnel is required large-scale excavation and longtime construction in the river, the impact on the water environment such as the water quality or river ecosystem will be large.
Road transport system	× Increased traffic volume leads to congestion with a resulting drop in traffic flow and safety.	⊙ Sufficient traffic capacity ensures traffic flow and safety. Not only cars but also pedestrians can use the bridge.	○ Sufficient traffic capacity ensures traffic flow and safety, but the concentration of car emissions in the tunnel has a negative impact on pedestrians and bicycle/motorbike traffic.	○ Sufficient traffic capacity ensures traffic flow and safety, but the concentration of car emissions in the tunnel has a negative impact on pedestrians and bicycle/motorbike traffic.

Alternative	Alternative 0 : No structure	Alternative 1 : Bridge	Alternative 2 : Shield tunnel	Alternative 3 : Immersed tube tunnel
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. Limits on navigational clearance will negatively impact river traffic depending on ship height. Construction of bridge piers will occupy much of the busy river area, temporarily affecting river traffic.	⊙ 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. Construction will occupy much of the busy river area, affecting river traffic for a long time.
Project cost	⊙ No land acquisition or construction costs.	○ The project cost is lower than for the tunnel alternatives.	× The project cost is 2.0 times higher than for the bridge alternative, and the highest of all alternatives.	△ The project cost is 1.3 times higher than for the bridge alternative.
Maintenance costs	⊙ No maintenance costs.	○ Although bridges have many structures such as slope protection facilities which require maintenance, the maintenance costs are only 1/5 of those for the tunnel alternatives.	△ Tunnel facilities include lighting, ventilation, surveillance and fire protection equipment, all of which require maintenance. Maintenance costs are therefore expected to be about 5 times higher than for the bridge alternative.	△ Tunnel facilities include lighting, ventilation, surveillance and fire protection equipment, all of which require maintenance. Maintenance costs are therefore expected to be about 5 times higher than for the bridge alternative.



Alternative	Alternative 0 : No structure	Alternative 1 : Bridge	Alternative 2 : Shield tunnel	Alternative 3 : Immersed tube tunnel
Overall evaluation	×	◎ Alternative 1 is expected to improve the living environment, road transportation system, and socio-economic activity. Since the social impact and project cost are lower than for Alternative 2, and the impact on the natural environment and project cost are lower than for Alternative 3, the bridge is recommended as the best alternative.	○	△

## 1.4. Major Contents of the Project

### 1.4.1. Objectives of the Project

Nguyen Trai Bridge is planned to connect the current administrative center on the southern bank of the Cam River with the under-planning new administrative center on the northern bank of the river. Thus, Nguyen Trai Bridge will help to facilitate the traffic between the areas on two sides of the river serving the future development 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.
- 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 1.3.

**Table 1.3. Site Clearance Quantities**

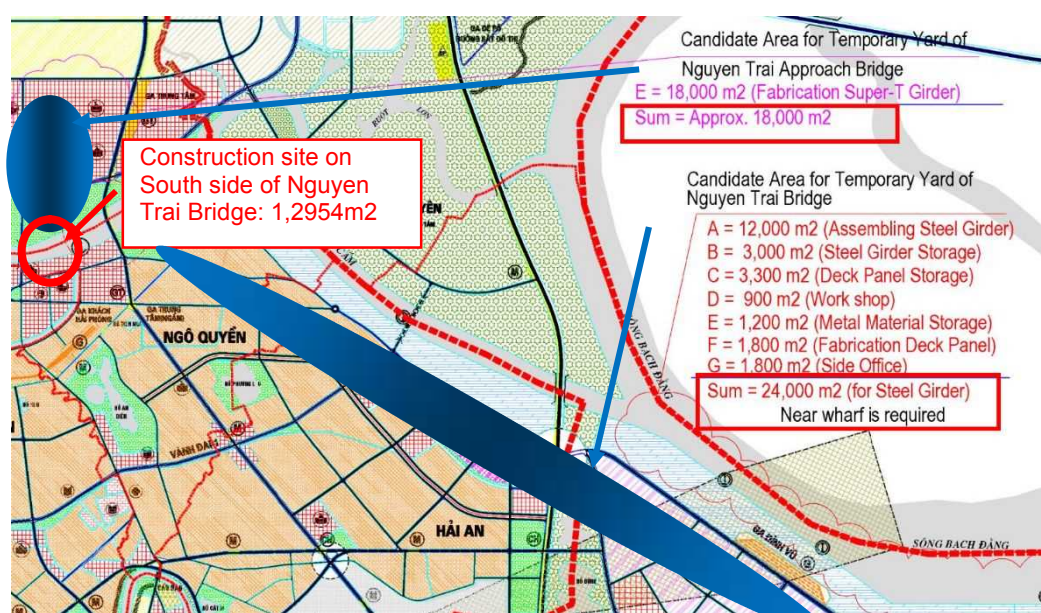
No.	Item	Unit	Quantity	Remarks
<b>I</b>	<b>Land occupancy</b>	m <sup>2</sup>	<b>134,633</b>	
<i>1</i>	<i>Non-agricultural land</i>			
	Residential land	m <sup>2</sup>	9,419	
<i>2</i>	<i>Agricultural land</i>			
	Agricultural land	m <sup>2</sup>	18,565	In the locality of Duong Quan commune. To be acquired in VSIP project
<i>3</i>	<i>Business land</i>	m <sup>2</sup>	11,640	
<i>4</i>	<i>Public land</i>	m <sup>2</sup>	95,009	
<b>II</b>	<b>Houses, properties. etc., on land</b>			
<i>1</i>	<i>Houses of all kinds</i>			
	1-storey houses	m <sup>2</sup>	51.5	
	2-storey houses	m <sup>2</sup>	5,741.2	

No.	Item	Unit	Quantity	Remarks
	3-storey houses	m <sup>2</sup>	13,799.85	
	Over 3-storey houses	m <sup>2</sup>	7,871.9	
<b>2</b>	<b>Grave relocation</b>			
	Tomb	pcs	0	
<b>3</b>	<b>Electric power poles</b>	pcs	35	
<b>4</b>	<b>Channels and ditches</b>	m	0	

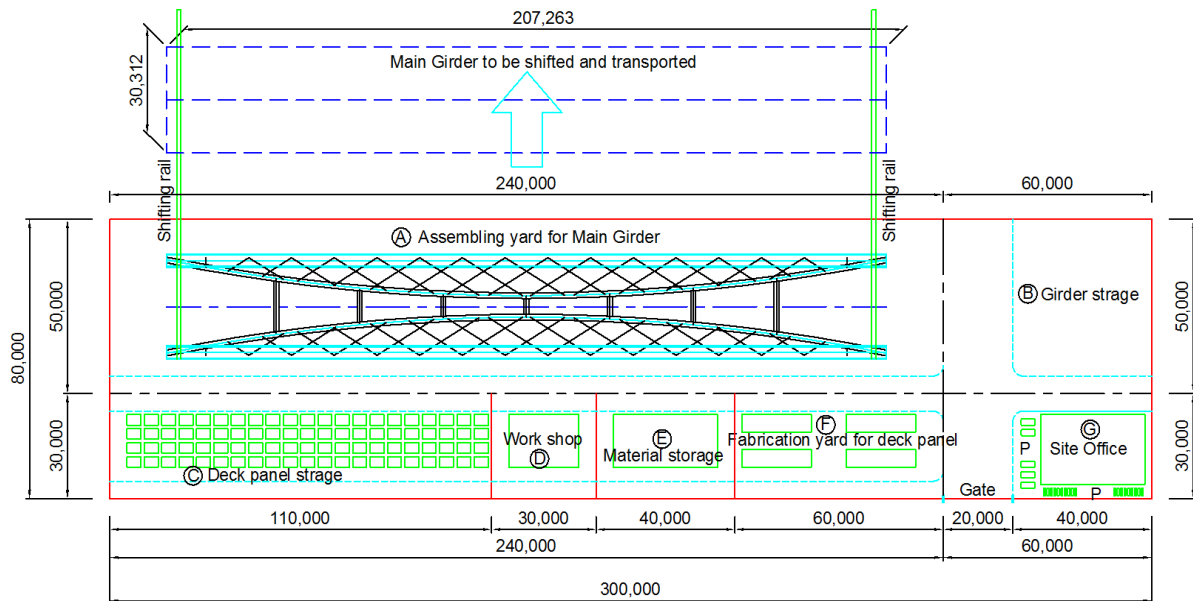
**1.4.2.1.2. Construction site levelling**

The Site is arranged in two banks of Cam River in the area of Nguyen Trai Bridge with the construction area of about 1.2954ha to the southern bank of Cam river (including assembling steel girder, steel girder storage, deck panel storage, workshop, metal material storage, deck panel fabrication yard, site office and worker camps), the construction area to the northern bank of Cam river is about 1.8ha (including super-T beam fabrication area, concrete mixing plant and worker camps). Construction site location is shown in figure 1.6.

At peak times, the construction site of Nguyen Trai Bridge has about 100 workers.



**Figure 1.6. Location of construction site**



**Figure 1.7. Temporary construction area for main girder fabrication**

***1.4.2.2. Construction Phase***

The works items include the followings:

- o Construction of Nguyen Trai Bridge and approaches with the total length of 1,403m
- o Construction of approaches with the total length of 680m;
- o Construction of approach bridge at the intersection with the total length of 1,222m
- o Drainage system, lighting system, protection and traffic safety works.

***1.4.2.2.1. Scale and Technical Standards of main items during construction phase***

**a. Bridges**

***a1. Scale and Technical Standards***

- Permanent bridge;
- Design standard: National Building Code 104-2007 (Urban Road Design Standard);
- Design water level frequency: flood frequency P=1%; ensuring required navigational clearance to navigable water level P=5%;
- Longitudinal slope: 4%;
- Navigational clearance : 25m x 80m;
- Bridge design standard: 22 TCN-272-05;

- Earthquakes: in accordance with 22 TCN-272-05.
- Scope of cross section: 4 lanes, with of lane 3,75m.

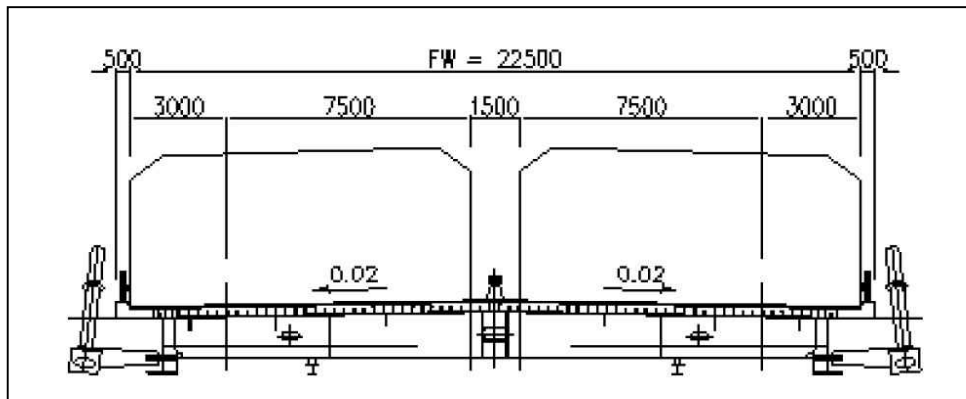


Figure 1.8. Cross section of Nguyen Trai Bridge

**a2. Sizes and Structures of Bridge**

Sizes and structures of the bridge are described in Table 1.4, plan view and general layout of the bridge are shown in figure 1.9 and 1.10 (see details in Appendix 4).

Table 1.4. Sizes and Structures of Nguyen Trai Bridge

No.	Bridge item	Length of bridge (m)	Width of bridge floor (m)	Superstructure	Substructure	Remarks
1	Main span	464	22.5	Balanced arch girder 92+280+92m	Steel pipe pile D=0.9m at abutment and pier of approach span.	Crossing Cam river with navigation clearance: 25m x 80m
2	Approach span	939	22.5	super T girder with length of 40m and 34m	Steel pipe pile D=0.9m at abutment and pier of main span.	-
3	Approach span at intersection	1,222	7.0	Hollow slab girder	Steel pipe pile D=0.9m at abutment and pier of main span.	-



Figure 1.9. Plan view of Nguyen Trai Bridge

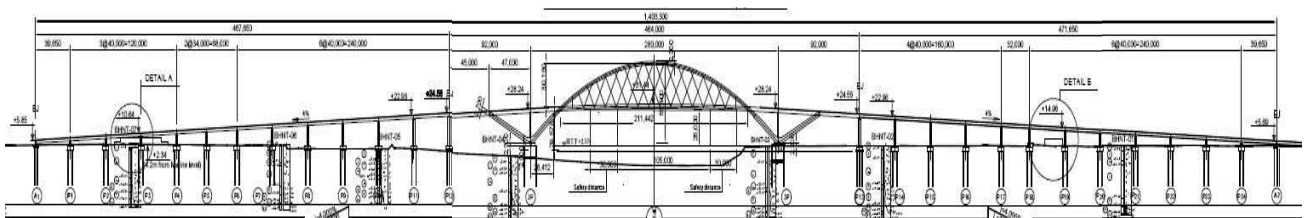


Figure 1.10. Span diagram of Nguyen Trai Bridge

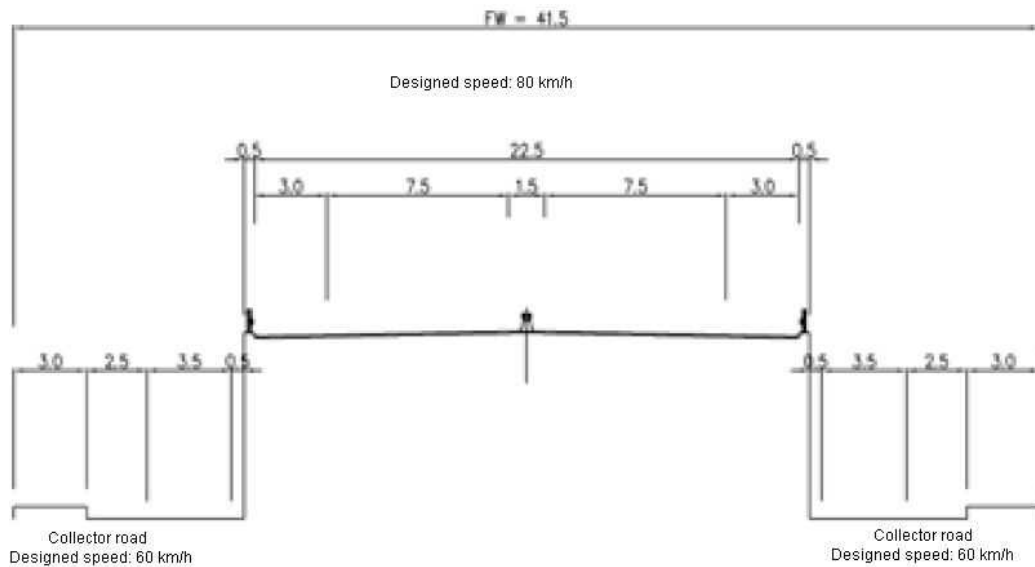
**b. Road works**

– **Road design standards**

- + Design standard: National Building Standard TCXDVN 104-2007;
- + Urban type: Special urban road, Grade – I urban main road;
- + Road type: Urban main road;
- + Design speed: 80km/h.

– **Scope of roadbed cross section:**

Roadbed width  $B = 41.5\text{m}$  with 2 collector roads on both sides. Details are provided in Figure 1.11.



**Figure 1.11. Typical road cross section of Nguyen Trai Bridge Approaching Road**

***b3. Roadbed structure***

- Sand embankment for roadbed with required compaction density of  $K \geq 0.95$ , sand embankment for foundation bottom junction, ensuring compaction density of  $K \geq 0.98$  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.

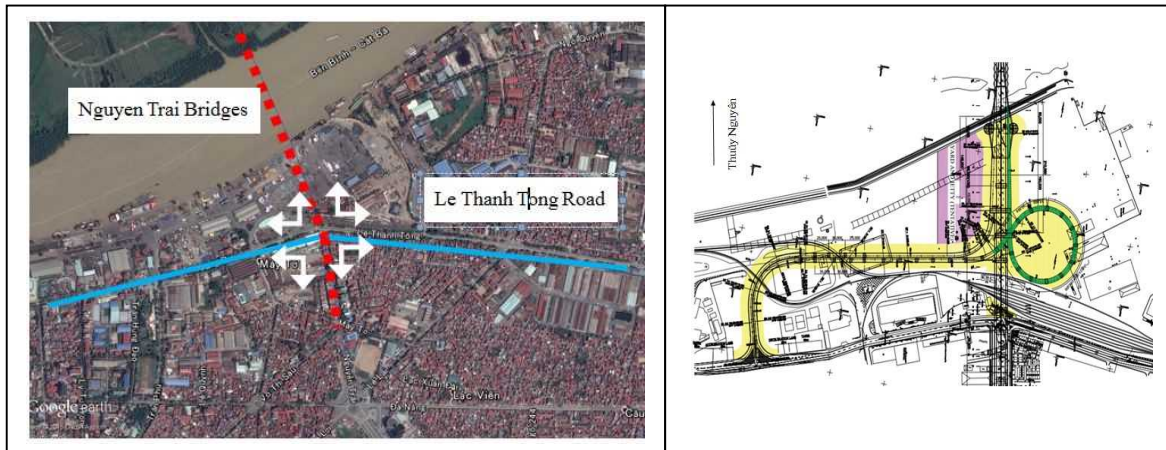
***b4. Road surface structure***

	$E_{yc} = 201.788$ (Mpa), $K_{cd}^{dv} = 1.1$	t(cm)
Surface Course	Bituminous layer type I (Surface Course) (BTNC20, Crushed Stone>50%)	5
Binder Course	Bituminous layer type I(Binder Course) (BTNC25, Crushed Stone>50%)	14
Asphalt Treated Base	Black crushed stone mixed with compact asphalt	12
Base	Crushed Stone Aggregate Base Class I	60
Embankment	Clay and loam, CBR=8	

Total Thickness 91cm + Subgrade 30cm

**c. Interchanges**

Interchanges between Nguyen Trai Bridge with Le Thanh Tong road



**Figure 1.12. Interchange**

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

**Table 1.5. Statistical data of interchange**

No.	Name of interchange	Remark
1	Interchange of south Nguyen Trai bridge	Crowded residential areas alongside Le Thanh Tong Street

**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.

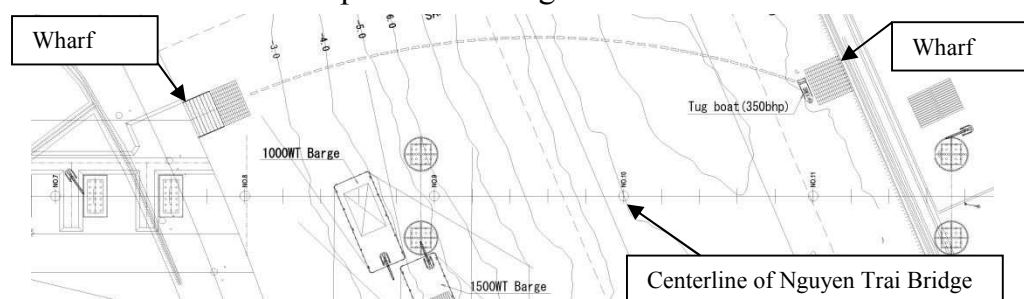
### **1.4.3.2. Key Construction Measures**

#### **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 roads to the construction site must be constructed before construction of the substructure.

Loading and unloading wharfs are constructed on two sides of Cam River. Assumed locations of these wharfs are presented in figure 1.13.



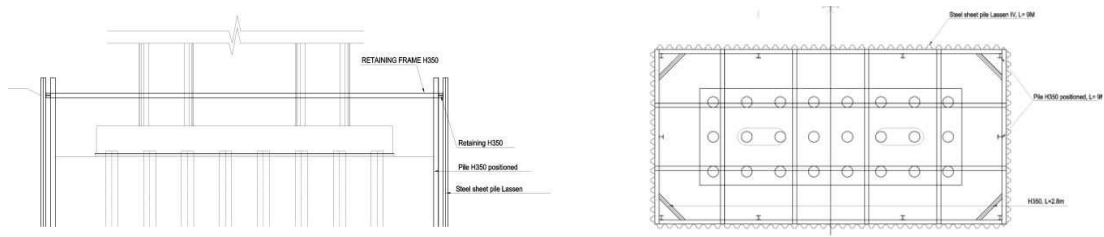
**Figure 1.13. Loading and unloading wharf at Nguyen Trai bridge area**

#### **b. Bridge Construction**

##### **b1. Substructure construction**

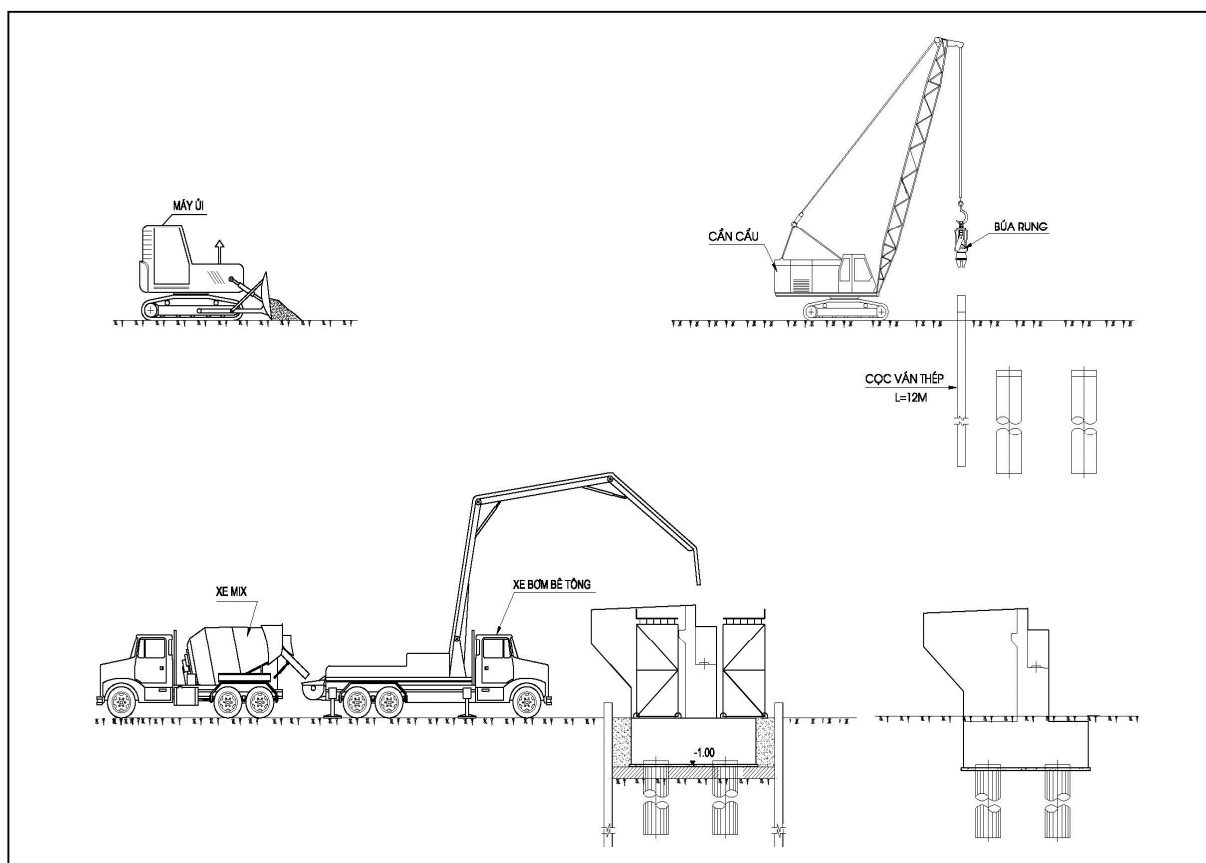
###### **b1.1. Abutment construction**

- Levelling the site, locating the abutment center line, pile lines, executing steel pipe piles for the bridge 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 1.14.



**Figure 1.14. 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.

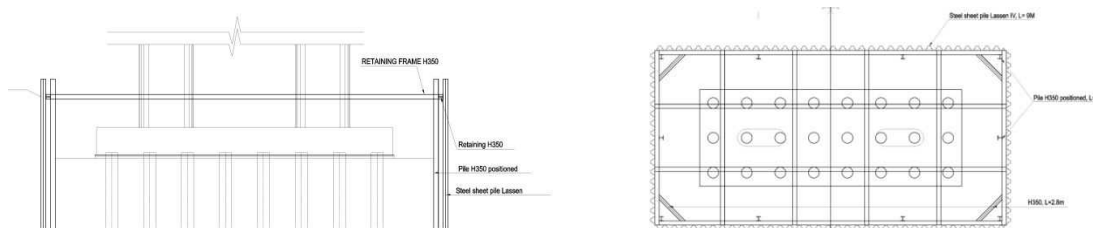


**Figure 1.15. Abutment construction**

**b1.2. Support construction**

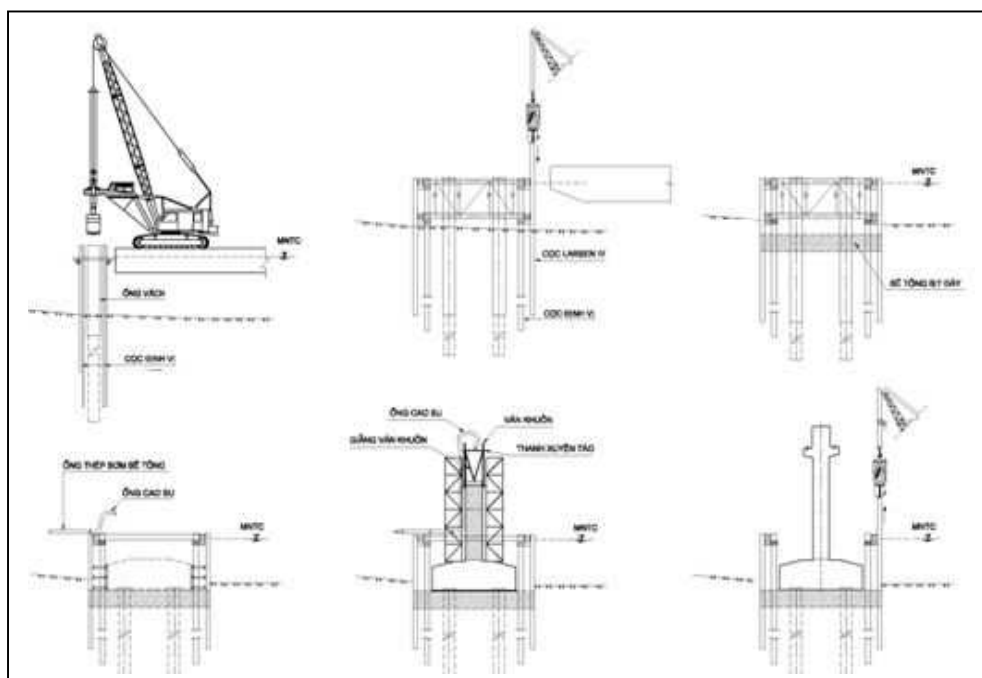
- Levelling the site, locating abutment center lines and pile lines.
- Use dedicated machines to construct steel pipe piles.

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 1.16. 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.



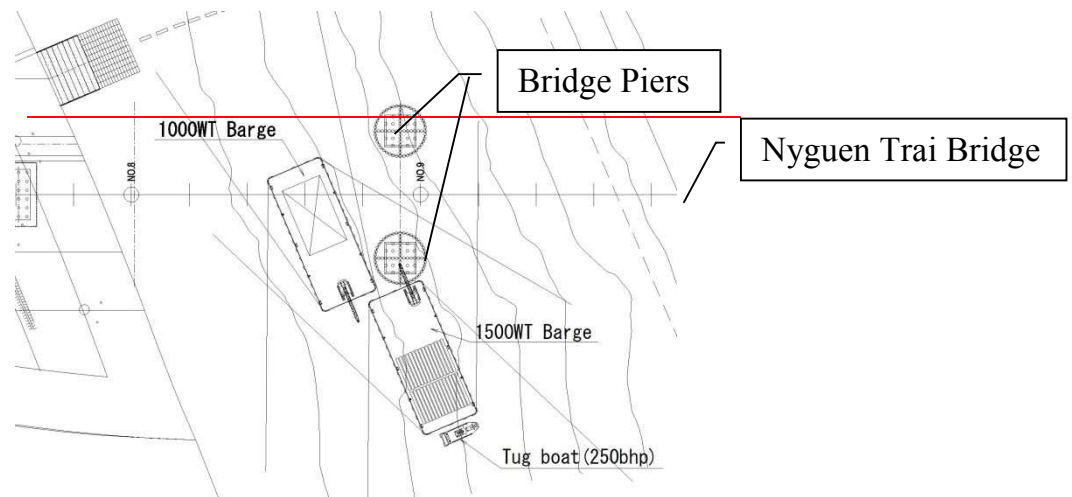
**Figure 1.17. Support construction**

***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.

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

Pier P13 will support the main span of Nguyen Trai Bridge on Cam river. The distance to river bank is 150m and elevation of the riverbed at the pier location is about -6.50m (water depth about 9.0m). With the above distance to river bank and water depth, a barge will be used to construct pier P13 instead of using temporary truss surrounding the pier P13.



**Figure 1.18. Construction of steel pipe pile foundation system**

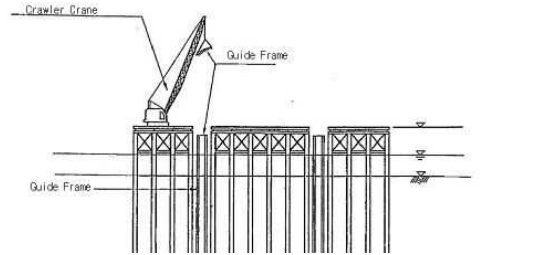
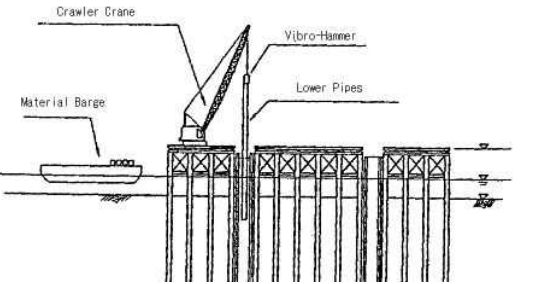
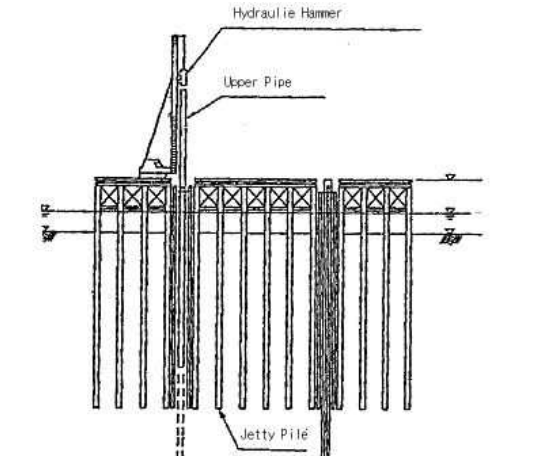
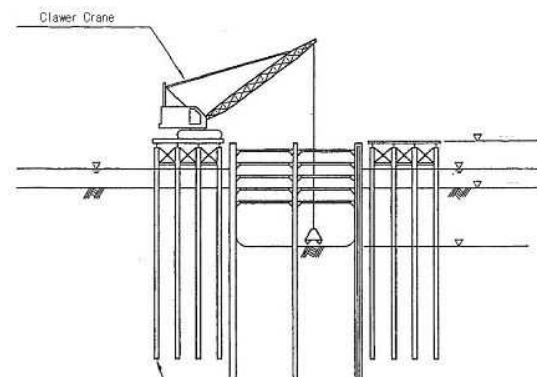
The annual highest water level in July and August is at +2.0m. The highest water level in the last 15 years reaches +2.37m in 2005. Therefore, the height of cofferdam piles is proposed at +3.0m in the method statement of cofferdam piles on Cam River.

**+ *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.

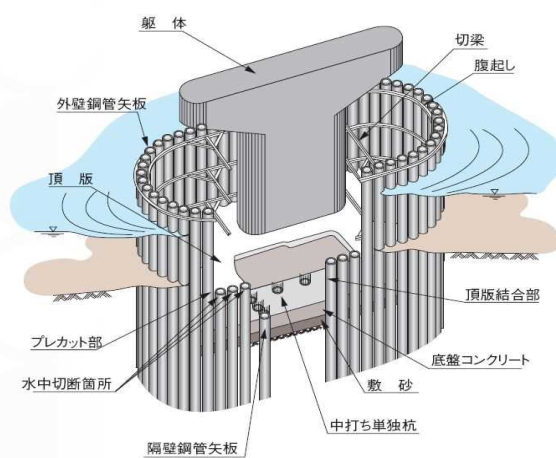
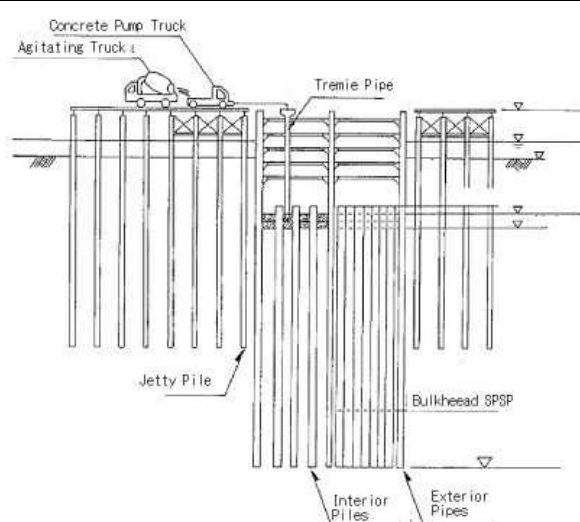
Description	Diagram
<p><b>Construction of temporary truss:</b></p> <p><b>Installation of guide frame:</b></p> <ul style="list-style-type: none"> <li>- Guide frame is used effectively to drive SPSP in case of changing pipe center.</li> </ul>	
<p><b>Driving SPSP (lower pipes):</b></p> <ul style="list-style-type: none"> <li>- Vibro hammer may be selected to drive lower pipes.</li> <li>- Precaution is made when adjusting pipe center and inclination angle.</li> </ul>	
<p><b>Driving SPSP (upper pipes):</b></p> <ul style="list-style-type: none"> <li>- Weld upper pipes with lower pipes which have been driven into ground.</li> <li>- Hydraulic hammer will be used to drive pipes finally.</li> </ul>	
<p><b>Excavation and formworks:</b></p> <ul style="list-style-type: none"> <li>- Excavate inside SPSP by clamshell excavator.</li> <li>- Install formworks, then suction out water to the height of next formwork.</li> </ul>	

**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.



**Figure 1.19. Construction of main support**

- 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, chipping pile ends, installing rebars and concreting footings.
- Erecting formwork, rebar and concreting abutment body and cap beam.
- Finishing piers.

**b2. Superstructure construction**

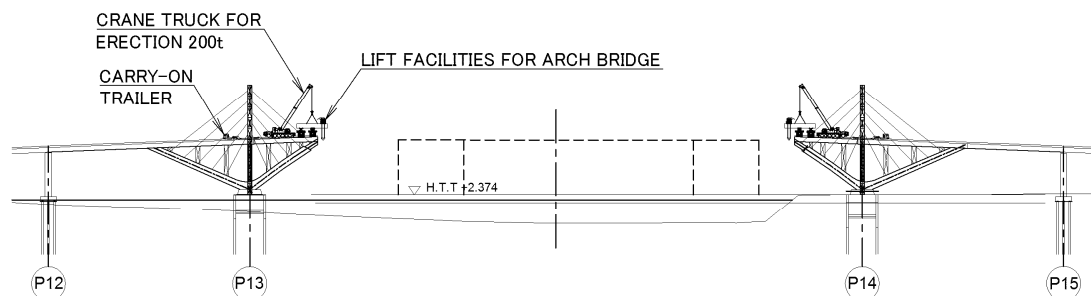
**b2.1. Superstructure**

**(1) Arch bridge end span (steel structure)**

Construction sequence of girder segments is shown in the below figure. Lohse arch of the main span is constructed by erecting the large arch block in the yard near the wharf. While constructing the arch bridge, large arch blocks are transported by barges and lifting method for installing these large arch blocks is planned. This method is suitable for erection of Nguyen Trai Bridge because time for riverbed occupancy is minimized.

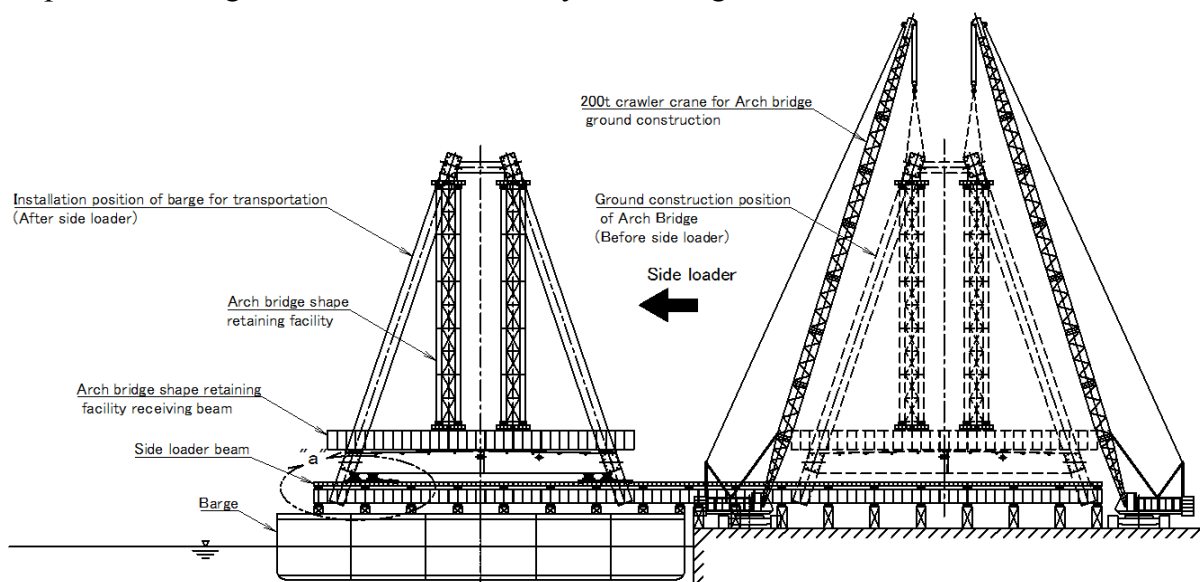
Large arch blocks can be erected during construction of V shape pylons; therefore, construction time can be shortened.

Step-1 Construction of steel girder for superstructure of V shape arch



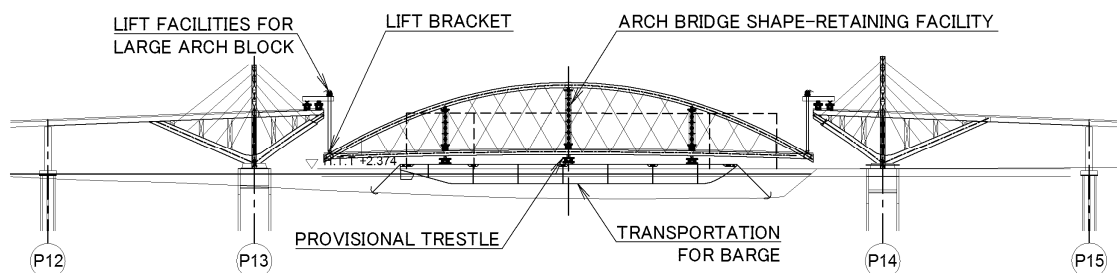
**Figure 1.20. Construction of steel girder for superstructure of V shape arch**

Step-2 Move large arch blocks from the yard to barges



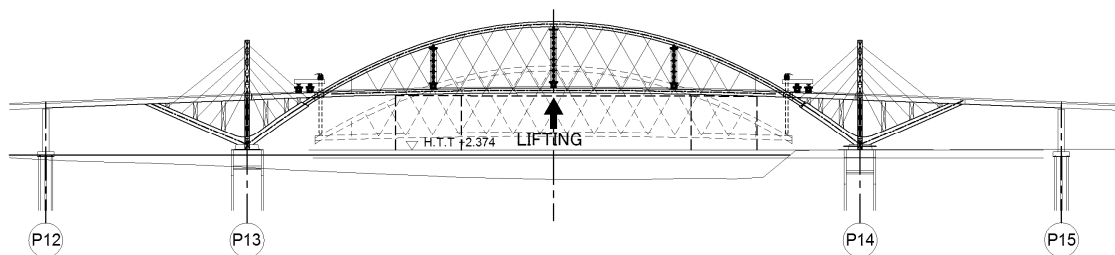
**Figure 1.21. Move large arch blocks from the yard to barges**

Step-3 Transportation of large arch blocks by barges and installation by lift jacks



**Figure 1.22. Transportation of large arch blocks by barges and installation by lift jacks**

Step-4 Lift large arch blocks, construction of pre-stressed reinforced concrete slabs



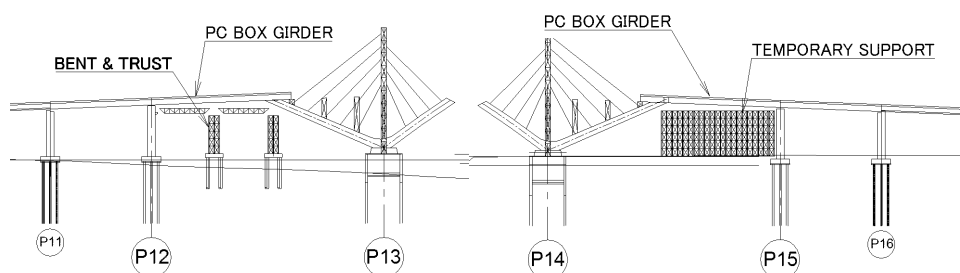
**Figure 1.23. Lift large arch blocks, construction of pre-stressed RC slabs**

**(2) End spans of arch bridge (pre-stressed RC box girder)**

To construct end spans, V- arch ribs are constructed by cantilever method and without provisional trestle for main spans.

Pre-stressed RC box girder of end spans of the arch bridge is constructed with temporary supports such as temporary pier or trust and trestle.

When the required compressive strength is reached, pre-stressed works can start with grouting works.



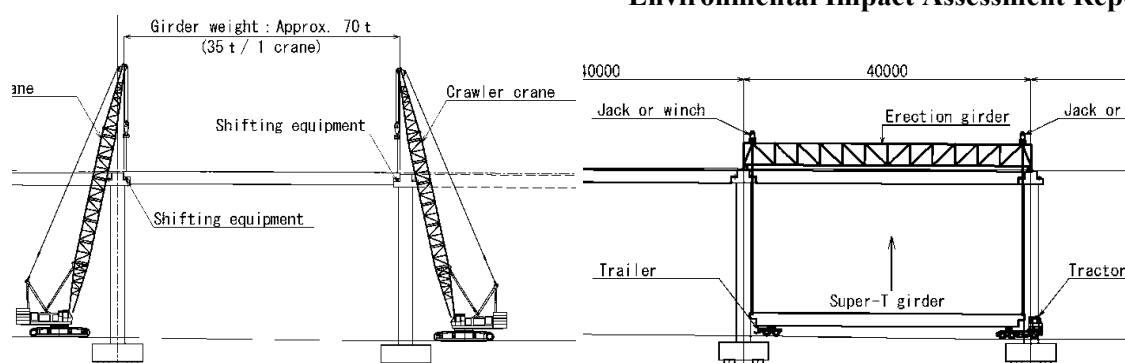
**Figure 1.24. Construction of end spans of arch bridge**

**(3) Approach bridge (Super-T girder)**

Super-T girders (L=38.3m and W= 70 tons) of approach bridge of Nguyen Trai 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.

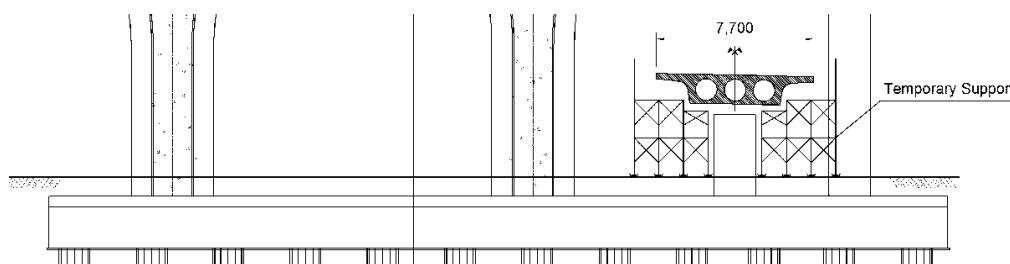




**Figure 1.25. Construction of approach bridge span (super T span)**

**(4) Approach bridge at interchange (Pre-stressed RC hollow slab girder)**

Pre-stressed RC hollow slab girder of approach bridge at interchange will be constructed with temporary support.



**Figure 1.26. Construction of approach bridge span (Pre-stressed RC hollow slab girder)**

**b2.2.3. 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 1.6.

**Table 1.6. Road construction quantities**

No.	Item	Unit	Quantity
1	Roadbed		
-	Soil excavation	m <sup>3</sup>	7,035
-	Embankment	m <sup>3</sup>	3,519
-	Embankment fill	m <sup>3</sup>	26,226
-	Surface soil excavation	m <sup>3</sup>	18,157
2	Road surface		
-	12cm asphalt treated base	m <sup>3</sup>	2,225
-	60cm Aggregate base	m <sup>3</sup>	10,005
-	Concrete mortar grade C25	m <sup>3</sup>	5,160

**b. Bridge construction quantities**

The bridge construction quantities are shown in Table 1.7.

**Table 1.7. Bridge construction quantities**

No.	Item	Unit	Quantity
<b>I</b>	<b>Nguyen Trai South Approach Bridge</b>		
<i>1</i>	<i>Surface treatment</i>		
-	Tack Coat	m <sup>2</sup>	11,248
-	Surface Course – 3.5cm (Bridge Section)	m <sup>2</sup>	11,248
-	Binder Course – 4.0cm (Bridge Section)	m <sup>2</sup>	11,248
<i>2</i>	<i>Steel Pipe Pile Foundation( <math>\phi = 0.9m</math>)</i>		
-	Structure Excavation Outside Cofferdam	m <sup>3</sup>	0
-	Structure Excavation Inside Cofferdam	m <sup>3</sup>	14,021
-	Structure Excavation Inside Piles and Joint Pipes	m <sup>3</sup>	5,584
-	Steel Pipe Pile SKK400	kg	2,306,800
<i>3</i>	<i>Concrete Structures</i>		
-	<i>Cast-in-place Concrete -Superstructure</i>		
+	Concrete C35 for Super-T Deck Slab and Cross Beam	m <sup>3</sup>	2,133
+	Concrete C25 for Guardrail Base at Shoulder and Median Block, light pole base	m <sup>3</sup>	225
-	<i>Cast-in-place Concrete -Substructure</i>		
+	Concrete C30A for Pier, Support Beam	m <sup>3</sup>	3,633
+	Concrete C30 for Pile Cap	m <sup>3</sup>	3,294
+	Concrete C10 for Blinding Concrete	m <sup>3</sup>	171
-	<i>Pre-cast Concrete</i>		
+	Concrete C50 for Super-T Girder(L40)	Nos.	91
+	Concrete C50 for Super-T Girder(L32)	Nos.	0
+	Concrete C50 for Super-T Girder(L36)	Nos.	20
+	Concrete C25 for Precast Concrete Curb	m	472
<i>4</i>	<i>Reinforcing Steel</i>		
-	Reinforcement Steel Bars SD390 for Superstructure	kg	543,638
-	Reinforcement Steel Bars SD390 for Substructure	kg	692,752
<i>5</i>	<i>Steel Structure</i>		
-	Steel box girder	ton	1,069
-	Erection Work of Steel Box Girder	ton	1,069
-	Composite Slab	m <sup>2</sup>	1,880
<i>6</i>	<i>Miscellaneous</i>		
-	Pot Bearing for Super-T	Nos.	26
-	Elastomeric Bearing for Super-T	Nos.	196
-	Expansion joint	m	71
-	Metal Bridge Railing at Shoulder	m	943
-	Metal Bridge Railing at Median	m	
-	Waterproofing Membrane	m <sup>2</sup>	11,248
-	Miscellaneous Metal	kg	1,344
-	Bridge Drainage	m	472
<i>7</i>	<i>Electrical Works</i>	m	472

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<b>No.</b>	<b>Item</b>	<b>Unit</b>	<b>Quantity</b>
<b>II</b>	<b>Ramp bridge at South of Nguyen Trai bridge</b>		
<i>1</i>	<i>Steel Pipe Pile Foundation( <math>\phi =0.9m</math>)</i>		
-	Structure Excavation Inside Cofferdam	m <sup>3</sup>	20,541
-	Structure Excavation Inside Piles and Joint Pipes	m <sup>3</sup>	6,172
-	Steel Pipe Pile SKK400	kg	2,549,600
<i>2</i>	<i>Concrete and Concrete Structures</i>		
-	Concrete C30-A for Piers and Abutment	m <sup>3</sup>	1,735
-	Concrete C30 for Pile Cap	m <sup>3</sup>	3,234
-	Concrete C10 for Blinding Concrete	m <sup>3</sup>	173
<i>3</i>	<i>Reinforcing Steel</i>		
-	Reinforcing Steel - SD390	kg	496,935
<i>4</i>	<i>Tack Coat 0.5kg/sq.m</i>	m <sup>2</sup>	8,554
<i>5</i>	<i>Coarse and fine grain Asphalt</i>		
-	Fine grain Asphalt for bridge, thickness 3.5cm	m <sup>2</sup>	8,554
-	Coarse grain Asphalt for bridge, thickness 4cm	m <sup>2</sup>	8,554
<i>6</i>	<i>Concrete Structures</i>		
-	Concrete C35 for Slab Girder	m <sup>3</sup>	7,177
-	Concrete C25 for Parapet including Lighting Pole Base	m <sup>3</sup>	245
-	Concrete C25 for handrail	m <sup>3</sup>	465
<i>7</i>	<i>Reinforcing Steel</i>		
-	Reinforcing Steel - SD390	kg	896,681
<i>8</i>	<i>Prestressing</i>		
-	Prestressing of Slab Girder, 4S15.2	kg	3,787.0
-	Prestressing of Girder, 12S12.7	kg	158,743.0
<i>9</i>	<i>Bridge Bearings</i>		
-	Elastomeric Bearing for slab Girder	nos	32
<i>10</i>	<i>Bridge Deck Joint Seal</i>		
-	Expansion Joint	m	80
<i>11</i>	<i>Railing</i>		
-	Railing steel	m	2,444
<i>12</i>	<i>Waterproofing</i>		
-	Deck Waterproofing Membrane	m <sup>2</sup>	8,554
<i>13</i>	<i>Bridge Drainage</i>	m	1,222
<i>14</i>	<i>Electrical Works</i>	m	1,222
<b>III</b>	<b>Nguyen Trai main bridge</b>		
<i>1</i>	<i>Pavements</i>		
-	Tack Coat	m <sup>2</sup>	11,322.0
-	Asphalt Surface Course – 3.5cm (Bridge Section)	m <sup>2</sup>	11,090.0
-	Asphalt Binder Course – 4.0cm (Bridge Section)	m <sup>2</sup>	11,090.0
<i>2</i>	<i>Concrete structures</i>		
-	Concrete C40 for Box Girder	m <sup>3</sup>	2,650.0
-	Concrete C40 for V Pier	m <sup>3</sup>	1,660.0
-	Concrete C25 for Sidewalk (Main Bridge), Guardrail Base at Shoulder and Median Block	m <sup>3</sup>	90.0
-	Concrete C25 for Top Slab	m <sup>3</sup>	3,715.8
-	Concrete C20 for Bottom Slab	m <sup>3</sup>	1,182.5

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<b>No.</b>	<b>Item</b>	<b>Unit</b>	<b>Quantity</b>
-	Concrete C30 for Pile Cap	m <sup>3</sup>	1,041.8
-	Concrete C30A for Pier, Support Beam	m <sup>3</sup>	3,064.2
-	Concrete C40 for Precast Concrete Deck Panel (RC)	m <sup>2</sup>	6,455.0
-	Concrete C40 for Precast Concrete Deck Panel	m <sup>3</sup>	136.0
-	Concrete C25 for Precast Concrete Curb	m	464.0
-	Concrete C10 for Blinding Concrete	m <sup>3</sup>	36
3	<i>Reinforcing Steel</i>		
-	Reinforcement Steel Bars SD390 (Arch)	kg	925,000
-	Reinforcement Steel Bars SD390 (Substructure)	kg	1,017,761
4	<i>Prestressing</i>		
-	Prestressing of PC Box Girder, SWPR7B S15.2B	kg	90,019.0
-	Longitudinal Prestressing of Concrete Deck	kg	27,066.0
5	<i>Steel Structure</i>		
-	Fabrication of Steel Arch girder	ton	4,718.3
-	Erection works of Steel Arch	ton	3,150.7
-	High Strength Bolt F10T/S10T for Main Bridge girder	kg	169,859
6	<i>Bridge Bearing and Joint</i>		
-	Elastomeric Bearing for P12 and P13	nos	4.0
-	Modular Bridge Joint System at P12, P13	m	55.2
7	<i>Miscellaneous works</i>		
-	Metal Railing at Shoulder (Main Bridge)	m	928.0
-	Metal Railing at Median	m	0.0
-	Waterproofing Membrane	m <sup>2</sup>	11,322.0
-	Inspection ladder	m	464.0
-	Prevention equipment for ship impact	m <sup>3</sup>	1,200.0
8	<i>Steel Pipe Sheet Pile Foundation( <math>\phi = 1.0m</math>)</i>		
-	Structure Excavation Inside Piles and Joint Pipes	m <sup>3</sup>	5,247.2
-	Steel Pipe Sheet Pile SKY490	kg	2,759,900.0
-	Joint pipe of Steel Pipe Sheet Pile	kg	524,000.0
9	<i>Steel Pipe Pile Foundation( <math>\phi = 0.9m</math>)</i>		
-	Structure Excavation Inside Cofferdam	m <sup>3</sup>	3,456.6
-	Structure Excavation Inside Piles	m <sup>3</sup>	1,281.6
-	Steel Pipe Pile SKK400	kg	529,900.0
10	<i>Stay Cable</i>		
-	Installation of Stay cable	ton	55.9
-	Tensioning of Stay cable	ton	55.9
-	Installation and Removal of Scaffolding for Stay Cable Work	set	60.0
-	Stay Cable Damping Devices	Nos	60.0
11	<i>Bridge Drainage</i>	m	464.0
<b>IV</b>	<b>Nguyen Trai North Approach Bridge</b>		
1	<i>Surface treatment</i>		
-	Tack Coat	m <sup>2</sup>	10,288
-	Surface Course – 3.5cm (Bridge Section)	m <sup>2</sup>	10,288
-	Binder Course – 4.0cm (Bridge Section)	m <sup>2</sup>	10,288
2	<i>Steel Pipe Pile Foundation( <math>\phi = 0.9m</math>)</i>		

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<b>No.</b>	<b>Item</b>	<b>Unit</b>	<b>Quantity</b>
-	Structure Excavation Outside Cofferdam	m <sup>3</sup>	0
-	Structure Excavation Inside Cofferdam	m <sup>3</sup>	12,973
-	Structure Excavation Inside Piles and Joint Pipes	m <sup>3</sup>	5,009
-	Steel Pipe Pile SKK400	kg	1,875,000
3	<i>Concrete Structures</i>		
-	<b><i>Cast-in-place Concrete -Superstructure</i></b>		
+	Concrete C35 for Super-T Deck Slab and Cross Beam	m <sup>3</sup>	2,322
+	Concrete C25 for Guardrail Base at Shoulder and Median Block, light pole base	m <sup>3</sup>	223
-	<i>Cast-in-place Concrete -Substructure</i>		
+	Concrete C30A for Pier, Support Beam, Abut	m <sup>3</sup>	3,530
+	Concrete C25 for Pile Cap	m <sup>3</sup>	2,916
+	Concrete C10 for Blinding Concrete	m <sup>3</sup>	152
-	<i>Pre-cast Concrete</i>		
+	Concrete C50 for Super-T Girder(L40)	nos	100
+	Concrete C50 for Super-T Girder(L34)	nos	20
+	Concrete C25 for Precast Concrete Curb	m	468
4	<i>Reinforcing Steel</i>		
-	Reinforcement Steel Bars SD390 for Superstructure	kg	589,807
-	Reinforcement Steel Bars SD390 for Substructure	kg	644,664
5	<i>Miscellaneous</i>		
-	Pot Bearing for Super-T	nos	20
-	Elastomeric Bearing for Super-T	nos	220
-	Expansion joint	m	24
-	Metal Bridge Railing at Shoulder	m	935
-	Metal Bridge Railing at Median	m	
-	Waterproofing Membrane	m <sup>2</sup>	10,288
-	Miscellaneous Metal	kg	1,344
-	Bridge Drainage	m	468
6	<i>Electrical Works</i>	m	468

### 1.4.4. Construction machinery and equipment

The list of major machinery and equipment expected to be used in construction is presented in Table 1.8 and Table 1.9.

**Table 1.8. Road construction machinery and equipment**

No.	Construction equipment	Unit	Quantity
1	110CV bulldozers	shift	5,446
2	110CV graders	shift	19
3	10-ton trucks	shift	5,284
4	5m <sup>3</sup> water tank trucks	shift	91
5	Air compressor 600m <sup>3</sup> /h	shift	113
6	1.6m <sup>3</sup> excavators	shift	102
7	16-ton tire rollers	shift	660
8	25-ton tire rollers	shift	157
9	50-60m <sup>3</sup> /h spreaders	shift	27
10	25-ton vibrating rollers	shift	91
11	10-ton steel-tired rollers	shift	367
12	130CV ÷ 140CV spreaders	shift	87
13	2.3m <sup>3</sup> tilt loaders	shift	140
	<b>Total</b>	shift	<b>12,584</b>

**Table 1.9. Bridge construction machinery and equipment**

No.	Construction equipment	Unit	Quantity
1	Pneumatic hammer	shift	264
2	BP170 pile hammers	shift	1466
3	Truck Crane 16T	shift	582
4	Truck Crane 25T	shift	5144
5	Truck Crane 100T	shift	480
6	Truck Crane 200T	shift	480
7	250T jack	shift	182
8	Concrete Pump 50m <sup>3</sup> /h	shift	3920
9	Water Pump 14KW (200m <sup>3</sup> /h)	shift	991
10	Water Pump 20KW	shift	252
11	Water Pump 6,5KW	shift	98
12	9m <sup>3</sup> mortar pump	shift	329
13	10kW wirerope cutter	shift	597
14	1.7KW handheld wire cutter	shift	1823

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<b>No.</b>	<b>Construction equipment</b>	<b>Unit</b>	<b>Quantity</b>
15	5KW wire cutting & bending machine	shift	4923
16	16-ton tire rollers	shift	6
17	Tampers	shift	1121
18	1.5KW needle vibrator	shift	5827
19	2.8KW needle vibrator	shift	988
20	10-ton steel-tired rollers	shift	7
21	Crawler Excavator 1.6m <sup>3</sup>	shift	131
22	23KW welding machine	shift	22495
23	300m <sup>3</sup> /h diesel air compressor	shift	186
24	Diesel Air compressors with capacity of 360m <sup>3</sup> /h	shift	106
25	Diesel Air compressors with capacity of 600m <sup>3</sup> /h	shift	621
26	130CV ÷ 140CV spreaders	shift	6
27	110 CV bulldozers	shift	387
28	0,8T crane	shift	94
29	1.25m <sup>3</sup> excavators	shift	716
30	10,7m <sup>3</sup> mixing trucks	shift	3417
31	10-ton trucks	shift	2234
33	150CV carrying ships	shift	563
34	5T electrical hoist	shift	67
35	200T Barges	shift	1649
36	400T Barges	shift	1008
	<b>Total</b>	shift	63163

**1.4.5. Materials, fuel (input) and the products (output) in the preparation phase and construction phase**

***a. Materials, fuel (input)***

***a1. Gasoline, oil***

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

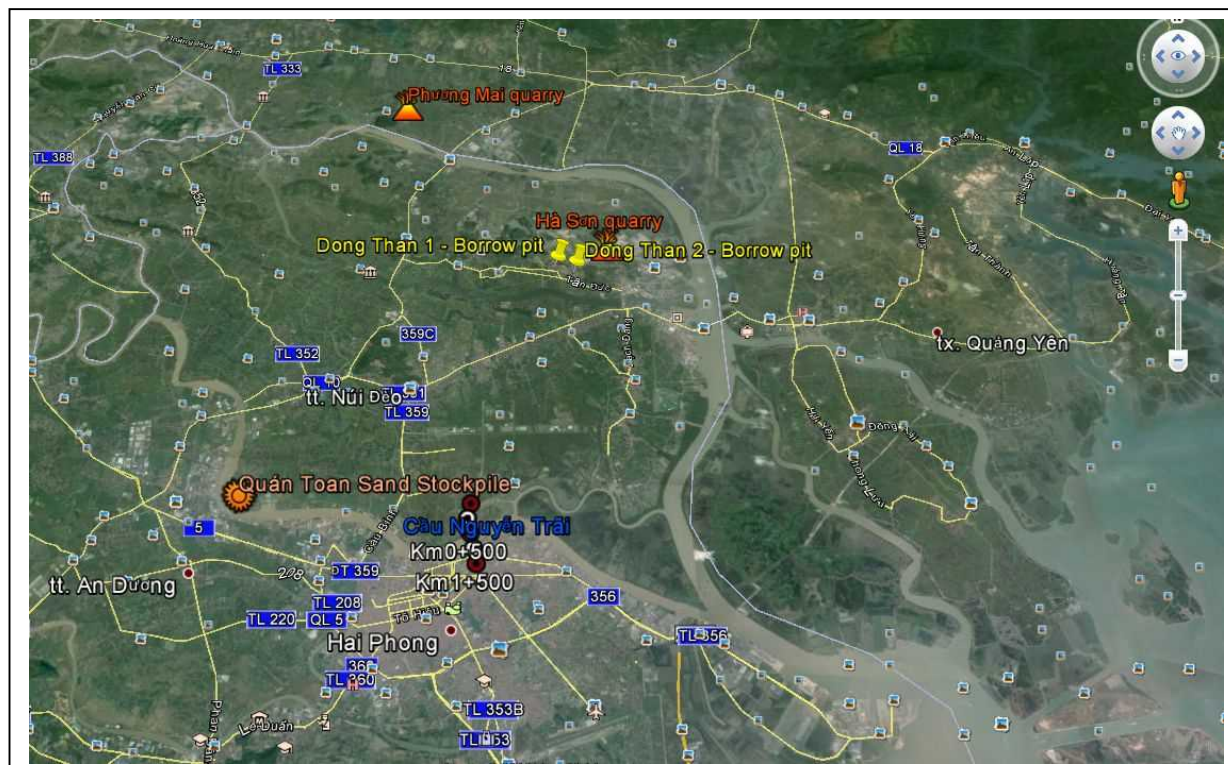
***a2. Construction Materials***

Materials such as soil, rock and sand for construction of bridges and roads were purchased at active material pits in the area near the Project, which shown in Table 1.10 and figure 1.27.



**Table 1.10. Material Pits tentatively supplied to the project**

No.	Name	Location	Quantity (million m <sup>3</sup> )	Materials transport road	Closest distance
<b>I Borrow pit</b>					
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	18km
2	Dong Than 2	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	
<b>II Quarry</b>					
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	17km
2	Phuong Mai	Phuong Nam commune, Uong Bi town, Quang Ninh province (near Da Bac bridge)	1,0	• Waterway: Bach Dang river, Cam river	35km
<b>III Sand Stockpile</b>					
1	Quan Toan	On the Cam river, at Quan Toan area, Hai Phong city	Big quantity	Waterway: Cam river	8km



**Figure 1.27. 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. In case of difficulties, power generators may be arranged on site.

**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 in the letter

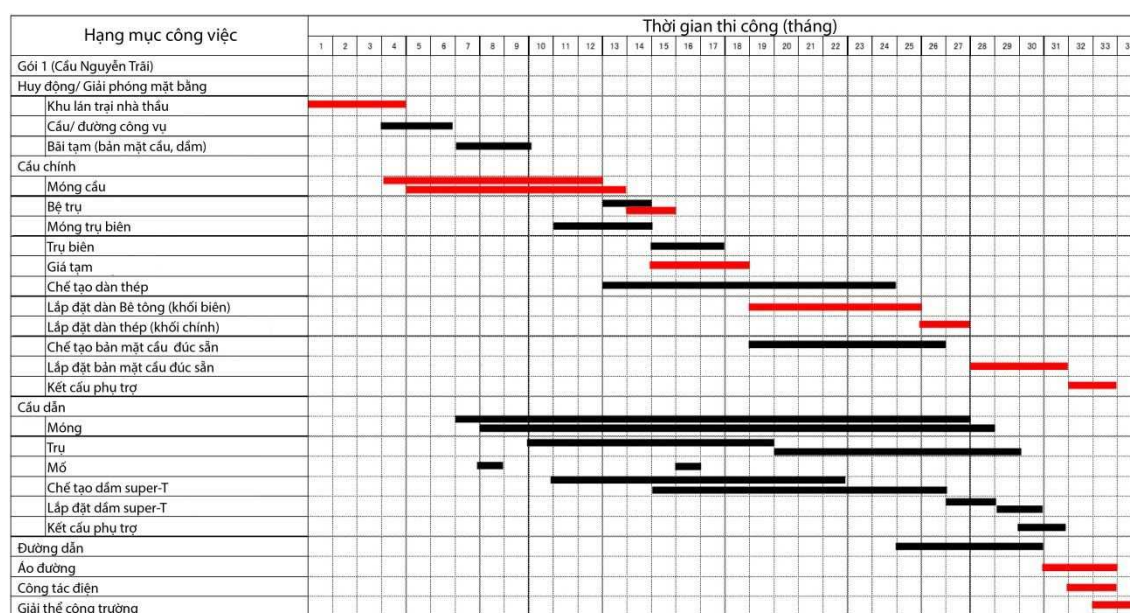
No.15/TN-KH dated 08/7/2016 (see more details in Appendix 5).

The volume of solid waste generated by the Project shall be received on the disposal of the Hai Phong Urban Environment Company Limited as in the letter No. 432/CV-MTDT dated 07/7/2016.

### 1.4.6. Project schedule

The construction period for Nguyen Trai Bridge: 34 months; details are presented in the table 1.11

**Table 1.11. Tentative construction schedule of Nguyen Trai Bridge**



### 1.4.7. Investment costs

The total investments of the Project is shown in Table 1.12.

**Table 1.12. The total investments of the Project**

No.	Items	Amount	
		F/C	L/C
		Million JPY	Million VND
<b>I</b>	<b>ODA funded portion</b>	<b>24,815</b>	<b>4,519,094</b>
1	Construction cost	16,295	2,967,460
2	Price escalation	3,425	623,732
3	Physical contingency	1,972	359,119
4	Consulting services	3,027	551,265
5	Interest during construction	96	17,518
<b>II</b>	<b>State budget portion</b>	<b>9,533</b>	<b>1,736,027</b>
1	Land acquisition	4,910	894,248

No.	Items	Amount	
		F/C	L/C
		Million JPY	Million VND
2	Administration cost	1,481	269,791
	In which, environmental monitoring and management costs		3,092
3	VAT	2,169	395,031
4	Import tax	922	167,918
5	Pre-paid costs	50	9,038
	<b>Total (A+B)</b>	<b>34,347</b>	<b>6,255,121</b>

#### **1.4.8. Organizational management and implementation of the Project**

##### ***a. Construction preparation phase and construction phase***

The Project Owner of the Nguyen Trai Bridge Construction Project is People's Committee of Hai Phong city. In particular, the Hai Phong 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 Bridge Projects Management Department and is responsible for timely handling matters beyond the competence of the Hai Phong 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 1.28.

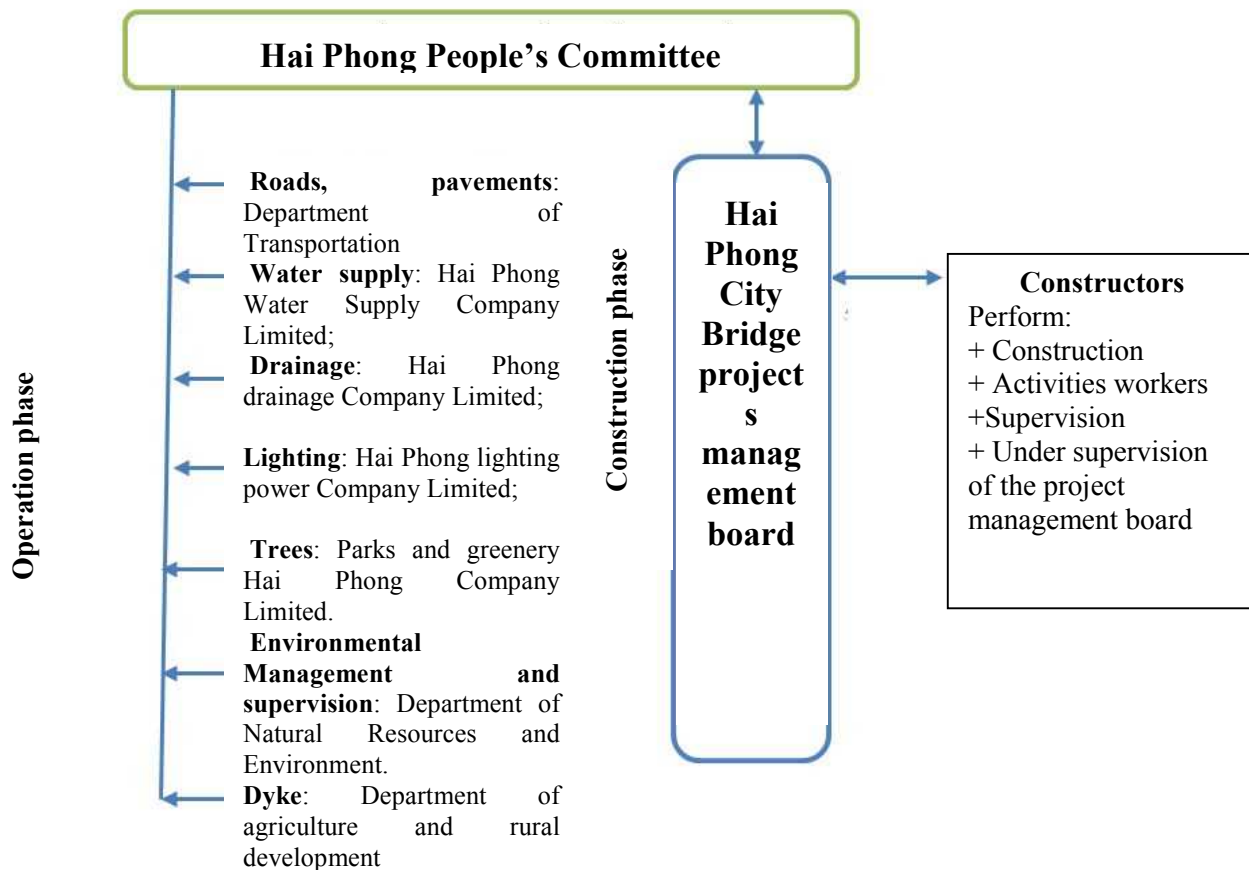


Figure 1.28. Management diagram

## 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

Nguyen Trai Bridge located in May To Ward, Ngo Quyen District and Duong Quan Commune, Thuy Nguyen District.

##### Geography of the project area

The project locates in the districts of Ngo Quyen and Thuy Nguyen, 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 approaching road in the South of Nguyen Trai bridge coincides with Nguyen Trai street, 2 sides of the road are crowded residential areas; the approaching road in the North runs through the area of aquaculture facilities.

*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 uppwe 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***

Based on drill results in Nguyen Trai bridge (see Figure 2.1), the stratigraphic layers top-down include:

- Melted - semi-hard fluvial alluvial cohesive soil layer, having dark gray, green-gray,

tan, sepia, or light gray color with thickness of 19 ÷ 39m.

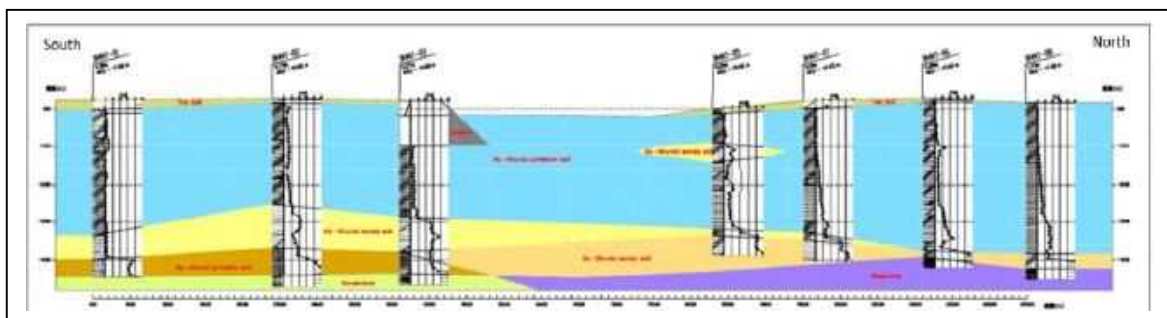
- Discrete - tight fluvial alluvial sand layer, having dark gray color with a thickness of 2 ÷ 12m.

- Medium tight - tight diluvium sand layer, having dark gray and gray color with thickness of 4 ÷ 5.4 m.

- Medium tight - tight diluvium pebble gravel layer, having dark gray and light gray color with thickness of 6 ÷ 7m.

- Medium hard - hard sandstone sandstone layer, having dark gray color with thickness of 2 - 3 m

- Medium hard - hard pelite layer, having sepia color with thickness of 3 ÷ 3.2m.



**Figure 2.1. Stratigraphic features of rock stratum in Nguyen Trai bridge 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.

Geographical 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 work; bearing capacity of the soil, potential risks like subsidence, 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 meteorological 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**

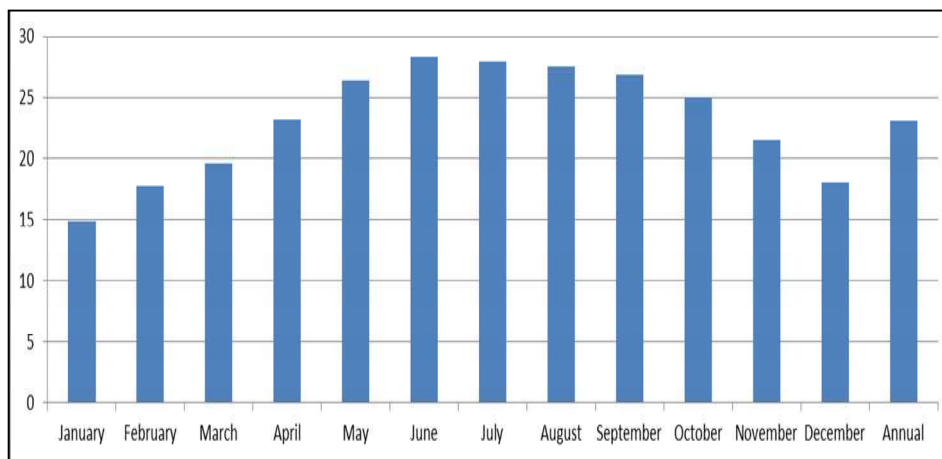
(Unit: °C)

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

<b>Month</b>	<b>2008</b>	<b>2009</b>	<b>2010</b>	<b>2011</b>	<b>2012</b>	<b>2013</b>	<b>Average</b>
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.

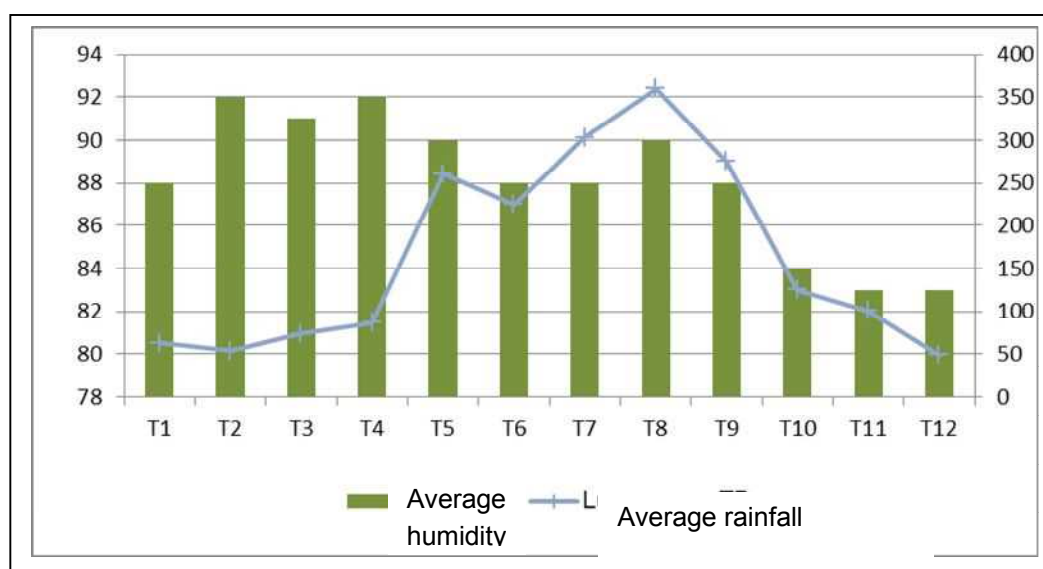
Dry season: each month has only a few rainy days on average, mostly light rain and drizzle. The lowest rainfall falls in of November, December, January and February.

**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)

Stat ion	Month												Annu al
	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/cm<sup>2</sup>); (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 ( $h_o > 60^\circ$ )	Medium ( $h_o = 35^\circ \div 60^\circ$ )	Light ( $h_o = 15^\circ \div 35^\circ$ )	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 Kinh 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<sup>3</sup>/h with silt content of 3.9kg/cm<sup>3</sup>.

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<sup>3</sup>/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 Kanh 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 2.4 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 recipients.



**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 south side of Nguyen Trai Bridge (6-way intersection - May To Ward)	NT-KK1, NT-O1, NT-R1	20°52'50"N 106°41'24"E	Sunny	8/2015	Crowded residential area at 6-way intersection, residential houses are on two sides of Nguyen Trai Street
(2)	The north side of Nguyen Trai Bridge (at the connection to the existing VSIP road)	NT-KK2, NT-O2, NT-R2	20°51'52"N 106°41'42"E	Sunny	8/2015	The surrounding area is aquaculture pond
2.	Surface water					
(1)	Upstream side of Nguyen Trai Bridge (on Cam River) during the rising tide	NT-Nm1	20°52'10"N 106°41'25"E	Sunny	8/2015	Boats are moving on Cam River. On the south bank of Cam River there is Hoang Dieu Port
(2)	Downstream side of Nguyen Trai Bridge (on Cam River) during the rising tide	NT-Nm2	20°52'20"N 106°41'42"E	Sunny	8/2015	As above
(3)	Upstream side of Nguyen Trai Bridge (on Cam River) during the neap tide	NT-Nm3	20°52'10"N 106°41'29"E	Sunny	8/2015	As above
(4)	Downstream side of Nguyen Trai bridge (on Cam river) during the neap tide	NT-Nm4	20°52'22"N 106°41'43"E	Sunny	8/2015	As above
3.	Underground water					
(1)	Residential area of May Chai Ward, near the south end of Nguyen Trai Street	NT-Nn1	21°51'50"N 106°41'49"E		8/2015	Residential area



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

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 2.6. 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/m <sup>3</sup> )				
				TSP	PM10	SO <sub>2</sub>	NO <sub>2</sub>	CO
I	Nguyen Trai bridge							
1	NT-KK1	The south side of Nguyen Trai Bridge (6-way intersection - May To Ward)	24h	155	132	73	94	1938
2	NT-KK2	The north side of Nguyen Trai Bridge (at the connection to current VSIP road)	24h	77	62	24	31	952
	QCVN 05:2013/BTNMT		24h	200	150	125	100	-

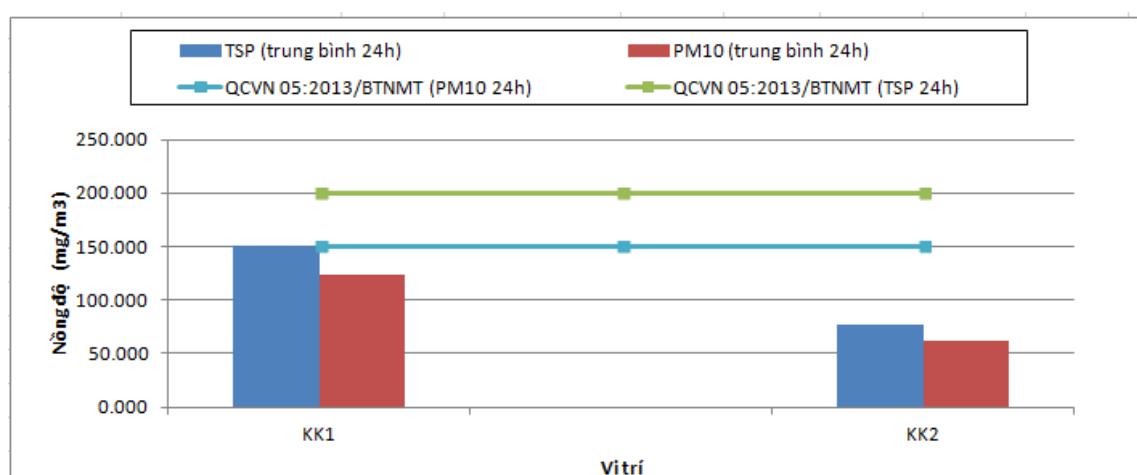


Figure 2.5. TSP and PM10 contents in the air

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

- Total suspended particulates (TSP) and PM10: TSP and PM10 contents at the South of Nguyen Trai bridge (NT-KK1) reach the permissible limit. Truck flow on Le Thanh Tong and adjacent roads may be reasons for high contents of TSP and PM10 at this location.
- Concentrations of SO<sub>2</sub>, NO<sub>2</sub>:

At all 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

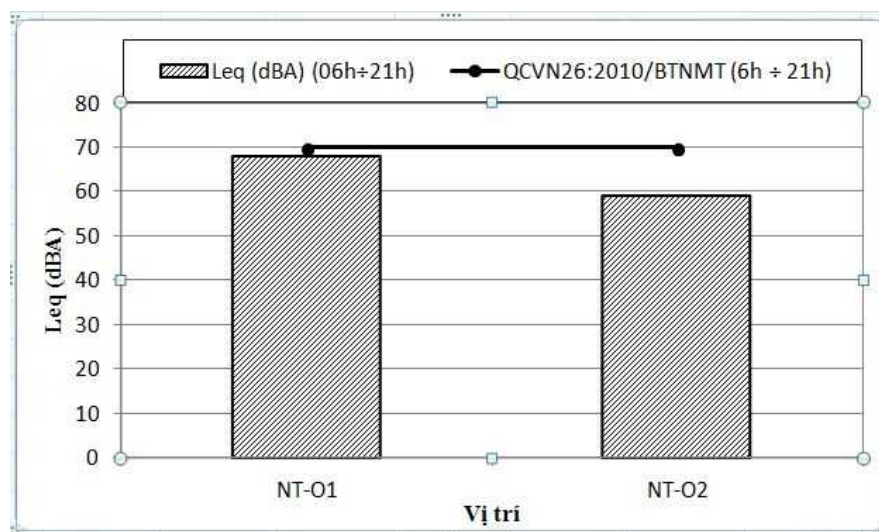
QCVN 26:2010/BTNMT, National Technical Regulations on Noise.

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 <sub>Aeq</sub>
<b>I</b>	<b>Nguyen Trai bridge</b>		<b>6h – 21h</b>	
1	NT-O1	The south side of Nguyen Trai Bridge (6-way intersection - May To Ward)		67,8
2	NT-O2	The north side of Nguyen Trai Bridge (at the connection to current VSIP road)		58,9
<b>QCVN 26:2010/BTNMT</b>				<b>70</b>



**Figure 2.6. Status noise level of the Project area**

Comparing with QCVN 26:2010/BTNMT has shown noise level measured at the South of Nguyen Trai Bridge (NT-O1) reaches the allowable limit. Truck traffic volume on Le Thanh Ton Street may be considered as main contributor to this high noise level.

2.1.4.3. *Vibration level*

**a. Basis for comparison**

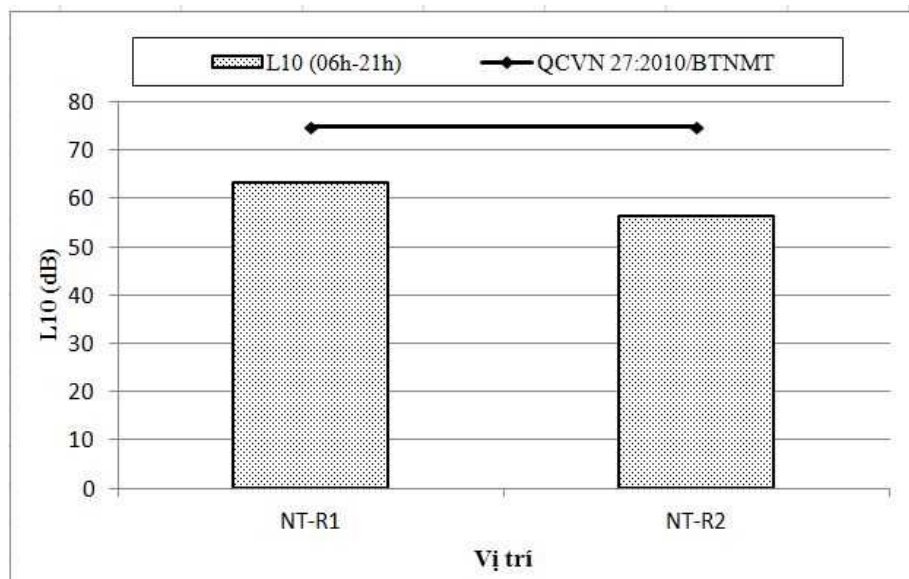
QCVN 27:2010/BTNMT – National Technical Regulations on Vibration.

**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 <sub>10</sub>
<b>I</b>	<b>Nguyen Trai bridge</b>			
1	NT-R1	The south side of Nguyen Trai Bridge (6-way intersection - May To Ward)		63.0
2	NT-R2	The north side of Nguyen Trai Bridge (at the connection to the existing VSIP road)		56.1
	<b>QCVN 27:2010/BTNMT</b>			<b>75</b>



**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°C	pH	DO	BOD5 (mg/L)	SS (mg/L)	Coliform (MPN/100mL)
(1)	Upstream side of Nguyen Trai Bridge (on Cam River)	NT-Nm1	Up	30.5	7.3	4	10	3	1000
(2)	Downstream side of Nguyen Trai Bridge (on Cam River)	NT-Nm2	Up	30.1	7.1	5	6	3	800
(3)	Upstream side of Nguyen Trai Bridge (on Cam River)	NT-Nm3	Down	31.2	7.3	5	9	4	900
(4)	Downstream side of Nguyen Trai bridge (on Cam river)	NT-Nm4	Down	30.8	7.2	5	5	4	700
<b>QCVN 08-MT:2015/BTNMT (B1)</b>				-	<b>5.5 - 9</b>	<b>≥ 4</b>	<b>15</b>	<b>50</b>	<b>7500</b>
<b>QCVN 08-MT:2015/BTNMT (B2)</b>				-	<b>5.5 - 9</b>	<b>≥ 2</b>	<b>25</b>	<b>100</b>	<b>10000</b>

*Note: QCVN 08:2008/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<sub>5</sub>), DO values at locations on Cam river meet B1 water standard; and BOD at all locations satisfies 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 2 - Report of Natural Environmental Baseline Survey.

**Table 2.11. Summary of underground water quality analysis results**

No.	Location	Sample sign	Temp (°C)	pH	Conductivity (MS/m)	BOD (mg/l)	Coliform (100ml)	Depth of well (m)
(1)	Residential area of May Chai Ward, near the south end of Nguyen Trai Street	NT-Nn1	28.5	6.7	23.4	4	KPH	6
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 according to QCVN 09-MT:2015/BTNMT;
- Coliform is within the permissible limit according to QCVN 09-MT: 2015/BTNMT.

### 2.1.4.6. Soil quality

According to analysis results of soil quality in the EIA report of Hai Phong political and administrative center infrastructure construction and investment project in 2015 is presented in the table 2.12.

**Table 2.12. Soil quality in the project area**

No.	Analyzed parameters	Unit	results					QCVN 03:2008/BTNMT	
			Đ1	Đ2	Đ3	Đ4	Đ5	Đất NN	Đất CN
1	As	mg/kg	3.432	2.852	3.064	2.494	2.608	12	12
2	Cd	mg/kg	0.601	0.450	0.651	0.503	0.552	2	10
3	Cu	mg/kg	17.95	18.50	29.45	25.75	24.65	50	100
4	Pb	mg/kg	37.95	21.50	27.35	30.70	20.80	70	300
5	Zn	mg/kg	30.80	24.35	44.45	31.05	33.25	200	300
6	pH	-	7.89	3.15	5.19	4.33	4.28		

Notes:

- Đ1: Soil sample at rice farming land of Hoa Dong commune;
- Đ2: Soil sample at swamp areas to be renovated to lakes;
- Đ3: Soil sample at swamp areas Tan Duong commune;
- Đ4: Soil sample at hamlet 4, Tan Duong commune;
- Đ5: Soil sample at Huu Quan village, Duong Quan commune.

Comparing with QCVN 03:2008/BTNMT- National Technical Regulations on permissible limit of heavy metals in ground – applicable to residential land, agricultural, forestry, industrial lands: almost criteria are within the permissible limit.

**2.1.4.7. Sediment quality**

According to analysis results of sediment quality on Cam River in the area of Binh Bridge, in the EIA report of Hai Phong political and administrative center infrastructure construction and investment project in 2015 is presented in the table 2.13.

**Table 2.13. Analysis results of sediment in the project area**

No.	Analysis parameters	Unit	TT1	QCVN 43:2012/BTNMT (Sediment in fresh water)
1	As	mg/kg	3.517	17.0
2	Cd	mg/kg	0.75	3.5
3	Cu	mg/kg	41.90	197
4	Pb	mg/kg	62.05	91.3
5	Zn	mg/kg	51.95	315

Notes:

- TT1: sediment sample in the area of Binh Bridge, Hoa Dong commune.

The analysis results have shown heavy metals in sediment of Cam river are within the permissible limit in comparison with QCVN 43:2012/BTNMT.

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

The bridge is planned to be located on straight segment of Cam River so that impacts of the bridge to the river flow regime and river dynamic regime are minimized. Since the approach road of Nguyen Trai Bridge coincides with Nguyen Trai Street, the scope of site clearance and resettlement is also minimized.



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. The bridges are 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.

## **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 results are incorporated in Appendix 1.

### ***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 *tracheophyta families* belonging to *Pteridophyta* and *Angiospermae* (see also Table 1 of Appendix 1). 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*, *Oleaceae*, *Schizaceae*, 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 *Thespesia populnea* and some other crops such as *Casuarina equisetifolia*, *Terminalia catappa*, *Muntingia calabura*, *Eucalyptus camphora*, *Khaya seneganiensis*, *Melia azedarach*, *Delonix regia* and *Acacia mangium*, etc.

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

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 river.

## 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 1*).

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 1). 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 1) 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 *Bufo* 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 1) 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 North of Nguyen Trai Bridge, 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 was 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**

In the survey area, there are 87 species of phytoplankton falling into 4 algae divisions including: *Bacillariophyta*, *Chlorophyta*, *Cyanophyta* and *Euglenophyta* (Table 5 of Appendix 1). Among them, *Bacillariophyta* has the highest number of species (39 species, accounting for 44.8%), followed by *Chlorophyta* (25 species, accounting for 28.8%), *Euglenophyta* (13 species, accounting for 14.9%), and finally *Cyanophyta* (10 species, accounting for 11.5%).

The density of phytoplankton in the area around Nguyen Trai Bridge ranges from 1417.5 Tb/l to 4422.6 Tb/l, i.e. 2721.6 Tb/l on average. *Bacillariophyta* has the highest average density of phytoplankton (41%), followed by *Cyanophyta* (31%), *Chlorophyta* (23%) and finally *Euglenophyta* (5%).

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 54 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 1). Among them, *Cladocera* has the highest number of species (22 species, accounting for 40.7%), followed by

*Copepoda* (16 species, accounting for 29.6%), *Rotatoria* (12 species, accounting for 22.3 %), and other groups (4 species, taking 7.4%).

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.

The density of zooplankton in Nguyen Trai Bridge area ranges from 29 to 7694 zooplankton/m<sup>3</sup>, i.e. 1464.2 zooplankton/m<sup>3</sup> on average. *Copepoda* has the highest average density of zooplankton (43%), followed by *Cladocera* (25%), *Rotatoria* (28%) and other groups (4%).

### **c. Zoobenthos**

30 species of zoobenthos of *Mollusca*, *Arthropoda* (*Crustacea* - *Decapoda*) and insect groups have been identified at the planned bridge construction sites (*Table 7 of Appendix 1*). Among them, *Mollusca*, *Bivalvia* (4 species, accounting for 13.3%), and *Gastropoda* (14 species, accounting for 46.7%). *Arthropoda*, *Crustacea* (5 species, accounting for 16.7%) and Insect (7 species, accounting for 23.3%).

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<sup>2</sup>, i.e. 21.9 zoobenthos/m<sup>2</sup> on average. Zoobenthos biomass ranges from 4.15 to 16.96 g/m<sup>2</sup>, i.e. 18.04 g/m<sup>2</sup> on average. *Gastropoda* and *Bivalvia* have the highest average density among zoobenthos. Other groups have insignificant density.

### **d. Flora**

The project is planned to pass through a number of residential areas, aquaculture ponds, and mangrove forests along Cam River. There are about 181 species of plants (*Table 1 of Appendix 1*) 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:*

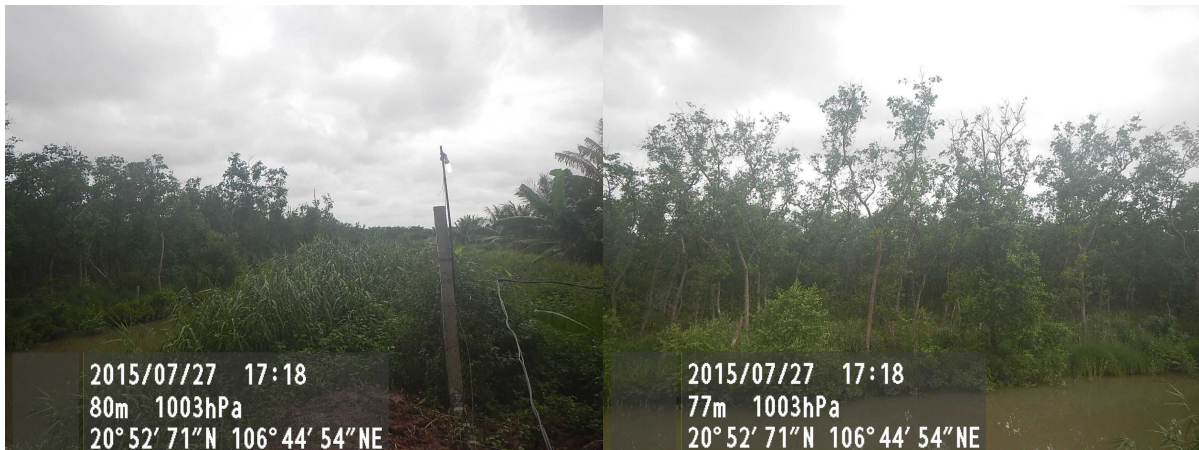
- *Sonneratia caseolaris* (with *Acanthus ilicifolius* growing under its canopy) dominates in the community of brackish water plants on the river banks of Ruot Lon River, Cam River and other rivers. *Sonneratia caseolaris* can be found even at the location 30 km far away from the seashore. *Sonneratia caseolaris* is the main vegetation growing in the areas (totally about 1.2 ha) affected by the construction of Nguyen Trai Bridges. It is estimated the occupied area is about 0.18ha 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 Cam and Ruot Lon Rivers**

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 1*).

**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 density (*Table 6, 7, 8 – Appendix 1*).

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 Cam, Ruot Lon Rivers and on Vu Yen Island.

## 2.2. Social and economic conditions

### 2.2.1. Social and economic conditions of Hai Phong city<sup>1</sup>

Hai Phong has a total natural area of 1,527.4 km<sup>2</sup> 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<sup>2</sup>.

#### 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-

<sup>1</sup> - 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 Northern aquaculture processing and production. Logistics for aquaculture are focused, strengthened and extended.

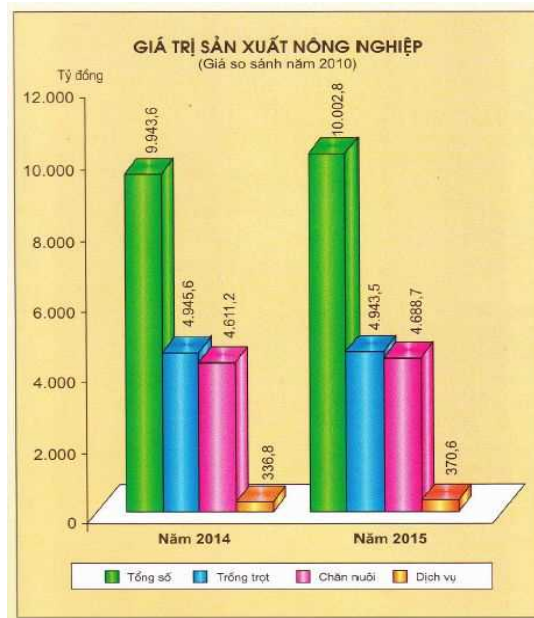


Figure 2.8. Agricultural production in Hai Phong City in 2015

**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 7<sup>th</sup> in production value in the country and ranking 3<sup>rd</sup> 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 2<sup>nd</sup> 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<sup>2</sup>***

##### **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<sup>2</sup>. 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 billion VND. Agriculture - fisheries sector accounted for 17.8%, industry & construction sector 48.1%, service sector 34.1%.

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<sup>2</sup> - Report on realizing socio-economic development mission in 2015 of Thuy Nguyen District People's Committee

- 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 m<sup>3</sup>, 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 Road No.10 is the main route connecting National Road No.5 and National Road No.18. Besides, Provincial Roads No.351, 352, and 359 have been completed. In addition, many inter-village and inter-commune roads have been concretized 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 uses 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. Ngo Quyen district<sup>3</sup>**

**a. Population and Labor**

Ngo Quyen district is home to around 158,674 people, of which about 49.3% is male and 50.7% is female. Natural population growth rate accounts for about 0.62%. Population density reaches about 14,165 people/km<sup>2</sup>.

**b. Economy**

Ngo Quyen district is the center of economy, industry and services of Hai Phong city. Economic activities in the district are dynamically carried out. In 2015, total production value of all sectors in Ngo Quyen district reached 3,220 billion VND. In particular, industry accounted for 1,082 billion VND, trade-service - 2,138 billion VND. There are more than 2,000 enterprises and more than 8,000 business households, and several commercial centers and large wholesale markets such as Big C supermarket, Intimex supermarket, TD Plaza, Cat Bi Plaza in the district.

**c. Infrastructure**

Road traffic in the district is relatively fully worked-out system with urban roads. All roads have been quipped with drainage system and lighting system. Currently, the district continues to develop road traffic system through projects of interchange construction and route expansion.

Cam river is the major waterway route playing very important role in economic activities and seaport services. This is the main circulation route for vessels and boats to land Hoang Dieu and Hai An ports for trading purpose.

Electric network for domestic use and for business purpose is installed in all residential areas in the district

All residential areas in the district are provided with clean water.

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<sup>3</sup> - 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**

Education and training quality has been improved; there are 2 schools meeting standard of level 2 among 8 schools.

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. Census**

Statistical data of land use of 2 communes in the project area are presented in the table 2.14.

**Table 2.14. Land area in the project area**

*Unit: ha*

No.	Commune	Area	Agricultural land	Forestry land	Residential land	Dedicated land	Unused land
1	Duong Quan	592.5	211.2	-	83.9	172.2	38.2
2	May To	152.26	-	-	19.09	93.21	0.62
<b>Total/average</b>		744.76	211.2	-	102.99	265.41	38.82
<i>Ratio (%)</i>		54.6	15.5	-	7.6	19.5	2.8

According to survey results and census of affected people, the Project could affect 106 households and 7 organizations. All affected people are the Kinh (100%). There is no ethnic minorities in project areas. The average scale of the demographic affected households is 3.35 persons per household.

**Table 2.15 Affected people**

No.	Commune	Number of household	Remark
1	May To	106	
2	Duong Quan	-	The land acquired for the project has been done in VSIP project
<b>Total</b>		<b>106</b>	



### 2.2.2.2. Source of Income

Regarding occupation of interviewed affected households in May To ward, as shown in the table below, the largest proportion is wage labour in May To Ward (accounted for 20.5%), the next is worker (14.7%) and trading (13.2%).

**Table 2.16 Structure of Affected Population by Main Occupation**

No	Commune	Main occupation (%)						
		Agri-culture	Tradin-g	Worke-r	Wage labor	Fisher-men	Aqua-culture	Other
1	May To	0	13.2	14.7	20.5	0	0	51.6

**Table 2.17 Distribution of affected households by income per capita (%)**

Commune	Distribution of affected households by income per capita (1,000VND/person/month)				Average income (VND/person/month)
	<250	250-500	500-1000	>1000	
May To	0.00	0.00	2.16	97.84	6,502,302

### 2.2.2.3. Household Assets

Living conditions of the households are summarized in the following Table 2.18 ~ Table 2.19.

**Table 2.18 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

*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 2.19 Living Conditions of Affected People – Sanitation**

No	Commune	Septic tank (%)	Unseptic tank (%)	Without toilet (%)
1	May To	100	0	0

*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.*

### 2.2.2.4. 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 2.20.

Table 2.20 List of Vulnerable Households

No	Ward/Commune	Poor HH		Female-headed		Social Policy	
		Quantity	%	Quantity	%	Quantity	%
<b>I</b>	<b>Nguyen Trai Bridge</b>						
1	May To	0	0	39	45.9	14	16.5

#### 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.

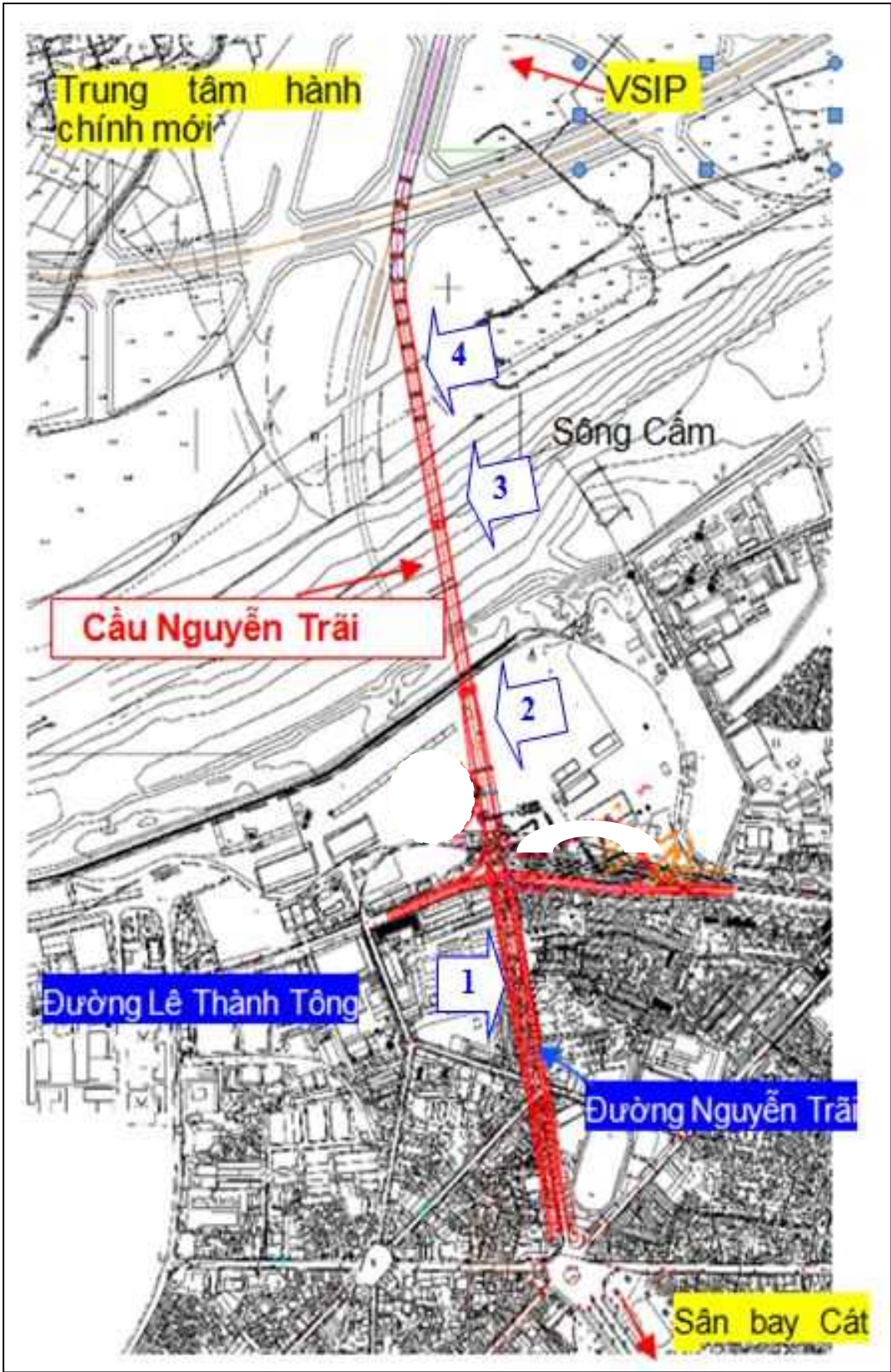


Figure 2.10 Map of forecast impacts at locations on construction site

**Table 2.21. Forecast impacts at locations on construction site**

No.	Forecasted impacts in pre-construction phase and construction phase	Forecasted impacts in operation phase
1	<ul style="list-style-type: none"> <li>- A number of houses and offices on Nguyen Trai street (May To Ward) shall be relocated.</li> <li>- About 30 trees (with height of 5~20m) planting along Nguyen Trai Street shall be relocated.</li> <li>- Houses and shops along Nguyen Trai Street, and Einstein high school may be affected by dust, noise, etc., during construction.</li> </ul>	<ul style="list-style-type: none"> <li>- Schools like Einstein high school may be affected by air and noise pollution</li> <li>- Houses and shops along Nguyen Trai Street may be affected by increased air pollution, noise, etc. generated from the new approach road.</li> </ul>
2	<ul style="list-style-type: none"> <li>- Hoang Dieu Port, and Bach Dang Shipyard shall be relocated before construction (according to Hai Phong City Master Plan).</li> <li>- Rail road and other facilities related to Hai Phong Port shall be relocated (according to Hai Phong City Master Plan)</li> </ul>	
3	<ul style="list-style-type: none"> <li>- River transportation shall be obstructed during construction.</li> <li>- River water may be polluted during construction of bridge piers.</li> <li>- Risk of accident on the river may be increased during construction</li> </ul>	<ul style="list-style-type: none"> <li>- Risk of accident on the river may be increased due to the appearance of the bridge piers.</li> </ul>
4	<ul style="list-style-type: none"> <li>- A part of the mangrove forest in the area under the planned bridge in the north will be lost.</li> <li>- A part of aquaculture pond along the approach road in the north of the planned bridge will be affected.</li> <li>- A section of the dyke on the north side of Cam River will be affected.</li> </ul>	<ul style="list-style-type: none"> <li>- A part of wetland ecosystem on the north side of Cam River may be affected by the appearance of the new approach road.</li> </ul>

**Table 2.22. Potential impacted entities alongside the project area**

No.	Affected parties/ station	Distance (m)	Remark
-	Residential houses on both sides of Nguyen Trai street	5	
-	Einstein High school	100	School gate on Nguyen Trai street
-	Bonded warehouse	0	Approaching road expanding towards the agency
-	Hoang Dieu port	0	The bridge goes through port area

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

### 3.1. Assessment of environmental impacts in the preparation stage

#### 3.1.1. Impacts of land acquisition, relocation and resettlement

##### a. Sources of Impacts/Generation Activities

###### *a1. Impacts on relocating entities*

In the south of Cam river, the project will occupy around 9,419 m<sup>2</sup> of residential land in the area located along Nguyen Trai street. As estimated, 106 households will be affected by land acquisition, in which 101 households are totally affected; 11,640 m<sup>2</sup> of land for production and business purpose, with 7 facilities being affected.

###### *a2. Impacts of permanent and temporary occupancy of agricultural land*

The Project will permanently occupy around 18,565 m<sup>2</sup> of agricultural land in Duong Quan commune, Thuy Nguyen district in the northern bank of Cam river. The land in this area has been acquired for the Vietnam Singapore Industrial Park project (VSIP).

The Project will temporarily occupy one land plot of 4.2ha in which 1.8ha is agricultural land in the land area of the VSIP Project to be construction site for the northern bank of Nguyen Trai bridge. One land plot of around 2.4ha in area of Hoang Dieu port will also be temporarily occupied to be construction site for southern bank of Nguyen Trai bridge.

###### *a3. Impacts to existing social infrastructure and service*

- Relocation of power posts: 35 power posts;
- The expansion of Nguyen Trai Street will affect around 30 trees along the street with height of 5m ~ 20m.

##### 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: Once relocated, the neighborhood and family relationships maintained for generations will be interrupted.
- Loss of production facilities: All households to be located reside in the south of Nguyen Trai bridge, in the area along Nguyen Trai road which is the inner area of

the city; most of households with street-front houses are doing business or leasing their houses for shops so they are having stable income source. When relocated, they may lose location advantage and may lead to lose their stable income source.

- 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.

*\* Loss of productive land*

Households in the north of Nguyen Trai Bridge (Duong Quan commune) will lose agricultural land (aquacultural land) for the implementation of the VSIP project. Land in this area is being acquired for the VSIP project.

***3.1.1.2. Impacts of temporary occupancy of land***

South of Nguyen Trai Bridge: the construction site will be placed in the Hoang Dieu port area. Relocation of Hoang Dieu Port is undergoing in accordance with Hai Phong City General Master Plan. Relocation of the port facilities which are located near the planned bridge may be considered as first priority to make land for the bridge construction project.

North of Nguyen Trai Bridge: Construction sites will be located in the area of agricultural land, but the land acquisition is being conducted by VSIP Project.

***3.1.1.3. Impact to the poor***

According to the census survey, there is no poor household affected by the Project in May To ward and Duong Quan commune. Vulnerable households (female-headed households and social policy households) are listed in table below (Table 3.1). These households can face difficulty to restore their living and livelihood after resettlement. Special assistants should be provided to them as described in RAP.

**Table 3.1 Number of Vulnerable Households in the affected ward/commune**

No	Ward/Commune	Poor HH		Female-headed		Social Policy	
		Quantity	%	Quantity			Quantity
1	May To	0	0	39	45.9	14	16.5

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

#### ***3.1.1.4. Impacts to local economy (such as employment and livelihood)***

The widening of Nguyen Trai Street is required for the construction of the approach road on the southern side of Nguyen Trai Bridge. A number of stores/business entities located along this street will be relocated.

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.

#### ***3.1.1.5. Impact to land use and utilization of local resources***

The north side of the expected Nguyen Trai Bridge: the area is currently used for aquacultural purpose. However, there are 2 investment projects of the Government: (1) Vietnam Singapore Industrial Park project (500ha invested by VSIP); and (2) Hai Phong Municipal administrative and political center Project (1,400 ha invested by Hai Phong City People's Committee). According to these two projects, the area in the north of Cam River will be constructed to be urban area, business and industrial area (see Figure 3.1).

The south of expected Nguyen Trai bridge: to be urban land at the present. According to the planning, land use objectives will not change.

Therefore, Nguyen Trai bridge project will not cause significant impact on the current use of local land and resources of the project area.



**Figure 3.1. Development project on north side of Cam River**

#### ***3.1.1.6. Impacts to existing social infrastructure and service***

35 power poles and the utilities located in the area along Nguyen Trai road will be relocated. According to the construction sequence of transport projects, power poles will be renewed before power cut. After completion and commissioning, the local electricity authority will be asked to cut the supply and former transmission line and then switch to the new one. Detailed steps have been stated in the design and the costs of this work is charged into the project's funds. Thus, the power supply interruption time is negligible. The impacts caused by the relocation of power posts are not considerable.

#### ***3.1.1.7. Impact to eco-system (impact to mangrove forests)***

There is a range of mangrove trees with thickness of 30m in the northern side of Cam River in Nguyen Trai bridge area. Construction of Nguyen Trai Bridge will delete 1,800m<sup>2</sup> of this forest.

#### ***3.1.1.8. Misdistribution of benefit and damage***

Some households will be relocated due to the widening of Nguyen Trai road and land acquisition for construction of approach road in the south of Nguyen Trai Bridge. 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 which not being relocated can benefit from the project, thanks to the business environment improved, rising land prices ... after the Project is completed.



### ***3.1.1.9. Impacts to landscape***

Trees along the existing Nguyen Trai road will be displaced by the expansion of the road bed. The loss of trees will affect landscape beauty.

Wastes generated when carrying out demolition works along Nguyen Trai Street in the preparation stage 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 ...).

### ***3.1.1.10. Incidents caused by explosives 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 and 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. Source 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 living quarters along Nguyen Trai road, Hoang Dieu port area;
- Activities of leveling the site to set up beam casting yard and other ancillary items on the banks of Nguyen Trai 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 3.2.

**Table 3.2. Waste generating during the construction preparation phase**

No.	Activity	Type	Quantity	Generating area	Period
1	Demolition of houses	Waste (concrete, brick, wood, etc.)	30,200 m <sup>3</sup>	- Residential areas along Nguyen Trai Street and Hoang Dieu Port;	2 weeks
2	Tree cutting down and clearing	Wood, leaves	Negligible	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 3.3);
- The formula for calculating the total noise:

$$L_{\Sigma} = 10 \lg \sum_i^n 10^{0.1 L_i}$$

*in which:*

- $L_{\Sigma}$ : total noise level;
- $L_i$ : source noise level No.  $i$ ;
- $n$ : total noise sources.

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

**Table 3.3. 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 truck	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***

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 Nguyen Trai Street are 1 to 4 – storey solid houses which are adjacent to each other, as well as to other houses outside the site clearance area. Therefore, dust pollution is caused in the demolition process.

Demolition of works for site clearance in Hoang Dieu port area is expected not to cause much air pollution because there are not many houses and buildings in this area and they are scattered in the large space of the port.

#### ***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 (two banks of Nguyen Trai bridge) and the duty roads long the approaching road of the bridge. Due to the large load of the environmental 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.

The Table 3.4 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:

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

In which:

*ΔL*: noise degradation in the distance of *r*<sub>2</sub> in comparison with noise source;

*R*<sub>1</sub>: distance of noise source (*r*<sub>1</sub>=8m).

*a*: impact coefficient of surface topography on noise absorption and reaction (*a*=0.1 – grassland)

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

**Table 3.4. Noise levels caused by demolition of buildings**

Location where demolition of buildings may occur	Distance (m)	Noise level exceeding allowable maximum noise level (dBA) (*)			
		Daytime		Night-time	
		Min 6-21h	Max 6-21h	Min 21-6h	Max 21-6h
The residential area along Nguyen Trai Street	5	5.5	18.1	20.5	33.1

(\*) 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 5.5 dBA to 18.1 dBA in daytime, and particularly from 20.5dBA 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. 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 residents, especially those living in Nguyen Trai street area.

***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
<b>I</b>	<b><i>Impacts of land acquisition, relocation and resettlement</i></b>			
1	Disturbing life by occupancy of residential land	Residential land along Nguyen Trai street, Ngo Quyen district	Long time	High
2	Loss of income due to permanent and temporary occupancy of agricultural land, land in Hoang Dieu port area.	North bank of Nguyen Trai bridge, Duong Quan commune, Thuy Nguyen district	Long time	Medium
		Construction sites	Short time	
3	Impact on poor HHs, vulnerable HHs due to acquisition of land and houses .	Nguyen Trai street area	Long time	Medium
4	Impact on local economic condition (employment, livelihood) due to land acquisition for the project implementation.	Nguyen Trai street area	Long time	High
5	Impact to land use, and local resources due to land acquisition for the project implementation.	Nguyen Trai street, Duong Quan commune	-	Medium
6	Impact to existing social infrastructure and service due to acquisition of existing infrastructure (Electric line, water drainage system, supply system...)	Nguyen Trai street	Short time	Medium
7	Impact to eco-system (due to acquisition of land for mangrove forest)	North bank of Nguyen Trai bridge	Long time	Medium
8	Misdistribution of benefit and damage	Residential area along Nguyen Trai street	Long time	Medium
9	Impact to landscape due to displacement of trees and due to waste generated from demolition work and site clearance	South bank of Nguyen Trai bridge,	Short time ~ long time	Medium
10	Risk of explosion due to bombs/mines when acquiring land and water area for the implementation of the project.	Whole project	Short time	Medium
<b>II</b>	<b><i>Impacts of site clearance and preparation of construction yards</i></b>			

<b>No.</b>	<b>Impacts</b>	<b>Location</b>	<b>Time</b>	<b>Degree of impact</b>
1	Air pollution due to dust from demolition activity and leveling work for preparation of the beam casting area in construction site	Residential area along Nguyen Trai street, construction site, south and north banks of Nguyen Trai bridge	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.	Along Nguyen Trai street	Short time	Medium
4	Traffic jam, accidents and obstruction to movement of local people.	Along Nguyen Trai street, residential area adjacent to construction site	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 has the approved environmental impact assessment and the license of exploitation/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), water pollutants, 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

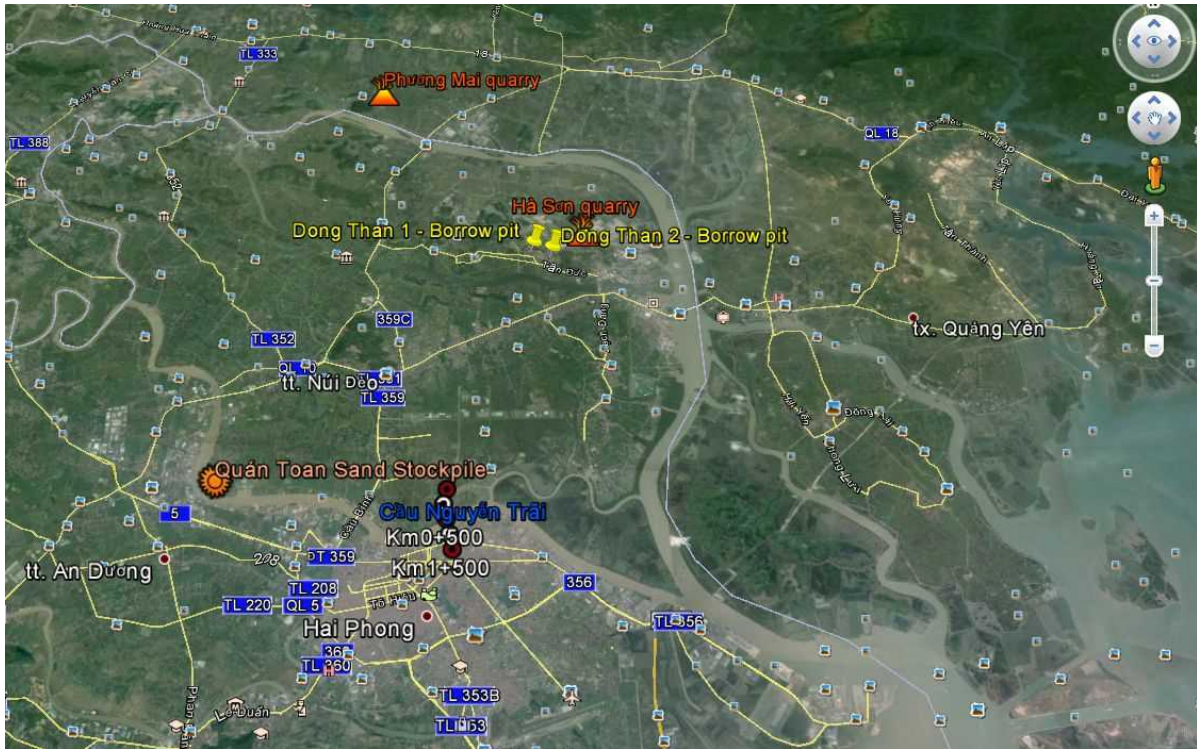
According to Decree No.18/2015/ND-CP (Annex II), the mining land (with a volume of over 100,000 m<sup>3</sup> of soil exploitation in a year), or quarry, sand mine (with volume of over 50,000m<sup>3</sup> of stone/sand exploited in a year) will have to be approved in term of environmental impact assessment 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 Pproject, the transportation of construction materials by river is convenient thanks to Hoang Dieu port in the south bank. The impacts of pollution such as dust, noise, traffic accidents and will mitigate much of the material transported by river.

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 for the project**

No.	Name	Location	Quantity (million m <sup>3</sup> )	Materials transport road	Distance
<b>I Borrow pit</b>					
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	18km
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	
<b>II Quarry</b>					
1	Ha Son	Minh Duc town, Thuy Nguyen District, Hai Phong city	0.8	Tan Duc road, NH10, PR359, Road No.9C, VSIP road	17km
2	Phuong Mai	Phuong Nam commune, Uong Bi town, Quang Ninh province (near Da Bac bridge)	1.0	• Waterway: Bach Dang river, Cam river	35km
<b>III Sand Stockpile</b>					
1	Quan Toan	On the Cam river, at Quan Toan area, Hai Phong city	Exploiting source from Cam river with huge quantity	Waterway: Cam river	8km



**Figure 3.2. Location of 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 gas 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 gas emissions (NO<sub>2</sub>, SO<sub>2</sub>, CO and HC);
  - ✓ Transportation of redundant soil and stone by road generates dust and emissions (NO<sub>2</sub>, SO<sub>2</sub>, 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*

b.1.1 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 <sup>3</sup> )		
		Excavated Soil	Embanked Soil, sand	Total
-	Nguyen Trai Bridge	74,286	22,286	96,572
-	Approach road of Nguyen Trai Bridge	25,192	29,745	54,937
	<b>Total:</b>	<b>99,478</b>	<b>52,031</b>	<b>151,509</b>

- Dust generation coefficient 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 ~ 100g/m <sup>3</sup>
2	Dust from process of loading, unloading building material (soil, stone, sand ...).	0,1 ~ 1g/m <sup>3</sup>
3	Vehicles transporting sand, soil scattered on road producing dust	0,1 ~ 1g/m <sup>3</sup>

- 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	Volume of dust (kg)		Scope <sup>(1)</sup> m	Construction period <sup>(2)</sup> month	Dust flow (mg/ms)	
		Min	Max			Min	Max
-	Nguyen Trai bridge	116	9850	1,403	23	0.005	0.442
-	Approach road of Nguyen Trai Bridge	66	5604	680	4	0.035	2.981

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)		
		Construction	Transportation	Total
-	Nguyen Trai bridge	714.2	78.6	<b>792.8</b>
-	Approach road of Nguyen Trai Bridge	295.1	260.7	<b>555.8</b>

(\*) 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/QĐ-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 about 4,3kg of TSP; 20S kg of SO<sub>2</sub> (S is sulfur amount in diesel, according to QCVN 01: 2007/BKHCN S = 0.05%); 55kg of NO<sub>2</sub>; 28kg of CO and 12kg of HC ; into the atmosphere 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 (*) (month)	Emission flow (mg/ms)				
					TSP	SO <sub>2</sub>	NO <sub>2</sub>	CO	HC
-	Nguyen Trai bridge	714.2	1,403	23	0.138	<0.001	0.176	0.897	0.384
-	Access road of Nguyen Trai bridge	295.1	680	4	0.674	0.002	0.863	4.395	1.884

(\*) 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 <sub>2</sub>	NO <sub>2</sub>	CO	HC
-	Nguyen Trai bridge	0.580	<0.001	0.176	0.897	0.384
-	Approach road of Nguyen Trai Bridge	3.655	0.002	0.863	4.395	1.884

(\*) 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 dispersion model:

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

In which:

- C: concentration of pollutant in the air (mg/m<sup>3</sup>).
- 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° (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  $u_{average} = 2,9\text{m/s}$  and  $3,1\text{m/s}$ .
- $\sigma_z$ : diffusion coefficient vertical direction z (m).

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

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

*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/m<sup>3</sup>*

Items	Parameters	Season	Distribution of concentration with distance (*)					QCVN 05:2013 & 06:2009/BTNMT
			5m	10m	25m	50m	100m	
Nguyen Trai Bridge	TSP	Rainy	0.063	0.054	0.043	0.027	0.018	0.2
		Dry	0.067	0.058	0.046	0.029	0.019	
	SO <sub>2</sub>	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 <sub>2</sub>	Rainy	0.019	0.016	0.013	0.008	0.005	0.1
		Dry	0.020	0.018	0.014	0.009	0.006	
	CO	Rainy	0.097	0.084	0.066	0.042	0.028	5
		Dry	0.103	0.089	0.071	0.045	0.030	
HC	Rainy	0.041	0.036	0.028	0.018	0.012	1.5	
	Dry	0.044	0.038	0.030	0.019	0.013		
Approach road of Nguyen Trai bridge	TSP	Rainy	0.301	0.270	0.226	0.155	0.106	0.2
		Dry	0.322	0.289	0.241	0.166	0.114	
	SO <sub>2</sub>	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 <sub>2</sub>	Rainy	0.071	0.064	0.053	0.037	0.025	0.1
		Dry	0.076	0.068	0.057	0.039	0.027	
	CO	Rainy	0.362	0.325	0.271	0.186	0.128	5
		Dry	0.387	0.347	0.290	0.199	0.137	
HC	Rainy	0.155	0.139	0.116	0.080	0.055	1.5	
	Dry	0.166	0.149	0.124	0.085	0.059		

From the predicted results of dust concentration and gas emission generated from earthwork, horizontal construction and their scope of dispersion, it is able to see that:

- For the Nguyen Trai Street Bridge: When excavating and backfilling the pit foundation, TSP concentration and gas emissions are smaller than value of the maximum allowable concentration.
- ✓ For the approach roads at two heads of the bridge: When performing the earthwork of excavating and backfilling the bed for the approach road, TSP concentration in the area 5m from the construction site is higher 1.5-1.6 times of the maximum allowable concentration, and GHCP value exceeding  $1.5 \div 1.6$  times and only equal to the maximum allowable concentration at the area about  $28 \div 33$ m far from construction road. Concentration of gas emissions is lower than the maximum allowable value.

Dust pollution affects not only human health (causing diseases related to eyes, respiratory system), but also affects socio-economic activities. Long-time impact beyond the construction period can cause diseases related to eyes and respiratory system for people in residential areas along the construction site of the approach road.

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

Vertical Construction: Dust amount and gas 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 19.5 km. Sutton diffusion model is also 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)				
<i>(ton of diesel)</i>	<i>(km)</i>	<i>(Month)</i>	TSP	SO <sub>2</sub>	NO <sub>2</sub>	CO	HC
339.3	19.5	34	0.003	<0.001	0.041	0.021	0.009

(\*) *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).

**Table 3.15. Emission Coefficient of Dust Whirled from Road Surface**

No	Type of road	Unit (U)	TSP (kg/U)
<b>I</b>	<b>Unpaved road</b>		
1	Gravel road	1.000 km	3.7f
2	Dirt road	1.000 km	21f
3	Crushed limestone road	1.000 km	7.1f
<b>II</b>	<b>Paved road</b>		
1	Local streets (width <10m, <500 vehicles/day)	1000km	15
2	Collector streets (width >10m, 500 ~ 10.000 vehicles/day)	1000km	10
3	Highways (>10.000 vehicles/day)	1000km	4.4
4	Expressway (>50.000 vehicles/day)	1000km	0.35

Source: 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  $f = S \cdot (W^{0.7}) (w^{0.5})$ , 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.vehicle)	Transportation Number	Transportation period (month)	Emission Flow from road surface (mg/m.s)
871	22,554	34	0.835

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 <sub>2</sub>	NO <sub>2</sub>	CO	HC
Transportation	0.838	<0.001	0.041	0.021	0.009

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

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

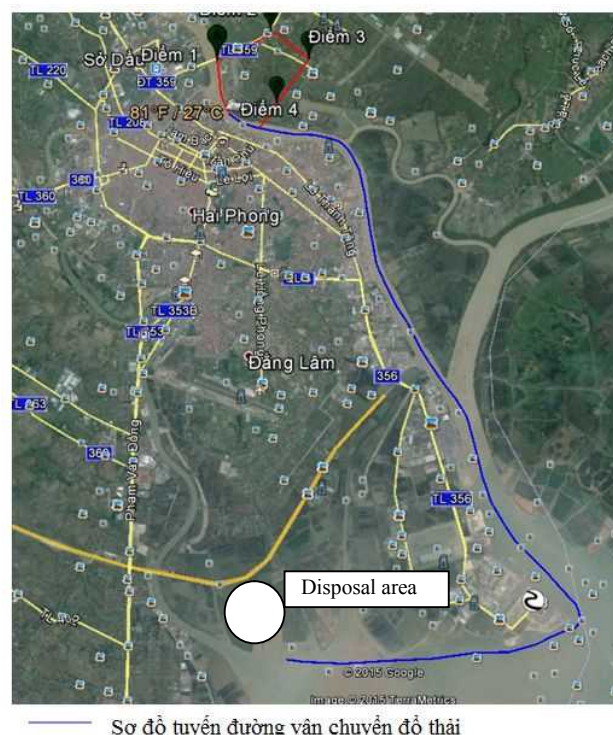
Unit: mg/m3

Items	Parameters	Season	Distribution of concentration with distance (*)					QCVN 05:2013 & 06:2009/BTNMT
			5m	10m	25m	50m	100m	
Transportation	TSP	Dry	0.114	0.097	0.074	0.045	0.029	<b>0.2</b>
		Rainy	0.107	0.090	0.069	0.042	0.027	
	SO <sub>2</sub>	Dry	<0.001	<0.001	<0.001	<0.001	<0.001	<b>0.125</b>
		Rainy	<0.001	<0.001	<0.001	<0.001	<0.001	
	NO <sub>2</sub>	Dry	0.006	0.005	0.004	0.002	0.001	<b>0.1</b>
		Rainy	0.005	0.004	0.003	0.002	0.001	
	CO	Dry	0.003	0.002	0.002	0.001	0.001	<b>5</b>
		Rainy	0.003	0.002	0.002	0.001	0.001	
	HC	Dry	<0.001	<0.001	<0.001	<0.001	<0.001	<b>1.5</b>
		Rainy	<0.001	<0.001	<0.001	<0.001	<0.001	

(\*) Distance of the center of transportation road

Predicted results showed that dust and toxic gases concentration generated by transport activities are smaller than the maximum allowable emission stipulated in QCVN06 / 2009: BTNMT.

However, transportation of materials and waste soil is made via waterway toward the disposal area with distance of 16 ÷ 28 km will not generate much impact on air quality in the transport process (see Figure 3.3).



**Figure 3.3. Expected waterway for transportation of waste and redundant material**

***b3. Dust generated from the concrete mixing plants***

A considerable amount of dust can be generated from the operation of concrete mixing plant such as the operation of dumping ballast, sand from vehicle trunk to the storage area or dumping of sand and cement into the mixer. If there is no proper management, this dust will affect and degrade ambient air quality of the surroundings.

***b4. Dust pollution impacts on public health***

Dust pollution affects not only human health (causing diseases related to eyes, respiratory system), but also affects socio-economic activities. With impacts beyond the construction period, the above diseases are suffered by residents along Nguyen Trai road, workers working at Hoang Dieu port, residents living in areas along national highway No.10, provincial road 359, Le Thanh Tong street, and roads in the project area.

However, the impact can vary 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). Contractors should be obligatory to implement measures 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	Spoiled rocks and soils, paper, milled wood, concrete, bricks, steel, waste, etc	Along the route

**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, interchanges, 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:***

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 Cam 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***

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 Cam River at the bridge construction location. These risks will only disappear when the reversion work is done perfectly.

***2. Domestic solid waste***

**a. Domestic solid waste generation activities**

Domestic solid waste generated in the worker camps includes:

- Garbage workers;
- Waste from cafeteria 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...	Workmen's huts and Construction offices

Construction site will be arranged near the location for construction of Nguyen Trai Bridge. About 100 workers may be required for each construction site.

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 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 workmen's huts near Cam 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 sources

- *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, 63,160 work-shift of vehicles shall correspond with 3,778 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 <sup>3</sup> / 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
<b>Total</b>	<b>11</b>	<b>30 ~ 49</b>	<b>0,6 ~ 1,3</b>	<b>81 ~ 124</b>
<i>QCVN 40:2011/BTNMT, column A</i>		<i>C=50</i>	<i>C=5</i>	<i>C=50</i>
<i>QCVN 40:2011/BTNMT, column B</i>		<i>C=100</i>	<i>C=10</i>	<i>C=100</i>

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 Cam 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 the north bank of Cam River. Through the food chain, oil will accumulate in all types of organisms: from low-level ones (algae, zooplankton 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 wastewater**

##### **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 5.6m<sup>3</sup> 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.	Parameter	Emission flow coefficient (g/person/day)	Wastes from worker camps with 100 workers per day (kg/day)
1	BOD <sub>5</sub>	45 ~ 54	4,5 ~ 5,4
2	Total solid (TS)	170 ~220	7 ~ 14,5
3	Coliform	10 <sup>6</sup> ~ 10 <sup>9</sup>	10 <sup>8</sup> ~ 10 <sup>11</sup>

**Table 3.23. Concentration of Pollutants in Domestic Wastewater**

No.	Parameter	Concentration of Pollutants (mg/l) in non-treated domestic wastewater	C <sub>max</sub> (QCVN 14:2008/BTNMT)
1	BOD <sub>5</sub>	281,2 ~ 337,5	60
2	TSS	437,5 ~ 906	120
3	Total Coliform (MNP/100ml)	0,6x10 <sup>7</sup> ~ 0,6x10 <sup>10</sup>	6.000

Note:  $C_{max} = C \cdot K$

- $C_{BOD} = 50\text{mg/l}$ ,  $C_{TSS} = 100\text{mg/l}$  (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 C<sub>max</sub> (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<sub>5</sub> concentration is 4.5 times higher; TSS - about 4 times. 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<sup>3</sup>/h is expected to be located at the site on both sides of Nguyen Trai Bridge. According to the standard, with capacity of 50m<sup>3</sup>/h, 87 m<sup>3</sup> and 10 m<sup>3</sup> 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<sup>3</sup> of wastewater with high content of TSS.

### b. Impacts of wastewater from concrete mixing

Considering the demand for concrete of 21,680 m<sup>3</sup>, amount of wastewater generated is 9,020 m<sup>3</sup>.

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 Cam 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. Nguyen Trai bridge construction project 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.

Besides, rainwater runoff on the embankment during the construction process will be able to take away our land and sand, increasing the turbidity of surface water around.

### **3.2.3. Impacts of sources unrelated to waste**

#### ***3.2.3.1. Noise***

##### **a. Impact source / impact source generating activities**

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

Some equipment and machinery with large and medium sized to be used for the construction of Nguyen Trai 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. Although, noise impact will be temporary in the construction phase, it can also cause significant impact to the surrounding residential areas along Nguyen Trai Street if having 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	<i>Route construction</i>		
-	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	<i>Bridges construction</i>		
-	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	<i>Related activities</i>		
-	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:

$$\Delta L = 10 \lg \left( \frac{r_2}{r_1} \right)^{1+a} \text{ (dB)} \text{ (applied to noise sources from road)}$$

*In which:*

- $\Delta L$ : level of noise attenuation at a distance  $r_2$  from the source of noise
- $r_1$ : the distance from sound characterizing the noise source ( $r_1 = 8m$ )
- $a$ : 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 along Nguyen Trai Street	10	4.7	16.3	19.7	31.3

(\*)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 4.7 dBA (when machines generating low-noise are used) and by 16.3 dBA (when machines generating high-level noise are used).
- At night-time, the noise levels exceed allowable limit by 19.7 ~ 31.3 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 vibration/vibration generating 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 (limited amount of vibration in Germany - DIN 4150 is 2mm / s for work construction).

**b. Impacts of vibration**

**b1. Construction-period vibration impacts on public health**

Forecast vibration attenuation with distance, using the formula:

$$L = L_0 - 10\log (r/r_0) - 8,7a (r - r_0) \text{ (dB)}$$

In which: *L* - the vibration level in dB at a distance "r" meter to sources;  
*L<sub>0</sub>* - the vibration level in dB at a distance "r<sub>0</sub>" meter from sources.  
 Vibration level at a distance r<sub>0</sub> = 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 <sub>0</sub> =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
<b>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.</b>					

(\* Distance from edge of the road

In case of the Project, the construction of approach bridge foundations along Nguyen Trai Street may cause vibration impact to the residential areas. Construction machine such as the tilt hammer shall not be used at this construction site. Depending on the foundation construction method and everyday construction time, impact of vibration to the surrounding residential areas may become insignificant.

**3.2.3.3. Impacts of Erosion and sedimentation**

**a. Impact source / 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**

***b1. Impacts from soil erosion and sedimentation***

During the construction process, the excavation locations, materials stockpiling sites and dumping sites are adjacent to many different objects such as aquacultural farming ponds, residential areas and roads, therefore the impacts of over spilled 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 location spills down to the flow of rivers, canals and aquaculture lagoon, the water quality shall be decreased due to the increasing levels of total suspended solids in the water.

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 Cam River.

***3.2.3.4. Impacts on Ecosystem***

There is a part of mangrove vegetation (mainly *Sonneratia caseolaris*) along Cam River can be affected by the construction of the bridge. So, it is required to consider mitigation measures for the impacts on the mangrove ecosystem.

The water of Cam River may be degraded by the construction of bridge piers, workers' camps...Sediments 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 Cam river, and it may change the dominance and the composition of the plankton. Oil and toxic substances entering water source of Cam 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 Cam 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 Cam River is still good and plankton, benthos 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**

During the construction phase, the construction activities will cause emission of gases like CO<sub>2</sub> increasing the greenhouse effect. With a total volume of diesel used in the project of 1,348.6 tons, the emission rate of CO<sub>2</sub> is 2,712 kg/litter then the total CO<sub>2</sub> emitted in the construction process of the project will be approximately 3,471 tons.

Formula for calculating the emission rate of CO<sub>2</sub> from fuel consumption:

$$\text{Emission rate of CO}_2 = \frac{\text{Fuel ratio} \times \text{Net calorific value} \times \text{Default CO}_2 \text{ emission factor}}{\text{Of fuel} \times 1000}$$

Where:

- Emission rate of CO<sub>2</sub> of fuel (kg CO<sub>2</sub>/litter);
- Ratio (kg/litter): for diesel is 0.8439 (as in “Energy data, OECD/IEA, 2004”);
- Net calorific value (GJ/t): for diesel is 43.38 (as in “IPCC 2006 Guidelines for National Greenhouse Gas Inventories”);
- Default CO<sub>2</sub> emission factor (tCO<sub>2</sub>/TJ): for diesel is 74.1 (As in Volume 2, IPCC 2006”).

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

**a. Impact source/ generation activities**

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

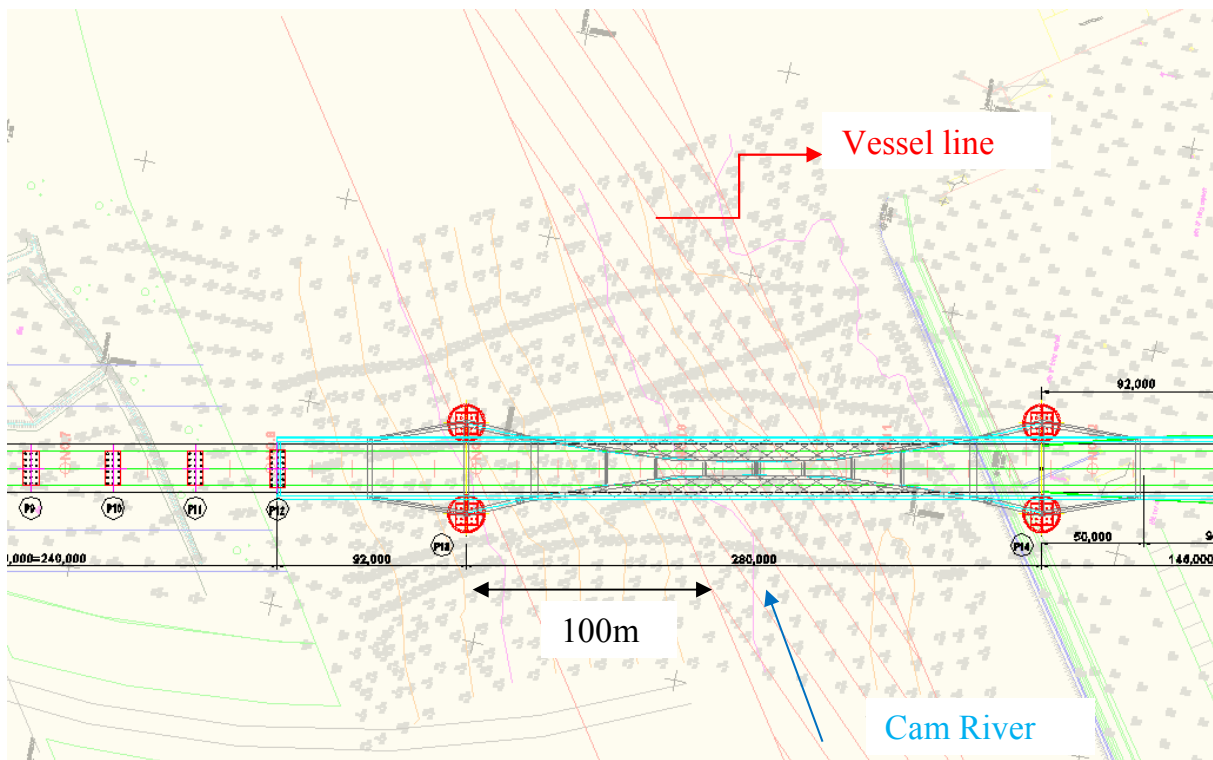
- Construction activities of pier P13 near flow of Cam river;

- Construction activities at the intersection with the existing routes like Nguyen Trai Street, Le Thanh Tong Street.
- Transportation of redundant stone and soil by roads, particularly district roads and local roads;
- Operation of devices on site and along the route.

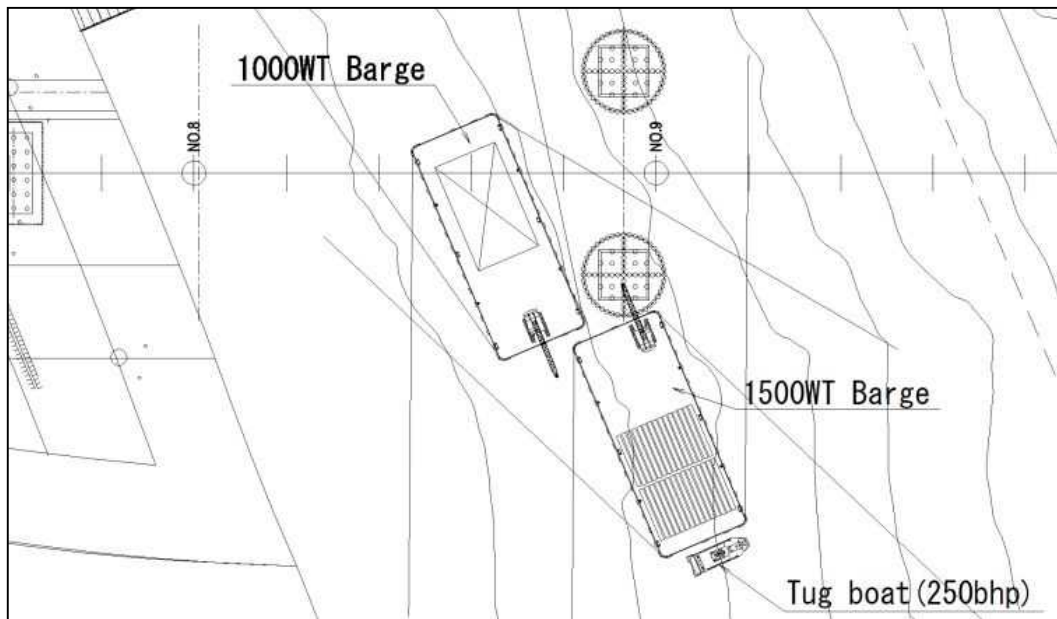
**b. Assessment**

***b1. The risk of accidents for waterway transport means due to construction of pier P13 on flow of Cam river***

A great numbers of vessels, ships and ferries...carrying materials and goods frequently go on Cam River toward Hai Phong port. The clearance distance from pier P13 to the nearest waterline of the vessel is 100m, so the construction activities of P13 pier does not affect significantly the transportation of the boats on Cam River. Details are presented in Figure 3.3 and Figure 3.4. However, accidents can still occur, leading to the risk of over spilling of hazardous substances toward the river. Therefore, it is required that measures for waterway transport will be still implemented and closely monitored throughout the construction process.

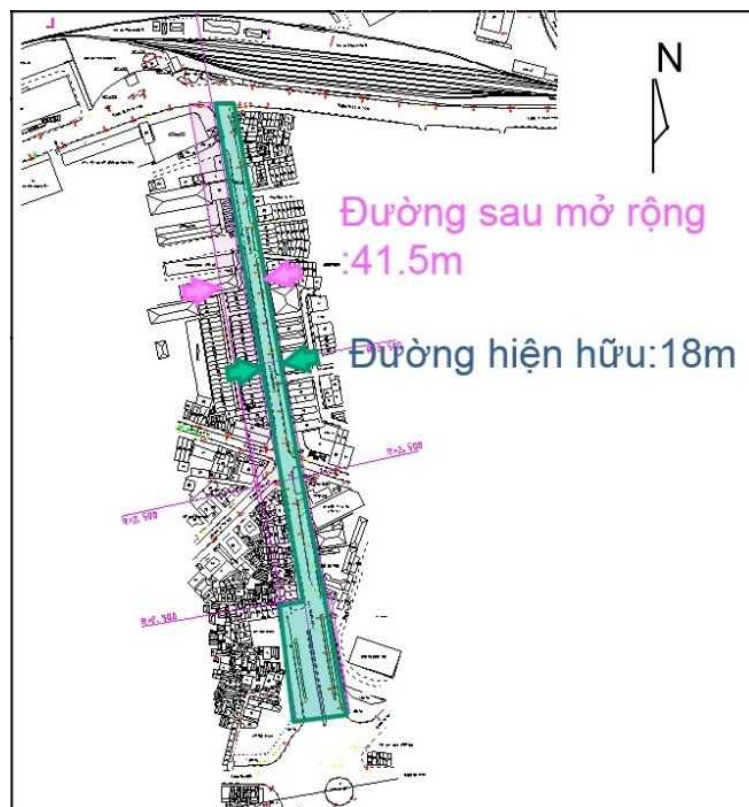


**Figure 3.4. Layout of construction site of P13 pier and vessel line on Cam River**



**Figure 3.5. Construction of steel pipe sheet pile at P13 pier**

During construction process of the approach road and bridge section in the south of Nguyen Trai bridge and the bridge at the intersection with Le Thanh Tong street, the construction will affect traffic activities on Nguyen Trai and Le Thanh Tong streets due to the fact that one part of those two streets can be temporarily blocked, leading to traffic jams.



**Figure 3.6. Expansion of the existing Nguyen Trai road**

The operation of a large number and diverse types of equipment such as bulldozers, excavators, cement mixers ... can also cause traffic jams on the roads around the site. Daily life activities of households around the construction site will be affected temporarily. And some households will have to take longer way for their daily activities.

The business establishments located along the areas for material handling, disposal as Le Thanh Tong Street will be affected by noise, air pollution, vibration ... Transportation of goods and production activities...around the project area will be hampered by the transportation means of the project.

***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 is will be very small.

***3.2.3.7. Impacts of hydrological conditions***

**a. Impact source/ generation activities**

Construction of pile and pier on Cam River

**b. Assessment**

Nguyen Trai bridge has 2 piers of P12, P13 in the Cam river main flow, and the approach piers on the north bank of the river are all located on the river banks.

During the construction phase, the use of barges to build the piers and girders can alter the flow of the river in temporarily and locally.

***3.2.3.8. Impacts related to the use of water***

**a. Impact source/ generation activities**

Piers construction in Cam River.

**b. Assessment**

The river water is used largely for the purpose of navigation, agriculture and aquaculture at downstream of Cam river, particularly at the location for construction of Nguyen Trai bridge.

During the construction phase, aquaculture ponds at downstream of Nguyen Trai 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 occupy the navigable channel on the river, so they do not affect the operation of navigation (this content has been mentioned in Section "3.2.3.6. Operation of machinery, vehicles, occupation of traffic artery").

**3.2.3.9. Worker concentration**

**a. Impact source/ source generation activities**

The construction phase (estimated to last in 34 months) requires a large number of construction workers for construction sites at the two banks of the bridge.

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
<b>I</b> <i>Impacts related to waste</i>				
1	Air pollution by dust and impact on public health	<ul style="list-style-type: none"> <li>– Along Nguyen Trai street, intersection with Le Thanh Tong street;</li> <li>– Along the roadway for transportation (NH10, Provincial road 359, VSIP, Le Thanh Tong street and collector roads);</li> <li>– Near the area of concrete mixing plant at the construction site .</li> </ul>	Short time	Low ~ Medium
2	Generation of construction solid waste, domestic solid waste, waste oil and oil-containing wastewater, wastewater from concrete mixing plant and rainwater runoff from construction site, degrading water quality and causing sedimentation	<ul style="list-style-type: none"> <li>– Temporary storage area of redundant soil, construction site of the approach road and bridge on Cam river</li> <li>– Worker camps, construction offices at two construction sites</li> <li>– Maintenance station for machinery and equipment at the two construction sites and the erection area of steel beam in the south of Nguyen Trai bridge</li> <li>– Concrete mixing plant at the construction site</li> </ul>	Short time ~ Long time	Low ~ Medium
<b>II</b> <i>Non-related waste impacts</i>				
1	Noise	<ul style="list-style-type: none"> <li>– Residential area along Nguyen Trai street;</li> <li>– Residential area at two sides of Le Thanh Tong street, near the intersection area</li> </ul>	Short time	Medium
2	Vibration	<ul style="list-style-type: none"> <li>– Residential area along Nguyen Trai street;</li> <li>– Residential area at two sides of Le Thanh Tong street, near the intersection area</li> </ul>	Short time	Medium
3	Erosion and sedimentation	<ul style="list-style-type: none"> <li>– The embankment at the north of Nguyen Trai bridge;</li> <li>– Construction of piers in Cam river</li> <li>– Material landfill</li> </ul>	Short time	Low ~ Medium



<b>No.</b>	<b>Impacts</b>	<b>Location</b>	<b>Time</b>	<b>Degree of impact</b>
4	Impact on ecosystem	– Construction of piers in Cam river	Short time	Medium
5	Impact on global warming	– Operation of machinery and equipment on 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 P13 in Cam river; – Construction at intersestion with existing roads like Nguyen Trai, Le Thanh Tong; – Transportation of material, stone, redundant soil via local roads	Short time	Medium
7	Impact on hydrological condition	– Construction of piers in Cam river	Short time	Low ~ Medium
8	Impact on water use	– Construction of pier P13 in Cam river	Short time	Low ~ Medium
9	Impact due to worker concentration	2 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<sub>2</sub>, NO<sub>2</sub>, 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<sub>2</sub>, SO<sub>2</sub>, 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 Sulphur in the gasoline and diesel fuel in the transportation is S = 0.05%.

**Table 3.29. The figure of forecasted traffic volume in 2025 and 204**

Unit: (\*)day

Year	MC (Motor-cycle)	Car	Mini Bus	Medium Large Bus	Pick up Truck	Rigid class Truck (2 axles)	Rigid class Truck (3 axles)	Trailer (Separate d)	Total	Speed at peak hour (*)
2025	46.538	27.105	1.837	2.203	1.237	2.876	485	593	<b>82.874</b>	64 (48)
2040	26.628	45.265	2.682	3.216	1.460	3.394	572	700	<b>83.917</b>	64 (48)

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 <sub>2</sub> (kg/U)	NO <sub>x</sub> (kg/U)	CO (kg/U)	HC (kg/U)
<b>1. Car (small car and pass. car)</b>						
- 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
<b>Average</b>	<b>1000 km</b>	<b>0.07</b>	<b>2.05S</b>	<b>1.19</b>	<b>7.72</b>	<b>0.83</b>
<b>2. Truck</b>						
- 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					

Vehicle	Unit (U)	TSP (kg/U)	SO <sub>2</sub> (kg/U)	NO <sub>x</sub> (kg/U)	CO (kg/U)	HC (kg/U)
<b>Average</b>	<b>1000km</b>	<b>0.9</b>	<b>4.76S</b>	<b>10.3</b>	<b>18.2</b>	<b>4.2</b>
<b>3. Motor bicycle</b>						
- Engine <50cc. 2 stock	100	0.12	0.36S	0.05	10	6
	0km	6.7	20S	2.8	550	330
- Engine >50cc. 2 stock	ton diesel	0.12	0.6S	0.08	22	15
	1000km	4.0	20S	2.7	730	500
- Engine >50cc. 4 stock	ton diesel		0.76S	0.30	20	3
	1000km		20S	8	525	80
	ton diesel					
<b>Average</b>	<b>1000km</b>	<b>0.08</b>	<b>0.57S</b>	<b>0.14</b>	<b>16.7</b>	<b>8</b>

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 at Nguyen Trai bridge**

Year	Dust and exhaust emission (mg/ms)				
	TSP	CO	NO <sub>2</sub>	SO <sub>2</sub>	HC
2025	0,323	33,972	0,599	0,169	12,017
2040	0,369	30,002	0,834	0,222	8,299

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)
	<b>Paved roads</b>		
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 Nguyen Trai Bridge**

Year	Traffic flow at peak hour (car/h)	Emission coefficient (kg/1000km.car)	Load of dust (mg/ms)
2025	8,287	0.35	0.806
2040	8,392	0.35	0.815

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 from 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 Nguyen Trai bridge**

*Unit: (mg/m.s)*

Year	TSP	CO	NO <sub>2</sub>	SO <sub>2</sub>	HC
2025	1.129	33.972	0.599	0.169	12.017
2040	1.184	30.002	0.834	0.002	8.299

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 dispersion model:

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

*In which:*

- *C: concentration of pollutant in the air (mg/m<sup>3</sup>).*
- *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  $u_{average} = 2.9\text{m/s}$  and  $3.1\text{m/s}$ .*

–  $\sigma_z$ : diffusion coefficient vertical direction z (m).

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

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

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 Nguyen Trai bridge**

Unit: mg/m<sup>3</sup>

Item	Parameters	Season	Distribution of Pollutants according to distance (*) (mg/m <sup>3</sup> )					QCVN 05:2013 & 06:2009	
			5m	10m	20m	50m	100m		
2025	TSP	Rainy	0.184	0.149	0.108	0.061	0.038	0.3	
		Dry	0.197	0.159	0.116	0.065	0.040		
	SO <sub>2</sub>	Rainy	0.028	0.022	0.016	0.009	0.006	0.35	
		Dry	0.029	0.024	0.017	0.010	0.006		
	NO <sub>2</sub>	Rainy	0.098	0.079	0.057	0.032	0.020	0.2	
		Dry	0.104	0.084	0.061	0.035	0.021		
	CO	Rainy	5.535	4.479	3.257	1.835	1.132	30	
		Dry	5.917	4.788	3.482	1.962	1.210		
	HC	Rainy	1.958	1.584	1.152	0.649	0.400	5	
		Dry	2.093	1.694	1.232	0.694	0.428		
	2040	TSP	Rainy	0.193	0.156	0.114	0.064	0.039	0.3
			Dry	0.206	0.167	0.121	0.068	0.042	
SO <sub>2</sub>		Rainy	0.036	0.029	0.021	0.012	0.007	0.35	
		Dry	0.039	0.031	0.023	0.013	0.008		
NO <sub>2</sub>		Rainy	0.136	0.110	0.080	0.045	0.028	0.2	
		Dry	0.145	0.118	0.085	0.048	0.030		
CO		Rainy	4.888	3.956	2.877	1.621	1.000	30	
		Dry	5.225	4.229	3.075	1.732	1.069		
HC		Rainy	1.352	1.094	0.796	0.448	0.277	5	
		Dry	1.445	1.170	0.851	0.479	0.296		

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

Comparing the results predicted of toxic gas concentration with maximum allowable value in QCVN06 /2009: BTNMT, it is found that:

In 2025: On the centerline of the road, concentrations of dust generated from operation of vehicle flow is smaller than allowable Limit of QCVN06/2009: BTNMT

In 2040: On the centerline of the road, concentrations of dust and toxic gas generated from operation of vehicle flow smaller than allowable Limit of QCVN06/2009:BTNMT.

### ***3.3.1.2. Water pollution***

During the operational phase, the appearance the piers will degrade water quality due to changes in the sediment environment of 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 were 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 the 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 bridge/road construction project itself does not cause increase in greenhouse gases. 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<sub>2</sub> 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<sub>2</sub> emission coefficient under IPCC 2006 “Guidelines for Statistics on Greenhouse Gases for Countries” (Table 3.36).

**Table 3.36. Coefficient of CO<sub>2</sub> emissions from vehicle engines running on the road**

<b>Types of vehicles</b>	<b>CO<sub>2</sub> emission rate (kg/km)</b>
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<sub>2</sub> emissions from vehicle engines**

<b>Year</b>	<b>Distance (km)</b>	<b>CO<sub>2</sub> emission (tons/year)</b>
2025	2,803	15,156
2040	2,803	18,544

From the forecast results, it is found that CO<sub>2</sub> emissions from vehicles running along the entire Project road is 15,156 tons/year in 2025 and 18,544 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. Impact sources/Source generation activities**

Forecasted traffic volumes during peak hours 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.

ASJ 2003 model is used to predict the equivalent sound level  $L_{eq}$  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:

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

*In which:*

- $L_{AE}$ : sound exposure level from a vehicle at a certain time
- $\Delta t_i$ : a certain period of time set to calculate  $L_{AE}$
- $L_i$ : source noise level in a period of time  $\Delta t_i$

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

$$L_{eq} = L_{AE} + 10 \lg N - 10 \lg (T/t_0)$$

*In which:*

- $N$ : traffic volume;
- $L_{eq}$ : 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:

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

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

$V$ : vehicle's speed.

Input of Model

- Vehicle flow in 2025 and 2040 in peak hour. In which traffic volume in the peak



- hour is estimated about 10% traffic volume total/day
- 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 in the 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 Nguyen Trai bridge**

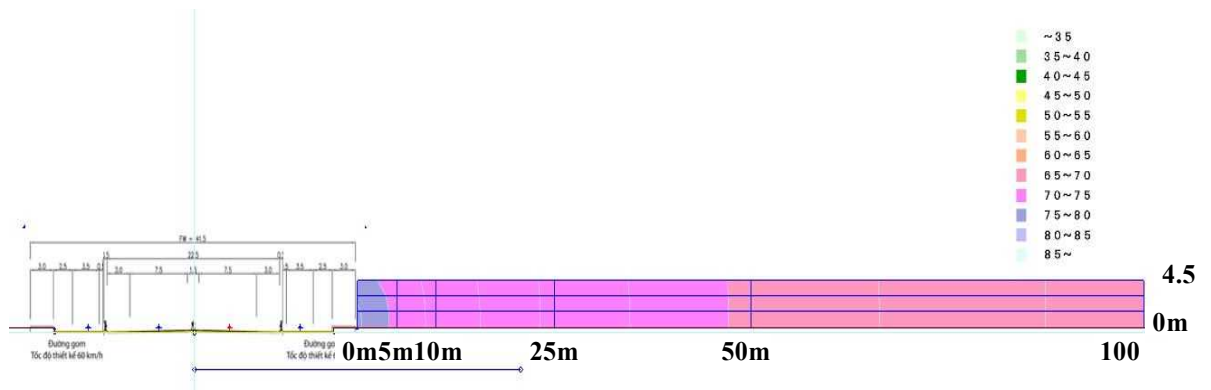
(Unit: dBA)

No	Year	Height <sup>(2)</sup> (m)	Noise levels by distance <sup>(1)</sup> (m)					
			0	5	10	25	50	100
	2025	4.5	75.5	74.5	73.7	71.7	69.8	67.4
		3	75.9	74.7	73.7	71.8	69.8	67.4
		1.5	76.1	74.7	73.7	71.8	69.8	67.4
		0	76.2	74.7	73.7	71.8	69.8	67.4
	2040	4.5	76.4	75.4	74.5	72.6	70.7	68.3
		3	76.7	75.6	74.6	72.6	70.7	68.3
		1.5	77.0	75.6	74.6	72.7	70.7	68.3
		0	77.0	75.6	74.6	72.7	70.7	68.3

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

(2) Height from the earth surface

Cell with grey highlight: noise level exceeds the allowable limit stipulated in QCVN 26:2010/BTNMT (70dBA).



**Figure 3.7. Predicted noise levels near Nguyen Trai Bridge in 2025**

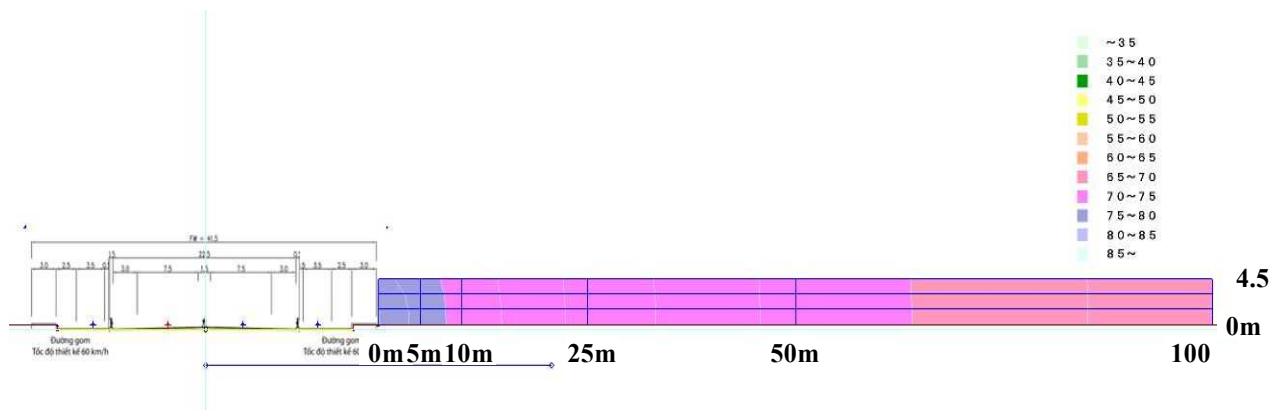


Figure 3.8. Predicted noise levels near Nguyen Trai Bridge in 2040

c. Assessment

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

Table 3.39. Noise level impact on the objects in 2025 and 2040 on Nguyen Trai Bridge

No	Object	Distance <sup>(1)</sup> (m)	Noise affected (dBA)	Note
1	<i>Year 2025</i>			
-	Nguyen Trai Street Residential Area	5	74.7	
-	Anhxtanh High School <sup>(2)</sup>	100	-	It's hidden behind the wall. trees and house so that it won't be affected by noise
2	<i>Year 2040</i>			
-	Nguyen Trai Street Residential Area	5	75.6	
-	Anhxtanh High School <sup>(2)</sup>	100	-	It's hidden behind the wall. trees and house so that it won't be affected by noise

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

Comparing forecast results with Allowable Limit of QCVN 26/2010/BTNMT (70dBA during the day), it is found that:

- In 2025 (*in the peak hours*):
  - The special areas won't be affected by noise;
  - The exceeding of impact noise level on resident areas that is located in the pavement with the allowable Limit according to QCVN 26:2010 (70dBA) is not significant (4.7dBA). This impact is negligible comparing with benefits that people with street-front houses can get.
- In 2040 (*in the peak hours*):
  - o Anhxatnh high school (Le Loi high school) will not be affected by noise;
  - o The exceeding of impact noise level on resident areas that is located in the pavement with the allowable Limit according to QCVN 26:2010 (70dBA) is not significant (5.6dBA). This impact is negligible comparing with benefits that people with street-front houses can get.

### **3.3.2.2. *Vibration***

#### **a. Impact sources/ 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 when carrying out the surveying for component of ring road 3 of the Project of Hai Phong main road 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. 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***

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

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. Impacts to landscape***

During the operational phase, if Nguyen Trai bridge was designed and constructed consistent and in harmony with the surrounding landscape, it can become a symbol of the city of Hai Phong, linking existing centers and new city center, contribute to beautify the city landscape.

Nguyen Trai Bridge construction area has no special landscape, so the appearance Nguyen Trai Bridge will not have a negative impact on the landscape.

The shadows of South Nguyen Trai Bridge will appear on the area surrounding residential areas. However, the shade will bring people comfort, particularly for urban areas in Vietnam, thus helping people avoid the sun.

#### ***3.3.2.5. Impact on ecosystem***

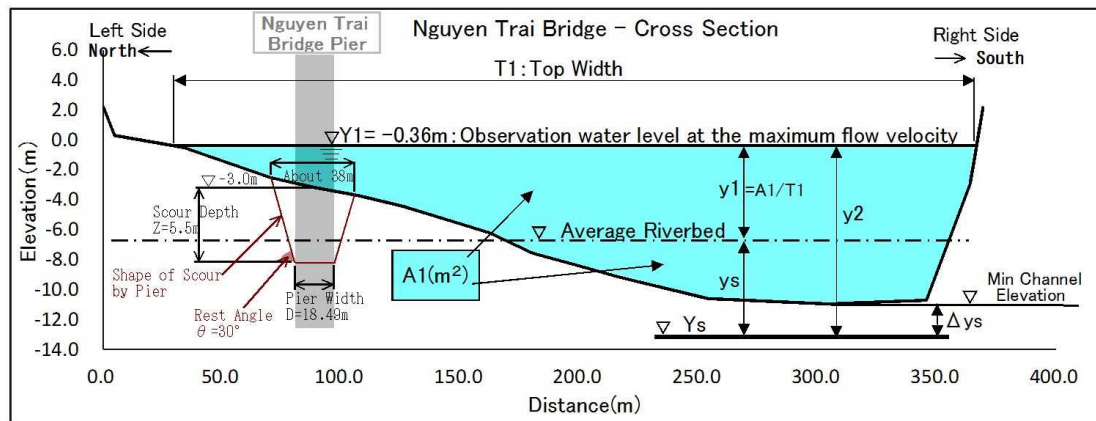
During the operational phase, one part of the mangrove forest area of the riverbank under Nguyen Trai Bridge will be affected by air pollution and the shade from the bridge.

#### ***3.3.2.6. Impact of hydrology***

Nguyen Trai Bridge has piers of P12. P13 located in the main flow of Cam river. Piers of the approach bridge on the north bank are all located on the river bank. The pier (P13) is located on the main stream of Cam river, 90m from north bank of the river. Direction and shape of the piers have been designed in such a way that the water displacement is minimal and convenient for the flow (Figure 3.4).

Total water displacement of piers is  $(18.491\text{m} \times 5.0\text{m}) + (4.95\text{m} \times 4.0\text{m}) = 111.3\text{ m}^2$ . Equivalent to 3.5% of the area of cross section of Cam River ( $3.203\text{m}^2$ ). 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 Nguyen Trai Bridge, this percentage is 3.5% so the two piers under the Cam River will not cause significant impact on hydrological condition of the river

However, during the operation phase, the river bed around the bridge piers will be eroded locally. Calculated depth of local erosion at the pier P13 is approximately 5.5m



**Figure 3.9. Erosion depth at the pier of Nguyen Trai bridge**

### 3.3.2.7. Impact of Water usage

Presently, the downstream area of Cam River from location for construction of Nguyen Trai Bridge is used primarily for water transportation, aquaculture, and agriculture on Vu Yen Island.

The appearance of Nguyen Trai Bridge will not affect the water transportation activities because the piers of the bridge are designed far from navigable clearance of vessels (Pier P13 is 100m from the navigable clearance of vessel).

The appearance of Nguyen Trai Bridge will also not affect water quality of the river for aquacultural purposes at downstream area.

### 3.3.3. Social impacts

#### 3.3.3.1. Social impacts on local organizations

Along Nguyen Trai Street, there are located Le Loi High School (near the intersection of Nguyen Trai Street and Le Thanh Tong Street), and the office of May To Ward PC (at the southern end of Nguyen Trai Street).

In the operation phase, the new bridge may help improve the accessibility of local residents in a large area between two banks of Cam river.

However, Nguyen Trai Street will be widened. Traffic volume may become heavier and vehicle speed may become faster. Local residents along Nguyen Trai Street will get difficulties to cross the street and access to the public facilities, shops, etc.. on the other side of the street. Students who are residing on the western side of Nguyen Trai Street will get difficulties crossing this street to go to Le Loi High School on the eastern side.

Therefore, it is required to arrange crossroad painted for pedestrians and students crossing the road to go to school and for local people coming to PC of May To ward.

**3.3.3.2. Local economy**

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 completed, particularly the north bank of Nguyen Trai Bridge. In the near future, areas at the north bank of Nguyen Trai Bridge will be developed to be northern urban area of Cam River.

**3.3.3.3. The poor**

Project-affected vulnerable households including the poors would face difficulty in restoring their living and livelihood after relocation. Therefore, the need 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 rise faster. The risk of traffic accidents will increase. Children in the Project area. Especially students of Anhxtanh high school (near the intersection between Nguyen Trai and Le Thanh Tong streets) 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
<b>I</b>	<b><i>Impacts related to waste</i></b>			
1	Air pollution by dust and gas emission	– Along road and bridge of the Project	Long time	Low ~ Medium
2	Water pollution 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	Long time	Medium
4	Impact on climate change/greenhouse gas	– All route of the project	Long time	Low ~ Medium
<b>II</b>	<b><i>Non-related waste impacts</i></b>			
1	Impact on public health by noise	– Approach road and bridge at the south of Nguyen Trai bridge	Long time	Low ~ Medium
2	Impact on public health by vibration	– Approach road and bridge at the south of	Long time	Low ~ Medium

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No	Impact	Location	Time	Degree
		Nguyen Trai bridge		
3	Impact on erosion. sedimentation	– Cam river where the section of Nguyen Trai bridge is built	Long time	Low ~ Medium
4	Impact on landscape	– Surrounding area of the project	Long time	Positive
5	Impact on ecosystem	– Mangrove forest area near the northern approach bridge of Nguyen Trai street	Long time	Low ~ Medium h
6	Impact on hydrology	– Downstream area of Nguyen Trai bridge	Long time	Low
7	Impact on water use	– Water transport on Cam river – Irrigation condition at the downstream area of Nguyen Trai bridge	Long time	Low
<b>III</b>	<b><i>Social impact</i></b>			
1	Impact on social capital. local organizations	– Along Nguyen Trai street – Anhxtanh highschool	Long time	Medium
2	Impact on local economy	– Project area	Long time	Positive
3	Impact on the poor	– Relocated Households by the project	Long time	Medium
4	Impact on children's rights	– Anhxtanh highschool	Long time	Medium

### **3.4. Environmental incidents**

#### ***3.4.1. Environmental incidents during the 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 at intersection with Le Thanh Tong street. 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 (on the Cam river) and roadway (on Le Thanh Tong street) when operating under the bridges.

##### ***2. Risks of fires and explosions***

During the construction phase, oil and gas used for the operation of construction equipment 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***

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 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***

Although the distance from the outer edge of the navigable clearance on Cam river to construction location of pier P13 is quite far (100m). However, in the construction process due to unexpected factors. There may be incidents of collision or impact between boats and the pier under construction. 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 abutments 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 abutments)

#### ***3.4.2.2. Risk of traffic accidents***

Traffic accidents on road can happen, not only cause loss and damage to people and assets but also cause damage to the bridge's auxiliary works.

### **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 were 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 Sutton 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.

Plan for relocation of Hoang Dieu port facilities affected by permanent land acquisition of the project needs to be prepared carefully. The relocation of these facilities must be completed early before construction stage

*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 Hoang Dieu port will be relocated to prepare for construction site on the South side of Cam river in Nguyen Trai bridge area.
- A part of land area (currently cultivation land and aquacultural ponds) will be rehired to prepare for construction site on the North side of Cam river in Nguyen Trai bridge area.
- Implement impact mitigation measures of temporary land acquisition 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, especially poor households**

**a. Description of mitigation measures**

According to investigation results for Nguyen Trai bridge project, though there is no poor affected households, some vulnerable households such as (social policy households and female headed households, etc.) are 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 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.

**4.1.1.5. For use of power 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 Duong Quan commune and May To ward.
- *Implementation time:* During preparation phase.

**4.1.1.6. For impacts on existing properties of the society and social organization in the locality**

- At location near schools and public facilities, design aid means to facilitate pedestrians safely crossing the road.

**4.1.1.7. For impacts of relocating utilities**

**a. Description of mitigation measures**

- Diversion plan of utilities like electricity, communication cables, water supply pipes, waste water drainage system, 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, drainage culverts, water pipes, etc. (relocation costs were included in the project total investment cost).

**b. Objects and implementation time**

- *Applicable objects:* Power, communication, water supply and drainage system along Nguyen Trai street.
- *Implementation time:* Before construction of approaching 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 1,800m<sup>2</sup>.



- 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 preparation and construction phases.

**4.1.1.9. For impacts by unfair 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 landscape impacts**

**a. Description of mitigation measures**

- Trees along Nguyen Trai street will be relocated temporarily and re-planted after the project completion.
- Plant trees along roads of the project.
- Existing trees along the planned roads will be protected and maintained under reasonable and feasible conditions.
- Classify, collect and treat construction waste from house and structure demolition. Transport daily to the disposal site.

**b. Objects and implementation time**

- *Applicable objects:* Urban trees, construction waste from house and structure demolition.
- *Implementation time:* During preparation phase, and at end of the project construction 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:* demolition location: Residential houses along Nguyen Trai street and Hoang Dieu port.
- *Implementation time:* 1 month 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, preparing site for beam casting yard and service road along Nguyen Trai bridge.
- *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* : residential area along Nguyen Trai street
- *Implementation*: During demolition period (1 month) and construction site preparation period (3 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 and vibration impacts**

**a. Description of measures**

The following measures shall be implemented to mitigate noise and vibration 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 along Nguyen Trai street
- *Applicable time*: 1 month 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 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 site.
- *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 Section 4.2.3.2-2.
- 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.*

***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 in the South of Nguyen Trai bridge, and sensitive objects along the project, residential area along Nguyen Trai street, Hoang Dieu port.
- *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.
- 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.
- Unreusable 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 31<sup>st</sup> 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 30<sup>th</sup>, 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 10m<sup>2</sup> 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 3m<sup>3</sup> 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 maintained 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 rain water spilled over from the construction site to rivers:

- The construction site shall be designed with a suitable rain water drainage system including culverts, ditches, manholes, pits, grass of low areas, etc., to prevent rain 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 Nguyen Trai 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 impacts on residents caused by noise and vibration***

**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 machineries, 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 machineries 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;
- Machineries 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 along Nguyen Trai street, Hoang Dieu port, Le Thanh Tong street near interchanges.
- *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.

## **2. Mitigation of vibration impacts**

### **a. Description of mitigation measures**

- *Control the vibration including:*
  - 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 along Nguyen Trai street, Hoang Dieu port, Le Thanh Tong street near interchanges
- *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.

#### ***4.2.3.2. 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*: Construction site along North side of Nguyen Trai 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<sup>3</sup> 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.

#### ***4.2.3.3. 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*: Approaching road and bridge in the North of Nguyen Trai bridge.
- *Implementation time*: During construction phase.

**4.2.3.4. 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.

**4.2.3.5. 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 collect and clean.
  - During the construction of interchanges, surface of Le Thanh Tong road near the interchange will be cleaned daily. The length of Le Thanh Tong to be cleaned will be shown by supervision engineers on the base of dirt 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 Le Thanh Tong street 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 be guided to suitable bypass roads.

**b. Location and time for implementation**

- *Location:* construction area along Nguyen Trai road, interchange with Le Thanh Tong road
- 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 Road No. 10, Provincial Road No. 359, Bach Dang road, and inter-village roads, inter-communal roads etc.
- Implementation time: During construction period.

#### ***4.2.3.6. Mitigation of impacts on hydrological conditions surrounding the bridge foundation***

##### **a. Description of mitigation measures**

- Nguyen Trai bridge is designed with only two piers (P12, P13) in the main flow of Cam 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 P12, P13 so as to minimize the water occupation area of Cam River, especially in flood season.

##### **b. Location and Implementation time**

- *Location*: Nguyen Trai bridge
- *Implementation time*: Pre-construction and construction phases.

#### ***4.2.3.7. 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 Nguyen Trai bridge
- *Implementation time*: During construction phase

#### ***4.2.3.8. 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, 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.

**4.2.3.9. 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:* in the entire project
- *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 of steel bridge arch 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 and vibration 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*: approaching road of Nguyen Trai bridge
- 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.

### **4.3.3. 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, signage, 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*: Nguyen Trai road 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 May To and Duong Quan communes 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 May To and Duong Quan 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 May To and Duong Quan communes for first aids, or to the nearest hospital, 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:* Cam river in Nguyen Trai 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 PLAN

### 5.1. Environmental Management Plan

#### 5.1.1. Objectives

The objective of the project's environmental management plan is to propose a plan to manage environmental protection issues during pre-construction, construction and operation phases of the project. Details of this plan will consist of the following objectives:

- 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 Regulation.
- The information obtained in the course of the project's environmental management shall ensure the following key attributes:
  - o Data accuracy: The observation data accuracy is assessed in terms of the similarity between data and reality;
  - o Data specificity: The data collected at an observation location represents a certain space;
  - o 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;
  - o Continuous monitoring capability over time: As per environmental observation plan defined during the Project implementation;
  - o 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
<b>1. In preparation phase</b>						
<b>1.1. Involuntary – Impacts from land acquisition, relocation and resettlement</b>						
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, ...	<p>- Measures to mitigate impacts are described in the separately-prepared Resettlement Action Plan (RAP) and Livelihood Restoration Plan.</p> <p>- 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.</p> <p>- 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</p> <p>- Project owner shall ensure to provide properly and timely information, necessary documents of project, budget for compensation, support and resettlement.</p> <p>- Relocation plan of premises of Hoang Dieu port was impacted by permanent land acquisition for Project should be carefully prepared and relocation would be carried out soon before construction stage.</p>	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	<p>- A part of Hoàng Diệu port will be relocated for site preparation at the South bank of Cam River, near Nguyen Trai Bridge.</p> <p>- A part of agricultural land will be hired for site preparation at the North bank of Cam River, near Nguyen Trai Bridge.</p> <p>- Measures to mitigate impacts of temporary land acquisition are included in the separately-prepared Resettlement Action Plan (RAP) and Livelihood</p>	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
		<p>Restoration Plan</p> <ul style="list-style-type: none"> <li>- The properties are lost or damaged including trees, crops will be compensated at full replacement price level and in accordance with consent of the owners of temporary land acquisition.</li> <li>- Rental price of temporarily occupied land will not less than the net income that farmers can obtain if their land was not occupied.</li> <li>- The Contractor shall reinstate land area as original status within 3 months after completion of construction.</li> </ul>				
1.1.3 Permanent land acquisition, resettlement.	Impact on poor household (difficulty in restoring livelihoods after relocation, resettlement)	<ul style="list-style-type: none"> <li>- 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.</li> <li>- 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.</li> <li>- Vulnerable households to be relocated who have more than 10% 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</li> </ul>	Counterpart funds of Vietnamese Government	Before construction	<ul style="list-style-type: none"> <li>- Compensation and Site clearance Committee at district level</li> <li>- Labor, Invalids, and Social Department of Thuy Nguyen District</li> </ul>	Labor, Invalids, and Social Department of Thuy Nguyen, Ngo Quyen Districts.
1.1.4 Permanent land acquisition, Demolitions for site clearance, prepare for construction sites	Impact on local economy such as employment, business of households affected by land acquisition, site clearance, v.v.	<ul style="list-style-type: none"> <li>- Measures to mitigate impacts on employments and livelihood of relocated residents are described in separate RAP report and Livelihood Restoration Program.</li> <li>- In construction period, the contractors would be encouraged to employ project-affected residents and other local residents to work as construction worker..</li> </ul>	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
1.1.5 Permanent land acquisition	Impact on usage of local natural resources (loss living land and production lands)	<ul style="list-style-type: none"> <li>- Properly compensate and support for affected households whose land is lost by Project.</li> <li>- When making livelihood restoration plan for affected households, using effectively land and existing natural resources of local should be taken into consideration.</li> </ul>	Counterpart funds of Vietnamese Government	Before construction	Compensation and Site clearance Committee at district level	Hai Phong Bridge Projects Management Department
1.1.6 Construction and operation of bridges, roads	The existing assets of social organizations, organizations at local (divided community)	<ul style="list-style-type: none"> <li>- During design, crosswalk for pedestrians should be arranged at locations near schools, public places to help people crossing street easily and safety.</li> </ul>	Construction costs	Before construction, construction stage	Construction Contractor	Hai Phong Bridge Projects Management Department
1.1.7 Relocation of facilities (relocation of electric poles, water supply)	Interrupt water supply and power supply, affecting the daily life and production activities of local residents	<ul style="list-style-type: none"> <li>- Relocation plan of utilities systems (electrical cable, communication cable, water supply pipe, drainage system...) 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.</li> <li>- 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).</li> </ul>	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)	<ul style="list-style-type: none"> <li>- Reforestation plan of about 18,000 m<sup>2</sup> of area of mangrove forests lost by the project should be prepared in detail.</li> <li>- 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/QĐ-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.</li> <li>- Plan of reforestation to compensate to the mangrove forests lost by the project can be combined with the plan prepared by Vingroup JSC with aim to develop the land in the east of Vu Yen Island as an eco-logical park.</li> </ul>	Construction costs	In construction period	Forest Planting Company under contract with Hai Phong Bridge Projects Management Department	<ul style="list-style-type: none"> <li>- Hai Phong Bridge Projects Management Department</li> <li>- Consultant of Forest Development and Protection Center</li> </ul>

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
1.1.10 Land acquisition, widen the existing road	Impact on landscape (remove trees along existing road)	- Trees along Nguyen Trai Road (south of Nguyen Trai bridge) will be relocated temporarily and replanting after completion of project. - Planting trees along two roadside of frontage roads in the north to improve the cityscape and minimize noise impacts, air pollution ... - The existing trees along the planned road will be protected and preserved where reasonable and feasible.	Construction costs	Before starting construction and after completion of Project	Contractor under contract with Project Owner	- Hai Phong Bridge Projects Management Department. - Supervision Consultant
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	1-3 months	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
1.2.2 Demolition, clearing surface and preparation of construction sites	Discharge wastes causing environmental pollution (affecting health of local people damage the landscape, make environmental sanitation problems more serious).	<ul style="list-style-type: none"> <li>- Wastes from demolition work would be classified for reuse. Construction scraps (concrete, brick,...) may be reused for levelling ground of 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...</li> <li>- Wastes will be collected and gathered on appropriate areas at site as regulated.</li> <li>- No burning of debris, construction wastes or vegetation shall be allowed on-site.</li> <li>- 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.</li> </ul>	Construction costs	1-3 months	Contractor under the contract with Project owner	<ul style="list-style-type: none"> <li>- Hai Phong Bridge Projects Management Department</li> <li>- Supervision Consultant</li> </ul>
1.2.3 Demolition, clearing surface and preparation of construction sites	Noise and vibration (affecting people's health)	<ul style="list-style-type: none"> <li>- Do not carry out demolition, levelling and transportation at night time: from 10p.m to 6a.m.</li> <li>- Maintenance of equipment to ensure smoothly operate, so reduce noise.</li> <li>- Operation of all equipment at the same time should be limited.</li> <li>- Manual manner and machinery manner would be combined.</li> </ul>	Construction costs	1~3 weeks in the duration of demolition	Contractor under the contract with Project owner	<ul style="list-style-type: none"> <li>- Hai Phong Bridge Projects Management Department.</li> <li>- Supervision Consultant</li> </ul>
1.2.4 Demolition, clearing surface and preparation of construction sites	Traffic accidents, impact on travelling of local persons	<ul style="list-style-type: none"> <li>- Install barriers at boundary between demolished areas and surrounding areas.</li> <li>- Arrange warning signs at demolition places</li> <li>- 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.</li> <li>- Do not transport construction wastes on the peak hours.</li> <li>- Trucks for carrying construction wastes should be a dedicated one, with covered wagon body to avoid drop wastes into the roadway.</li> </ul>	Construction costs	In construction preparation stage	Contractor under the contract with Project owner	<ul style="list-style-type: none"> <li>- Hai Phong Bridge Projects Management Department.</li> <li>- Supervision Consultant</li> </ul>

Project activities	Environmental Impacts	Impact mitigation measures	Financial sources	Period of Implementation	Responsible entity	Supervision Agency
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.	<p>- Materials for construction would only be provided from licensed mines, operated under good environmental management.</p> <p>- In case materials would be transported by waterway, the following measures should be applied:</p> <p>Equip protective plate around materials to prevent them from falling down the river.</p> <p>+ Cover dedicated canvas for dispersible fine materials during transportation.</p> <p>+ Prohibit to transport overload exceeding load of ships and boats.</p> <p>+ Only use the vessel comply with standards for waterway traffic.</p> <p>+ 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 2.3.2-2.</p> <p>- In case materials are transported by roadway, the mitigation measures will include:</p> <p>+ Spray water frequently on soil-roads along transportation route, at material storage areas and areas potentially arising dust.</p> <p>+ 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.</p> <p>+ 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).</p> <p>- 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.</p>	Construction costs	During construction period	Construction Contractor under the contract with Project owner	<p>- Hai Phong Bridge Projects Management Department.</p> <p>- Construction Supervision Consultant (CSC)</p> <p>- Environmental Supervision Consultant(EMC)</p> <p>- Safety and Environmental Officer of Contractors (SEO)</p>

Project activities	Environmental Impacts	Impact mitigation measures	Financial sources	Period of Implementation	Responsible entity	Supervision Agency
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)	<ul style="list-style-type: none"> <li>- Site training would be provided to make construction workers aware of air quality control practices and responsibilities.</li> <li>- 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).</li> <li>- Construction activities would be modified, reduced or controlled during high or unfavorable wind conditions if they would potentially increase off-site dust emissions.</li> <li>- 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.</li> <li>- Excavation or backfilling areas would be stabilized as soon as practicable (by compacting, covering, planting grass) to prevent or minimize windblown dust.</li> <li>- Temporary massive land dump will be gathered around by canvas to avoid dust generation.</li> <li>- 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.</li> <li>- Construction areas and surrounding public roads would be cleaned, as required.</li> <li>- Speed limits would be posted and observed by all construction vehicles on the construction site.</li> <li>- Trucks and equipment would be switched off when not in operation for periods of greater than 15 minutes</li> <li>- Construction equipment and machinery must meet the emission requirements under Decision No. 249/2005/QD-TTg.</li> <li>- Construction equipment would not be allowed to operate outside the</li> </ul>	Construction costs	During construction period	Construction Contractor under the contract with Project owner	<ul style="list-style-type: none"> <li>- Hai Phong Bridge Projects Management Department.</li> <li>- Construction Supervision Consultant (CSC)</li> <li>- Environmental Supervision Consultant(EMC)</li> <li>- Safety and Environmental Officer of Contractors (SEO)</li> </ul>



Project activities	Environmental Impacts	Impact mitigation measures	Financial sources	Period of Implementation	Responsible entity	Supervision Agency
		<p>construction area.</p> <ul style="list-style-type: none"> <li>- Construction equipment and vehicles have to be maintained in accordance with guidelines of Manufacturer in order to work in good condition.</li> </ul>				
2.2.1-2 Transport waste rock, soils	Arising dust from material transportation (degrade air quality, especially dust, affecting health of local people, business activities...)	<ul style="list-style-type: none"> <li>- Vehicles delivering waste soil, rock should have to meet the requirements of emission standards under the "Decision No. 249/2005/QĐ-TTg dated 10/10/2005</li> <li>- 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.</li> <li>- Waste rocks would not be transported at peak hours and on holidays.</li> <li>- Land spillage during transport on the road have to be collected, and transportation routes of waste soil have to be regularly cleaned.</li> <li>- Make plan to transport majority or the entire volume of waste soil by waterway.</li> </ul>	Construction costs	During construction period	Construction Contractor under the contract with Project owner	<ul style="list-style-type: none"> <li>- Hai Phong Bridge Projects Management Department.</li> <li>- Construction Supervision Consultant (CSC)</li> <li>- Environmental Supervision Consultant(EMC)</li> <li>- Safety and Environmental Officer of Contractors (SEO)</li> </ul>
2.2.1-3 Cement mixing plant	Dusts come from mixing plant causing degrading air quality	<ul style="list-style-type: none"> <li>- 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.</li> <li>- Spray water when pouring materials down from trucks to avoid dust generation;</li> <li>- Rocks should not be crushed at site. Rocks and gravels for concrete mixing shall be purchased from licensed suppliers.</li> <li>- Moisten materials for concrete (sand and gravel) before pouring onto the belt conveyor leading to the mixer.</li> <li>- Fabric dust filter shall be installed inside the silo of concrete mixing plant and regularly maintained.</li> </ul>	Construction costs	During construction period	Construction Contractor under the contract with Project owner	- Hai Phong

Project activities	Environmental Impacts	Impact mitigation measures	Financial sources	Period of Implementation	Responsible entity	Supervision Agency
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,	<p>- The waste management plan covering the following things should be developed:</p> <ul style="list-style-type: none"> <li>+ Specify person in charge of managing waste on site</li> <li>+ Establish objectives of waste management plan.</li> <li>+ Estimate the waste types and amounts involved.</li> <li>+ Set targets for reducing the amount of each waste sent to landfill.</li> <li>+ Describe recycling/reuse methods for each material</li> <li>+ Identify the waste destinations and transport modes, including what materials are being segregated on site for reuse or recycling.</li> <li>+ Identify monitoring modes of waste processing progress.</li> <li>+ Describe special measures for material use and handling.</li> <li>+ Describe communication and training to support and encourage participation from everyone on site</li> </ul> <p>- Raw material requirements shall be planned at the outset of each construction activity to avoid excess material storage and wastage on-site.</p> <p>- 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.</p> <p>- No burning of debris, construction wastes or vegetation shall be allowed on-site.</p> <p>- 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:</p> <ul style="list-style-type: none"> <li>+ 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 (eg. to backfill the hollows such as ponds, lakes, fields, gardens ... or constructions). The</li> </ul>	Construction costs	During construction period	Construction Contractor under the contract with Project owner	<ul style="list-style-type: none"> <li>- Hai Phong Bridge Projects Management Department.</li> <li>- Construction Supervision Consultant (CSC)</li> <li>- Environmental Supervision Consultant(EMC)</li> <li>- Safety and Environmental Officer of Contractors (SEO)</li> </ul>

Project activities	Environmental Impacts	Impact mitigation measures	Financial sources	Period of Implementation	Responsible entity	Supervision Agency
		<p>re-use will not cause more environmental impact.</p> <p>+ 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</p> <p>- 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.</p> <p>- 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,...</p> <p>- 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.</p> <p>- In technical design stage, positions of dumps would be defined clearly and impacts arising from disposal activities shall be surveyed and accessed in detail.</p>				
2.2.2-2. Activities of Workers (at Worker Camps)	Generation of living solid wastes causing environmental unsanitary, water pollution, affecting health, living environment of local residents	<p>- 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.</p> <p>- 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.</p> <p>- Food scraps, vegetables would be used for animal feed. Wastes can be reused like plastic, cardboard, cans, bottles can be sold for recycle.</p> <p>- Wastes cannot be reused shall be moved to temporary properly designed storages with walls and cover.</p> <p>- Under an economic contract, Project Owner shall request contractor to</p>	Construction costs	During construction period	Construction Contractor under the contract with Project owner	<p>- Hai Phong Bridge Projects Management Department.</p> <p>- Construction Supervision Consultant (CSC)</p> <p>- Environmental Supervision Consultant(EMC)</p> <p>- Safety and Environmental Officer of</p>

Project activities	Environmental Impacts	Impact mitigation measures	Financial sources	Period of Implementation	Responsible entity	Supervision Agency
		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.				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	<ul style="list-style-type: none"> <li>- 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.</li> <li>- 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.</li> <li>- 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.</li> <li>- Through the economic contracts, the Project owner shall request the contractor to synthesize and report on hazardous wastes arising from operations of the Project.</li> <li>- 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.</li> </ul>	Construction costs	During construction period	Construction Contractor under the contract with Project owner	<ul style="list-style-type: none"> <li>- Hai Phong Bridge Projects Management Department.</li> <li>- Construction Supervision Consultant (CSC)</li> <li>- Environmental Supervision Consultant(EMC)</li> <li>- Safety and Environmental Officer of Contractors (SEO)</li> </ul>
2.2.3. Water pollution						
2.2.3-1 Workers' activities	Generation of domestic waste water causing degrading surface water quality	<ul style="list-style-type: none"> <li>- Wastewater from bath would be reused to moisten surface of the road or places can emit dust during construction work.</li> <li>- 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 10m<sup>2</sup>) 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. 3m<sup>3</sup> of replaced sand per week can be considered as</li> </ul>	Construction costs	During construction period	Construction Contractor under the contract with Project owner	<ul style="list-style-type: none"> <li>- Hai Phong Bridge Projects Management Department.</li> <li>- Construction Supervision Consultant (CSC)</li> <li>- Environmental Supervision Consultant(EMC)</li> </ul>

Project activities	Environmental Impacts	Impact mitigation measures	Financial sources	Period of Implementation	Responsible entity	Supervision Agency
		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.				- 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." - After completion of project construction, culverts and clarifier should be leveled before handover to the owner.	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- 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	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
		emissions of dust in the dry season and pollutants in the water entrained with storm water overflow during the rainy season.				- Safety and Environmental Officer of Contractors (SEO)
2.2.3- 4 Construction activities	Increase waste water causing degrading quality of surface water	<ul style="list-style-type: none"> <li>- 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:</li> <li>+ Legal requirements related to water quality.</li> <li>+ Problems of erosion, sedimentation, water quality likely arising from the project.</li> <li>+ Management measures of water quality and soil erosion during construction period.</li> <li>+ Roles and responsibilities of involved persons in the development and implementation of quality management terms on water and soil erosion.</li> <li>+ Monitoring mechanism, monitoring and reporting to assess the effectiveness of taken control measures.</li> <li>- Apply technology to build a friendly environmental technology such as 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.</li> <li>- Apply the construction methods that use efficiency of water, saving the amount of water used, under means of reprocessing and reuse of water.</li> <li>- Check regularly garbage screens, sediment deposition to prevent overflow of water with pollutants to outside.</li> <li>- Develop a monitoring program of surface water quality during the construction process to monitor the water quality at upstream and downstream of Nguyen Trai bridge. The monitoring program will start before construction.</li> </ul>	Construction costs	During construction period	Construction Contractor under the contract with Project owner	<ul style="list-style-type: none"> <li>- Hai Phong Bridge Projects Management Department.</li> <li>- Construction Supervision Consultant (CSC)</li> <li>- Environmental Supervision Consultant(EMC)</li> <li>- Safety and Environmental Officer of Contractors (SEO)</li> </ul>
2.3. Impacts from sources not related to waste						
2.3.1-1	Generate noises	- A Construction Noise Management Plan would be prepared and would	Construction	During	Construction	- Hai Phong

Project activities	Environmental Impacts	Impact mitigation measures	Financial sources	Period of Implementation	Responsible entity	Supervision Agency
Construction activities	affecting health of local people	<p>include the following:</p> <ul style="list-style-type: none"> <li>+ Identification of nearby residences and other sensitive land uses.</li> <li>+ Description of approved hours of work.</li> <li>+ Description and identification of all construction activities, including work areas, equipment and duration.</li> <li>+ Description of what work practices (generic and specific) would be applied to minimize noise according to Vietnamese Standards about Noise (QCVN 26:2010/BTNMT).</li> <li>+ A complaints handling process.</li> <li>+ Noise monitoring procedures.</li> <li>+ Overview of community consultation required for identified high impact works.</li> <li>- Induction and training would be provided to relevant staffs and workers of contractors outlining their responsibilities with regard to noise.</li> <li>- Equipment would be regularly inspected and maintained to ensure it is in good working order.</li> <li>- The machinery with low sound level shall be priority to use when construction work is undertaken near noise sensitive areas.</li> <li>- Noisy equipment would be orientated away from residential areas and would not be concentrated in a narrow space.</li> <li>- All vehicles stay on site must be switch off.</li> <li>- 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).</li> <li>- Noisy operations such as piling, road-making, drilling concrete ... would be implemented in time frame match with high background noise levels.</li> <li>- Transportation of waste materials, soil would only be conducted during</li> </ul>	costs	construction period	Contractor under the contract with Project owner	<p>Bridge Projects Management Department.</p> <ul style="list-style-type: none"> <li>- Construction Supervision Consultant (CSC)</li> <li>- Environmental Supervision Consultant(EMC)</li> <li>- Safety and Environmental Officer of Contractors (SEO)</li> </ul>

Project activities	Environmental Impacts	Impact mitigation measures	Financial sources	Period of Implementation	Responsible entity	Supervision Agency
		<p>permitted construction time-frame, when feasible and appropriate.</p> <ul style="list-style-type: none"> <li>- 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.</li> <li>- 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.</li> <li>- Construction sites and access roads should be located at far as possible from noise sensitive objectives.</li> <li>- Use temporary noise barrier at the auxiliary construction locations where quite close to residential areas.</li> <li>- 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.</li> </ul>				
2.3.1-2 Construction activities	Generate vibrations affecting health of local people	<ul style="list-style-type: none"> <li>- Vibration Management Plan would be prepared and would include the following:               <ul style="list-style-type: none"> <li>+ Identification of vibration sensitive areas.</li> <li>+ Description of approved hours of work.</li> <li>+ Description and identification of all construction activities, including work areas, equipment and duration.</li> <li>+ Description of what work practices (generic and specific) would be applied to minimize vibration.</li> <li>+ A complaints handling process.</li> <li>+ Vibration monitoring procedures.</li> <li>+ Public consultation progress where there are demands for carrying out construction activities under high vibrations.</li> </ul> </li> </ul>	Construction costs	During construction period	Construction Contractor under the contract with Project owner	<ul style="list-style-type: none"> <li>- Hai Phong Bridge Projects Management Department.</li> <li>- Construction Supervision Consultant (CSC)</li> <li>- Environmental Supervision Consultant (EMC)</li> <li>- Safety and Environmental Officer of Contractors</li> </ul>



Project activities	Environmental Impacts	Impact mitigation measures	Financial sources	Period of Implementation	Responsible entity	Supervision Agency
		<ul style="list-style-type: none"> <li>- Induction and training would be provided to relevant staffs and workers of contractors outlining their responsibilities with regard to vibrations.</li> <li>- In principle, construction work only be allowed to implement within allowable time-frame.</li> <li>- 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)</li> </ul>				(SEO)
2.3.2-1 Excavation, embankment works for bridge abutment/piers foundations	Soil erosion, arising sediment causing degrading water quality by TSS	<ul style="list-style-type: none"> <li>- 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.</li> <li>- The Contractor shall plan his works to minimize surface excavation works during the rainy season (from May ~ October).</li> <li>- The plan shall be made to minimize the extent and duration of disturbing the vegetation.</li> <li>- 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.</li> <li>- 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.</li> <li>- 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.</li> <li>- 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.</li> <li>- All exposed earth areas shall be completed and revegetated as soon as possible after earthworks have been completed. Specially, in rainy season,</li> </ul>	Construction costs	During construction period	Construction Contractor under the contract with Project owner	<ul style="list-style-type: none"> <li>- Hai Phong Bridge Projects Management Department.</li> <li>- Construction Supervision Consultant (CSC)</li> <li>- Environmental Supervision Consultant(EMC)</li> <li>- Safety and Environmental Officer of Contractors (SEO)</li> </ul>

Project activities	Environmental Impacts	Impact mitigation measures	Financial sources	Period of Implementation	Responsible entity	Supervision Agency
		<p>ground must be compacted to avoid erosion by rain. The Contractor shall continue reinforcement if any erosive sign is found.</p> <ul style="list-style-type: none"> <li>- 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.</li> <li>- 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.</li> </ul>				
2.3.2-2 Storage, transportation of materials, waste soils	Soil erosion, sediment arising causing degrading water quality by TSS	<ul style="list-style-type: none"> <li>- Temporary store yards of construction materials (e.g.: rock, gravel, sand and backfilling soil) and waste soil should be arranged before any construction activities.</li> <li>- 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.</li> <li>- Waste material/ soil stored location would be arranged in scope of site clearance and far from surface water sources and storm water runoff areas. Do not arrange storage location in the residential, business areas where elevation lower than waste material/soil stored areas.</li> <li>- Bulk materials should be packed off or covered by geotextile. Digging ditches around the storage area to prevent sewage from entering.</li> <li>- Construction material/waste soil storages over 50m<sup>3</sup> 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.</li> </ul> <p>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.</p> <ul style="list-style-type: none"> <li>- In particular, during the rainy season, from May to October, waste rocks</li> </ul>	Construction costs	During construction period	Construction Contractor under the contract with Project owner	<ul style="list-style-type: none"> <li>- Hai Phong Bridge Projects Management Department.</li> <li>- Construction Supervision Consultant (CSC)</li> <li>- Environmental Supervision Consultant(EMC)</li> <li>- Safety and Environmental Officer of Contractors (SEO)</li> </ul>

Project activities	Environmental Impacts	Impact mitigation measures	Financial sources	Period of Implementation	Responsible entity	Supervision Agency
		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.				
2.3.3 Construction activities of main bridge, access road in the North; Activities of construction sites	Discharge waste causing water impairment affecting ecosystems of mangrove forest	<ul style="list-style-type: none"> <li>- Environmental-friendly construction method such as steel pipe sheet pile should be applied to minimized polluted water from the construction of bridge piers' foundations</li> <li>- No clear vegetation outside Project site clearance area.</li> <li>- Site fencing shall be erected around construction sites, storage areas, etc. to avoid unnecessary damages to vegetation, trees and landscape, etc.</li> <li>- 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.</li> <li>- Embankments and slopes shall be stabilized by grass planting, ideally by hydro-seeding, to minimize erosion.</li> </ul>	Construction costs	During construction period	Construction Contractor under the contract with Project owner	<ul style="list-style-type: none"> <li>- Hai Phong Bridge Projects Management Department.</li> <li>- Construction Supervision Consultant (CSC)</li> <li>- Environmental Supervision Consultant(EMC)</li> <li>- Safety and Environmental Officer of Contractors (SEO)</li> </ul>
2.3.4 Equipment, machinery operated by diesel, petrol	Emission of CO2, causing global heat increasing	<ul style="list-style-type: none"> <li>- Material transportation distance would be considered for material supply process.</li> <li>- Excess material like gravel left from the road foundation construction activities, road surface, etc. would be reused if possible.</li> <li>- Fuel efficiency of the machines and devices would be considered when selection.</li> <li>- 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.</li> <li>- Use as maximum as possible powered construction machinery and equipment.</li> <li>- Use domestic goods and services, especially at the locality to reduce</li> </ul>	Construction costs	During construction period	Construction Contractor under the contract with Project owner	<ul style="list-style-type: none"> <li>- Hai Phong Bridge Projects Management Department.</li> <li>- Construction Supervision Consultant (CSC)</li> <li>- Environmental Supervision Consultant(EMC)</li> <li>- Safety and Environmental Officer of Contractors</li> </ul>

Project activities	Environmental Impacts	Impact mitigation measures	Financial sources	Period of Implementation	Responsible entity	Supervision Agency
		<p>emissions of exhaust air from transportation.</p> <p>- 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.</p>				(SEO)
2.3.5-1 Operate machine, vehicles ...	Impacts generated from operations of machines, vehicles, encroaching on road traffic	<p>- Obey the general regulations:</p> <p>+ Construction methods and sequence, etc. should be designed to minimize block-out duration of public road, do not interrupt traffic around construction area.</p> <p>+ Construction items potentially caused a major obstacle for local traffic should be scheduled to implement in less traffic density time.</p> <p>+ In the case block-out of local roads is necessary during construction progress, an access roads should be opened or should have other appropriate measures to help local residents can access their homes, business and manufacture every day.</p> <p>+ Do not concentrate construction equipment, vehicles of Project on the existing roads.</p> <p>+ During construction of intersections, surface of Le Thanh Tong road section, near intersection point should be cleaned every day. Hygiene in Le Thanh Tong road section would be instructed by supervision inspector, depending on stains caused by Project's vehicles.</p> <p>+ Drivers and construction workers should be aware and comply with traffic safety regulations and should not drink alcohol and use drugs.</p> <p>+ Coordinate with the local traffic police to regulate traffic at intersection area.</p> <p>+ Limit travelling during peak hours from 6 ~ 8 and 16 ~ 18h.</p> <p>- Reasonable construction organization: girder erecting of access bridge crossing Le Thanh Tong Road would not carry out during peak hours, in order to not affect road traffic.</p> <p>- 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.</p>	Construction costs	During construction period	Construction Contractor under the contract with Project owner	<p>- Hai Phong Bridge Projects Management Department.</p> <p>- Construction Supervision Consultant (CSC)</p> <p>- Environmental Supervision Consultant (EMC)</p> <p>- Safety and Environmental Officer of Contractors (SEO)</p>

Project activities	Environmental Impacts	Impact mitigation measures	Financial sources	Period of Implementation	Responsible entity	Supervision Agency
		<p>- 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 marker 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.</p> <p>- Traffic Guide: Guiding to ensure traffic during construction period at the intersection location. Flagman should be assigned to regulate the traffic.</p>				
2.3.5-2 Operate vehicles and equipment	Damage the local roads which used for delivery for material, waste soil	<p>- Regarding to Provincial Roads and National Roads:</p> <p>+ Do not transport over speed, over load: the trucks shall go with right speed and shall not carry overload</p> <p>- Transport on inter-communal and inter-village roads:</p> <p>+ 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;</p> <p>+ 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;</p> <p>+ 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.</p>	Construction cost	During construction period	Construction Contractor under the contract with Project owner	<p>- Hai Phong Bridge Projects Management Department.</p> <p>- Construction Supervision Consultant (CSC)</p> <p>- Environmental Supervision Consultant(EMC)</p> <p>- Safety and Environmental Officer of Contractors (SEO)</p>
2.3.6 Construction of bridge piers	Make hydrological conditions changing, erosion under the bridge	<p>- Select technology, construction duration, organization method for the construction of piers P12, P13 in the direction of reduced displacement area of water flow of Cam river, especially in the rainy season</p>	Construction cost	During construction period	Construction Contractor under the contract with Project owner	<p>- Hai Phong Bridge Projects Management Department.</p> <p>- Construction Supervision Consultant (CSC)</p> <p>- Environmental Supervision</p>

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)
2.3.7 Construction of bridge piers under Cam River	Impact on water use at downstream of Cam River because of water pollution. Obstructing traffic on Cam River	- Implement measures to minimize the impact of water pollution (Section 2.2.3). - Implement measures to minimize impacts to waterway (Section 4.2.1)	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 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.	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

Project activities	Environmental Impacts	Impact mitigation measures	Financial sources	Period of Implementation	Responsible entity	Supervision Agency
		<ul style="list-style-type: none"> <li>- Coordinate and cooperate closely with local communities to prevent the social crimes and disease arising in the region.</li> <li>- 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.</li> </ul>				Officer of Contractors (SEO)
2.3.9 Activities of worker, construction activities	Safety environment for work	<ul style="list-style-type: none"> <li>- Workers would be provided adequately personal protective equipment such as helmets, anti-noise device, safety shoes, etc.</li> <li>- Organize training for workers on safety measures to protect the local people, especially the students.</li> <li>- Provide workers good living conditions and health care services during construction process.</li> <li>- Install of instruction signs, indication lights, Etc. at positions potentially occurring accident.</li> <li>- 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.</li> <li>- Arrange person for guidance and keeping safety at/near position concentrating construction vehicles.</li> </ul>	Construction costs	During construction period	Construction Contractor under the contract with Project owner	<ul style="list-style-type: none"> <li>- Hai Phong Bridge Projects Management Department.</li> <li>- Construction Supervision Consultant (CSC)</li> <li>- Environmental Supervision Consultant(EMC)</li> <li>- Safety and Environmental Officer of Contractors (SEO)</li> </ul>
3. Operation phase						
3.1. Effect sources related to wastes						
3.1.1 Activities of vehicles	Arising dust and emissions of CO <sub>2</sub> , NO <sub>x</sub> , SO <sub>2</sub> , and HC causing degrade surrounding air quality, affecting people's health	<ul style="list-style-type: none"> <li>- Conduct regularly maintenance of access road to bridge.</li> <li>- Conduct regularly maintenance of roads surface and bridges.</li> <li>- Spray water regularly for cleaning road surface.</li> <li>- 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.</li> </ul>	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 vehicles.	CO2 emission may change the climate/ greenhouse effect	- Strictly implement maintenance mode for roads and auxiliary infrastructure aiming at slowing the degradation of materials.	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
3.2. Impacts do not relating to waste sources						
3.2.1 Activities of vehicles on bridge and access road	Generation of noise, vibration, 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 Transportatin	Hai Phong Department of Transportation
3.2.2 Operation of bridge access	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 Agriculture and Rural Development
		- Take care of Project's plants.			Hai Phong Green Park Co., Ltd.	Hai Phong Department of Construction

Project activities	Environmental Impacts	Impact mitigation measures	Financial sources	Period of Implementation	Responsible entity	Supervision Agency
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.	<ul style="list-style-type: none"> <li>- 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.</li> <li>- 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.</li> </ul>	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	<ul style="list-style-type: none"> <li>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.</li> <li>- Continue to implement a monitoring program to livelihoods restoration of vulnerable households.</li> </ul>	Annual budget of Hai Phong City	Operation stage of project	Department of Labor, Invalids and Social Affairs of Hai Phong; City Compensation Council of Ngo Quyen and Thuy Nguyen districts	Department of Labor, Invalids and Social Affairs of Hai Phong; City Compensation Council of Ngo Quyen and Thuy Nguyen districts
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	<ul style="list-style-type: none"> <li>- Strictly comply with quality control procedures, including survey work before construction, construction plan, construction drawings, etc.</li> <li>- Comply with the labor safety plan.</li> <li>- 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.</li> </ul>	Construction costs	In construction process	Construction Contractor under contract with Project Owner	<ul style="list-style-type: none"> <li>- Hai Phong Bridge Projects Management Department.</li> <li>- Construction Supervision Consultant (CSC)</li> <li>- Environmental Supervision Consultant(EMC)</li> <li>- Safety and</li> </ul>

Project activities	Environmental Impacts	Impact mitigation measures	Financial sources	Period of Implementation	Responsible entity	Supervision Agency
						Environmental Officer of Contractors (SEO)
4.1.2 Activities at construction site	Fire incidents causing human mortal and damage equipment and machinery	<ul style="list-style-type: none"> <li>- 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.</li> <li>- 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.</li> <li>- Fire Prevention Training: Training, advocacy should be held to improve workers' capacity and awareness of safety and fire prevention.</li> </ul>	Construction costs	In construction process	Construction Contractor under contract with Project Owner	<ul style="list-style-type: none"> <li>- Hai Phong Bridge Projects Management Department.</li> <li>- Construction Supervision Consultant (CSC)</li> <li>- Environmental Supervision Consultant(EMC)</li> <li>- Safety and Environmental Officer of Contractors (SEO)</li> </ul>
4.1.3 Construction activities, operation of machinery, equipment and delivery	Labor accident causing human mortal and damage equipment and machinery	<ul style="list-style-type: none"> <li>- Comply with all the regulations on labor safety:</li> <li>The contractor shall establish regulations on labor safety in the construction process.</li> <li>Establish periodical health checks programs for employees and workers.</li> <li>Organizing training courses and dissemination of hygiene and labor safety.</li> <li>Fully equipped for workers the necessary protective equipment.</li> <li>Establish communication systems to ensure safety during construction –</li> <li>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.</li> </ul>	Construction costs	In construction process	Construction Contractor under contract with Project Owner	<ul style="list-style-type: none"> <li>- Hai Phong Bridge Projects Management Department.</li> <li>- Construction Supervision Consultant (CSC)</li> <li>- Environmental Supervision Consultant(EMC)</li> <li>- Safety and Environmental Officer of Contractors (SEO)</li> </ul>

Project activities	Environmental Impacts	Impact mitigation measures	Financial sources	Period of Implementation	Responsible entity	Supervision Agency
4.1.4 Construction activities on river, on the height in storm season	Disaster like storm, flood, heavy rain causing human mortal and damage equipment and machinery	<ul style="list-style-type: none"> <li>- 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.</li> <li>- Make construction plan how to complete items such as pile foundation, underwater bearings before the typhoon season.</li> <li>- In storm season, the scaffolding system should be reinforced to ensure stability when heavy rain, high winds.</li> <li>- Install lightning system.</li> <li>- Make relocation plan for vehicles, machinery, construction materials when heavy rains and storms, floods occur.</li> <li>- 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 at May To Ward and Duong Quan commune to use this room as first aid stations. Arrangement of rescues equipment for emergency should be approved by the supervision engineer.</li> </ul>	Construction costs	In construction process	Construction Contractor under contract with Project Owner	<ul style="list-style-type: none"> <li>- Hai Phong Bridge Projects Management Department.</li> <li>- Construction Supervision Consultant (CSC)</li> <li>- Environmental Supervision Consultant(EMC)</li> <li>- Safety and Environmental Officer of Contractors (SEO)</li> </ul>
4.2. Traffic accidents (on the river and on the road, in the construction phase and operation phase)						
4.2.1 Construction activities of P13 pier on Cam River	The accident on the river due to collisions between boats and construction equipment, construction works	<p>Accident on River in construction period</p> <ul style="list-style-type: none"> <li>- The Contractor shall prepare security plans for inland waterway transport and submitted to the Inland Waterways Regulatory Agency for approval. The profile shall include:</li> </ul> <p>A request letter asking for approval of the plan to ensure the safety of inland waterway transport;</p> <p>Construction method;</p> <p>Method for ensuring safety of inland waterway transport in the area of construction;</p> <ul style="list-style-type: none"> <li>- 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</li> </ul>	Construction costs	In construction process	Construction Contractor under contract with Project Owner; Inland Waterway Traffic Management Agency	<ul style="list-style-type: none"> <li>- Hai Phong Bridge Projects Management Department.</li> <li>- Construction Supervision Consultant (CSC)</li> <li>- Environmental Supervision Consultant(EMC)</li> <li>- Safety and Environmental Officer of</li> </ul>

Project activities	Environmental Impacts	Impact mitigation measures	Financial sources	Period of Implementation	Responsible entity	Supervision Agency
		<p>allowed; equip with safety equipment, including sirens, lights, life buoy.</p> <ul style="list-style-type: none"> <li>- 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 completion of construction, all these signs would be removed.</li> <li>- 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.</li> <li>- 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.</li> </ul> <p>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.</p> <ul style="list-style-type: none"> <li>- 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.</li> <li>- Establish salvage procedures when the accident occurred on the river, including carry the victims to the medical bases of May To Ward and Duong Quan commune where have rooms to be used as first-aid station or bring the victims to the nearest hospital or call the city's ambulances.</li> </ul>				Contractors (SEO)
4.2.2 Piers appear on the main streamline of	Risk of increasing collision of boats, causing	<p>Accident on river in operation stage</p> <ul style="list-style-type: none"> <li>- Fully install of signal lights, buoys and signs as prescribed by the inland waterway transport</li> </ul>	Budget of Hai phong City	Operation stage	Inland Waterway Traffic Management	People's Committee of Hai Phong City People's

Project activities	Environmental Impacts	Impact mitigation measures	Financial sources	Period of Implementation	Responsible entity	Supervision Agency
Cam river	loss of people, vehicles, especially age of Nguyen Trai Bridge	<ul style="list-style-type: none"> <li>- Working closely with the Inland Waterway Traffic Management Agency to ensure traffic safety on the river.</li> <li>- Guide the ship owners who frequently pass through bridge construction area 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 on boats and ships.</li> <li>- Carry the victims to the medical bases of May To Ward and Duong Quan commune where have rooms to be used as first-aid station or bring the victims to the nearest hospital or call the city's ambulances..</li> <li>- Alerts devices, traffic safety protection on the river such as Signs, buoys, lights, etc. should be regularly checked and maintained.</li> </ul>			Agency Control Steering Committee for the prevention of floods, storms and search and rescue of Hai Phong city People's Committee of May To Ward, and Duong Quan Commune	Committee of Thuy Nguyen Rural district, Ngô Quyền district
4.2.3 Road traffic in operation stage	Risk of increasing traffic accidents on bridge and roads.	<ul style="list-style-type: none"> <li>- 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.</li> <li>- 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.</li> </ul>	Budget of Hai phong City	Operation stage	Road Maintenance Company under contract with Hai Phong Department of Transportation	Hai Phong Department of Transportation

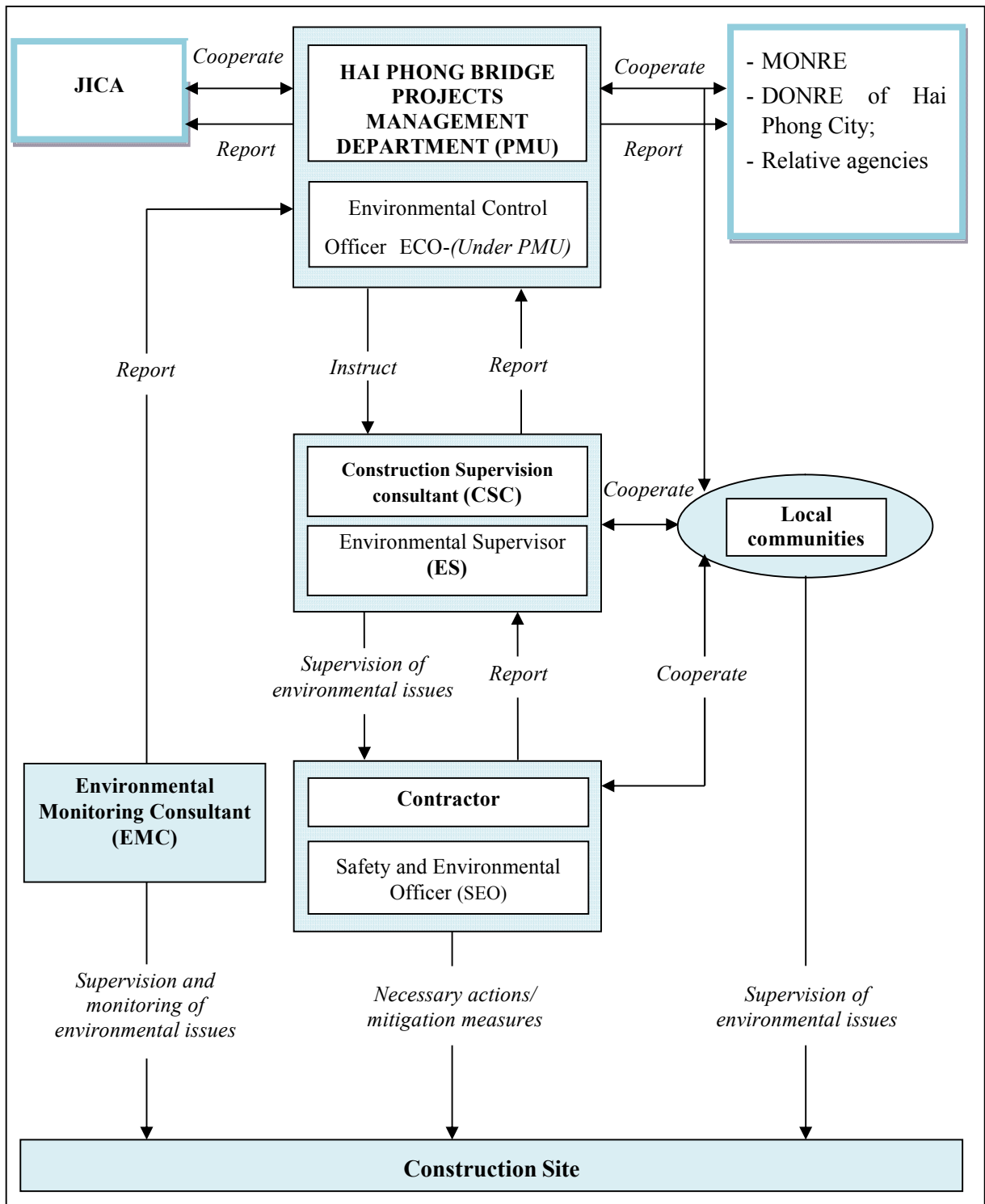
### **5.1.3. Implementation of Environmental Management Plan (EMP)**

#### ***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) (under consideration)
- 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)	<p>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:</p> <ul style="list-style-type: none"> <li>- 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.</li> <li>- Be responsible for organization and management of environmental protection in construction activities and shall perform the following tasks: <ul style="list-style-type: none"> <li>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</li> <li>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</li> <li>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.</li> <li>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.</li> <li>o Immediately taking remedy and informing the agency approving the decision on investment in project and Communal/District PPC or the Department of Natural Resources and Environment at the project</li> </ul> </li> </ul>

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<b>Roles</b>	<b>Responsibilities regarding Environment matters</b>
	<p>location in case of suspension of construction activities due to environmental incidents,</p> <ul style="list-style-type: none"> <li>○ 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.</li> <li>○ Handling violations of construction contractor with regards to environmental protection in the bidding package under the terms of the contract signed.</li> </ul>
<p>Environmental Control Officer (ECO) - (<i>under Hai Phong Bridge Projects Management Department</i>)</p>	<p>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:</p> <ul style="list-style-type: none"> <li>- Considering EIA and EMP conducted by consultant;</li> <li>- Integrating EMP in detailed engineering design documentation and in contract documents and tender;</li> <li>- Including the responsibility for monitoring and supervision of EMP in the outline, contract documents and tender for Environmental Supervisor (ES);</li> <li>- Providing relevant data in the process of selecting consultant;</li> <li>- Reviewing reports submitted by the Environmental Supervisor;</li> <li>- Directly monitoring the management, supervision and monitoring;</li> <li>- 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.</li> <li>- Giving advice to the Director of Hai Phong Bridge Projects Management Department on resolutions for environmental issues of the Project</li> </ul>
<p>Construction supervision consultant (CSC)/ Environmental Supervisor (ES)</p>	<ul style="list-style-type: none"> <li>- 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.</li> <li>- 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</li> </ul>

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<b>Roles</b>	<b>Responsibilities regarding Environment matters</b>
	<p>with requirements specified in the contract signed with the project owner, in approved EIA report, as well as in EMP.</p> <ul style="list-style-type: none"> <li>- 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.</li> <li>- Directly notifying construction units of any potential environmental issues that may hinder the progress of the Project.</li> <li>- Monitoring the implementation of mitigation measures by the contractor, promptly proposing and implementing additional interventions so as to complete the said mitigation measures and meet requirements on environmental protection.</li> <li>- Making plan to prevent and respond to environmental issues, emergency situations that may occur during construction.</li> <li>- 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.</li> <li>- Reporting periodically on environmental monitoring results to Hai Phong Bridge Projects Management Department</li> </ul>
<p>Environmental Monitoring Consultant (EMC)</p>	<ul style="list-style-type: none"> <li>- Conduct periodic environmental monitoring.</li> <li>- Reporting periodically on monitoring results to Hai Phong Bridge Projects Management Department.</li> <li>- Perform additional measurements upon request.</li> </ul>
<p>Construction contractor</p>	<p>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:</p> <ul style="list-style-type: none"> <li>- 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.</li> <li>- During construction, the construction contractor shall perform the following basic tasks: <ul style="list-style-type: none"> <li>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.</li> <li>o Regularly monitoring and urging officials and employees to comply with requirements on environmental protection with regards to the bidding package in construction process; raising awareness and consciousness of environmental protection in employees.</li> </ul> </li> </ul>

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Roles	Responsibilities regarding Environment matters
	<ul style="list-style-type: none"> <li>○ 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.</li> <li>○ Collecting and storing household waste and hiring local environmental sanitation unit to transport and treat; or treating waste in accordance with regulations.</li> <li>○ Collecting and storing hazardous waste and hiring licenced hazardous waste management unit to transport and treat.</li> <li>○ Preparing toilet, waste collector and container, temporary sewage treatment works on construction sites, construction administration office and worker camps.</li> <li>○ 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.</li> <li>○ 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.</li> <li>○ Recovering the initial environmental state, cleaning the construction site, making clearance of river and channel beds after completing the construction.</li> <li>○ Providing the State management agency for environmental protection with relevant information for purpose of inspecting.</li> </ul> <p>- Being subject to the management of ES, adjusting or strengthening measures when being required by the ES or ECO.</p>
Owners of other project concerned	<p>Vingroup JSC:</p> <ul style="list-style-type: none"> <li>- 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.</li> <li>- Conserving the mangrove forest remaining in the eastern area of Vu Yen Island.</li> </ul> <p>VSIP:</p> <ul style="list-style-type: none"> <li>- Conserving the mangrove forest remaining in the southern area of VSIP Industrial Park along the north bank of Cam River.</li> </ul>
Local community (government, Non-governmental organizations, etc.)	<p>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:</p> <ul style="list-style-type: none"> <li>- Monitoring and assessing the compliance with regulations on investment management of competent investment decision authority, project owner,</li> </ul>

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<b>Roles</b>	<b>Responsibilities regarding Environment matters</b>
	<p>PMU, contractors and construction unit during the investment process (including environmental aspect);</p> <ul style="list-style-type: none"><li>- 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.</li></ul>

5.1.3.2. EMP Implementing Organization in Operation Stage

EMP implementing organization in operation stage is presented in Figure 5.2.

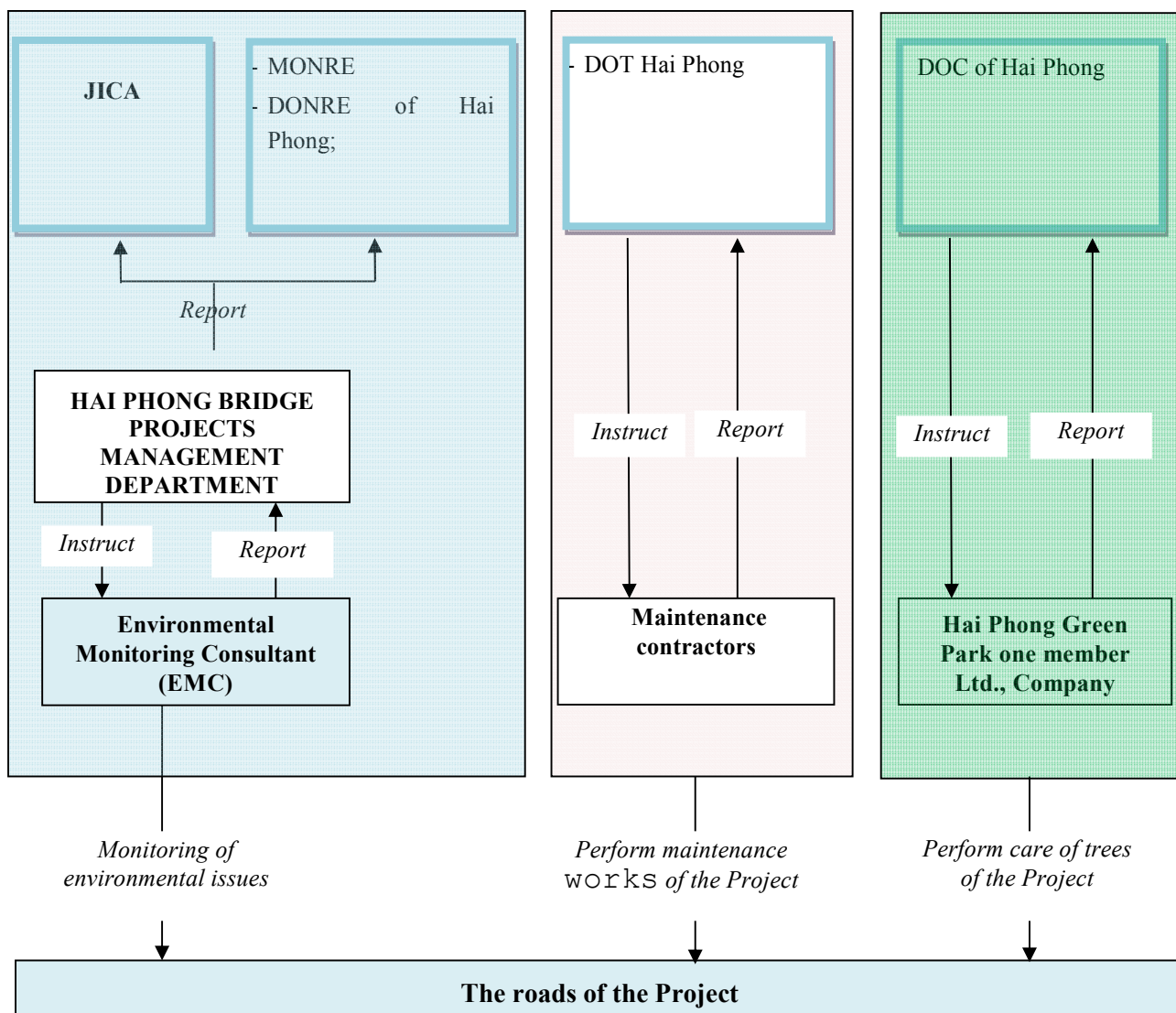


Figure 5.2. Organization Chart of Environmental Management in Operation Stages

**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	<ul style="list-style-type: none"> <li>- 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 City Bridge Projects Management Department</li> <li>- The other responsibility is to select maintenance contractor and monitor maintenance activities of traffic works of the project</li> </ul>
Department of Construction	- Means the State management agency which organizes and supervises the works of planting and caring for public trees including thoses 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)	<ul style="list-style-type: none"> <li>- Periodically monitor environmental factors</li> <li>- Periodically report the monitoring results to Hai Phong Bridge Projects Management Department</li> </ul>
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



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No	Items	Construction Stage
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
<b>II Domestic Solid Waste</b>		
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 02 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
<b>III Hazardous waste</b>		
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 02 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
<b>IV Wastewater</b>		
1	Monitoring parameter	Domestic wastewater (*):domestic wastewater collection, total volume of wastewater and monitoring parameters (including BOD <sub>5</sub> , 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<sub>5</sub>, 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 5.3.

**Table 5.5. Ambient Environment Monitoring Plan**

No	Items	Stage		
		Pre-construction	Construction	Operation
I	Air quality			
1	Monitoring parameter	TSP, PM10, NO <sub>2</sub> , SO <sub>2</sub> , CO and microclimate (Temperature, humidity, speed, wind direction), atmospheric pressure.		
2	Location	NT-KK1: Starting point of Nguyen Trai Bridge (intersection area of May To Ward) – Coordinates: 20°52'50"N; 106°41'24"E NT-KK2: Ending point of Nguyen Trai Bridge (at the location connects with the existing VSIP – Coordinates: 20°51'52"N; 106°41'42"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 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). For every point, monitoring continuous 24 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 <sub>5</sub> , COD, Coliform		
2	Location	NT-Nm1: 300m from upstream of Nguyen Trai Bridge (on the Cam River) – Coordinates: 20°52'10"N; 106°41'25"E NT-Nm2: 300m from downstream of Nguyen Trai Bridge (on the Cam River) – Coordinates: 20°52'20"N; 106°41'42"E		

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No	Items		Stage		
			Pre-construction	Construction	Operation
3		Monitoring frequency	Once prior to construction. Taking two samples/ one point on ebb-tide and flood-tide.	Once every three months. Taking two samples/ one point on ebb-tide and flood-tide.	Once every six months. Taking two samples/ one point on ebb-tide and flood-tide.
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 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	<u>1) Monitoring location</u> As described in Table 5-4 <u>2) Monitoring frequency</u> As described in Table 5-4 <u>3) Monitoring method</u> As described in Table 5-4	<u>1) Monitoring location</u> Around Nguyen Trai Bridge <u>2) Monitoring frequency</u> Every month <u>3) Monitoring method</u> 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	<u>1) Monitoring location</u> River beds of Cam River <u>2) Monitoring frequency</u> Regular monitoring by Environmental Supervisor <u>3) Monitoring method</u> Water sampling and analysis Check reports on construction works prepared by contractors Check records of complaints raised by local residents Conduct observation on construction sites	<u>1) Monitoring location</u> River beds of Cam River <u>2) Monitoring frequency</u> Every 3 months by DOT <u>3) Monitoring method</u> Water sampling and analysis Check complaints raised by local residents

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No	Item Monitoring	Construction Stage	Operation Stage
3	Eco-system	<u>1) Monitoring location</u> Mangrove forests and wetlands along Cam River Street trees along Nguyen Trai Street <u>2) Monitoring frequency</u> Regular monitoring by Environmental Supervisor <u>3) Monitoring method</u> 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.	<u>1) Monitoring location</u> Mangrove forests and wetlands along Cam River Street trees along Nguyen Trai Street <u>2) Monitoring frequency</u> Every 3 months by DARD (Forest Protection and Development Division) for mangrove forests. Hai Phong Green Park Company for street trees. <u>3) Monitoring method</u> 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	<u>1) Monitoring location</u> Cam River <u>2) Monitoring frequency</u> Regular monitoring by Environmental Supervisor <u>3) Monitoring method</u> 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	<u>1) Monitoring location</u> As described in the monitoring plan for surface water quality in Table 5.5 Monitor obstruction to waterway transport <u>2) Monitoring frequency</u> As described in the monitoring plan for surface water quality in Table 5.5 <u>3) Monitoring method</u> As described in the monitoring plan for surface water quality in Table 5.5	<u>1) Monitoring location</u> As described in the monitoring plan for surface water quality in Table 5.5 <u>2) Monitoring frequency</u> As described in the monitoring plan for surface water quality in Table 5.5 <u>3) Monitoring method</u> As described in the monitoring plan for surface water quality in Table 5.5
10	Existing social infrastructure and service	<u>1) Monitoring location</u> Relocation sites of electric poles, communication cables, water supply pipes, drainage gutters, etc. <u>2) Monitoring frequency</u> Regular monitoring by PMU during the pre-construction phase <u>3) Monitoring method</u> Check reports on the works to relocate	<u>1) Monitoring location</u> Traffic signs, traffic safety facilities, road drainage ditches, etc. <u>2) Monitoring frequency</u> Every month by DOT <u>3) Monitoring method</u> Check monthly work reports submitted by the road, bridge

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No	Item Monitoring	Construction Stage	Operation Stage
		public facilities prepared by contractors Conduct on-site observation on the relocation works.	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	<u>1) Monitoring location</u> Sites planned for pedestrian crossings <u>2) Monitoring frequency</u> Regular monitoring by Environmental Supervisor <u>3) Monitoring method</u> Check reports on construction works prepared by contractors Check complaints raised by local residents Conduct on-site observation at the construction sites	<u>1) Monitoring location</u> Pedestrian crossings <u>2) Monitoring frequency</u> Every month by DOT <u>3) Monitoring method</u> 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	<u>1) Monitoring location</u> Trees along Nguyen Trai Street; and all existing vegetation along the bridge approach roads <u>2) Monitoring frequency</u> Regular monitoring by Environmental Supervisor <u>3) Monitoring method</u> Check reports on construction works prepared by contractors Check complaints raised by local residents Conduct on-site observation at the construction sites	<u>1) Monitoring location</u> Trees along Nguyen Trai Street; and all existing vegetation along the bridge approach roads <u>2) Monitoring frequency</u> Every month by DOC <u>3) Monitoring method</u> Check monthly work reports submitted by the Green Park Limited 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	<u>1) Monitoring location</u> Sites planned for pedestrian crossings at Einstein High School <u>2) Monitoring frequency</u> Regular monitoring by Environmental Supervisor <u>3) Monitoring method</u> Check reports on construction works prepared by contractors Check complaints raised by local residents Conduct on-site observation at the construction sites	<u>1) Monitoring location</u> Sites planned for pedestrian crossings at Einstein High School, traffic safety facilities, etc. <u>2) Monitoring frequency</u> Every month by DOT <u>3) Monitoring method</u> 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 pedestrian crossings, road auxiliaries, etc.
15	Concentration of workers	<u>1) Monitoring location</u> All worker camps <u>2) Monitoring frequency</u> Regular monitoring by Environmental Supervision consultant	=

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No	Item Monitoring	Construction Stage	Operation Stage
		<u>3) Monitoring method</u> Check reports on construction site management prepared by contractors Conduct on-site observation at the worker camps	
16	Incidents	<u>1) Monitoring location</u> All construction sites and along the roads used to transport materials and waste soil <u>2) Monitoring frequency</u> Regular monitoring by Environmental Supervisor <u>3) Monitoring method</u> Check reports on working safety management prepared by contractors Conduct on-site observation at the waterbodies around the construction sites	<u>1) Monitoring location</u> Traffic signs, signals, safety facilities, etc., along the bridge approaches <u>2) Monitoring frequency</u> Every month by DOT <u>3) Monitoring method</u> 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	<u>1) Monitoring location</u> All construction sites and along the roads used to transport materials and wastes <u>2) Monitoring frequency</u> Regular monitoring by Environmental Supervisor <u>3) Monitoring method</u> Check reports on construction work management prepared by contractors Conduct on-site observation at the construction sites	<u>1) Monitoring location</u> Road surface, structures of Nguyen Trai Bridge <u>2) Monitoring frequency</u> Every month by DOT <u>3) Monitoring method</u> 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 and bridge 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	<ul style="list-style-type: none"> <li>- Environmental Management Process in the overall project.</li> <li>- Improving awareness of the central role of environmental management system (EMS).</li> <li>- Supplementing new knowledge / legislation related to environment and handling of environmental violations.</li> <li>- Supplementing solutions to issues arising at site.</li> </ul>
2	Officers in group of Construction Supervision Consultant	Environmental Supervision Consultant	<ul style="list-style-type: none"> <li>- Fundamentals of Environmental Management.</li> <li>- EMP Supervision content approved by Hai Phong Bridge Projects Management Department.</li> <li>- Assessment of compliance, monitoring and tracking of environmental protection activities of the Project.</li> <li>- Improving awareness and response process with environmental incidents.</li> <li>- Monitoring of environmental protection activities during the construction, etc.</li> </ul>
3	Representative of local government	Environmental Supervision Consultant	<ul style="list-style-type: none"> <li>- Updating new regulations on environment in contents related to the monitoring and supervision implemented by ward/communal units in collaboration with local projects.</li> <li>- Providing construction content and environmental protection measures in EMP of the project.</li> <li>- Notifying project's divisions of the mechanisms for monitoring, exchange of information and address in collaboration with local government.</li> </ul>

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<b>No.</b>	<b>Trainees</b>	<b>Trainer</b>	<b>Training contents</b>
4	Representative of Community Supervision Board	Environmental Supervision Consultant	<ul style="list-style-type: none"> <li>- Improving awareness of rights and responsibilities of community with regards to EMP (as prescribed by law).</li> <li>- Providing environmental impact mitigation measures of the project as well as environmental management plan that will be applied to the project.</li> <li>- Notifying and providing the address for receiving feedback from the community and project settlement process, and giving reply to the community.</li> </ul>
5	Environmental & Safety Officer of Construction Contractor	Environmental Supervision Consultant	<ul style="list-style-type: none"> <li>- 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.</li> <li>- Updating new regulations on environment, focusing on contents related to the role of local units and of community supervision.</li> <li>- Notifying the monitoring procedures, information exchange mechanism within the project.</li> <li>- Notifying the environmental monitoring form, keeping information and documents, etc.</li> </ul>
6	Workers of Construction Contractor	Environmental & Safety Officer of Construction Contractor	<ul style="list-style-type: none"> <li>- Policies and regulations on occupational safety, environmental hygiene;</li> <li>- An overview of contractor's work and equipment under strict requirements on occupational safety and environmental hygiene</li> <li>- Environmental protection measures of the contractor applied to the project</li> <li>- Mechanism for testing, giving information and feedback on the implementation of environmental protection measures by contractor</li> <li>- Rules on occupational safety, environmental hygiene when working or operating equipment;</li> <li>- The process of handling environmental situations and accidents, first aid for occupational accidents.</li> </ul>



**Table 5.8. Plan to strengthen the capacity of environmental management**

<b>TT</b>	<b>Subject to be trained</b>	<b>Number of trainees</b>	<b>Times</b>	<b>Unit to organize</b>	<b>Source of cost</b>
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
2	Engineers of Construction Supervision Consultant	2 persons	- ditto -	- ditto -	- ditto -
3	Representatives of local government	2 persons/ commune About 4 pers in total	- ditto -	- ditto -	- ditto -
4	Representative of Community Supervision Board	2 persons/ commune About 4 pers in total	- ditto -	- ditto -	- ditto -
5	Heath, Safety and Environmental Officer (SEO) of the contractor	About 2 pers 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 labor cost in the management of the construction cost;
- Circular No. 33/2007/TT-BTC dated on April 9<sup>th</sup>, 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 12<sup>th</sup>, 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/QĐ-BGTVT dated on August 25<sup>th</sup>, 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, 24<sup>th</sup>, 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
<b>I</b>	<b>Construction phase</b>				<b>1,507,000,000</b>	<b>66,978</b>
1	Monitor compliance with environmental management plan					
-	01 person supervises continuously in 34 months for Nguyen Trai bridge	month	34	30,000,000	1,020,000,000	45.333
2	Other costs					
-	Per diem					
	34 months x 4 weeks x 5 days/week	day	680	150,000	102,000,000	4.533
-	Accommodation	day	680	250,000	170,000,000	7.556
-	Car rental	day	680	300,000	204,000,000	9.067
-	Take a photograph. printing. photocopy (once every three months)	time	11	1,000,000	11,000,000	489
<b>II</b>	<b>Operation phase</b>					
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 10<sup>th</sup>, 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	47,244,000	2,100
2	Construction wastewater	2	43,912,000	1,952
3	Other cost		54,776,000	2,434
	<b>Total</b>		<b>145,932,000</b>	<b>6,486</b>

*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		VND	USD
		Location	Cost (VND)	Location	Cost (VND)	Location	Cost (VND)		
1	Air quality	2	33,285,000	2	244,089,000	2	133,139,000	410,513,000	18,245
2	Noise and vibration	2	5,540,000	2	60,943,000	2	22,161,000	88,644,000	3,940
3	Surface water quality	2	4,247,000	2	46,720,000	2	16,988,944	67,955,944	3,020
4	Other cost		19,976,000		186,651,000		56,584,000	263,211,000	11,698
	<b>Total</b>		<b>63,048,000</b>		<b>538,403,000</b>		<b>228,872,944</b>	<b>830,323,944</b>	<b>36,903</b>

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 February 14th, 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	58,249,000	2,589
2	Others cost	17,832,000	793
	<b>Total</b>	<b>76,081,000</b>	<b>3,381</b>

*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)
2	Engineer Supervisors	2 persons	2 persons x 12 times x 1,500,000 VND / person = 36,000,000 VND	- This cost is included in the Contract with ES
3	Representatives of local government	4 persons	4 persons x 12 times x 1,500,000 VND / person = 72,000,000 VND	
4	Representatives of Community Supervision Board	4 persons	4 persons x 12 times x 1,500,000 VND / person = 72,000,000 VND	
5	Health, 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	
	<b>Total (1+2+3+4+5)</b>		<b>= 252,000.000 VND</b>	<b>(=11,200 USD )</b>

*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	1,507,000,000	66,978	Table 5.9
2	Monitoring wastewater	145,932,000	6,486	Table 5.10
3	Ambient environmental quality monitoring	830,323,944	36,903	Table 5.11
4	Preparation and disclosure of the EMP	76,081,000	3,381	Table 5.12
5	Capacity building and training program	252,000,000	11,200	Table 5.13
	<b>Sub-total (1-5)</b>	<b>2,811,336,944</b>	<b>124,948</b>	
6	Contingency (10%)	281,133,694	12,495	
	<b>Total (1-6)</b>	<b>3,092,470,638</b>	<b>137,443</b>	

*Note:*

- Exchange Rate dated on January 11, 2016 of Vietcom Bank: 1USD = 22,500 VND

Total Estimated Budget for EMP Implementation is **3,092,470,638 VND (≈ 137,443 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, 2015)

#### 6.1.1. Objectives

Under the provisions of Vietnam and the requirements of the JICA on the environmental protection, 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 1<sup>st</sup>**

No.	Location	Time
1	May To ward – Ngo Quyen district	18/4/2015; 30/5/2015
2	Duong Quan commune – Thuy Nguyen district	17/4/2015

**Table 6.2. Some images at the 1<sup>st</sup> public consultation meetings**

No.	Images	Remarks
1		Project staff are welcoming and guiding participants
2		<b>Project introduction:</b> The Consultant's representative is giving an overview of the Project and environmental impacts.
4		<b>A resident is raising her opinions.</b>

**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 3 – Public Consultation.

**Table 6.3. Synthesis of public consultations with residents directly affected by the project**

No.	Public Consultations		Answers of the Project Owner's representative - the Consultant
	Residents' concerns about the Projects	Proposals to the Project Owner	
	<b>May To Ward</b>		
1	Information about the project implementation	Residents should be notified and provided with updated information for spiritual stabilization, avoidance of anxiety affecting their daily lives.	The project owner agreed on such opinions and promised to closely coordinate with the local authority to promptly inform the residents in the implementation process
2	Site clearance and resettlement: The Project's acquisition of residential, gardening and agricultural land, etc. to construct the Project may affect their income, relocation and resettlement. Residents were anxious about policies on compensation or relocation of their houses and lands, etc. Additionally, they were concerned that the construction delay causing negative effects to people who received or did not receive compensation and those not promptly receive compensation ... (as occurring to some other projects), the delay may obstruct people to carry out new construction or renovation of their houses or land investment, etc.	<ul style="list-style-type: none"> <li>- The Project Owner must early notify details in the project implementation period.</li> <li>- The project study should consider minimizing losses and clearance volume.</li> <li>- The scope of affected households must be clearly determined.</li> <li>- Fairness, transparency, publicity and compliance with the state regulations regarding compensation, support and resettlement for people must be ensured.</li> <li>- The resettlement areas for residents must be arranged reasonably.</li> </ul>	<p>The scope and volume of site clearance were considered and discussed in details in the environmental impact assessment report. The Project Owner was committed to providing adequate compensation for affected households, creating jobs for people losing their jobs due to their loss of residential, cultivating and aquatic farming land, etc.</p> <p>The Project Owner promised to study and select resettlement areas in accordance with local planning.</p>

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No.	Public Consultations		Answers of the Project Owner's representative - the Consultant
	Residents' concerns about the Projects	Proposals to the Project Owner	
3	Effects on works of agencies and schools including Einstein High School and Hai Phong Water Supply Company.	<p>- Einstein High School: A specific plan should be prepared and announced early for the school to make the learning plans for teachers and students at the school.</p> <p>- Hai Phong Water Supply Company: The Project will likely affect May To pumping station. It was recommended that the pumping station should be relocated with funds for no effects on the use of water by households, businesses and industrial parks.</p>	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 Owner received ideas from the units and promised to apply proper compensation and support policies (in case of the ward's relocation).
<b>Dong Quan Commune</b>			
4	Acquisition of aquatic farming land and part of shipbuilding facilities: The Project will affect the farmland and aquatic farming ponds. Chemicals from the surveys and exploration may have an influence on aquaculture.	<p>It was proposed that the safety issues and technical assurance of machinery, facilities and manpower should be considered in the implementation process, to minimize damages to people's lives.</p> <p>The Project Owner was requested to make reasonable compensation since the land not subject to acquisition will no longer be used for the original purposes.</p>	The residents' ideas were received. Safety and technical assurance will be ensured during the project implementation.
5	Environmental pollution: During the construction process, there will generate dust and noise affecting trading and production activities of residents.	The Project Owner must seriously implement measures to minimize environmental impacts during the project implementation; and	The Project's environmental impact assessment report will contain all measures to minimize environmental impacts. After approved

## Environmental Impact Assessment Report

No.	Public Consultations		Answers of the Project Owner's representative - the Consultant
	Residents' concerns about the Projects	Proposals to the Project Owner	
		publicly declare mitigation measures and the project's commitment to enable residents to monitor environmental impacts during the Project construction.	by the Ministry of Natural Resources and Environment, it will be publicly posted at the Communal/ward peoples' committees.
6	Project implementation progress: Currently there are various suspended projects, affecting people's psychology, lives and production activities.	The Project Owner must publicly announce the construction schedule and time to people for checking.	The implementation schedule and construction time were shown in the Project's EIA report.

### 6.2. Public Consultation – Stage 2 (December, 2015)

#### 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 – 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 08, 2015 and December 09, 2015 in the May To ward Duong Quan commune, 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 PCPs and Organizations Directly Affected by the Project**

No.	Ward/Commune/Organization	District	Time of consultation	Local representative	Position	Written response
1	May To	Ngo Quyen	08/12/2015;	Dang Hong Duong	Vice Chairman	125/CV-UB
2	Duong Quan	Thuy Nguyen	09/12/2015	Tran Ba Binh	Chairman	77/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 Urban Construction 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	May To	The report highlighted the negative impacts and assessed the social and environmental impacts	To agree upon the proposed mitigation measures, strictly implement them and regularly monitor the implementation avoiding environmental pollution.	<ul style="list-style-type: none"> <li>- To give maximum support to residents losing land and house. To support local area in construction and renovation of infrastructure works in the ward.</li> <li>- All plans of the Project must be notified to and in close collaboration with local authorities in next steps.</li> </ul>
2	Duong Quan	To approve the assessments on negative environmental impacts of the Project stated in the report	To approve the measures to reduce negative environmental impacts 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 localities 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	<i>Project implementation progress:</i> At present, there are many suspended project affecting people's psychology as well as life and production of the people.	<ul style="list-style-type: none"> <li>- Residents should be notified and provided with updated information, especially construction plan and duration of project for spiritual stabilization, avoidance of anxiety affecting their daily lives.</li> </ul>
2	<i>Site clearance and resettlement:</i> The Project's acquisition of residential, gardening and agricultural land, etc. to construct the Project may affect their income, relocation and resettlement. Residents were anxious about policies on compensation or relocation of their houses and lands, etc. Additionally, they were concerned that the construction delay causing negative effects to people who received or did not receive compensation and those not promptly receive compensation ... (as occurring to some other projects), the delay may obstruct people to carry out new construction or renovation of their houses or land investment, etc.	<ul style="list-style-type: none"> <li>- The Project Owner must early notify details in the project implementation period.</li> <li>- The project study should consider minimizing losses and clearance volume.</li> <li>- The scope of affected households must be clearly determined.</li> <li>- Fairness, transparency, publicity and compliance with the state regulations regarding compensation, support and resettlement for people must be ensured.</li> <li>- The resettlement areas for residents must be arranged reasonably.</li> </ul>
3	<i>Environmental pollution (air, dust, noise or vibration):</i> During the construction process, there will generate dust and noise affecting trading and production activities of residents.	<ul style="list-style-type: none"> <li>- The Project Owner must seriously implement measures to minimize environmental impacts during the project implementation;</li> <li>- Publicly declare mitigation measures and the project's commitment to enable residents to monitor environmental impacts during the Project construction.</li> </ul>
4	<i>Effects on works of agencies and schools:</i> Einstein High School and Hai Phong Water Supply Company.	<ul style="list-style-type: none"> <li>- Einstein High School: A specific plan should be prepared and announced early for the school to make the learning plans for teachers and students at the school.</li> <li>- Hai Phong Water Supply</li> </ul>

No.	Public Consultations	
	Residents' concerns regarding the Project	Recommendations for the Project Owner
		Company: The Project will likely affect May To pumping station. It was recommended that the pumping station should be relocated with funds for no effects on the use of water by households, businesses and industrial parks.

**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	Information about the project implementation	The project owner agreed on such opinions and promised to closely coordinate with the local authority to promptly inform the residents in the implementation process
2	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.
6	<i>Effects on works of agencies and schools:</i> Einstein High School and Hai Phong Water Supply Company.	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 Owner received ideas from the units and promised to apply proper compensation and support policies (in case of the ward's relocation).

*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 of temporary acquisition of agricultural land and land of Hoang Dieu port to serve for the construction site.
- The water environmental: the bridge construction activities over Cam river and the operation of construction site are main elements affecting water, sediment, wetland ecosystems, mangroves, and aquaculture ponds in the North of Nguyen Trai bridge.
- 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 Cam river due to the construction of pier P13 and the main span bridge abutments in the flow of Cam river, and material/waste soil transportation by waterway.
- The impacts on residents due to air pollution, noise and vibration affecting the health and the lives of communities surrounding 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 contractors.

## **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. 38/2015/ND-CP dated 24/04/2015 approved by the Government on the management of waste and scrap;

- d. 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;
  - e. Circular No.36/2015/TT-BTNMT dated 30/06/2015 approved by the Ministry of Natural Resources and Environment on the hazardous waste management.
  - f. Applicable standards and regulations of Vietnam on the environment;
  - g. Applicable standards for measurement and analysis methods;
  - h. 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 power supply and domestic water supply, disrupting economic activities of the locality;
  - g. To strictly following Hai Phong City's regulations on environmental management and protection;

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.