TABLE OF CONTENT

LIST OF TABLES

LIST OF FIGURES

INTRODUCTION

1. THE GROUND AND OBJECTIVES OF THE PROJECT

1.1. The purpose of this Environmental Impact Assessment Report

- To comply with the Law on Environmental Protection adopted by National Assembly of Socialist Republic of Vietnam on 29 November 2005 (come into effect as from 1 July 2006)
- To supply information about status quo of social and natural environment in the Project area
- To identify the major impacts of the Project on natural and socio-economic environment, the vulnerable areas of the Project
- To forecast the possible impacts on the environment of the Project areas in the construction and operation period
- To analyze the selection of optimal technology on the basis of comprehensive assessment of socio-economic and environmental factors
- To suggest the measures to mitigate the adverse impacts on environment in construction and operation periods, in compliance with the regulations on environmental protection of Socialist Republic of Vietnam.

The EIA Report will help the local authorities and the Project managing agencies to select reasonable implementation methods, mitigating the adverse impacts on environment in construction and operation periods of the Project.

1.2. The ground of the Project

The economic triangle of Hanoi-Hai Phong-Quang Ninh, located in the center of the key economic zone of Bac Bo (Tonkin), is developing energetically, asserting its important position in the economic development of the region. The Industrial Zones located in Hanoi, Hai Phong and Quang Ninh together with the new Industrial Zones along the National highway No.5 are the impetus to economic development in the North of Vietnam. Furthermore, the group of famous beauty spots of Mong Cai - Ha Long - Cat Ba - Bach Long Vi - Do Son are attracting ever more domestic and foreign tourists, giving impetus to economic development. To make most use of the resources in the region, the road network must be improved.

In the last years, the National highway No.5 has been upgraded from 2-lane to 4 and 6-lane, meeting the technical standards of Class I road. This is arterial highway connecting Hanoi and Hai Phong; its traffic volume is very big. However, the National highway No.5 is now in full load state, moreover, the Industrial Zones and populated areas alongside the road are causing difficulties for operation of the roads, and traffic accidents happen frequently.

As stipulated in the Transportation Development Strategy to 2020, approved by the Prime Minister (as per Decision No.206/2004/QD-TTG), the Hanoi – Hai Phong Expressway together with Hanoi – Lao Cai, Noi Bai – Ha Long, Hanoi – Thai Nguyen, Hanoi – Lang Son expressways will form expressway network for the northern part of Vietnam. The network will speed up the socio-economic development in the areas and also help to attract tourists to Hai Phong and Quang Ninh natural landscapes and beauty spots.

The Feasibility Study Report for the Hanoi – Hai Phong Expressway Project has been approved the Government (Letter No. 1393/CPCN dated 24 September 2004); the alignment, the investment in the Project, and the BOT contract form have been accepted. Ministry of Transport has permitted preparation of investment project for construction of Hanoi – Hai Phong Expressway (Decision No. 3026/QD-BGTVT dated 12 October 2004)

Pursuant to Letter No. 75/TB-VPCP dated 17 April 2007 informing the Prime Minister's conclusions on the Hanoi – Hai Phong Expressway Project, and the Letter No. 227/BGTVT-KHDT dated 27 April 2007 of Minister of Transport, all the Project dossiers have been handed over to Vietnam Development Bank, the new Investment Owner.

The Project has been approved by Vietnam Infrastructure Development and Financel Investment Joint Stock Company.

2. THE LEGAL AND TECHNICAL BACKGROUND FOR ASSESSING ENVIRONMENTAL IMPACTS OF THE PROJECT

The Hanoi – Hai Phong Expressway will cross 4 provinces and cities, therefore, the Environmental Impact Assessment Report shall be appraised and approved by the Ministry of Natural Resources and Environment.

The EIA Report must be in compliance with the following laws and regulations:

- The Law on Environmental Protection, 2005 (come into effect as from 01 July 2006);
- Decree No. 80/2006/ND-CP dated 9 August 2006 of the Government providing detailed guidance for implementation of Law on Environmental Protection;
- Circular No. 08/TT-BTNMT dated 8 September 2006 of Ministry of Natural Resources and Environment on assessment of strategic environment, environmental impacts, and environmental protection undertakings;
- The Law on Construction and Decree No. 16/2005/ND-CP dated 7 February 2005 of the Government on management of investment projects for construction

- The Law on Land, 2003 and Decree No. 197/2004/ND-CP dated 3 December 2004 of the Government on compensation and support for resettlement in the cases of recovery of land;
- The Law on Dikes and Decree No. 113/2007/ND-CP dated 28 June 2007 of the Government providing detailed guidance for implementation of Law on Dikes;
- The Law on Water Resources and the Decree No. 179/1999/ND-CP dated 30 December 1999 of the Government providing detailed guidance for implementation of Law on Water Resources;
- The National Action Program for Environment and Sustainable Development approved by the Prime Minister in 2005;
- Decree No. 197/2004/ND-CP dated 3 December 2004 of the Government on compensation and support for resettlement in the cases of recovery of land, and the Circular No. 116/2004/TT-BTC dated 7 December 2004 guiding implementation of the Decree No. 197/2004/ND-CP dated 3 December 2004 of the Government;
- Decision No. 255/GTVT-KHDT dated 14 January 2005 of Ministry of Transport on assigning Institute of Meteorology and Hydrology (under Ministry of Natural Resources and Environment) with the task of conducting Environmental Impact Assessment for Hanoi – Hai Phong Expressway Project;
- Economic Contract No. 06/HDKT-DMT dated 10 May 2005 between the Project Management Board and the Institute of Meteorology and Hydrology;
  - The Contract No. 01/HDKT dated 31 July 2007 between the Vietnam Development Bank and the Institute of Meteorology and Hydrology;

Technical bases

- The Standard No. 22TCN 242-98 - Procedure for Environmental Impact Assessment in feasibility study and designing of communication works (issued by Ministry of Transport);
- Guidance on conducting EIA Report for communication projects (road, railway, bridges) issued by Ministry of Science, Technology and Environment in 1999;
- The Environmental Standards TCVN-1995, 1998, 2000, 2001, and 2005, issued by Ministry of Science, Technology and Environment;
  - The decisions of the Government and the Ministry of Transport on investment preparation and investment.

3. ORGANIZATION FOR CONDUCTING ENVIRONMENTAL IMPACT ASSESSMENT REPORT

The EIA Report will be conducted by Vietnam Development Bank in cooperation with Institute of Meteorology and Hydrology (under the Ministry of

Natural Resources and Environment). The environmental experts come from Institute of Geology, Institute of Ecology and Biological Resources, Institute of Environmental Engineering (under Vietnam Academy of Sciences and Technologies), Division of Meteorological and Hydrological Survey, Center for Technological Development and Natural Resources Survey… will also take part in assessing environmental impacts.

List of the key members taking part in preparation of the EIA Report

Full names	*Agencies*
Mr. Nguyen Duc Minh	Vietnam Development Bank
Dr. Dinh Van Thuan	Institute of Geology
Eng. Pham Hong Phuong	Institute of Meteorology and Hydrology
MS. Pham Thanh Huong	Institute of Meteorology and Hydrology
MS. Dinh Xuan Truong	Institute of Meteorology and Hydrology
Dr. Duong Hong Son	Institute of Meteorology and Hydrology
MS. Tran Thanh Thuy	Institute of Meteorology and Hydrology
Eng. Nguyen Trong Tan	Institute of Geology
Eng. Vu Van Ha	Institute of Geology
Eng. Nguyen Linh Giang	Institute of Geology
BA. Nguyen Thi Huong Linh	Institute of Geology
MS. Mai Thanh Tan	Institute of Geology
Dr. Do Van Tu	Institute of Geology
Eng. Tran Van	Institute of Geology
Eng. Pham Dinh	Institute of Environmental Engineering
Dr. Dam Quang Tho	Institute of Environmental Engineering
Dr. Le Dinh Thuy	Institute of Environmental Engineering
MS. Le Quang Hai	Division of Meteorological and Hydrological Survey
Eng. Nguyen Nguyen Cuong	Center for Technological Development and Natural Resources Survey

4. THE CONTENT OF THE ENVIRONMENTAL IMPACT ASSESSMENT REPORT

The Report includes following sections and chapters:

Introduction

Chapter 1. Brief description of the Project

Chapter 2. Natural, environmental, and socio-economic conditions

Chapter 3. Assessment of Environmental Impact

Chapter 4. Measures for settlement and mitigation of bad impacts on environment

Chapter 5. Commitments to observe the Environmental protection measures

Chapter 6. Environmental Treatment works, environmental management and supervision programs

Chapter 7. Cost estimation for environmental protection facilities

Chapter 8. Puplic opinion poll

Chapter 9. Documents resources and methods for assessing environmental impact

Conclusions

To prepare the report on "Environmental Impact Assessment for Hanoi - Hai Phong Expressway Project" we have studied the Project dossier, conducted additional field investigation in the areas along the route, sampling and analyses of basic environmental components, data processing and compiling the report.

CHAPTER 1. BRIEF DISCRIPTION OF THE PROJECT

1.1 NAME OF THE PROJECT

HANOI - HAI PHONG EXPRESSWAY PROJECT

1.2 THE PROJECT OWNER

VIETNAM DEVELOPMENT BANK

Represented by Mr. Dao Van Chien. Title: Deputy General Director

Address: 4th floor, DMC building, No. 535, Kim Ma st, Ba Dinh district, Hanoi

Tel: (04) 2209668. Fax: (04) 2209666

1.3 THE PROJECT LOCATION

The Beginning is located on ring road No.3 of Hanoi city, 1025 m far from Thanh Tri bridge abutment, 1420 m away from Red River dike to Bac Ninh direction, in Thuong Hoi village, Thach Ban ward, Long Bien district, Hanoi.

This beginning will be located at the joint point with Long Bien – Thach Ban road.

The ending point: located at Dinh Vu dam, Hai An district, Hai Phong city

The areas where EIA is conducted include the areas occupied and impacted by the Project. The Hanoi - Hai Phong Expressway will cross 4 cities and provinces, namely Hanoi, Hung Yen, Hai Duong, and Hai Phong, including the following villages, communes and districts:

Starting point is located in Thuong Hoi village, Thach Ban ward, Long Bien district, the road will cross Dao Xuyen village (Da Ton commune); Kieu Ky commune (Gia Lam district, Hanoi). The Beginning is located on the ring road No.3 of Hanoi.;

Communes of Cuu Cao, Long Hung, Tan Tien (Van Giang district); communes of Hoang Long, Yen Phu, Viet Cuong, Minh Chau, Thuong Kiet, Tan Viet (Yen My district); and commune of Van Du (An thi district, Hung Yen province) – from Km 6.1 to Km 25;

Communes of Thai Duong, Thai Hoa, Thai Hoc, Co Bi (Binh Giang district); communes of Yet Kieu, Phuong Hung, Gia Khanh, Gia Xuyen, and Gia Loc town (Gia Loc district); communes of Thanh Hong, Thanh Cuong, Vinh Lap (Thanh Ha district, Hai Duong province) – from Km 25 to Km 82

Communes of Quang Trung, Quoc Tuan, My Duc, An Thai (An Lao district); commune of Huu Bang, Hoa Nghia (Kien Thuy district); Trang Cat ward (An Hai district, Hai Phong city) – from Km 82 to Km 105 + 500

The Design Consultants, in their Feasibility Study Report, have presented three route plans, and the route running through the south of National highway No.5 has been approved by the Prime Minister.

This selected route is 105.5 km long, including the following sections:

- The section crossing Hanoi city is 6.1 km long (crossing 3 communes and wards)
- The section crossing Hung Yen province is 26.4 km long (crossing 10 communes)
- The section crossing Hai Duong province is 40 km long (crossing 15 communes)
  - The section crossing Hai Phong city is 33 km long (crossing 7 communes and wards)

1.4 MAIN CONTENTS OF THE PROJECT

1.4.1 Alignment

The Beginning point is located on Ring road No.3 of Hanoi city, 1025m far from Thanh Tri bridge abutment, 1420 m away from Red River dike to Bac Ninh direction, in Thuong Hoi village, Thach Ban ward, Long Bien district, Hanoi. This beginning will be the joint point with Long Bien – Thach Ban road, 40 m wide; this section crosses populated areas and agricultural land.

The section crossing Vegetable and Fruits Research Institute (under the Ministry of Agriculture and Rural Development) occupies about 10 ha. The section crossing University of Agriculture occupies about 1.6 ha, mainly of experimental rice field. The next section crosses rice field of Dao Xuyen village, Da Ton commune and Kieu Ky rubbish dump (at Km 4+300), occupying about 1 ha of the rubbish dump.

As from Km 6+100, the route running through Hung Yen province, crossing Bac-Hung-Hai canal and provincial highway No.179 at Bao Dap bridge area, and crossing the rice fields of communes of Cuu Cao, Long Hung (Van Giang district), Tan Tien, Hoang Long, Phu Yen, and Viet Cuong (Yen My district). The section crosses provincial highway No. 206 (at Km 14+839) and provincial highway No. 199 (at Km 15+275), 600 m to the south of Luc Dien bridge.

As from Km 22, the route turns left, running in line with the Northeast – East

direction, crossing the fields of Tan Viet and Van Du communes (An Thi district), and then, crosses the provincial highway No. 200 (at Km 10+900), crossing football field of Van Du commune. The route passes through Thi Tan village, Tai Duong commune, An Thi district, crossing National highway No.38 at Km 42+500, crossing Sat river at Km 32+900 (this is the boundary between Hai Duong province and Hung Yen province).

Subsequently, the route runs through Binh Gia district, Hai Duong province, crossing the fields of Ha Dong, Ha Cho villages (Thai Duong commune), Nhu Thi, Mao Trach villages (Thai Hoa commune), An Dong, Soi To villages (Thai Hoc commune), and then, crossing provincial highway No. 20 at Km 8+400. The route avoiding population areas of Co Bi commune, passing through the right side of Co Bi pumping station, crosses Cam Xa village at Km 43+600. The route crosses Dinh Dao river at Km 44+800, running through the fields of villages Khuong and Gach (Yet Kieu commune), passing by populated areas of Phuong Hung commune, and then, crossing National highway No.38B at Km 12+200. The route runs straight ahead, crossing provincial road No. 17A at Km 2+700.

As from Km 50, the route runs through agricultural lands of villages of Duc Dai, Hoi Xuyen (Gia Loc town), Binh De, Dai Tinh (Gia Khanh commune), and then, crossing Do Day river, running into Tu Ky district (Hai Duong province). The route passes by the population area of Co village, crossing the fields of Dai Dinh, Chung Son villages (Ngoc Ky commune) and crossing provincial highway No. 191 at Km 10, and then, the route passes by the left side of An Lac pagoda, running along Thai Bing river, crossing the fields of Toai An, Hien Sy villages (Dong Ky commune), running through population area of Vuc village, Tu Xuyen commune. This population area is rather large, extending over 500 m either side of the center line of the road.

The route crosses Thai Binh river at Km 64+926, runs through plantation areas of Bau and Tien Kieu villages (Thanh Hong commune) , crosses Thanh Hong river at Km 68+639. Going further, the route crosses cultivation areas of Vinh Linh village (Thanh Cuong commune) and Kien village (Vinh Lap commune), crosses provincial highway No. 190B at Km 69+391, and then, crosses Van Uc river at Km 72+900, about 1 km to downstream of Soi wharf (this is border between Hai Duong province and Hai Phong city).

As from Km 75 the route has two plans:

a) Plan I.

Starting from Km 75 (Cam Van village, Quoc Tuan commune, An Lao district, Hai

Phong) the routes crosses district road No.306, and then, Da Do river at Luong Cau village, turns left, passes by Cot Co mountain, crosses the access road for petrol storage of Division No.363, at Km 83+788. The rout run by Tuberculosis Hospital, crosses street Tran Tat Van (Kien An district) at Km 87+170.

Passing through Kien Thuy cemetery, the route runs in parallel with provincial highway No.355, crossing Thai Son (An Lao district), Trang Minh, Phu Lien, Van Dau wards (Kien An district) Da Phuc, Hung Dao communes (Kien Thuy district), crossing provincial highway No.353 at Km 93+841, crossing Lach Tray river, runs into Hai An district.

After crossing Lach Tray river, the route runs in line with the 35m-wide street of Hai An district, crossing aquatic cultivation lagoon, and then, joins with the route of Plan II, at Km 99+10.

The length of the route of the Plan I is 102.5 km.

b) Plan II: the route crosses the areas in the south of Da Do river

Starting from Km 75+500 (Cam Van village, Quoc Tuan commune, An Lao district, Hai Phong) the routes turns right, running in parallel with provincial highway No.190B, going through rice fields of Du Vien and Ly Cau villages (Quoc Tuan commune), crossing over Da Do river at Km 80+300, 700 m away from the confluence.

The route runs in parallel with provincial highway No.190B, through rice fields of villages of Bieu Da, Kim Tram, Sai Nghi, Minh Khai (My Duc commune, Kien Thuy district), and crossing provincial highway No.354 at Km 84+50. At this crossroad, a flyover will be constructed and provincial highway No.354 will pass over the Hanoi - Hai Phong Expressway.

The route run in southern part of Da Do river, 0.3 – 1 km away from the river bank, crossing the rice fields of Quan Re, Uc Gian, and Xuan Uc (An Thai commune), Van Cao, Kim Doi, Tam Kiet villages (Huu Bang commune, Kien Thuy district), and then, crossing over Da Do river and provincial highway No.210 (at the point 150 m far from Vietnam-Korea Garment Joint venture). Going further, the route crosses the rice fields of Dai Dong and Hoa Nghia communes (Kien Thuy district), and crosses provincial highway No.353 (leading to Do Son) at Km 96+650. At this point, an overpass will be constructed in combination with the bridge crossing Lach Tray river, with total length is 1.144.80 m.

After crossing Lach Tray river, the route runs through Hai An district, crossing mangrove forest of Trang Cat ward (the section crossing the mangrove forest is 4.5

km long), after that the rout joins with the route of Plan I at Km 99+100. Total length of the route of Plan II is 105.5 km.

c) Recommendation on selection of route

+ Advantages:

The Plan I: The total length of the route is 3 km shorter than that of the Plan II; the number of bridges to be constructed is lesser by one bridge.

The Plan II: The route is located in the south of Da Lo river, not causing affects on urban planning of Kien an, Hai An districts…, reducing compensation for land clearance. The traffic organization of the junction with provincial highway No.353 is more simple; the overpass is shorter than that of the Plan I. This route has been accepted in writing by the provincial People's Committees.

+ Disadvantages:

The Plan I: The compensation for land clearance is larger; the route crosses planed urban areas of Kien An, An Hai districts. The length of the viaduct is rather big (3.6 km), the traffic organization of the junction with provincial highway No.353 is more complex due to high population density.

The Plan II: The total length of the route is 3 km shorter than that of the Plan I; the geological conditions of the section crossing Hai Phong is more complicated; the number of bridges to be constructed is bigger.

The advantages of the Plan II:

- Have more favourable conditions for building an expressway of high standards;
- It is located in the south of National highway No.5, avoiding crossing Industrial Zones, populated areas and minimizing compensation for land acquisition;
- The route is 3 – 15 km away from the National highway No.5; this distance is reasonable for two parallel trunk highways;
- Most of sections of the Expressway are newly-built;
- The construction volume is reasonable;
- Giving more impetus on socio-economic development of the areas crossed by the Expressway;
- In line with the local development planning;
- The route has been accepted by the local authorities (Hanoi, Hai Duong, Hung Yen, Hai Phong).

+ Recommendation: Considering the Letter No. 2712/UBND-GT of the People's Committee of Hai Phong city on selection of the Plan II of Hanoi - Hai Phong

Expressway; considering the status quo of the urban areas of Kien An, Hai An districts, we recommend to select the Plan II.

Figure 1.1. Map of alignment of Hanoi – Hai Phong Expressway

1.4.2 Key control points of the route

- Crossing Bac-Hung-Hai canal and provincial highway No.179 in area of Bao Dap bridge (Km 6+600);
- Crossing Thai Binh river – Tu Xuyen bridge, Thanh Hong commune, Thanh Ha district, Hai Duong province (Km 65+100);
- Crossing Van Uc river – Than Ha bridge, Quang Trung commune, An Lao district, Hai Phong (Km 72+900);
- Crossing road of the planed urban area 353 and Lach Tray river (Km 96+700)
- Tan Vu junction at Km 101+500;
- The ending point at Dinh Vu dam, An Hai district, Hai Phong.

1.4.3 Alignment design

1.4.3.1 Cross section scale:

The cross section of the Hanoi - Hai Phong Expressway is designed by two stages as follows:

Table 1.1. Cross section of the Expressway of each stage

Width of carriageway	4x3.75m =15,00m	6 x 3.75m = 22.50m
Width of median strip	10.50m	3.00m
Width of safety strip	2x0.75m = 1,50m	2x0.75m = 1.50m
Width of emergency parking strip	2x3.00m = 6,00m	2x3.00m = 6.00m
Width of grass strip	2x1.00m = 2,00m	2x20.00m = 40.00m
Total width of carriageway formation	35.00m	45.00m
Width of carriageway	4x3.75m =15,00m	6 x 3.75m = 22.50m

1.4.3.2 Cross section of frontage road

In general, the frontage roads shall have 5.5 m subgrade and 3.5 m carriageway. In particular, the frontage roads for the sections crossing Long Bien district (Hanoi) and Hai An district (Hai Phong) shall be expanded to become urban roads in compliance with the local planning.

The frontage road from Industrial Zones shall be built as a road of Class IV, with 7.5 m subgrade and 5.5 m carriageway.

1.4.3.3 Design of the Expressway pavement

Based on the forecast traffic volume for 2025, the pavement must reach grade of

Eyc ≥ 237.5 Mpa.

The rough asphalt concrete layer shall be made 2 -3 years later for the subgrade getting required stability.

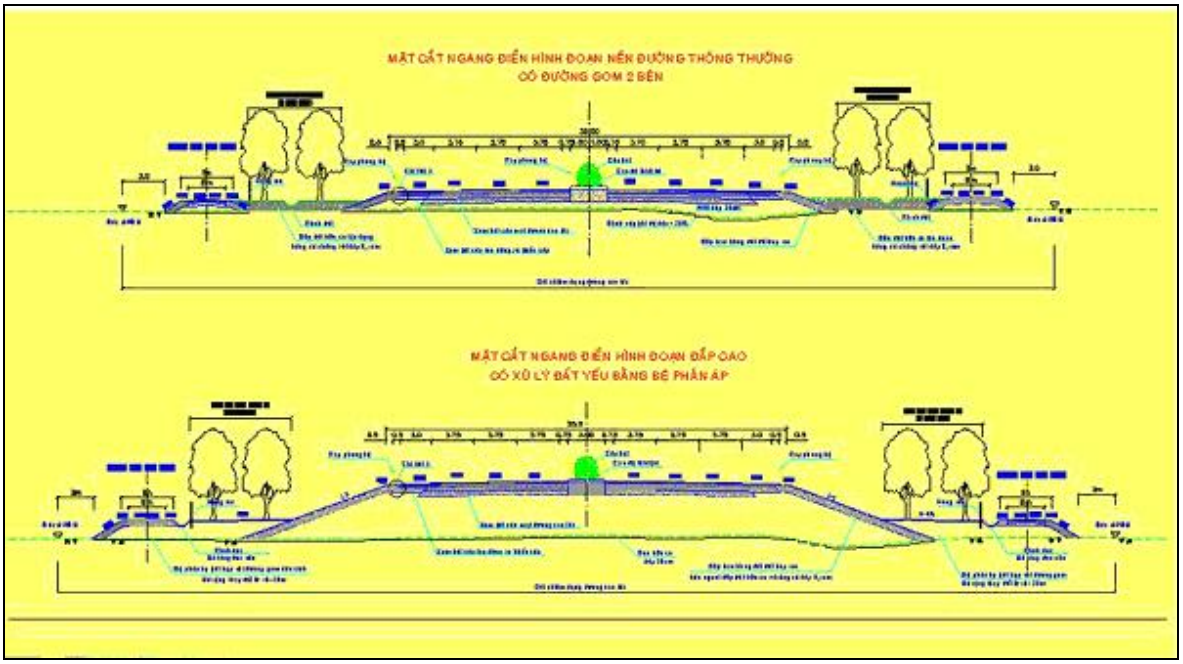


Figure 1.2. Typical cross-section of Hanoi – Hai Phong Expressway

1.4.3.4 Drainage system on the Expressway

A*) Cross culverts:*

Cross culverts shall be constructed with reinforced concrete. About 314 culverts will be constructed, with total length of 18,642 m.

B*) Drainage ditches and longitudinal culverts*

*D*rainage ditches and collection pits will be constructed along the central line and sides of the expressway

U-shaped drainage ditches will be excavated in the verge either side of the expressway for drainage of surface water; drop water will be constructed for preventing erosion of side slopes, at spacing of 40 m.

C*) Reconstruction of irrigation system*

To minimize the construction of cross culverts, some irrigation channels will be re-constructed, making them suitable to the new conditions. The re-construction locations are shown on the plan.

1.4.3.5 Design of frontage roads and underpasses

The specifications of frontage roads are as follows:

The carriageway is 3.5 m wide, and the subgrade is 5.5 m wide

The pavement is of A2 grade, with Eyc = 980 daN/cm^2

Maximum longitudinal slope is 4%

The sections coincide with the road planning of Hanoi and Hai Phong, the cross sections of the frontage roads shall be in compliance with the approved planning.

Total number underpasses is 124, with total length of 4848 m.

1.4.3.6 Road intersections

There are 7 interchanges in the whole roate at Ring road No.3, National highways No.39, 38B, 10; provincial road No.353, Dinh Vu; and the remaining intersections are flyovers with the details as follows:

Table 1.2. Design of interchanges and flyovers

No.	*Bridge name and station*	*Span structure*	*Length, m*	*Plan*
1	3-grade (branch 1)- Km 0	9x38,6+38,65+9x38,69	742.35	Both plans
2	3-grade (branch 2)- Km 0	6x38,6+38,65+6x38,6	510.45	Both plans
3	Bridge Km4+121.9	2x21; 4x33	186.35	Both plans
4	Intersection PR 179– m6+609.7	5x33	179.3	Both plans
5	Intersection PR 207B– Km8+321.25	2x21+4x33	184.4	Both plans
6	Intersection PR 207C – Km12+007	12x21	264.65	Both plans
7	Intersection PR 206 – Km14+839.25	12x21	264.65	Both plans
8	Intersection PR 199- KM15+273	10x21	220.55	Both plans
9	Interexchange NR 39 Thuong Kiet – Km20+264	12x21	264.65	Both plans
10	Intersection - Overpass PR 200 – Km26+76.8	27+4x33+27	198.2	Both plans
11	Intersection - Overpass QL38(No. 1) – Km29+296	27+4x33+27	196.0	Both plans

12	Intersection - Overpass QL38(No. 2) – Km29+820	27+4x33+27	198.2	Both plans
13	Intersection - Overpass PR 20 – Km39+600	27+4x33+27	198.2	Both plans
14	Interexchange -Overpass QL38B – Km48+744	27+4x33+27	198.2	Both plans
15	Intersection - Overpass PR 17A – km50+190	27+4x33+27	198.2	Both plans
16	Intersection -Overpass PR 191 – Km58+100	27+4x33+27	198.2	Both plans
17	Intersection - Overpass PR 190B – Km69+342	12x21	266.7	Both plans
18	Interexchange NH 10 Cau Cat Tien – Km74+431.5	6x21	139.35	Both plans
19	Intersection - Overpass HL306 –Km82+334.16	10x24	252.55	Plan I
20	Intersection – PR u Lien bridge – Km84+170.2	25+6x35+25	273.9	Plan I
21	Intersection Overpass PR 401 – km88+241	10x24	250.55	Plan I
22	Intersection -Overpass PR 302 – Km78+230	27+6x33+27	264.2	Plan II
23	Intersection -Overpass Tran Tat Van – Km84+45	27+4x33+27	198.2	Plan II
24	Interexchange Overpass PR 353 – Km96+700 - Branch 1	10x30	306.6	Plan II
25	Intersection - Lạch Tray approach bridge – Km 96+700- Branch 4	7x30	214.2	Plan II

The intersections with Ring Road IV of Hanoi city planned for future.

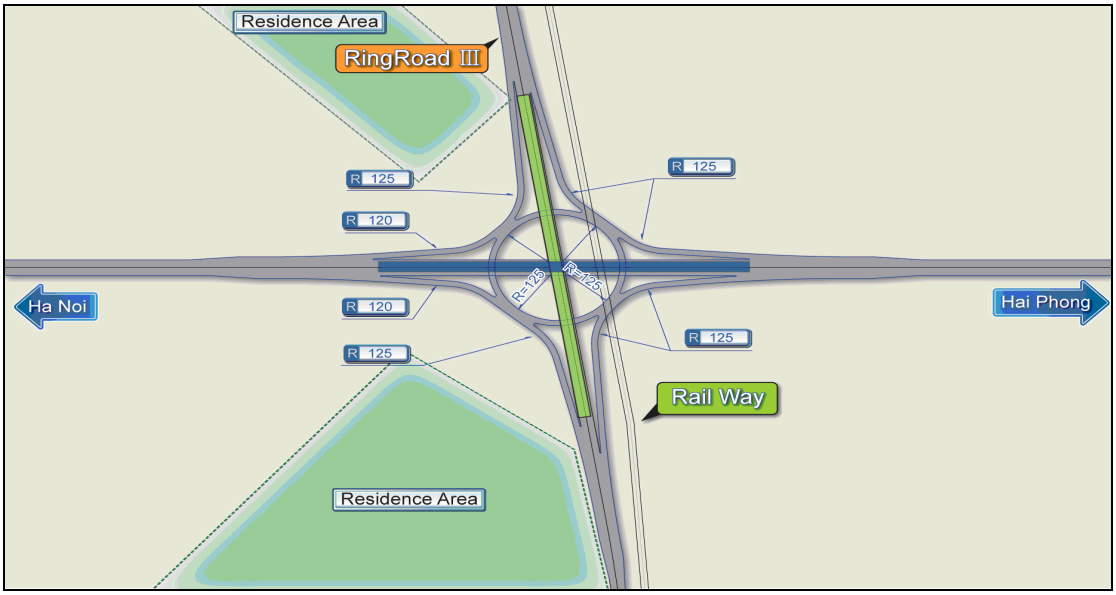


Figure 1.3. Interchange with Ring Road 3 (Hanoi city)

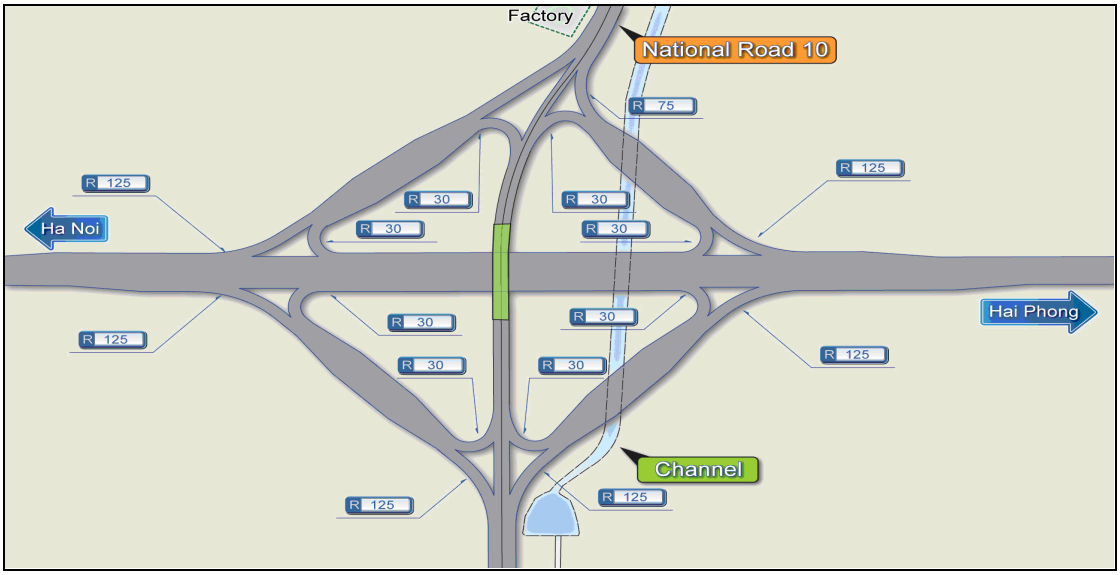


Figure 1.4. Interchange with NH No.10

1.4.4 Facilities for Traffic safety

Facilities for traffic safety are designed according to standards applicable to Expressway of Class A.

1.4.5 Design of bridges

- Long span river bridges: 9 bridges/ 4531 m
- Medium span bridges: 21 bridges/ 1068.4 m

- Overpasses at road crossing: 22 overpasses/ 5589 m
- Underpasses: 124 underpasses/ 4848 m.

The design principles

- The geometrical parameters of the bridges must be in compliance with the Expressway;
- Suitable to the topographical, geological and hydrological conditions;
- Meeting all requirements in respect of clearance height for boats and vehicles;
- Application of advanced technology, easy construction, low costs.

Specifications

- The bridges will be constructed with prestressed concrete and reinforced concrete;
- Design load: HL93, human 300 kg/m^2 ;
- Design frequency: P = 1%;
- Earthquake of 7 and 8 scales;
- The bridge width:

  B = 16.5 + 2.0 + 16.5 = 35.0 (for long and medium span bridges on the Expressway)

  B = 0.5 + 8(11) + 0.5 = 9(12) m (for long-span bridges overpassing the expressway)

Span structure

- The spans with L = 15m; 33m; 38.6m; 40m, 42m; I beams and Super-T beams are constructed with prestressed concrete; cast-in-situ deck slabs
- The spans with L = 18m; 21m; 24m; simple plate girders are constructed with prestressed concrete, with plate bonding layer
- The spans with continuous plate girders: (27+4x33+27)m; (27+6x33+27)m; 7x30m; 10x30m.
- The major spans with continuous box girders: (42+63+42)m; (60+5x90+60)m, (63+90+63)m; (65+102+65)m; (73+120+73)
- The pavement of the bridges (of expressway) will include the following layers:

  Non-skid asphaltic concrete layer, 3.0 cm thick

  Fine grained asphaltic concrete, 5.0 cm thick

Water-proof layer, 04 cm thick.

Structure of abutments, piers and foundation

- The supports of the bridges and underpasses will be constructed with reinforced concrete; with bored pile foundation, D = 1.0m, 1.2m, 1.5m; 40x40 reinforced concrete piles.

Table 1.3. Designs of long span bridges

No.	*Bridge name and station*	*Span structure*	*Length, m*	*Plan*
1	Bridge Km5+767,5	4x38,6	162,65	Both plans
2	Bridge Bai Say-Km32+615,79	3x33	115,2	Both plans
3	Bridge Ô Xuyen-Km44+670,64	3x33+(42+63+42)+5x33	427,6	Both plans
4	Bridge Ngọc Ky-Km54+44.34	5x33	181,3	Both plans
5	Bridge Thai Binh-Km64+926.34	3x40+(60+5x90+60)+3x40	821,6	Both plans
6	Bridge Thanh Ha-Km72+854,85	9x38+(65+102+65)+9x38	960,37	Both plans
7	Bridge Ba La Km80+339,04	11x33	379,6	Plan II
8	Bridge Đa Đo – Km90+939,9	39,15+7x40+39,15	371,4	Plan II
9	Bridge Lạch Tray – Km97+157,039	6x30+7x40+5x35+(73+120+73)+5x40	1111,25	Plan II

- Total number of river long-span bridges according to Plan I: 08 bridges/ 6742 m;
- Total number of river long-span bridges according to Plan II: 09 bridges/ 4531 m;
- Total number of overpasses according to Plan I: 21 bridges/ 5482 m;
- Total number of overpasses according to Plan II: 22 bridges/ 5589 m.

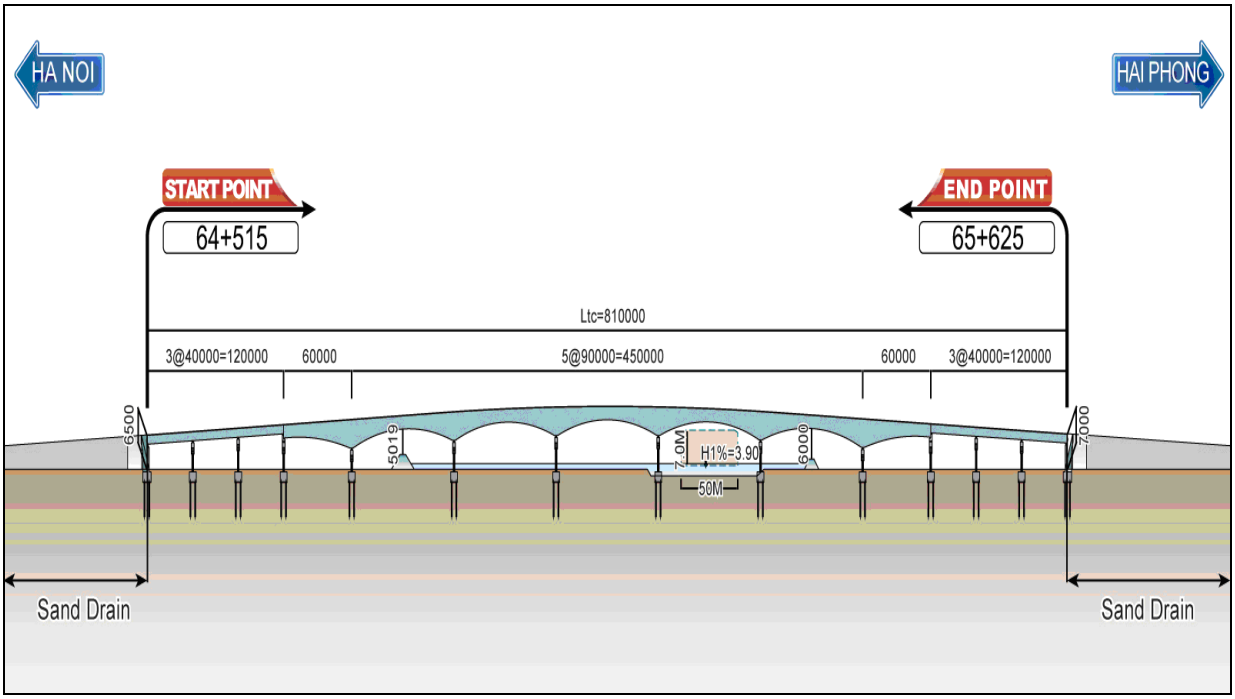


Figure 1.5. Arrangement of Thai Binh bridge

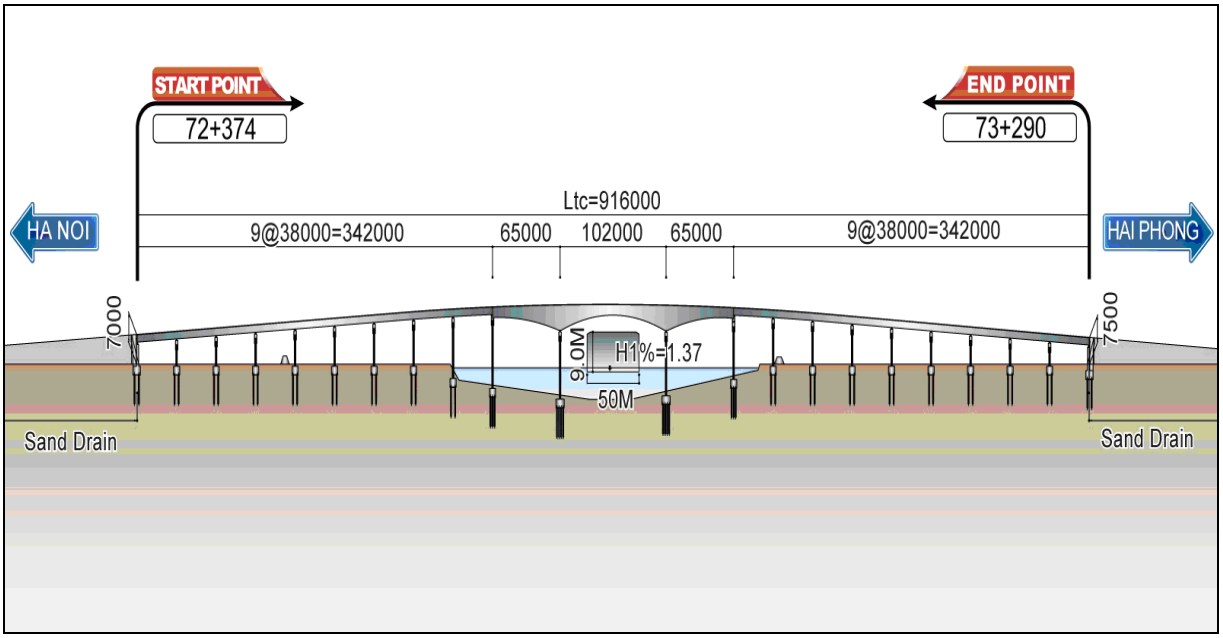


Figure 1.6. Arrangement of Thanh Ha bridge

Table 1.4. Designs of medium span bridges

No.	*Bridge name and station*	*Span structure*	*Length, m*	*Plan*
1	Bridge Km1+456	21+33	63.65	Both plans
	Bridge Km1+456(frontage road)	21+33	63.65	Both plans
2	Bridge Km1+648	21+33	66.15	Both plans
	Bridge Km1+648(frontage road)	21+33	66.15	Both plans
3	Bridge Km2+453,3	1x18	30.10	Both plans
4	Bridge Km3+096	1x18	26.70	Both plans
	Bridge Km3+096(frontage road)	1x18	26.70	Both plans
5	Bridge Km7+895.3	1x18	26.10	Both plans
6	Bridge Km9+055,0	1x33	43.10	Both plans
7	Bridge Km9+598,5	1x18	25.10	Both plans
8	Bridge Km10+614,5	1x18	27.10	Both plans
9	Bridge Km14+812,0	1x33	42.10	Both plans
10	Bridge Km16+748	2x21	51.15	Both plans
11	Bridge Km20+264	1x33	42.10	Both plans
12	Bridge Km 21+823.2	1x21	30.10	Both plans
13	Bridge Km22+490	3x21	73.20	Both plans
14	Bridge Đao Duong – Km28+900,54	1x33	49.10	Both plans
15	Co Bi Bridge– Km43+88,79	2x33	80.15	Both plans
16	Bridge Khuong Phu – Km 45+840,21	1x25	35.10	Both plans
17	Bridge Km63+545,51	1x33	45.10	Both plans
18	Thanh Hong Bridge – Km 68+639,16	2x33	76.15	Both plans
19	Bridge Km69+334.69	2x24	60.65	Both plans
20	Bridge No.1 (crossing canal)	1x24	32.10	Both plans

21	Bridge of short span	1x20	28.00	Both plans

- Medium-span bridges according to Plan I: 22 bridges/ 1116 m
- Medium-span bridges according to Plan II: 21 bridges/ 1008.

1.4.6 Construction materials supply sources

The construction materials are of different types and can be supplied from the sources as follows:

Embankment materials

- Do Mong earth resource: located in Kim Mon district, Hai Duong province, about 500 m away from provincial highway 186. The earth is sandy clay mixed with gravel, brown – yellow colour. The earth reserve is about 40,000 m^3, suitable for embankment. The transportation distance is 31.5 km
- An Luu earth resource: located in Thai Thinh commune, Kim Mon district, Hai Duong province, about 1 km away from provincial highway 188. The earth is sandy clay mixed with gravel, brown – yellow colour. The earth reserve is about 50,000 m^3, suitable for embankment. The transportation distance is 28km
- The earth resource near military head quarter of Hai Phong city: located in right on the expressway route, at Km 38+600. The earth is sandy clay mixed with much gravel, brown – yellow colour. The earth reserve is about 100,000 m^3, suitable for embankment. The transportation distance is 150 m
- Han Ho earth resource: located in Phuc Thien village, Hoang Tien commune, Chis Linh district, Hai Duong province. The earth is sandy clay mixed with gravel, brown – yellow colour, half-stiff to stiff. The earth reserve is about 4,500,000 m^3, suitable for embankment. The transportation distance (from the source to the beginning point of the route) is about 51 km.

Sand

- Do Han sand resource: located in Nam Sach district, Hai Duong province, about 1 km away from National highway No.5. The annual output is about 150,000 m^3. The fine sand is suitable for embankment; while medium and coarse sand (quartz sand) are suitable for concrete structures. The transportation distance is 13 km
- Cong Cau sand resource: located in Gia Loc district, Hai Duong province, about 500 m away from provincial highway No.191. The annual output is about 180,000 m^3. The fine sand is suitable for embankment; while medium and coarse sand (quartz sand) are suitable for concrete structures. The transportation distance is 10 km
- Quy Cao sand resource: located near Quy Cao bridge, in Gia Loc district, Hai Duong province, about 50 m away from provincial highway No.191. The annual output is about 200,000 m^3. The fine sand is suitable for embankment; while

medium and coarse sand (quartz sand) are suitable for concrete structures. The transportation distance is 14 km

- Yen Lenh sand resource: located about 500 m away from Yen Lenh bridge, in Hung Yen town, Hung Yen province. The annual output is about 200,000 m^3. The fine sand is suitable for embankment; while medium and coarse sand (quartz sand) are suitable for concrete structures. The transportation distance is 27 km
- Bu wharf sand resource: located in Hong Thanh commune, Thanh Ha district, Hai Duong province. The main component is fine sand mixed with dust, brown-grey colour. The sand reserve is about 200,000 m^3. The medium and coarse sand is suitable for embankment and concrete structures. The supply capacity is 50 m^3 per day. The transportation distance is about 100 km (from Bau wharf to Km 64+500).
- Cau Niem sand resource: located near Km 36 of National highway No.10, Hai Phong city. The supply capacity is about 300 m^3/h. The sand is suitable for embankment and concrete structures. The transportation distance is 12 km, from the source to Km 90+500.

Stone

- Thong Nhat lime stone quarry: located in Hong Phong commune, Kim Mon district, Hai Duong province, about 1.5 km away from provincial highway No.383. The lime stone is hard compact, of grey-white and grey-brown colour. The reserve is about > 1.000,000 m^3. The lime stone is suitable for aggregate of asphaltic concrete and cement concrete; while medium and coarse sand (quartz sand) are suitable for concrete structures. The transportation distance is 40.5 km
- Kien Khe quarry: located to the right side of National highway No.1A, in Kien Khe commune, Thanh Liem district, Ha Nam province. The quarry supplies crushed stone, graded aggregate, ashlars stone… The annual potential output is about 200,000 m^3. The transportation distance is 59 km
- Binh Minh quarry: located at about 8 km to the right side of National highway No.6, about 5 km away from Lang – Hoa Lac T-junction. The reserve is about >1,000,000 m^3. The transportation distance is 82.5 km
- Stone stock yard is located near Road No.190B, in Thanh Cuong commune, Thanh Ha district, Hai Duong province, with supply capacity of 100 m^3/ day. The distance from the stock yard to Km 69+350 is about 3.5 km.
- Cau Niem stone stock yard is located at Km 36 of National highway No.10 (in Hai Phong city), with supply capacity of 250 m^3/ day. The transportation distance is about 12 km

Other materials: cement can be supplied from Hoang Thach Cement Plant; steel from the steel plants located along National highway No.5 or the sea ports of Hai Phong city. Precasted reinforced concrete products and other construction materials can be got from Hanoi, Hai Phong, Hai Duong, and transported by National

highways No.5, No.10; No.38 and provincial highways.

1.4.7 Summary of work volume

The occupied areas and the work volumes of the Project are presented in the following Tables:

Table 1.5. The land areas occupied by the Project

No.	*Items*	*Unit*	*Hanoi*	*Hung Yen*	*Hai Duong*	*Hai Phong*
I	**Dwelling houses**					
1	3-storey buildings	m	100	420	0	0
2	2-storey buildings	m	150	560	546	5394
3	Flat roof houses	m	288	1233	5001	2547
4	Tile-roofed houses	m	1260	7232	7558	19095
5	Corrugated iron roofed houses	m	0	336	2295	0
II	**Land**			0	0	0
1	Rice field	m^2	571029	2142228	3543273	2684642
2	Hill land	m^2	0	0	0	165578
3	Residential land	m^2	35	26456	25350	227666
4	Orchard	m^2	107467	35066	582220	313885
III	**Grave**			0	0	0
1	Earth grave	grave	0	6	39	19
2	Masonry graves	grave	0	95	29	239
IV	**Trees**			0	0	0
1	Timber trees	tree	0	2196	3186	768
2	Fruit trees	tree	15006	6640	142722	2171
V	**Other works**			0	0	0
1	High-voltage poles	pole	0	11	12	11
2	Medium-voltage poles	pole	10	21	0	0
3	Low-voltage poles	pole	10	20	74	188
4	Telephone poles	pole	0	1	19	20
5	Pumping stations	station	0	0	1	0
6	Transformer stations	station	0	0	1	1

7	Earth channel	m	0	0	385	25000
8	Masonry channels	m	0	0	3312	8625
9	Petrol stations	station	0	0	0	1
10	Rivers	m^2	0	0	10000	20000

Table 1.6: The Project construction volume

N	*Items*	*Unit*	*Hanoi*	*Hung Yen*	*Hai Duong*	*Hai Phong*	*Total*
A	**Subgrade**						
1	Excavation of unsuitable soil	m^3	135730.90	524805.00	605303.52	484200.05	1750039.47
2	Filling subgrade with sand	m^3	1360449.55	4655414.61	4766235.78	5131545.36	15913645.30
3	Side filling with hill earth	m^3	171217.03	583198.94	750041.83	737226.16	2241683.96
5	Transportation of removed soil (10 km)	m^3	143092.84	1118313.00	765938.00	1006554.00	3033897.84
6	Grassing	m^3	142345.72	604481.00	677148.00	684779.00	2108753.72
B	**Pavement**						
1	Pavement of carriageway	m^2	141596.76	675672.81	1104898.60	776255.34	2698423.51
2	Pavement of emergency parking strip	m^2	34507.74	156365.70	227311.67	181063.86	599248.97
3	Pavement of frontage roads	m^2	104348.64	193063.73	54325.46	83318.85	435056.68
4	Pavement of provincial highway			38336.89	92565.25	67181.78	198083.92
5	Pavement National highways	m^2	37665.00	79686.26	16390.00	47208.61	180949.87
C	**Side slope treatment**						
	Grassing	m^2	142345.72	604481.05	677148.19	684778.50	2108753.46
D	**Drainage along the road**						
	reinforced concrete ditches						
1	Gully-hole for cross drainage	piece	287.00	1280.00	1985.00	1714.00	5266.00
2	U-shaped reinforced concrete ditches	md	11502.58	51246.02	73176.48	59253.98	195179.06
	Drainage ditches for central reserve						
1	Precast reinforced concrete gutter	md	5008.94	27774.71	45100.26	53678.80	131562.71
2	Gully hole for connecting cross drainage	piece	69.00	76.00	30.00	107.00	282.00
3	Excavation of ditches	m^3	1952.17	1264.00	730.59	23903.93	27850.69
4	Gully basin	piece		84.00	96.00	345.00	525.00
5	Pipe culverts, D = 750	m		2898.15	3446.94	5006.50	11351.59
	Drainage for side slope						
	U-shaped masonry drop-water for drainage from pavement	m	3513.91	14080.00	22204.80	19613.00	59411.71
E	**Cross road drainage**						
1	Reinforced concrete pipe culverts	piece (m)		11 (215)	1 (48)	1 (37)	14 (300)
2	Reinforced concrete pipe culverts	piece (m)		99 (3604)	101 (3517)	45 (2724)	245 (9845)
3	Reinforced concrete pipe culverts	piece (m)			2 (98)		2 (98)
4	Reinforced concrete pipe culverts	piece (m)	3 (293)	21 (1203)			24 (1496)

5	Reinforced concrete pipe culverts	piece (m)	4 (408)	4 (250)			8 (658)
6	Reinforced concrete box culverts (1x1)	piece (m)			1 (53)		1 (53)
7	Reinforced concrete box culverts (1.25x1.25)	piece (m)				1 (38)	1 (38)
8	Reinforced concrete box culverts (1.5x1.5)	piece (m)		7 (274)	44 (1617)	9 (550)	60 (2441)
9	Reinforced concrete box culverts (1.5x1.5)	piece (m)			2 (101)		2 (101)
10	Reinforced concrete box culverts (1.5x1.5)	piece (m)			4 (217)		4 (217)
11	Reinforced concrete box culverts (2x2.5)	piece (m)		2 (103)		1 (39)	3 (142)
12	Reinforced concrete box culverts (2x2)	piece (m)	1 (82)	4 (171)	2 (94)	5 (342)	12 (689)
13	Reinforced concrete box culverts (2x2)	piece (m)	1 (83)				1 (83)
14	Reinforced concrete box culverts (2.5x2.7)	piece (m)		6 (291)			6 (291)
15	Reinforced concrete box culverts (2.5x2.75)	piece (m)	2 (173)				2 (173)
16	Reinforced concrete box culverts (2x3)	piece (m)				5 (278)	5 (278)
17	Reinforced concrete box culverts (2.5x3)	piece (m)			7 (256)		7 (256)
18	Reinforced concrete box culverts (3x3)	piece (m)		19 (864)	11 (367)	10 (601)	40 (1832)
19	Reinforced concrete box culverts (3x3.5)	piece (m)				5 (264)	5 (264)
20	Reinforced concrete box culverts (3x3)	piece (m)		5 (125)		2 (134)	7 (259)
21	Reinforced concrete box culverts (3x3.5)	piece (m)	2 (188)	1 (55)			3 (243)
22	Reinforced concrete box culverts (4x2.7)	piece (m)			2 (107)		2 (107)
23	Reinforced concrete box culverts (4x2.7)	piece (m)			1 (38)		1 (38)
24	Reinforced concrete box culverts (4x3.2)	piece (m)			1 (56)		1 (56)
25	Reinforced concrete box culverts (4x3.5)	piece (m)				2 (219)	2 (219)
26	Reinforced concrete box culverts (4x3.5)	piece (m)				3 (108)	3 (108)
27	Reinforced concrete box culverts (4x4)	piece (m)		2 (103)			2 (103)
28	Reinforced concrete box culverts (4x4)	piece (m)		2 (114)	3 (71)		5 (185)
29	Reinforced concrete box culverts (5x4)	piece (m)			3 (75)		3 (75)
30	Reinforced concrete box culverts (5x4)	piece (m)			1 (38)		1 (38)
31	Reinforced concrete box culverts (6x3.5)	piece (m)			1 (37)		1 (37)
32	Reinforced concrete box culverts (6x4)	piece (m)			1 (38)		1 (38)
F	**Planting, lighting**						
1	Single lamp posts	post	525.00	2564.00	3207.00	2462.00	8758.00
2	Planting bushes	plant	2327.00	15100.00	30519.00	10317.00	58263.00
3	Grassing on the central reserve	m^2	46010,32	208487,60	307383,58	243056,53	
G	**Traffic safety**						
1	Milestones	piece	6.00	27.00	40.00	32.00	105.00
2	Signing	sign	18.00	231.00	927.00	210.00	1386.00
3	Retroreflecting painting	m^2	6612.00	39025.70	57487.57	41891.49	145016.76
4	Speed limiting painting	m^2	84.60	2815.20	12417.34	1061.80	16378.94
5	Corrugates steel guard	m	25165.16	116236.80	157743.40	119636.48	418781.84
6	Safety fence, 2.5 m high	m	11502.58	52121.90	76723.86	59414.24	199762.58
H	**Underpass**						

1	Reinforced concrete box underpass, 4x2.7	piece (m)	3 (127)	25 (957)	39 (1513)	20 (744)	87 (3341)
2	Reinforced concrete box underpass, 4x3.2	piece (m)	4 (190)				4 (190)
3	Reinforced concrete box underpass, 6.5x3.2	piece (m)	2 (78)	4 (154)	19 (795)	8 (290)	33 (1317)
I	**Bridges**						
	River bridges						
1	Long-span bridges	piece/m	1 (163)	1 (115)	3 (1431)	4 (2823)	9 (4532)
2	Medium-span bridges	piece/m	4 (187)	10 (394)	5 (268)		19 (849)
	Bridges of road intersection						
1	Expressway over road	piece/m	1 (742)	1 (179)			2 (921)
2	Road over expressway	piece/m	1 (186)	8 (1791)	6 (1092)	5 (1123)	20 (4192)
3	Overpasses for pedestrians	piece/m	4 (667)		1 (28)		5 (695)

1.4.8 Capital resources and implementation schedule

The capital resources: VND 19,610 billion comes from Infrastructure Development and Financial Investment Corporation.

The planned schedule:

From December 2007 to May 2008: Land acquisition and invitation for bids

From June 2008 to October 2010: commencement of execution

December 2010: completion of execution, opening to traffic through the Expressway

1.4.9. Organization of implementation

Division of bidding packages.

The construction volume of the Project is rather big, therefore it is divided into 11 packages, including 9 packages of construction, 1 package of equipment, and 1 package of planting and lighting.

The package of road and bridges construction will be designated on the basis of border between the provinces, prices of construction and installation, the similarity of the main items, the scale of land acquisition… in compliance with the following principles:

- One package must consist of works within only one province; this creates favorouble conditions for the land acquisition and construction
- The value of a package of construction and installation is VND 1,100 to 1,800 billion
- Each package shall include complete construction of subgrade, pavement, and other structures of the road such as bridges, culverts, road crossing…

Architectural construction, lighting, and equipment shall be included in a separate package.

Package	***Section***	***Locality***	***Length, km***	***Value, VND billion***
R1	Km0+000 – Km6+100	TP. Hà Nội	6.70	1,1056
R2	Km6+700 – Km19+000	Hanoi	12.30	1,190
R3	Km19+000 – Km32+700	Hung Yen	13.70	1,204
R4	Km32+700 – Km47+500	Hung Yen	14.80	1,826
R5	Km47+500 – Km63+500	Hai Duong	16.00	1,837
R6	Km63+500 – Km72+300	Hai Duong	8.800	1,837
R7	Km72+300 – Km81+000	Hai Duong	8.700	1,764
R8	Km81+000 – Km96+000	Hai Phong	15.00	1,467
R9	Km96+000 -Km105+500	Hai Phong	9.50	1,411
TB10	Equipment	Hai Phong	105.50	132
PT11	Lighting, planting	Total	105.50	272

Land acquisition work.

The land acquisition work shall be conducted in compliance with the Decree No. 197/2004/ND-CP dated 03 December 2004, and the Letter No. 1665/TTg-CN dated 17 October 2006 the Prime Minister. This work will be conducted as an independent project. The People's Committee of the provinces and cities related to the Project shall conduct the land acquisition, and then, hand over the site to the Investment Owner. The People's Committee of the provinces and cities shall be responsible for payment of compensation and support to resettlement.

The Investment Owner shall cooperate with the local authorities in conducting land acquisition, ensuring sufficient financial sources for the payment.

The land acquisition work is scheduled as from the fourth quarter 0f 2007 to the second quarter of 2008.

Survey, design, and approval of the Project.

The surveying and designing are planned to start in July 2007, and divided into two phases:

- Phase 1: conducting detailed designs for 4 packages having smaller land acquisition volumes in order to commence the construction in 12 months.
- Phase 2: conducting detailed designs for the remained packages; the commencing and completion time for this Phase may be 5 – 6 moths later than that of the Phase 1. All the survey and designing work of the Project must be executed within 15 months, and completed in August 2008.

Construction

The construction is divided into two phases: the Phase 1 includes the packages of R1, R3, R5 and R7; the Phase 2 includes the remained packages. The priority order of the package is based on the work volume, especially the land acquisition volume, bridges, treatment of soft ground. The total construction time is 36 months.

Major construction methods

- Application of advanced technologies and equipment in construction of high embankment or on soft ground
- Most of work will be executed with machinery and equipment; some small parts of work may be implemented by hand.
- Make most use of precast reinforced concrete structures such as piles, girders, slabs… minimizing cast-in-situ structures.
- Expand construction works during dry season
  The pavement must be constructed consecutively to ensure the conformity and flatness of the layers as required by Specifications.

Priority work.

The land acquisition work: Nowadays land acquisition is always a difficult work, causing much delay for construction. Therefore, priority should be given to this work and settle down all problems before commencing construction. The sections crossing population areas should be executed sooner. The payment of compensation must be made fairly and promptly.

The priority sections of a package.

- The sections crossing areas of soft ground, need much treatment to ensure the settlement as required
- The river and intersection bridges having complicate structures and big construction volume; the subgrade of approach roads need to be strengthened.

CHAPTER 2. NATURAL, ENVIRONMENTAL, AND SOCIO-ECONOMIC CONDITIONS

2.1. NATURAL AND ENVIRONMENTAL CONDITIONS

2.1.1. Geographic and geological conditions

The study area extends over Hanoi, Hung Yen, Hai Duong, and Hai Phong. The terrain of the area is rather flat, sloping gently toward the east. As located in a plain area, the route is dissected by natural rivers (namely Thai Binh, Kinh Thay, Bac Hung Hai) and irrigation channels. The route crosses the areas having the following geological formations:

- *Hanoi Formation*: composed of quartz cobles and gravel, interbeded with clay of yellow colour; 2 – 20 m thick.
- *Vinh Phuc Formation*: composed of sand mixed with little gravel and patchy clay; 5 – 20 m thick
- *Hai Hung Formation*: composed of yellow-grey sand, dust and clay; black-grey fine sand, dark-grey sand, black-blue clay, kaolin mixed with plant residuals; 2 – 10m thick
- *Thai Binh Formation*: composed of brown-grey clay, dust and sand; black-grey sand, dust and clay; brown-grey clay mixed with plant residuals, grey fine sand; 1 – 5 m thick

The results of engineering geological survey, standard penetration tests, and physico-mechanical property tests show that the stratigraphic section of the areas includes the following main layers (top to bottom):

- *Layer 1*: Clay or sandy clay, of grey-blue colour, in plastic to rigid plastic state (depending on season), mixed with plant residual. This layer is distributed on the surface of the area. The layer thickness ranges from1.0 to 2.0 m. This is considered as overburden of the area. The soil is soft, with nominal load bearing capacity R < 1.0 kG/cm^2
  - ❖ *Layer 2*: Silt, sandy clay, clayey sand or clay in plastic to liquefied state, of black-blue to grey-brown colour (collectively referred to as soft earth layer). This layer is distributed under Layer 1; its thickness ranging from 3 to 40 m. In some places, there are interbeded fines and layers, with thickness ranging from 2 to 5 m. This layer is very soft, unstable, with nominal load bearing capacity R < 1.0 kG/cm^2. The sections from Km 61+500 to Km 72+200 and from 75+00 to 102 crossing the areas having 30 – 40 m thick soft earth layer.

The physico-mechanical properties of the soft earth are presented in the following table:

Table 2.1: Physico-mechanical properties of soft soil

No.	*Properties*	*Symbol*	*Unit*	*Value*
1	Consistency	B		>1
2	Natural moisture	W_o	%	45-60
3	Density	γ_o	g/cm^3	1,6-1,7
4	Porosity	ε_o		1,2-1,8
5	Unit coherence force	C^{tc}	kG/cm^2	0,05-0,08
6	Angle of internal friction	φ^{tc}	Degree	$4 - 7^0$
7	Shear stress	Su	KG/cm^2	0,14 - 0,2
8	Compression index	Cc		0,4 - 0,5
9	Pre-consolidation pressure	Pc	KG/cm^2	0,5 - 0,7

Source: "Report on Engineering Geological Investigation of road bed, bridges and underpass on the section from Km 0 to Km 105+500". (TEDI - 2005)

Table 2.2: Thickness of soft earth layers (Plan II)

No.	*Thickness of soft layers, m*	*Length of the sections crossing the soft layer, km*	*(%)*
1	Without or with soft soil < 3m	9.6	9.1
2	Soft soil layer of 10m	28.6	27.1
3	Soft soil layer of 10 – 20m	38.7	36.7
4	Soft soil layer of 20 – 25m	9.2	8.7
5	Soft soil layer of 25 – 30m	7.6	7.2
6	Soft soil layer of 30 – 35m	3.6	3.4
7	Soft soil layer of 35 – 40m	8.1	7.7
	Total	105.5	100.0

Source: "Report on Engineering Geological Investigation of road bed, bridges and underpass on the section from Km 0 to Km 105+500". (TEDI - 2005)

- *Layer 3*: sandy clay in plastic state, fine sand in water saturation state, of medium compactness, 5 – 7 m thick, with nominal load bearing capacity R = 1.0 – 1.5 kG/cm^2
- *Layer 4*: sandy clay and clay in plastic-stiff to stiff state, 5 – 15 m thick, with nominal load bearing capacity R = 1.5 – 2.0 kG/cm^2
  - ❖ *Layer 5*: Fine to coarse sand mixed with gravel in water saturation state, of medium to high compactness, over 10 m thick, with nominal load bearing capacity R = 2.0 – 3.0 kG/cm^2. This layer is the main load-bearing layer for bridge and culvert structures.

2.1.2. Climate conditions

The route is located in Bac Bo (Northern Part of Vietnam) plain, with climate conditions varying slightly from coastal areas to inland areas.

There several meteorological stations located near the route, namely Hanoi, Hung Yen, Hai Duong, and Phu Lien stations. The average values in 1961-2004 period of some climate factors are presented below.

2.1.2.1. Temperature

The annual average temperature of the area is 23 – 24 °C. January is the coldest month, with average temperature of 16 °C; July is the hottest month, with average temperature of 28.2 – 29.2 °C. Four months having average temperature lower 20°C are December, January, February and March.

Table 2.3. Annually and monthly average temperatures (°C)

Station	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Năm
Hanoi	16.5	17.4	20.2	24.0	27.4	29.0	29.2	28.6	27.5	25.0	21.5	18.2	24.0
Hung Yen	16.2	17.0	19.7	23.4	26.8	28.5	29.0	28.2	27.0	24.4	20.9	17.6	23.0
Hai Duong	16.3	17.0	19.7	24.0	27.1	28.6	29.0	28.4	27.1	24.6	21.1	17.8	23.3
Phu Lien	16.3	16.7	19.1	22.6	26.4	28.0	28.2	27.7	26.8	24.5	21.3	18.1	23.0

Source: Center for Climate Study, Institute of Meteorology and Hydrology (1965 – 2006 period)

The absolutely highest temperature is 41.5 °C

The absolutely lowest temperature is 4.5 °C

The highest annual average temperature is 26.6 °C

2.1.2.2. Humidity

The annual average ambient relative humidity is 84 – 85%. Spring (February, March and April) usually have highest humidity, over 85%; April is the most humid

month, with humidity reaching 87 – 90%. The beginning months of winter (November and December) are driest ones, with average humidity lowering to 79%.

Table 2.4. Annually and monthly average humidity (%)

Station	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Năm
Hanoi	83	85	87	87	84	83	84	86	85	82	81	81	84
Hai Hung	83	85	87	88	85	84	83	86	85	82	80	81	84
Hai Duong	82	85	88	89	85	84	83	86	85	83	80	80	84
Phu Lien	83	88	91	90	87	86	86	88	85	80	78	79	85

Source: Center for Climate Study, Institute of Meteorology and Hydrology (1965 – 2006 period)

2.1.2.3. Rain

The annually average rainfall is about 1560 – 1800 mm, the number of rainy days is 120 – 150 days; the rainfall is distributed evenly all over the area. The rainy season is from May to October; the months having biggest rainfall are July, August and September; total average rainfall of the three months is about 900 mm, making up 40 – 45% of annual rainfall. Total rainfall of rainy season makes up 80 – 85% of annual rainfall. The dry season is from November to April of the next year; total rainfall of this season makes up only 16% of annual rainfall.

Table 2.5. Annually and monthly average rainfall (mm)

Station	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Năm
Hanoi	18.6	26.2	43.8	90.1	188.5	239.9	288.2	318.0	265.4	130.7	43.4	23.4	1676.2
Hung Yen	19.7	25.5	42.8	93.2	189.0	230	239.1	310.0	240.0	131.0	42.5	21.0	1583.8
Hai Duong	20.1	25.1	37.7	96.9	199.3	228.1	237.8	294.9	225.3	131.7	45.4	19.6	1561.9
Phu Lien	25.4	34.3	48.2	92.9	203.1	240.1	274.0	348.6	299.1	156.2	54.4	31.9	1808.2

Source: Center for Climate Study, Institute of Meteorology and Hydrology (1965 – 2006 period)

2.1.2.4. Wind

North and North-East winds blow in winter, and South and South-East winds blow in summer. The wind average speed is about 2 – 3.6 m/s. The wind speed in typhoon is very high; the highest wind speed recorded in Phu Lien meteorological station is 40 – 50 m/s. Typhoons usually bring about heavy rains, prolonging several days, sometime a week.

Table 2.6. Annually and monthly average wind speed (m/s)

Station	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Năm
Hanoi	1.5	2.4	2.3	2.5	2.4	2.1	2.1	1.8	1.8	1.8	1.9	2.0	2.0
Hung Yen	2.2	2.3	2.3	2.4	2.5	2.2	2.3	2.0	1.9	2.1	1.9	2.2	2.1
Hai Duong	2.4	2.5	2.3	2.4	2.5	2.4	2.5	2.1	2.1	2.2	2.3	2.4	2.3
Phu Lien	3.3	3.3	3.4	3.8	4.0	3.6	3.7	3.3	3.4	3.7	3.7	3.5	3.6

Source: Center for Climate Study, Institute of Meteorology and Hydrology (1965 – 2006 period)

2.1.2.5. Evaporation

Annually average evaporation is about 700 – 1000 mm. The months of rainy season have biggest evaporation; the monthly average evaporation of July is about 70 – 110 mm. The months of dry season have smallest evaporation; the monthly average evaporation of the season is about 30 - 70 mm from February to April.

Table 2.7. Annually and monthly average evaporation (mm)

Station	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Năm
Hanoi	71.4	59.7	56.9	65.2	98.6	97.8	100.6	84.1	84.4	95.6	89.8	85.0	989.1
Hung Yen	74.2	57.3	54.5	61.2	90.3	96.2	104.1	82.3	83.2	94.5	90.1	88.1	976.0
Hai Duong	75.9	56.7	52.9	59.0	89.6	96.1	109.9	80.9	81.2	93.9	97.0	90.0	983.1
Phu Lien	54.7	34.5	31.9	38.8	62.4	65.7	70.8	55.9	63.8	76.2	75.2	68.2	698.1

Source: Center for Climate Study, Institute of Meteorology and Hydrology (1965 – 2006 period)

2.1.2.6. Sunlight

Table 2.8. Annually and monthly average sunny hours (h)

Station	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Năm
Hanoi	67.3	44.7	46.2	80.2	165.8	155.6	182.6	162.8	160.5	165.0	125.1	108.8	1464.6
Hung Yen	80.2	44.5	45.1	83.5	182.6	168.5	190.1	179.0	180.2	182.3	130.2	125.1	1591.3
Hai Duong	83.0	44.4	41.6	85.8	204.4	176.2	214.5	180.0	186.6	187.0	157.5	130.5	1691.5
Phu Lien	82.8	44.4	39.6	96.0	184.2	177.1	189.8	166.0	179.6	191.6	151.3	128.8	1631.2

Source: Center for Climate Study, Institute of Meteorology and Hydrology (1965 – 2006 period)

Annually average sunny hours are about 1400 – 1600 hours. The months from May to October have monthly average sunny hours over 160 hours. October has biggest number of sunny hours, about 191 hours. The period having least sunny hours is from January to April, with monthly average sunny hours are 40 – 95 hours.

2.1.3. Hydrological conditions

2.1.3.1. Hydrological conditions of the areas along the route

The route crosses the plain areas protected by dikes (Red river left bank dike, Duong river and Thai Binh river right bank dikes, dikes of Van Uc and Lach Tray rivers, and Luoc river left bank dike), therefore, the hydrological regime of the areas depends mainly on flood in the interior fields. The cause of heavy floods is the combination of flood in fields and flood in river and high tide; in these cases, the food water in the fields can not be drained.

The section from Km 44 to Km 65 (Thai Binh river)

This route section crosses Ba Hung Hai irrigation system at the following main points: Crossing with Bac Hung Hai river at Km 5+775, with Dien Bien river at Km 20+279, with Tam Do river at Km 28+900, with Tay Ke Sat river at Km 32+615, with Hinh Dao river at Km 44+741, with Tu Ky river at Km 54+44.

The irrigation system has been in operation for many years, however, flood and draught still happen frequently. The most heavy flood occurred in 1985, immersing an area of 62.980 ha. The irrigation is still in difficulty, especially in the period of irrigation for aerated soil. Bac Hung Hai now is an intensive farming area, demanding much more irrigation. Xuan Quan intake is designed with capacity of 75 m^3/s, but the actual supply capacity in the last years is only 45 – 50 m^3/s in average.

The section from Km 65 to Km 72+800

This section is in the areas protected by dikes of Thai Bing and Van Uc rivers, having good irrigation system. However, flood in interior fields still happened in 1978; 1983 and 1996.

The section from Km 72+800 to Km 94+130

This route section crosses Da Do irrigation system, crossing Da Do river at Km 79+492. The areas protected by dikes of Lach Tray and Van Uc rivers, having good irrigation system. However, flood in interior fields still happened in 1975; 1978 and 1990…

The section from Km 94+130 to the end of the route

These areas are under influence of flood in field and high tide

The section from Km 75 to Km 95 (Plan II)

This route section crosses Da Do irrigation system, crossing Ba La river at Km 80+339 and crossing Da Do river at Km 90+956. The areas protected by dikes of Lach Tray and Van Uc rivers, having good irrigation system. However, flood in

interior fields still happened in 1975; 1978 and 1990…

The section from Km 95 to Km 96+600 (Plan II)

The area of Lach Tray bridges and approach road is under influence of Lach Tray river and the tides of South China Sea

The section from Km 96+600 to Km 102 (Plan II)

This section is under influence of flood in the fields and the tides of South China Sea.

2.1.3.2. Tide regime of the Project areas

The tide influences the hydrological regime of estuary areas

The Bac Bo area has diurnal tide regime; one high tide and one low tide a day. The high tide is at 12h18', and the low tide is at 12h32'. Each month has 26 – 28 diurnal tide days. The further to the north the higher the tidal range increases. The highest tidal range is at Mui Ngoc (4.98 m), Mui Chua (5.26 m), Hon Gai (4.7 m), Co To (4.77 m), compared with "0" level at Hon Dau.

Strong tides usually occur in March, April, July and September. The tidal cycle is 18.716 years (approximate 19 years). Strong tide occurred in years of 1948 – 1951, 1968 – 1971, 1986 – 1990; and weak tides occurred in years of 1958 – 1961, 1977 – 1980. The speed of tidal current in Quang Ninh reaches 1 m/s.

2.1.3.3. Water levels along the route

KM0-KM24+700

No.	Sta	Highest flood level			$H_{1\%}$	$H_{10\%}$	Location
		1984	1993	2004			
1	Km0+000	4.57	4.50	4.45	4.71	4.41	Long Bien district
2	Km0+500	4.15	4.05	4.00	4.29	3.99	Gia Lam town
3	Km1+500	4.23	4.10	3.95	4.37	4.07	Dong D
4	Km1+663	4.23	3.61	3.49	4.37	4.07	Da Ton
5	Km2+200	4.02	4.10	3.70	4.24	3.94	"
6	Km3+600	4.25	4.15	4.05	4.39	4.09	Kieu Ky
7	Km5+000	3.70	3.52	3.40	3.84	3.54	"
8	Km5+820	4.51	4.37	4.25	4.65	4.35	"
9	Km6+000	5.05	4.98	4.95	5.19	4.89	Cuu Cao

10	Km6+500	3.92	3.75	3.61	4.06	3.76	"
11	Km6+600	3.60	2.85	2.72	3.74	3.44	
12	Km7+800	3.53	3.29	3.12	3.67	3.37	"
13	Km8+200	3.50	3.30	3.15	3.64	3.34	"
14	Km9+000	3.48	3.24	3.02	3.62	3.32	"
15	Km9+990	3.39	3.19	2.89	3.53	3.23	Nghaa Tru
16	Km10	3.39	3.19	2.89	3.53	3.23	Tan Tien
17	500	3.60	3.30	3.01	3.74	3.44	Tan Tien
18	Km11	3.67	3.37	3.07	3.81	3.51	Tan Tien
19	500	3.58	3.42	3.22	3.72	3.42	Tan Tien
20	Km12	3.68	3.38	3.23	3.82	3.52	Tan Tien
No.	Sta	Highest flood level			$H_{1\%}$	$H_{10\%}$	Location
		1984	1993	2004			
21	500	4.02	3.68	3.45	4.16	3.86	
22	Km13	4.07	3.71	3.54	4.21	3.91	Hoan Long
23	500	4.02	3.80	3.66	4.16	3.86	
24	Km14	4.39	4.19	4.09	4.53	4.23	
25	500	4.29	4.04	3.99	4.43	4.13	
26	Km15	3.87	3.70	3.62	4.01	3.71	Viet Cuong
27	500	4.29	4.09	4.04	4.43	4.13	
28	Km16	4.21	4.06	3.96	4.35	4.05	
29	500	4.29	4.09	4.04	4.43	4.13	
30	Km17	3.39	3.35	3.20	3.53	3.23	
31	500	4.09	4.05	3.85	4.23	3.93	
32	Km18	3.66	3.40	3.29	3.80	3.50	
33	500	3.47	3.46	3.46	3.61	3.31	Minh Chau
34	Km19	3.22	3.02	2.85	3.36	3.06	
35	500	3.42	3.10	2.91	3.56	3.26	
36	Km20	3.45	3.36	3.00	3.59	3.29	Thuong Kiet
37	500	4.29	4.09	4.04	4.43	4.13	

38	Km21	3.06	2.83	2.51	3.10	3.10	
39	500	2.75	2.59	2.43	2.79	2.79	
40	Km22	2.92	2.24	2.14	2.96	2.96	
41	500	2.92	2.50	2.30	2.96	2.96	Tam Thien Mau
42	Km23	2.80	2.57	2.28	2.84	2.84	
43	500	2.81	2.60	2.40	2.85	2.85	Xuan Truc
44	Km24	2.87	2.70	2.50	2.91	2.91	
45	Km24	2.75	2.61	2.55	2.79	2.79	

KM24+700-:-KM44+741

No.	Sta	Water level						Remarks
		$H_{max1985}$	$H_{max1994}$	$H_{max2004}$	H_{tx}	$H_{1\%}$	$H_{10\%}$	
1	2	3	4	5	6	7	8	9
1	Km24+748,70	2,79	2,65	2,59	2,21	2,87	2,67	
2	Km25+269,70	2,83	2,58	2,46	2,03	2,91	2,71	
3	Km25+757,70	2,82	2,57	2,44	2,03	2,90	2,70	
4	Km26+031,70	2,83	2,54	2,41	2,04	2,91	2,71	
5	Km26+416,70	2,84	2,53	2,46	2,21	2,92	2,72	
6	Km27+207,70	2,85	2,50	2,43	2,40	2,93	2,73	
7	Km27+638,30	2,83	2,53	2,46	2,20	2,91	2,71	
8	Km28+105,70	2,81	2,55	2,47	2,40	2,89	2,69	
9	Km28+717,70	2,68	2,50	2,36	2,30	2,76	2,56	
10	Km28+900,54	2,40	2,31	2,26		2,40		Tam Do
11	Km29+619,30	2,76	2,65	2,51	2,20	2,84	2,64	
12	Km30+020,70	2,75	2,61	2,42	2,20	2,83	2,63	
No	Sta	Water level						Remarks
		$H_{max1985}$	$H_{max1994}$	$H_{max2004}$	H_{tx}	$H_{1\%}$	$H_{10\%}$	

13	Km30+522,20	2.78	2.60	2.41	2.03	2.86	2.66	
14	Km31+005,70	2.75	2.56	2.35	2.20	2.83	2.63	
15	Km31+559,70	2.76	2.53	2.32	2.21	2.84	2.64	
16	Km32+100,70	2.74	2.55	2.31	2.17	2.82	2.62	
17	Km32+615,79	3.21	3.12	2.86		3.21		Tay Ke Sat river
18	Km33+463,20	2.71	2.45	2.26	2.20	2.79	2.59	
19	Km33+693,20	2.67	2.40	2.22	2.19	2.75	2.55	
20	Km34+405,20	2.69	2.41	2.21	2.18	2.77	2.57	
21	Km34+635,70	2.68	2.42	2.20	2.16	2.76	2.56	
22	Km35+381,70	2.69	2.40	2.31	2.23	2.77	2.57	
23	Km36+144,20	2.72	2.46	2.32	2.21	2.80	2.60	
24	Km36+713,20	2.69	2.56	2.41	2.25	2.77	2.57	
25	Km37+315,70	2.68	2.53	2.40	2.23	2.76	2.56	
26	Km38+315,70	2.67	2.51	2.43	2.21	2.75	2.55	
27	Km39+008,20	2.64	2.50	2.36	2.28	2.72	2.52	
28	Km39+340,70	2.65	2.51	2.35	2.28	2.73	2.53	
29	Km39+643,70	2.63	2.49	2.41	2.27	2.71	2.51	
30	Km40+137,70	2.64	2.48	2.39	2.07	2.72	2.52	
31	Km41+063,70	2.66	2.49	2.31	2.20	2.74	2.54	
32	Km41+660,70	2.65	2.46	2.35	2.03	2.73	2.53	
33	Km42+315,70	2.63	2.43	2.32	2.10	2.71	2.51	
34	Km42+537,70	$H_{tướimax}$ = 3.19 m						
35	Km43+088,79	2.48	2.36	2.29		2.50		Co Bi
36	Km43+615,70	2.60	2.45	2.23	2.20	2.68	2.48	
37	Km44+741,84	3.11	3.01	2.85		3.11		Dinh Dao

KM44+741-:-KM61+500

No	Sta	Water level	Remark

		$H_{max1978}$	$H_{max2004}$	$H_{max1980}$	H_{tx}	$H_{1\%}$	$H_{10\%}$	
1	2	3	4	5	6	7	8	9
1	Km45+229.70	2.61	2.45	2.23	1.97	2.84	2.49	
2	Km45+840.21	2.47	2.31	2.22		2.50		Khuong Phu bridge
3	Km46+615.70	2.58	2.38	2.21	1.92	2.81	2.46	
4	Km47+201.70	2.61	2.41	2.28	1.62	2.84	2.49	
5	Km47+406.70	2.60	2.42	2.27	1.69	2.83	2.48	
6	Km47+622.70	2.63	2.39	2.25	1.71	2.86	2.51	
7	Km48+715.70	2.65	2.55	2.35	1.89	2.88	2.53	
8	Km49+054.40	2.63	2.49	2.25	1.89	2.86	2.51	
9	Km49+248.90	$H_{tướimax}$ = 2.70 m						
10	Km49+830.70	2.61	2.56	2.47	2.40	2.84	2.49	
11	Km50+204.70	2.62	2.59	2.51	2.21	2.85	2.50	
12	Km51+081.70	2.67	2.57	2.48	2.23	2.90	2.55	
13	Km51+356.40	2.69	2.56	2.52	2.23	2.92	2.57	
14	Km52+130.20	2.64	2.61	2.59	2.51	2.87	2.52	
15	Km52+519.20	$H_{tướimax}$ = 3.01m						
16	Km52+570.20	2.65	2.61	2.57	2.61	2.88	2.53	
17	Km53+293.80	2.59	2.55	2.51	2.61	2.82	2.47	
18	Km54+044.34	2.45	2.28	2.20		2.86		Tu Ky river
19	Km54+711.20	2.58	2.45	2.41	1.89	2.81	2.46	
20	Km54+947.70	2.56	2.46	2.43	1.92	2.79	2.44	
21	Km55+788.40	2.52	2.46	2.40	2.14	2.75	2.40	
22	Km56+400.70	2.50	2.45	2.39	2.05	2.73	2.38	
23	Km56+620.70	2.48	2.46	2.41	2.06	2.71	2.36	
24	Km57+048.70	2.51	2.45	2.40	2.01	2.74	2.39	
25	Km57+574.70	2.49	2.38	2.31	2.00	2.72	2.37	
26	Km58+087.70	2.53	2.31	2.25	1.78	2.76	2.41	
27	Km58+575.70	2.52	2.36	2.30	1.02	2.75	2.40	

28	Km59+354.70	$H_{tướimax}$ = 2.80m						
29	Km60+009.20	2.51	2.38	2.31	1.89	2.74	2.39	
30	Km60+495.70	2.54	2.33	2.21	0.98	2.77	2.42	
31	Km61+178.70	2.55	2.37	2.20	0.96	2.78	2.43	

KM61+500-:-KM71+200

No.	Sta Km + ...	Highest water level (m)					Remarks
		$H_{max1971}$	$H_{max1978}$	$H_{max1983}$	$H_{max1996}$	$H_{1\%}$	
1	2	3	4	5	6	7	8
1	61 + 5553.06	3.19	2.53		2.39	2.63	
2	62 + 248.69	2.73	2.06		1.75	2.16	
3	63 + 603.06		1.95		1.64	2.05	
4	64 + 400.00	2.56	2.20			2.30	
5	67 + 500.00	1.69		1.54	2.05	2.35	
6	68 + 639.16	1.62		1.55	2.15	2.45	
7	69 + 349.56	1.65		1.58	2.25	2.55	
8	71 + 000.00				2.3	2.60	

KM75-KM87 (Plan II)

No.	Sta Km + ...	Water level (m)					Ground elevation (m)
		$H_{max1975}$	$H_{max1990}$	$H_{max2005}$	$H_{1\%}$	$H_{10\%}$	
1	75 + 292.49	1.45	1.38	1.25	1.52	1.15	1.31
2	+ 682.44	1.41	1.24	1.19	1.38	1.01	0.82
3	76 + 350.00	Highest irrigation water level = +1.50m					0.94
4	+ 541.61	Highest irrigation water level = +1.70m					1.01
5	+ 760.00	1.49	1.36	1.16	1.50	1.13	0.86
No.	Sta. Km + ...	Water level (m)					Elevation (m)
		$H_{max1975}$	$H_{max1990}$	$H_{max2005}$	$H_{1\%}$	$H_{10\%}$	
6	77 + 241.76	1.48	1.42	1.19	1.56	1.19	0.84

7	+ 322.29	Highest irrigation water level = +1.50m					0.83
8	+ 501.55	1.47	1.38	1.13	1.52	1.15	0.78
9	+ 929.76	Highest irrigation water level = +150m					0.77
10	78 + 617.44	1.50	1.37	1.10	1.51	1.14	0.66
11	79 + 022.69	1.51	1.42	1.15	1.56	1.19	1.13
12	+ 496.89	1.49	1.35	1.12	1.49	1.12	0.64
13	80 + 024.18	1.52	1.37	1.18	1.51	1.14	0.83
14	+ 339.04	1.49	1.36	1.25	1.50	1.13	-5.40
15	+ 483.87	Highest irrigation water level = +1.50m					0.85
16	+ 994.66	Highest irrigation water level = +2.40m					0.89
17	81 + 393.07	1.48	1.35	1.16	1.49	1.12	0.83
18	82 + 128.22	1.45	1.36	1.21	1.50	1.13	0.78
19	+ 778.89	Highest irrigation water level = +1.70m					1.38
20	83 + 461.38	Highest irrigation water level = +2.40m					1.67
21	84 + 650.38	1.41	1.37	1.19	1.51	1.14	0.52
22	85 + 326.38	Highest irrigation water level = +2.35m					0.62
23	+ 579.51	Highest irrigation water level = +1.50m					0.52
24	86 + 347.38	1.40	1.32	1.18	1.46	1.09	1.03
25	+ 555.00	1.41	1.38	1.22	1.52	1.15	0.66
26	87 + 000.00	1.43	1.30	1.18	1.44	1.07	0.35

Km87-Km96+600 (Plan II)

Section	*Recorded levels*	*Design water levels*			
		1%	2%	4%	10%
Section 1: Km 87+000 – Km 91+000	1.30	1.44	1.33	1.20	1.07
Section 2: Km 91+000 – Km 95+620	1.25	1.53	1.41	1.27	1.16
Section 3: Km 95+620 – Km 96+600	1.29	1.64	1.49	1.32	1.20

Section from km 96+600 to Km 103 (Plan II)

This section crosses shrimp hatching lagoons and mangrove forest in Trang Cat and Hai An districts. The areas are under influence of tide and storm. The water level recorded in the storm on 31 July 2005 is +3.61 m. The design water level for this section is 3.70 m, equivalent to the highest recorded level.

2.1.4. Status quo of the environmental components

2.1.4.1. Status quo of the air quality

The code number of the monitoring stations in each zone**.**

Code number: *Locality*	***Geograpical coordinates***	
Zone 1		
K1: Phuc Lap village - Vinh Khuc – Van Giang – Hung Yen	21º00’28.3"N	105º51’45.5"E
K2: Intersection with provincial highway No.191	21º00’25.4"N	105º54’41.4"E
K3: Group 13 - Cu Khoi ward - Long Bien district – Hanoi	20º58’11.3"N;	105º57’22.3"E
Zone 2		
K4: Cu Xa village – Kieu Kỵ commune - Gia Lam – Hanoi	20º55’44,6”N	105º59’40,1”E
K5: Quang Uyen village - Minh Chau – Yen My - Hung Yen	20º51’28,1”N	106º01’13,1"E
K6: Gia Loc town - Hai Duong (intersection with PR No.17A)	20º52’12.9"N	106º04’18.4"E
K7: Ngoc Chan village – Tai Son - Tu Ky - Hai Duong	20º51’00.3"N	106º06’38.7"E
Zone 3		
K8: Đan Loan village – Nhan Quyen – Binh Giang - Hai Duong	20º51’20.1"N	106º12’14.7"E
K9: Cau Go villages - Phuong Hung – Gia Loc - Hai Duong	20º51’52.1"N	106º17’29.9"E
K10: Gia Loc town - Hai Duong (intersection with PR No.17A)	20º51’29.2"N	106º18’15.6"E
K11: Ngọc Chan village – Tai Son - Tu Ký - Hai Duong	20º50’49.7"N	106º22’40.7"E
Zone 4		
K12: Kien Nhuệ village - Vinh lap – Thanh Ha - Hai Duong	20º48'46.5"N	106º29'54.2"E
K13: Quang Trung commune - An Lao district - Hai Phong	20º48’06.4"N	106º31’36.2"E
K14: Tan Vien commune - An Lao district - Hai Phong	20º48’05.3"N	106º32’23.0"E
Zone 5		
K15: 575 Tran Van Tat Rd - Trang Minh - Kien An – HP	20º47’09.9"N	106º37’02.7"E

K16: Đa Phuc junction – Phuc Hai – Da Phuc - Kien Thụy - Hai Phong	20°47'25.4"N	106°39'32.4"E
K17: Village 1 - Hai Thanh - Hai Phong	20°47'55.4"N	106°42'41.2"E

Figure 2.1. Sampling locations and zoning

1) *Measurements processing*

The locations of the Project are listed above. The measurements have been processed with statistic methods, interpolation, and conversion to the same time. The obtained results reflect the general conditions of each zone during the time from 6 o'clock to 4 o'clock of next day.

2) Display of the results

- Zone 1:

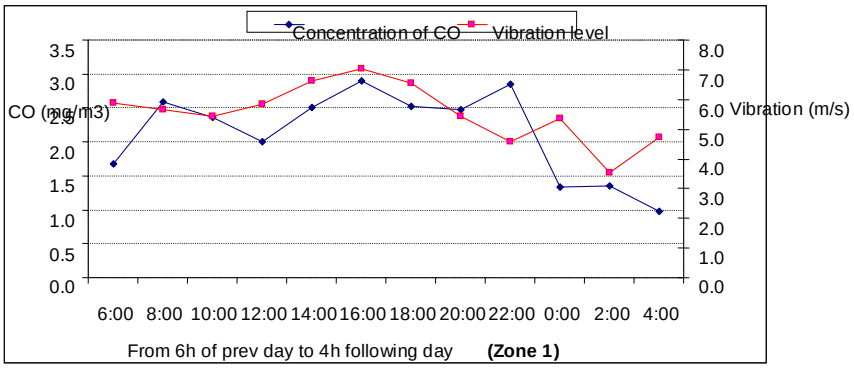


Figure 2.2. Variation of CO concentration and vibration level with time in Zone 1

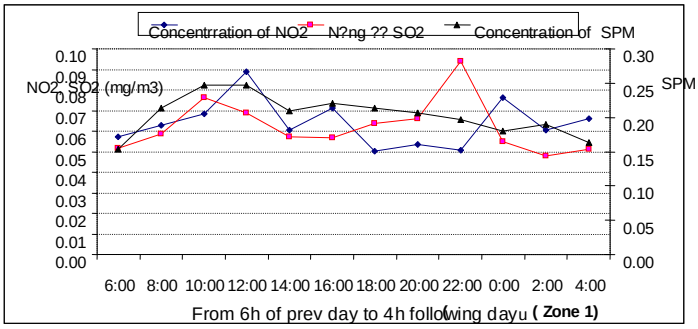


Figure 2.3. Variation of NO2, SO2 and SPM concentration in Zone1

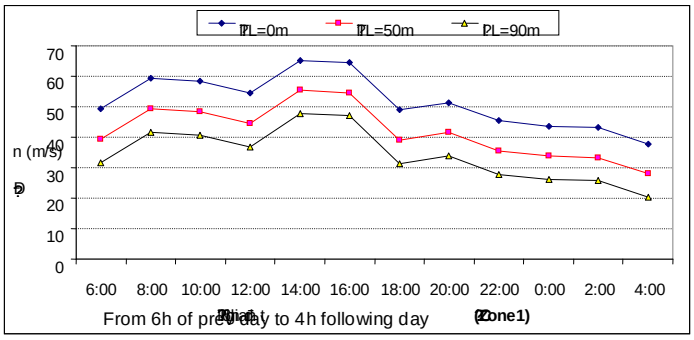


Figure 2.4. Variation of noise levels in Zone 1

Table 2.9: Statistic values of Zone 1 (Maximum, Minimum, Average, Norm deviation)

	CO	NO2	SO2	SPM	Vibration	Noise		
Max						*L=0m*	*L=50m*	*L=90m*
Min	*2.890*	*0.089*	*0.094*	*0.247*	*7.033*	*65.267*	*55.400*	*47.733*
Ave	*0.983*	*0.050*	*0.048*	*0.153*	*3.533*	*37.833*	*27.967*	*20.300*
Max	***2.126***	***0.064***	***0.062***	***0.203***	***5.553***	***51.764***	***41.897***	***34.231***
ND	*0.613*	*0.011*	*0.012*	*0.028*	*0.927*	*8.364*	*8.364*	*8.364*

- Zone 2:

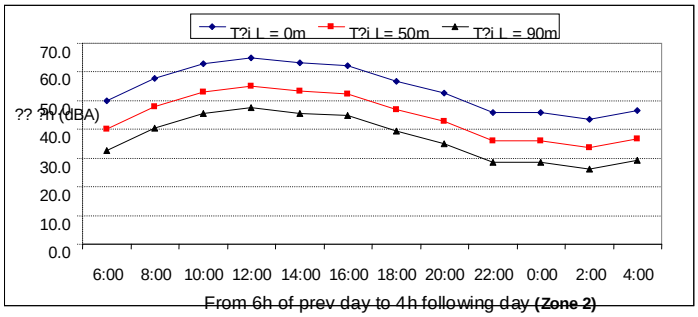


Figure 2.5. Variation of noise levels in Zone 2

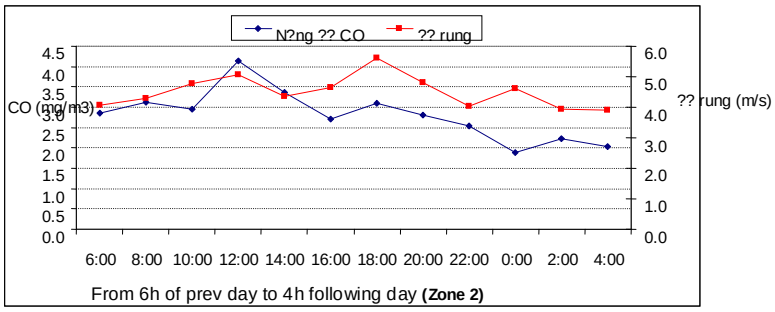


Figure 2.6. Variation of CO concentration and vibration level with time in Zone 2

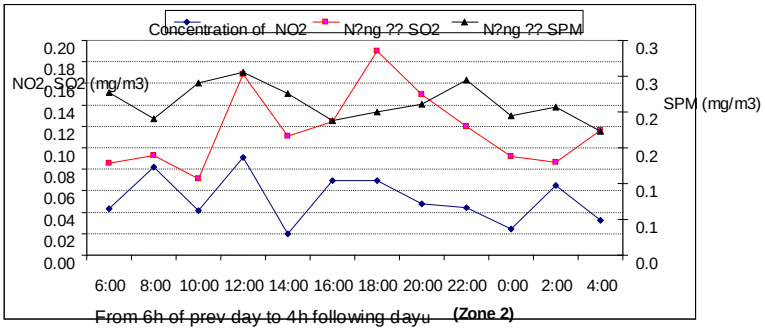


Figure 2.7. Variation of NO2, SO2 and SPM concentration in Zone 2

Table 2.10: Statistic values of Zone 2

	CO	NO2	SO2	SPM	Vibration	Noise		
Max						*L=0m*	*L=50m*	*L=90m*
	4.140	*0.091*	*0.190*	*0.255*	*5.600*	*64.900*	*55.100*	*47.525*
Min	*1.878*	*0.020*	*0.072*	*0.173*	*3.900*	*43.425*	*33.625*	*26.050*
Aver	***2.809***	***0.052***	***0.117***	***0.213***	***4.504***	***54.315***	***44.515***	***36.931***
ND	*0.591*	*0.021618*	*0.034661*	*0.024535*	*0.024535*	*0.493271*	*7.572865*	*7.581372*

- Zone 3:

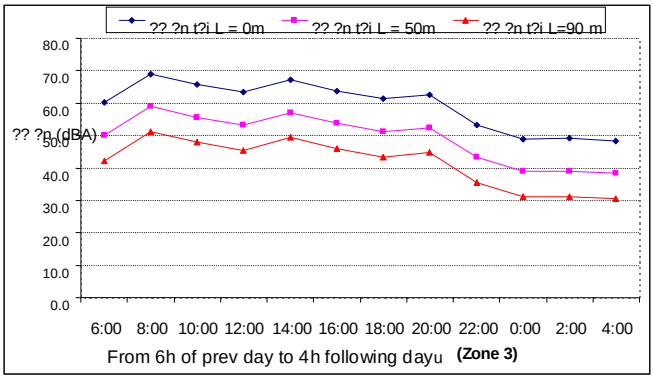


Figure 2.8. Variation of noise levels in Zone 3

From 6h of prev day to 4h following day

Figure 2.9. Variation of CO concentration and vibration level with time in Zone 3

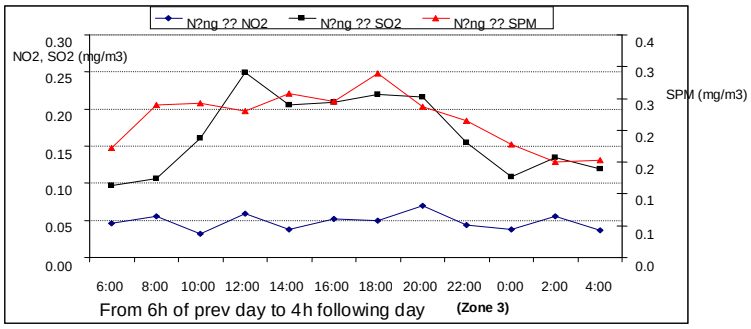


Figure 2.10. Variation of NO2, SO2 and SPM concentration in Zone 3

Table 2.11: Statistic values of Zone 3

	CO	NO2	SO2	SPM	Vibration	Noise		
Max	*3.443*	*0.069*	*0.249*	*0.290*	*7.000*	*L=0m*	*L=50m*	*L=90m*
						69.000	*58.925*	*51.150*
Min	*2.719*	*0.048*	*0.165*	*0.218*	*5.958*	*48.400*	*38.325*	*30.550*
Aver	***1.865***	***0.032***	***0.097***	***0.150***	***4.975***	***59.390***	***49.315***	***41.540***
ND	*0.446*	*0.011*	*0.051*	*0.043*	*0.6121*	*7.169*	*7.169*	*7.169*

- Zone 4:

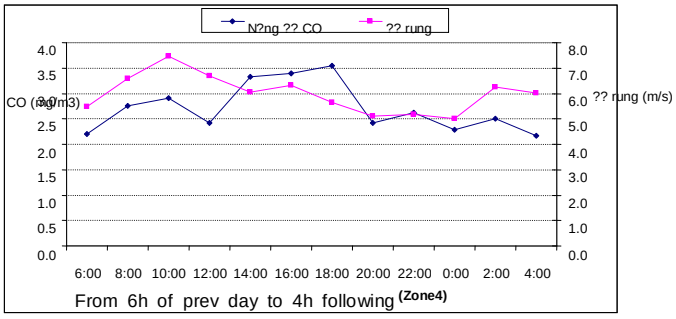


Figure 2.11. Variation of CO concentration and vibration level with time in Zone 4

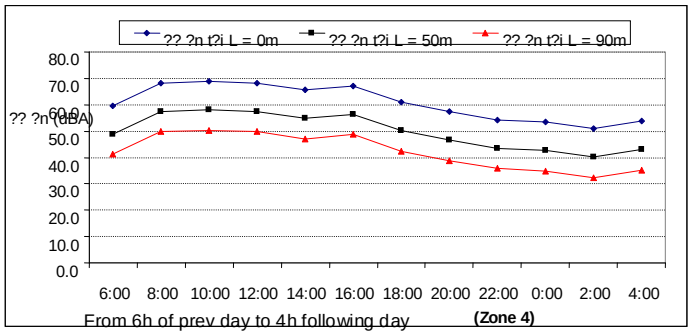


Figure 2.12. Variation of noise levels in Zone 4

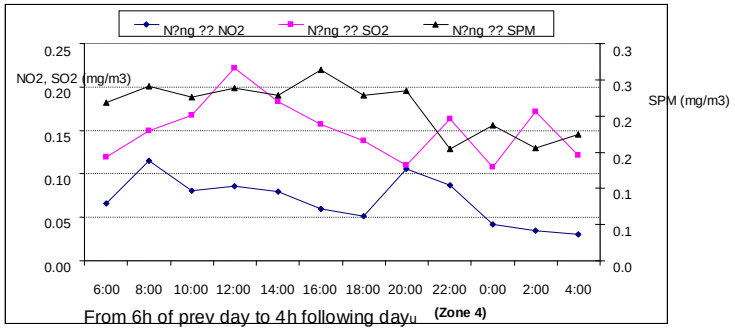


Figure 2.13. Variation of NO2, SO2 and SPM concentration in Zone 4

Table 2.12: Statistic values of Zone 4

	CO	NO2	SO2	SPM	Vibration	Noise		
						L=0m	*L=50m*	*L=90m*
Max	*3.543*	*0.115*	*0.222*	*0.263*	*7.467*	*68.933*	*58.100*	*50.400*
Min	*2.163*	*0.030*	*0.108*	*0.155*	*5.000*	*50.900*	*40.067*	*32.367*
Aver	***2.712***	***0.070***	***0.151***	***0.212***	***5.986***	***60.747***	***49.914***	***42.214***
ND	*2.300*	*0.714*	*0.026*	*0.032*	*0.714*	*6.459*	*6.459*	*6.459*

- Zone 5:

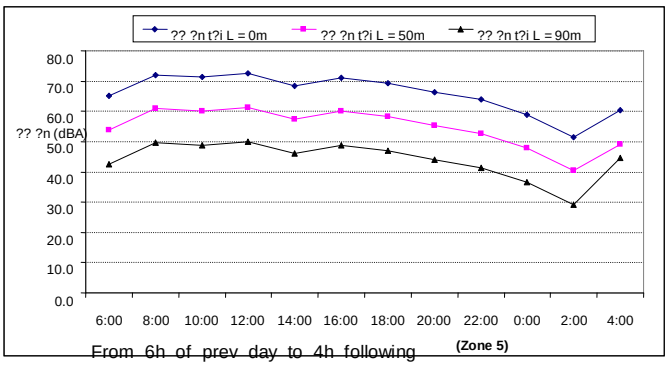


Figure 2.14. Variation of noise levels in Zone 5

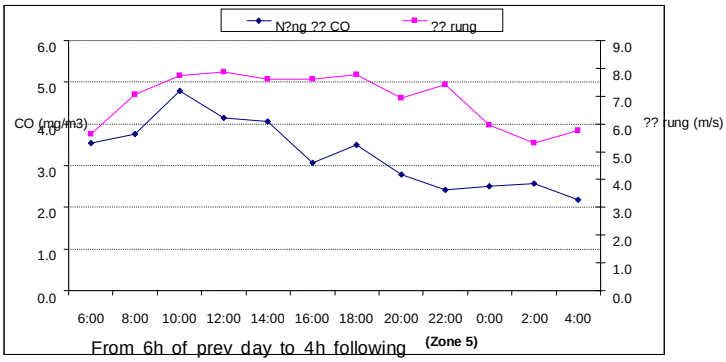


Figure 2.15. Variation of CO concentration and vibration level with time in Zone 5

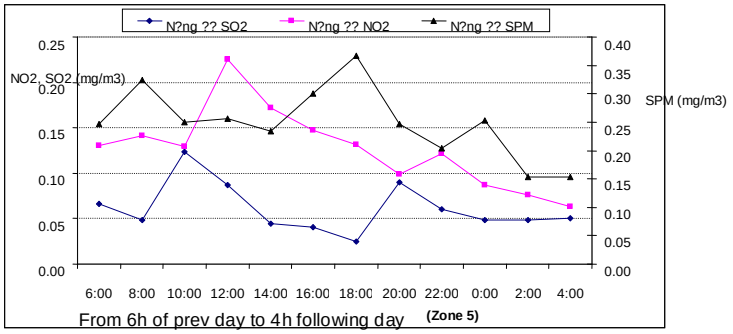


Figure 2.16. Variation of NO2, SO2 and SPM concentration in Zone 5

Table 2.13: Statistic values of Zone 5

	CO	NO2	SO2	SPM	Vibration	Noise		
						L=0m	*L=50m*	*L=90m*
Max	*4.797*	*0.123*	*0.225*	*0.367*	*7.867*	*72.467*	*61.333*	*50.033*
Min	*2.180*	*0.024*	*0.063*	*0.153*	*5.300*	*51.500*	*40.367*	*29.067*
Aver	***3.272***	***0.061***	***0.127***	***0.249***	***6.886***	***65.900***	***54.767***	***44.028***
ND	*0.785*	*0.063*	*0.042*	*0.060*	*2.198*	*6.092*	*6.092*	*5.859*

3) Comments:

As stipulated in Vietnamese standards of ambient environment (TCVN 5937:2005), the allowable maximum contents of gases and noise level are as follows:

CO : 30.0 mg/m^3

NO2 : 0.20 mg/m^3

SO2 : 0.35 mg/m^3

SPM : 0.3 mg/m^3

Noise level : <75 dBA

In general, the quality of the air environment along Hanoi - Hai Phong Expressway is in good conditions. The measurements of CO, SO2 and NO2 gases and SPM dust is far below the allowable maximum contents (TCVN 5937:2005).

2.1.4.2. Present noise and vibration levels

Noise and vibration levels have been measured at the points of air quality checking. The measurements are presented in the Table 2.14.

The measurements show that:

- In average, in the time from 6 to 18 o'clock, there are 13/17 measurements of noise levels exceeding the limits of TCVN 5949 m- 1998; there remained only four points, namely Vinh Khuc – Van Giang, Minh Chau – Yen My, Van Du – An Thy (Hung Yen province), and Cu Khoi – Long Bien district (Hanoi) have noise levels lower than the limits of TCVN 5949 m- 1998;
- In average, in the time from 18 to 22 o'clock, there are 14/17 points having high noise levels; the localities having highest noise levels are village 1 – Hai Thanh - Hai Phong (intersection between National highway No.14 and ring road No.3 of Hai Phong), with noise level of 69.9 dBA (compared with the standard limits of 55 dBa). There are three points having lowest noise levels, namely Vinh Khuc – Van Giang, Minh Chau – Yen My (Hung Yen province), and Tan Vien commune (An Lao district, Hai Phong).
- In average, in the time from 22 to 6 o'clock, there are 7/17 points having noise levels higher than the limits of TCVN 5949 m- 1998. The noise levels recorded in Quang Trung commune (An Lao district, Hai Phong) are the highest ones (63.2 dBA); this is the intersection with National highway No.10.

The standard TCVN 7210:2002 stipulates the limits vibration acceleration for population areas. The Table 2.14 shows that the recorded vibration acceleration values are lower than the limits of the standard TCVN 7210:2002.

In general, the noise levels at the checking points are rather high, especially the points near National highways. The vibration levels are under allowable limits.

Figure 2.17. Diagram of soil, water sampling and measurement of air quality

Table 2.14: Noise level measurements in October 2005

No.	Location	*Average, 6h-18h*			*Average, 18h-22h*			*Average, 22h-6h*			*Acceleration*
		L=0 m	*L=50m*	*L=90m*	*L=0 m*	*L=50m*	*L=90m*	*L=0 m*	*L=50m*	*L=90m*	m/s^2
1	Phuc Lap village – Vĩnh Khuc – Van Giang – Hung Yen	55.8	45.8	37.8	44	34	26	32.4	22.4	14.4	0.0114
2	Quang Uyen village - Minh Chau – Yen My - Hung Yen	58.7	48.7	40.7	40.8	30.8	22.8	40.3	30.3	22.3	0,0125
3	Tong Cu village - Van Du – An Thi – Hung Yen	56.5	46.8	39.2	62.8	53.1	45.5	43.2	33.5	25.8	0,0122
4	Ngoc Nhue village - Tan Phuc – An Thi – Hung Yen	64.7	54.4	46.8	62.1	51.8	44.2	51.3	41	33.4	0.0115
5	Dan Loan village – Nhan Quyen – Binh Giang - Hai Duong	63.9	53.5	45.8	61.1	50.7	43	50.1	39.7	32	0.0114
6	Go village Bridge - Phuong Hung – Gia Loc - Hai Duong	66.1	56.2	48.5	61.6	51.8	44	49.8	39.9	32.2	0.0123
7	Ngoc Chan village – Tai Son - Tu Ky - Hai Duong	64.9	55	47.3	62.1	52.2	44.5	52.9	43	35.3	0.0121
8	Kien Nhuệ villages - Vinh lap – Thanh Ha – Hai Duong	62.3	51.9	44.5	55.1	44.7	37.3	46.8	36.4	29	0.0123
9	Quang Trung commune - An Lao district - Hai Phong	71.2	58.9	50.8	69.7	57.4	49.3	63.2	50.9	42.8	0.0121
10	Tan Vien commune - An Lao district – Hai Phong	65.6	55.8	48.2	53	43.1	35.6	49.2	39.4	31.8	0.0125
11	Village 1 - Hai Thanh - Hai Phong (Crossing NH14(Ring road 3to Do Son)	71.2	62.5	55	69.9	61.2	53.7	61.3	52.6	45.1	0.0144
12	Da Phuc junction – Phuc Hai – Da Phuc - Kien Thuy - Hai Phong	71.7	59.3	46.5	66.8	54.4	41.6	58.6	46.2	38.4	0.0142
13	575, Tran Van Tat Rd – Group 4 - Trang Minh ward - Kien An – HP	67.4	55.1	41.5	67	54.7	41.1	56.2	43.9	30.3	0.0155
14	Gia Loc ton - Hai Duong (intersection with provincial highway 17A)	64.6	54.4	46.5	62.9	52.7	44.8	47	36.8	28.9	0.0150

15	Cu Xa village – Kieu Ky - Gia Lam – Hanoi	60.6	51.4	44.3	53.1	43.9	36.8	46.9	37.7	30.6	0.0123
16	Group 13 - Cu Khoi ward - Quan Long Bien – Hanoi	59.9	50.1	42.6	53.2	43.4	35.9	47.6	37.8	30.3	0.0158
17	Intersection with provincial highway No.191	69.8	57.1	47.3	69.4	56.7	46.9	54.3	41.6	31.8	0.0165

2.1.4.3. Status of surface water environment

a) Surface water environment

Surface water surveys were conducted in October 2005, and additional surveys for Plan II were conducted in June 2007, taking samples from rivers, lakes, canals, and the sites of future bridges.

The sampling locations and the analyses results are presented in Table 2.15.

Based on the standard TCVN 5942 – 1995, the quality of surface water in the Project areas may be assessed as follows:

- PH ranges from 6.7 to 7.8, within the limits of class A of the standard TCVN 5942 – 1995
- BOD_5 ranges from 6.1 to 8.5, within the limits of class B of the standard TCVN 5942 – 1995
- DO ranges from 3.8 to 7.4 mg/l, within the limits of the standard TCVN 5942 – 1995
- COD ranges from 9.0 to 11.7 mg/l, within the limits of class A of the standard TCVN 5942 – 1995
- TS ranges from 57 to 90 mg/l, exceeding 2.85 to 4.5 times the limits of class A of the standard TCVN 5942 – 1995; 13 samples exceed 1.01 to 1.12 times limits of class B of the standard TCVN 5942 – 1995
- Oil content ranges from 0.03 to 0.25 mg/l, within the limits of class B of the standard TCVN 5942 – 1995
- Mercury content ranges from 0.0003 to 0.003 mg/l, within the limits of class A of the standard TCVN 5942 – 1995
- Total content of plant protection products ranges from trace to 0.04 mg/l, within the limits of class A of the standard TCVN 5942 – 1995

Table 2.15: Results of surface water samples analyses in October 2005

Para	pH	BOD5 mg/l)	DO (mg/l)	TS (mg/l)	As (mg/l)	COD (mg/l)	Cd (mg/l)	Pb (mg/l)	Cr VI (mg/l)	Cu (mg/l)	Zn (mg/l)	Mn (mg/l)	Coliform (MPN/100ml)	PO4 (mg/l)	Hg (mg/l)	TBVTV (mg/l)	Dầu (mg/l)	NH4+ (mg/l)	NO2- (mg/l)	NO3- (mg/l)
NM1	7.6	7.8	6.7	80	0.001	11.7	0.009	0.03	0.01	0.2	0.75	0.04	1530	0.8	0.0008	0.006	0.06	0.01	0.007	0.02
NM2	7.5	7.7	6.5	75	0.001	11.2	0.008	0.03	0.01	0.2	0.72	0.04	800	0.7	0.0008	0.006	0.05	0.01	0.006	0.03
NM3	7.6	7.5	7.0	65	0.001	9.7	0.006	0.04	0.005	0.18	0.67	0.05	940	0.65	0.0007	0.005	0.006	0.02	0.005	0.01
NM4	7.5	7.4	7.4	57	0.001	9.5	0.004	0.03	0.004	0.16	0.62	0.04	1200	0.63	0.0006	0.006	0.011	0.03	0.006	0.02
NM5	7.2	8.5	7.2	85	0.001	9.2	0.003	0.03	0.003	0.15	0.27	0.02	1800	0.52	0.003	0.005	0.025	0.03	0.005	0.03
NM6	7.4	8.2	7.1	82	0.002	10.8	0.004	0.04	0.003	0.16	0.27	0.02	3200	0.47	0.003	0.006	0.026	0.04	0.007	0.02
NM7	6.7	6.5	6.8	71	vết	9.0	0.004	0.006	0.001	0.008	0.34	0.008	400	0.34	0.000 3	vết	0.04	0.013	0.006	0.04
NM8	6.6	6.4	6.9	69	0.001	10.5	0.003	0.005	0.001	0.009	0.35	0.008	1150	0.36	0.003	vết	0.003	0.014	0.006	0.02
NM9	7.6	7.2	4.1	87	vết	11.0	0.005	0.008	0.005	0.18	0.32	0.04	1320	0.67	0.0005	0.06	0.05	0.034	0.06	0.02
NM10	7.5	7.7	3.8	82	0.001	11.5	0.007	0.006	0.007	0.15	0.29	0.05	956	0.72	0.0006	0.04	0.06	0.041	0.04	0.03
NM11	7.6	6.1	6.6	71	0.001	10.8	0.004	0.02	0.006	0.1	0.55	0.04	1275	0.76	0.0006	0.004	0.05	0.04	0.03	0.04
NM12	7.5	6.2	6.5	73	0.001	9.7	0.003	0.002	0.005	0.1	0.50	0.04	1500	0.75	0.0005	0.004	0.05	0.04	0.04	0.03
NM13	7.6	7.6	6.5	90	0.001	9.4	0.009	0.03	0.005	0.2	0.58	0.05	840	0.8	0.0008	0.006	0.06	0.03	0.007	0.02
NM14	7.5	7.4	6.4	87	0.001	10.2	0.008	0.03	0.004	0.16	0.52	0.05	975	0.73	0.0004	0.006	0.11	0.04	0.006	0.02
NM15	6.7	7.5	6.8	81	vết	9.6	0.004	0.006	0.001	0.008	0.38	0.008	1100	0.34	0.000 3	vết	0.04	0.013	0.006	0.04
NM16	7.6	7.8	6.7	80	0.001	10.4	0.009	0.03	0.01	0.2	0.75	0.04	1600	0.8	0.0008	0.006	0.06	0.01	0.007	0.02
NM17	7.5	7.7	6.5	75	0.001	11.2	0.008	0.04	0.04	0.2	0.72	0.04	1540	0.07	0.0008	0.006	0.005	0.01	0.006	0.03
NM18	7.6	7.5	6.0	75	0.001	9.8	0.007	0.04	0.005	0.18	0.67	0.05	1300	0.065	0.0007	0.005	0.006	0.01	0.005	0.03
NM19	7.2	8.4	7.4	72	0.001	9.6	0.004	0.03	0.004	0.16	0.32	0.01	1470	0.63	0.0004	0.006	0.21	0.04	0.006	0.02
NM20	7.2	8.5	7.2	75	0.001	9.2	0.003	0.03	0.003	0.15	0.27	0.02	890	0.52	0.003	0.005	0.25	0.03	0.005	0.02
NM21	7.8	8.2	7.1	72	0.002	9.5	0.004	0.004	0.002	0.16	0.31	0.02	980	0.47	0.003	0.006	0.006	0.014	0.007	0.01
NM22	7.7	8.5	6.8	71	0.001	10.4	0.004	0.006	0.001	0.18	0.34	0.03	1100	0.44	0.003	0.005	0.004	0.013	0.006	0.02
NM23	7.4	6.4	4.9	85	0.001	11.6	0.003	0.005	0.001	0.009	0.35	0.008	1460	0.36	0.003	vết	0.003	0.014	0.006	0.02

NM24	7.6	6.2	4.6	87	vết	10.8	0.005	0.008	0.005	0.008	0.32	0.004	750	0.37	0.005	vết	0.05	0.014	0.006	0.02
NM25	7.1	7.7	3.8	52	0.001	9.8	0.007	0.006	0.007	0.15	0.29	0.05	1250	0.72	0.06	0.004	0.06	0.041	0.004	0.03
NM26	7.6	6.1	6.6	71	0.001	9.5	0.004	0.02	0.006	0.1	0.55	0.04	1300	0.76	0.0006	0.004	0.05	0.04	0.003	0.04
NM27	7.5	6.2	6.5	73	0.001	10.2	0.003	0.002	0.005	0.1	0.50	0.04	960	0.75	0.0005	0.004	0.05	0.04	0.004	0.01
NM28	7.6	7.6	6.5	90	0.001	10.3	0.009	0.03	0.01	0.2	0.78	0.05	1580	0.8	0.0008	0.006	0.06	0.03	0.007	0.02
NM29	7.2	8.4	6.4	77	0.001	10.5	0.004	0.03	0.004	0.16	0.52	0.02	1670	0.63	0.0004	0.006	0.21	0.014	0.006	0.03
NM30	6.7	7.5	6.8	81	vết	11.2	0.004	0.006	0.001	0.008	0.38	0.008	670	0.34	0.000 3	0.005	0.24	0.013	0.006	0.04

Sampling locations

NM1: Tan Quang Bridge , Bac Hung Hai river, left bank

NM2: Tan Quang Bridge, Bac Hung Hai river, right bank

NM3: Trieu river - Van Du – An Thi, right bank

NM4: Trieu River - Van Du – An Thi, left bank

NM5: Hoa Binh Bridge, Sat river (km 33+619) right bank

NM6: Hoa Binh Bridge , Sat river (km 33+619) left bank

NM7: Khuong Phu Bridge, Sat tributery river (km 45+841) right bank

NM8: Khuong Phu Bridge , Sat tributery river (km 45+841) left bank

NM9: Ngoc Ky Bridge , Tu Ky river(km 55+282) right bank

NM10: Ngọc Ky Bridge , Tu Ky river (km 55+282) left bank

NM11: Chua II village Bridge , Thai Binh tributery river (km 62+800) right bank

NM12: ChuaII village Bridge, Thai Binh tributary river (km 62+800) left bank

NM13 Tu Xuyen Bridge, Thai Binh river (km 65+167) right bank

NM14 Tu Xuyen Bridge, Thai Binh river (km 65+167) left bank

NM15 Thanh Hong Bridge, Thai Binh tributary river (km 70+320) right bank

NM16: Thanh Hong Bridge, Thai Binh tributery river (km 70+320) left bank

NM17: Thanh Ha Bridge, Van Uc river (km 74+600) right bank

NM18: Thanh Ha Bridge, Van Uc river (km 74+600) left bank

NM19: Bridge Tan Vien, river Đa Đo (km 79+429) right bank

NM20: Tan Vien Bridge , Da Đo river (km 79+429) left bank

NM21: Lai Ha Bridge, Da Đo tributary river (km 81+748) left bank

NM22: Lai Ha Bridge, Da Đo tributary river (km 81+748) right bank

NM23: Viet Khe Bridge, Da Đo tributary river (km 82+981) right bank

NM24: Viet Khe Bridge, Da Đo tributery river (km 82+981) left bank

NM25: Lach Tray Bridge, Lach Tray river(km 96+800) right bank

NM26: Lach Tray Bridge, Lach Tray river (km 96+800) left bank

NM27: Irigation ditch in Cau Đong village -Quang Trung- An Lão Hai Phòng

NM28: Irigation ditch in Phuc Hai village - Da Phuc, Kien Thuy, Hai Phong

NM29: Irigation ditch in Cu Xa village –Kieu Ky - Gia Lam- HaNoi

NM30: Irigation ditch in Kien village - Vinh Lap – Thanh Ha - Hai Duong

The contents of heavy metals: As content ranges from trace to 0.002 mg/l; Cd content ranges from 0.003 to 0.009 mg/l; Pb content ranges from 0.002 to 0.04 mg/l ; Cr(4) content ranges from 0.001 to 0.04 mg/l ; Cu content ranges from 0.008 to 0.2 mg/l; Zn content ranges from 0.27 to 0.75 mg/l; Mn content ranges from 0.008 to 0.05 mg/l; these contents are within the limits of classes A and B of the standard TCVN 5942 – 1995.

In general, the surface water in the areas is of good quality.

b) Status quo of ground water environment

Ground water quality assessment was conducted concurrently with assessments of surface water, air and soil. 13 water samples have been taken from boreholes and wells in population areas along the route. The wells have been used as domestic water supply sources for over twenty years now.

The sampling locations are as follows:

- NN01 – Group 13, Cu Khoi ward, Long Bien district - Hanoi
- NN02 – Cu Xa village, Kieu Ky -Gia Lam – Hanoi
- NN03 – Phuc Lap village, Vĩnh Khuc – Van Giang –Hung Yen
- NN04 – Quang Uyen village, Minh Chau – Yen Mỹ - Hung Yen
- NN05 – Tong Cu village, Van Du – An Thi – Hung Yen
- NN06 – Ngoc Nhue village, Tan Phuc - An Thi – Hung Yen;
- NN07 – Dan Loan village, Nhan Quyen –Binh Giang - Hai Duong
- NN08 – Ngoc Chan village, Tai Son - Tu Ky - Hai Duong
- NN09 – Kien Nhue village, Vinh Lap – Thanh Ha - Hai Duong
- NN10 – Quang Trung commune – An Lao - Hai Phong (Mr. Khan's house)
- NN11 – Village 1 - Hai Thanh - Hai An - Hai Phong (Mr. Khoi's)
- NN12 – Da Phuc commune -Kien Thuy - Hai phong (Mr. Tiem's)
- NN13 – Trang An ward - Kien An - Hai Phong (Mrs. Thao's);

The analyses results are presented in Table 2.16. In comparison with the Standard of ground water quality TCVN 5944 – 1995 and the Standard No. 1329/2002/BYT/QD dated 14 April 2002 issued by Ministry of Health for quality of domestic water, the ground water in the Project areas is appraised as follows:

- PH ranges from 6.9 to 7.5, within limits of Class A according to TCVN 5944 – 1995.
- The samples of NN4, NN5, NN6, NN8, NN9, NN11, NN13 have Coliform index ranges from 1 to 3 MPN/100 ml, within the limits of TCVN 5944 – 1995. The other samples have Coliform index ranges from 4 to 15 MPN/100ml,

exceeding the limits of TCVN 5944 – 1995; in particular, the sample NN07 has Coliform index reaches 15 MPN/100, exceeding 5 times the limits of TCVN 5944 – 1995.

- Except the sample NN07, all the ground water samples have ColiFecal index within the limits of TCVN 5944 – 1995; the sample NN07, beside Coliform (15 MPN/100 ml), ColiFecal is also found. This is the only point of the route which has been found to be contaminated with ColiFecal and Coliform.
- The contents of NO_2 (0.01 – 0.02 mg/l), SS (11 –26 mg/l), NO_2 (0.003 – 0.02 mg/l), NH_4 (0.005 – 0.01 mg/l) are within the limits of TCVN 5944 – 1995
- The ferrous content ranges from 3.74 to 6.35 mg/l. Most of the samples have ferrous content within the limits, however, some samples have rather high ferrous contents, such as NN03 (6.35 mg/l), NN08 (6.21 mg/l), NN11 (6.32 mg/l).
- Pb content ranges from < 0.001 to 0.003 mg/l; Cu content ranges from < 0.001 to 0.005 mg/l; Mn content ranges from < 0.01 to 0.02 mg/l; Hg content ranges from < 0.0001 to 0.0003 mg/l; As content ranges from < 0.0001 to 0.0003 mg/l; Cd content ranges from < 0.001 to 0.01 mg/l; Zn content ranges from < 0.01 to 0.02 mg/l; in general, the contents are within limits of TCVN 5944 – 1995

In general, the ground water in the Project areas has quality meeting the requirements of Standard TCVN 5944 – 1995. At some places, the ground water is contaminated slightly with Coliform, ColiFecal and ferrous composes. The water should be boiled before drinking.

Table 2.16: Results of ground water samples analyses in October 2005

No.	*Criteria*	*Unit*	*Sample code*												
			NN01	**NN02**	**NN03**	**NN04**	**NN05**	**NN06**	**NN07**	**NN08**	**NN09**	**NN10**	**NN11**	**NN12**	**NN13**
1	NO2-	mg/l	0,01	<0,01	0,01	0,01	<0,01	0,01	0,01	0,02	0,01	0,02	0,02	0,01	<0,01
2	Coliform	MPN/100ml	7	4	5	2	3	3	15	1	3	4	2	4	2
3	SS	mg/l	12	18	20	11	16	15	16	20	26	12	24	25	26
4	PH		7.2	7.4	7.1	7.0	6.9	7.3	7.2	7.4	7.0	7.5	7.1	7.4	7.2
5	NO2	mg/l	0.003	0.01	0.02	0.007	0.02	0.005	0.003	0.008	0.01	0.006	0.002	0.002	0.005
6	NH4	Mg/l	0.05	0.008	0.04	0.1	0.005	0.07	0.001	0.02	0.07	0.06	0.08	0.04	0.005
7	Pb	mg/l	0.001	<0.001	0.001	0.001	<0.001	0.001	0.001	0.001	0.002	0.001	0.002	0.001	0.003
8	Cu	mg/l	0.004	0.005	0.004	0.003	0.001	0.002	<0.001	0.002	0.001	0.002	0.003	0.001	0.002
9	Zn	mg/l	0.02	<0.01	0.02	0.02	<0.01	0.001	0.01	0.01	0.02	0.01	0.02	0.02	0.01
10	ColiFecal	MNP/100ml	0	0	0	0	0	0	1	0	0	0	0	0	0
11	Cr	mg/l	0.01	<0.001	<0.001	<0.001	<0.001	0.001	<0.001	0.001	0.002	0.003	0.002	0.003	0.001
12	Cd	mg/l	0.01	<0.001	<0.001	0.001	<0.001	0.002	0.001	0.002	0.001	0.002	0.003	0.001	0.002
13	As	mg/l	0.0001	<0.0001	0.0001	0.0002	0.0002	0.0003	<0.0001	0.0003	0.0002	0.0001	0.0001	0.0002	0.0001
14	Hg	mg/l	0.0002	0.0001	0.0002	0.0002	0.0003	0.0002	0.0001	0.0002	0.0003	0.0002	0.0002	0.0001	0.0002
15	Fe	mg/l	3.74	3.62	6.35	4.51	4.46	4.25	4.21	6.21	5.81	5.54	6.32	5.47	6.25

2.1.4.4. Status quo of soil environment

The land in the Project areas is mainly agricultural, land, orchards and plantation. The land utilization is being converted dynamically. The land utilization should be planned reasonably to prevent degradation and pollution otherwise it will cause negative impacts on soil quality and even on health of people

13 soil samples have been taken from the locations as follows:

- No.01 - Group 13, Cu Khoi ward, Long Bien district - Hanoi
- No.02 - Cu Xa village, Kieu Ky -Gia Lam – Hanoi
- No.03 – Phuc Lap village, Vinh Khuc – Van Giang –Hung Yen
- No.04 - Quang Uyen village, Minh Chau – Yen My - Hung Yen
- No.05 - Tong Cu village, Van Du – An Thi – Hung Yen
- No.06 - Ngoc Nhue village, Tan Phuc - An Thi – Hung Yen
- No.07 – Dan Loan village, Nhan Quyen –Binh Giang - Hai Duong
- No.08 – Cau Go ward, Phuong Hung - Gia Loc – Hai Hung
- No.09 – Ngoc Chan village, Tai Son - Tu Ky - Hai Duong
- No.10 – Kien Nhue village, Vinh Lap – Thanh Ha - Hai Duong
- No.11- Quang Trung commune – An Lão - Hai Phòng (Mr. Khan's house)
- No.12 - Village 1 - Hai Thành - Hai An - Hai Phòng (Mr. Khoi's)
- NO.13 - Da Phuc commune -Kien Thuy - Hai phòng (Mr. Tiem's)

The analysis results are presented in Table 2.17. In comparison with the Standard TCVN 7290 – 2002, the soil is assesses as follows:

- PH ranges from 6.6 to 7.8, the soil is neutral to alkaline
- Nitrogen content ranges from 0.08 to 0.34%
- Total P content ranges from 0.011 to 0.25%, rich in phosphorus
- The contents of heavy metals such as Pb, Cu, Ni, Zn, Cr, Cd, and as are within the limits of Standard TCVN 7290 – 2002.

The analyses of plant protection product residuals in the soil (Table 2.18) show that the contents of insecticide, herbicide residual in the soil are far below the limits of TCVN 5941 – 1995.

In general, the soil environment has not been polluted;

Table 2.17: Results of soil samples analyses in October 2005

KHM	No.01	No.02	No.03	No.04	No.05	No.06	No.07	No.08	No.09	No.010	No.11	No.12	No.13	TCVN 7290-2002
PH	7.1	6.7	6.9	7.2	6.8	7.3	7.5	7.8	6.6	7.1	7.0	7.1	7.5	
Total N (%)	0.08	0.12	0.14	0.15	0.22	0.25	0.08	0.34	0.14	0.32	0.15	0.22	0.25	
Total P (%)	0.15	0.19	0.21	0.22	0.12	0.18	0.12	0.17	0.11	0.25	0.22	0.12	0.18	
Pb (mg/kg)	19.2	14.3	15.1	17.2	14.3	14.2	16.5	21.3	20.1	18.2	17.1	21.6	14.6	94±10
Cu (mg/kg)	18.6	25.6	19.7	17.6	28.3	21.2	18.6	19.3	24.6	25.7	26.3	19.1	23.6	33± 3
Ni (mg/kg)	11	6	9	12	7	11	6	9	14	10	13	10	8	60 ± 4
Zn (mg/kg)	29	31	34	29	30	35	32	36	40	37	41	34	27	94 ± 9
Cr (mg/kg)	27	18	14	37	25	27	21	25	20	19	17	22	19	46 ± 4
Cd (mg/kg)	4.4	3.1	4.2	5.4	9.0	2.1	1.3	2.1	1.7	1.9	2.1	2.4	3.6	33±0,09
As (mg/kg)	0.02	0.01	0.02	0.03	0.02	0.02	0.01	0.02	0.01	0.01	0.01	0.02	0.01	

Table 2.18: Results of analyses of plant protection product residual in the soil

No	Criteria	Unit	Test method	Results of analysis													
				Đ01	Đ2	Đ3	Đ4	Đ5	Đ6	Đ7	Đ8	Đ9	Đ10	Đ11	Đ12	Đ33	TCVN: 5941-1995
1	Altrazine	µg/kg	EPA8081A	0.11	<0.01	0.82	0.01	-	0.01	0.24	-	<0.01	0.01	0.24	0.01	0.01	200
2	2,4 - D	µg/kg	EPA8081A	0.10	0.01	0.83	0.01	0.01	-	<0.01	0.01	0.54	0.01	0.01	0.64	0.02	200
3	Dual	µg/kg	EPA8081A	0.17	0.01	0.22	0.01	0.24	0.11	<0.01	0.82	0.01	-	0.01	0.01	0.54	500
4	Monitor	µg/kg	EPA8081A	0.01	0.01	0.54	0.01	0.01	0.01	0.22	0.01	0.01	-	0.01	0.01	0.01	100
5	Sofit	µg/kg	EPA8081A	0.12	0.01	2.33	0.01	0.22	0.11	<0.01	0.82	0.01	-	0.01	<0.01	0.82	500
6	Padan	µg/kg	EPA8081A	0.01	-	<0.01	0.01	0.83	0.10	0.01	0.83	0.01	0.01	-	<0.01	0.01	100
7	Simazine	µg/kg	EPA8081A	0.01	<0.01	<0.01	-	<0.01	0.01	0.24	-	2.33	0.01	0.22	-	0.01	200
8	Cypermethrin	µg/kg	EPA8081A	0.31	0.02	0.04	0.01	0.54	0.01	0.01	0.01	<0.01	0.01	0.83	0.01	0.22	500
9	Saturan	µg/kg	EPA8081A	0.15	0.01	-	0.82	0.01	-	0.01	0.82	<0.01	-	<0.01	0.01	0.83	500
10	Dalapon	µg/kg	EPA8081A	0.01	0.4	-	0.01	0.01	-	0.01	0.01	0.04	0.01	0.54	0.01	-	200
11	DDT	µg/kg	EPA8081A	0.46	0.01	0.14	0.82	0.01	-	0.01	0.82	-	0.82	0.01	<0.01	<0.01	100
12	Fenvalerat	µg/kg	EPA8081A	0.01	0.11	<0.01	0.82	0.01	-	0.01	0.01	0.54	0.10	0.01	-	0.01	100
13	Lindan	µg/kg	EPA8081A	0.01	0.01	0.22	0.01	0.01	-	0.01	0.01	0.01	0.01	0.24	0.01	0.24	100

14	MPCA	µg/kg	EPA8081A	0.48	0.11	<0.01	0.82	0.01	-	0.01	<0.01	0.82	0.01	0.01	0.01	2.33	200
15	Monocrotophos	µg/kg	EPA8081A	0.01	<0.01	-	<0.01	0.01	0.24	-	2.33	0.01	0.22	<0.01	-	<0.01	100
16	Dimethoate	µg/kg	EPA8081A	0.01	0.04	0.01	0.54	0.01	0.01	0.01	<0.01	0.01	0.83	0.04	0.01	0.01	100
17	M. Parathion	µg/kg	EPA8081A	<0.01	-	0.82	0.01	-	0.01	0.82	<0.01	-	<0.01	-	-	<0.01	100
18	Triclofon	µg/kg	EPA8081A	<0.01	-	0.01	0.01	-	0.01	0.01	0.04	0.01	0.54	-	<0.01	<0.01	100

2.1.5. Natural Resources

2.1.5.1. Water Resources

The Project areas are located in Red River – Thai Binh River system, with stream flows varying with time and places. The flow modulus ranges from 20 to 40 l/s.km2. The water quality is rather good.

2.1.5.2. Mineral resources

The minerals in the Project areas are mainly related to deposits, distributed in large areas, with big reserves:

- ❖ Clay is main raw material for brick and tile production. The clay is composed of caolinit, hydromica, ferrous and aluminum oxides.
- ❖ Sand is one of the biggest mineral resources in Hanoi plain. The sand deposits are distributed along Red River and Thai Binh River, consisted mainly of fine and medium sands, mixed with mica flakes and organic materials. The clay content in the sand increases with the increase of distance to the river bank; and to some extend, clay is interbeded with sand.
- ❖ About 51 deposits and occurrences of coal, lignite, and peat have been recognized; among them, 2 deposits of medium scale, and 18 deposits of small scale; total resource is about 200 million tons, including mainly coal (approximate 190 million tons) distributed in west and east of Hanoi city.

2.1.5.3. Status quo of biodiversity

1) Ecosystem on land

Flora on land

Species

Field surveys and study of available documents show that 249 species of higher plants, belonging to 78 families, 174 geniuses, three phyla (see the Appendix I) have been identified in the Project areas.

Among the identified phyla, flowering plants (Magnoliophyta) include most species (244 species), making up 98% of total species. Next is Fern (Polypodiophyta), including 4 species. The classification of the identified plants is presented in the Table 2.19:

Table 2.19. Floristic compositions in the Project region

Phyla	Number of families	Number of geniuses	Number of species

Lycopodiophyta	1	1	1
Polypodiophyta	3	4	4
Magnoliophyta	74	169	244
Magnoliopsida	61	134	191
Liliopsida	17	35	53
Total	**78**	**174**	**249**

The components of the flora is illustrated in the chart below:

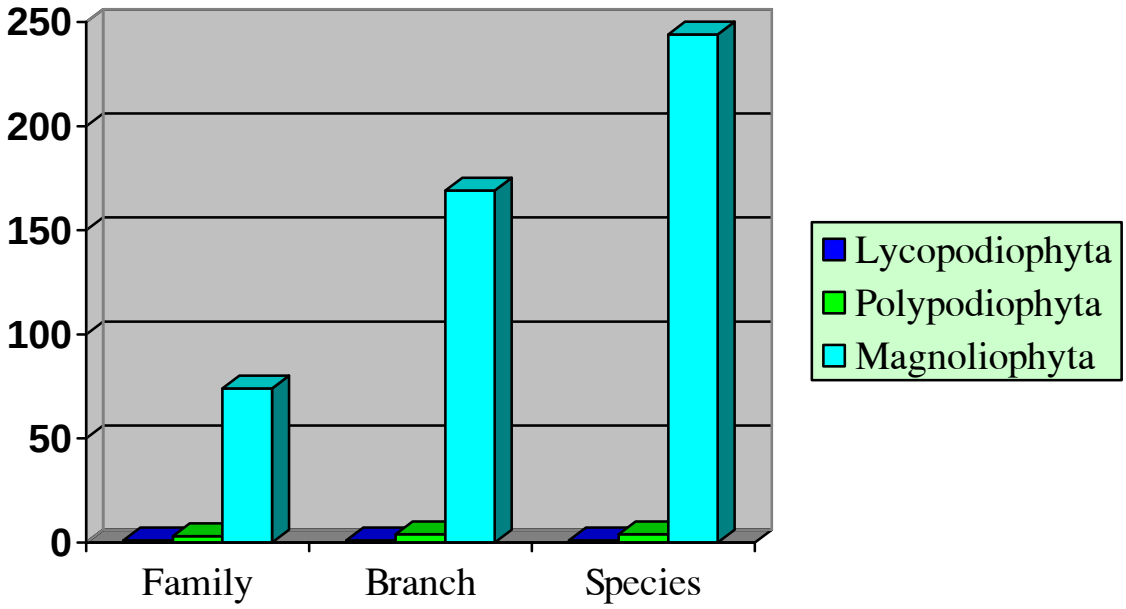


Figure 2.18. Components of the flora of the Project region

Among the 78 plant families identified in the Project areas, 36 families consist of one specie each; 26 families consist of 2 – 5 species each; and 12 families consist of6 – 10 species each; several families consist of more than 10 species.

Most of the plant species are crops; non of them is recorded in the Red List of threatened species in Vietnam.

Classification of the plant species according to Taxon

+ Classification of species according to growing forms

– Trees : 34 species
– Bushes : 87 species

– Vines : 20 species

– Herbs, grasses : 108 species

+ Classification of species according to phyla

There existing 8 plant phyla in Vietnam; 3 of the phyla have been identified in the Project areas, namely Clubmosses (Lycopodiophyta), Fern (Polypodiophyta), and Flowering plants (Magnoliophyta).

+ Classification of species according to plant family

Among the 78 plant families identified in the Project areas, 36 families have 1 species each; 26 families have 2 – 5 species each, 12 families have 6 – 10 species each; and only 5 families have over 10 species each.

Distribution of species in vegetation cover

As mentioned above, the flora in the Project areas can be divided into four vegetation covers

- Crops in cultural land

This vegetation cover include food and feeding crops. There are 13 species of this kind, most of them are short-day crops, covering large areas, such as rice, corn, legumes… this vegetation cover has largest distribution area.

- Fruit trees and decoration trees

There are about 143 species, making up 57.4% of total species in the areas. The trees of these kinds are distributed mainly in population areas, such as jackfruit, custard apples, peaches, plums, apricot…

- Crops and plants in coastal submerged land

These species make up 0.4% of total species in the Project areas.

Fauna on land

Species compositions

There are 11 wild animal species identified in the Project areas. Most of the species and geniuses belong to rodentia and Chiroptera orders (Table 2.20)

Table 2.20. Composition structure of animals inhabiting in the Project areas

No.	*Order*	*Number of families*	*Number of species*
1	Insectivorous	1	1
2	Chiroptera	4	6

3	Rodentia	2	5
Total: 3 orders, 7 families, 10 geniuses, 11 species			

There are 54 bird species occurring frequently in the Project areas; they belong to 31 families, 10 orders, especially the orders of Passeriformes, Falconiformes, Gruiformes and Ciconiformes.

Table 2.21. Composition structure of the birds in the Project areas

No.	*Order*	*Number of families*	*Number of species*
1	Ciconiiformes	1	5
2	Falconiformes	2	4
3	Gruiformes	2	2
4	Snipe	2	4
5	Columbiformes	1	2
6	Cuculiformes	1	1
7	Strigiformes	1	1
8	Fern owl	1	1
9	Coraciiformes	1	3
10	Passeriformes	19	31
Total: 10 orders, 31 families, 54 species			

There are 19 reptiles species, belonging to 9 families, 2 orders; and 13 amphibians species belonging to 5 families, 1 order. (Table 2.22)

Table 2.22. Composition structure of the reptiles and amphibians in the Project areas

No.	*Order*	*Number of families*	*Number of species*

Reptilia			
1	Squamata	6	13
2	Testudinata	1	1
Amphibian			
3	Frogs	4	10
Total: 3 orders, 11 families, 24 species			

Composition structures of insects species

There are 144 insects species, belonging to 63 families, 12 orders (see the Appendix 5). The orders having many species include *Lepidoptera* (32 species, making up 22.22%); *Coleoptera* (28 species, making up 19.44%); *Diptera* (26 species, making up 18.06.%); the orders having less species include: *Heteropter* (17 species, making up 11.81.%); *Orthoptera* (13 species, making up 9.03.%); *Hymenoptera* (11 species, making up 7.64.%); *Homoptera* (9 species, making up 6.25.%); The orders having only one specie each include: *Mantodea*, *Ephemeroptera*, and *Dermaptera*.

Table 2.23. Structure of insects

No.	**Vietnamese name**	**Scientific name**	**No. of families**	**No. of species**	**% species**
	Bộ Cánh vảy	Lepidoptera	14	32	22.22
	Bộ Cánh cứng	*Coleoptera*	8	28	19.44
	Bộ Hai cánh	*Diptera*	11	26	18.06
	Bộ Cánh khác	*Heteroptera*	6	17	11.81
	Bộ Cánh thẳng	*Orthoptera*	6	13	9.03
	Bộ Cánh màng	*Hymenoptera*	6	11	7.64
	Bộ Cánh giống	*Homoptera*	4	9	6.25
	Bộ Chuồn chuồn	*Odonata*	3	3	2.08
	Bộ Gián	*Blattodea*	2	2	1.39
	Bộ Bọ ngựa	*Mantodea*	1	1	0.69
	Bộ Phù du	*Ephemeroptera*	1	1	0.69
	Bộ Cánh da	*Dermaptera*	1	1	0.69
Total	12 groups		63	144	

Apart from the above-mentioned significant groups of insects, the rest 32.64 % are common ones, with large distribution. During the time of the survey, we did not see any kind of insects in the Red Book and Red List of Vietnam.

Table 2.24. Analysis of groups of insects in the area of the Project

No.	Group	No. of species	Percent (%)
1	Agricultural pestilent insects	67	46.53
2	Natural foes of insects	16	11.11
3	Medical insects	6	4.17
4	Veterinary insects	8	5.56
5	Others	47	32.64

During the survey, with the quantitative method, we collected total 698 samples of 123 species from 53 families, 10 groups of insects. The results of analysis shows the diversity of the area along the intended highway line of Hanoi – Hai Phong is very low, with the diversity index (H') of only 3.2643 and diversity (d) 19,319.

Distribution of species following habitat:

+Fields of rice and crops:

This is the main type of habitat of the project area intended for Hanoi – Hai Phong highway.

The survey results show that most of the species gather in the fields, which makes 79.86%. The structure of insects in this habitat is featured by the outnumber of agricultural pestilent insects such as *Schoenobius incertellus*, *Cnaphalocrocis medinalis, Agrotis ypsilon*, *Heliothis armigera*, *Plutella xylostella, Pyrausta nubilalis*, *Oxya spp.*, *Orgyia posticata*, *Nephotettix sp.*, *Nilaparvata lugens*, *Brevicoryne brassicae*, and other species of Acrididae family, etc. Besides, it also can be seen natural foes of pestilent insects such as species of Carabidae, Coccinellidae, Reduviidae, Ichneumonidae, Braconidae, etc., Tachinidae, Syrphidae, etc. and some species of Pieridae, Hesperidae, Satyridae, etc.

+ Coastal wetlands

Animals: There are 3 species, making 27% of the species of this habitat. The most seen animals are: huge earth rats, field mice, and brown vespertilis.

Birds: This is the habitat with the most monotonous topography of the 3 types of habitats. The vegetation is poor, therefore there are few ecological elements

related to distribution of birds. This may be the reason why there are the least birds here, only 34 species, making 62% of the total species.

Reptiles and amphibians: There are 14 species, making 58.4 % of the species of this habitat. The common ones are: *Phisignathus cocincinus, Hyla simplex, Mabuya multifasciata, Rana rugulosa*.

Insects: Taking the smallest area, distributing in the coastal area of Hai Phong with simple vegetation. The number of species of insects seen in the coastal wetland only makes 12.50% of the species.

The contents of insects here are quite poor, normally seen some kinds of butterflies belonging to Pieridae, Lycaenidae, and some kinds of Chrysomelidae, and some kinds of Orthoptera group, etc.

+ Residential area:

This habitat includes the hamlets gathering on the land with high topography surrounded by fields for agriculture. Normally each household has a garden, and may be a small pond for aquaculture.

Summary: The terrestrial fauna and vegetation of the project area includes the following species:

+ Vegetation: 249 species, 78 families, 174 lines belonging to 3 branches: Pines, Ferns and Magnolia.

+ Fauna:

- Animals: 11 species belonging to 7 families and 3 groups.
- Birds: 54 species belonging to 31 families and 10 groups.
- Reptiles and amphibians: 24 species belonging to 11 families and 3 groups.
- Insects: 144 species belonging to 63 families and 12 groups.

The vegetation includes 3 main types:

- *The vegetation with plants on agricultural land;*

- *The vegetation with plants and natural plants of the coastal wetlands;*

- *The vegetation with plants for fruits, foods and consumption of the residential areas.*

The correlative habitats for the above 3 types of vegetations are:

+ Fields of rice and crops: This is the main type of habitats of the project area.

Animals: 9 species, making 82 % of the total species in the project area.

Birds: 47 species, making 87% of the total species.

Reptiles and amphibians: 19 species, making 79.2% of the total species.

Insects: 115 species, making 79.86% of the total species.

+ Coastal wetlands:

Animals: 3 species, making 27 % of the total species in this habitat.

Birds: This is the habitat with the most monotonous topography of the project area, therefore there are the least species of birds seen of all habitats: 34 species, making 62% of the total species.

Reptiles and amphibians: 14 species, making 58.4% of the species in planted forests intermixing with fields.

Insects: 18 species, making 12.5% of the total species.

+ Residential areas:

Animals: 10 species, making 91 %, and 67 % of the total species, mostly are bats and mice.

Birds: the number of species of birds are quite many, particularly there are 45 species, making 83.3 % of the total species recorded in the project area.

Reptiles and amphibians: 16 species, making 67% of the total species in this habitat.

Insects: 68 species, making 47 %, and 22.5% of the total species.

There is no rare species and species in the Red Book or being reserved in the project area.

2) Aquatic ecosystem

Phytoplankton

Following the results of the survey reports of the project area, 32 types of phytoplankton belonging to Bacillariophyta, Chlorophyta, cyanophyta and Euglenophyta were identified. We collected all the data, together with the results of survey of the list of 89 species of phytoplankton in water bodies in the project line area (List VI). In the contents of phytoplankton, it can be easily seen the groups living in brackish water with lines of diatom such as Coscinodiscus, Chaetoceros, Biddulphia, Skeletonema in water bodies affected by the tide with salinity of over 3‰ as in Tam Bac river. Besides, the phytoplankton in fresh water distribute largely in most water bodies like lakes and ponds.

Following the initial results of sample analysis of phytoplankton, more than 80

species of phytoplankton belonging to 17 families of to Bacillariophyta, Chlorophyta, cyanophyta and Euglenophyta were identified. The number of species of phytoplankton can be higher in fact. The phytoplankton includes tropical species with large distribution.

The density of phytoplankton in general is low, from more than 9,000 to nearly 30,000 organisms/l. The discharge water channel Cau Tre has the highest density of phytoplankton, and De River the lowest.

In the contents of density of phytoplankton, it is clear that in water bodies taking discharge water such as Cau Tre channel and Tam Bac Lake, the group of Euglenophyta indicating polluted water bodies develops mainly that of *Euglena*, and *Phacus*.

Zooplankton

Hai Phong area

Following the results of sample analysis of the survey in Oct. 2005, 11 species belonging to 6 groups of zooplankton: Rotatoria, cladocera, Copepoda, larva of Diptera, small shrimps, small fish, and worm were identified. Collecting all the data, we issued the list of 43 species of zooplankton of the water bodies in the project area of Hanoi – Hai Phong highway (List VII). In the contents of zooplankton, there are some species representing for the ecological groups in coastal brackish water such as copepoda *Acartia sinensis, Sinocalanus laevidactylus*. Other are species in fresh water which can adapt to salinity such as *Mongolodiaptomus formosanus, Thermocyclops, Diaphanosoma sarsi, Moina dubia, Moinodaphnia macleayi*.

In general, the species originating from brackish water can be seen in rivers while those originating from fresh water can be seen in static water bodies such as lakes and ponds. Especially, the group of Rotatoria focuses in most of channels taking discharge water and lakes and ponds.

Hai Duong area

The density of zooplankton in Bac Hung Hai river (a small canal in Tonkin Delta) differs from 8,000 – 38,000 organisms/m3, the main component is ephemera crustaceans (73%). In Chau River, the density is greater with 52,100-123,600 organisms/m3, with the dominance of Rotatoria. Regarding the zoobethos, the density and biomass are relatively high. In Bac Hung Hai river, in summer average of 683 organisms/m2, with 8.7 g/m2 of biomass. The biomass in winter is higher, on average 9.3 g/m2, with main components of Amphipoda, Isopoda and Corbicula. The density of the zoobethos in the Kinh Thay river is 913 organisms/m2, biomass

3.078 g/m2, and crustaceans accounted for more than 90% of individuals.

The survey results in Thai Binh river in Hai Duong city in 2005 shows that the density of zooplankton varies from over 90 organisms/m3 to 1,600 organisms/m3, of which, the Copepoda is dominant (over 70% of the total quantity).

Following the results of sample analysis, about 45 species of zooplankton belonging to 13 families of groups of Copepoda, Cladocera, Rotatoria, and Ostracoda were identified. The number of species of the zooplankton identified in the region may be lower than in reality. However, these figures also reflect the richness and diversity of species composition of zooplankton species.

The density of zooplankton in different types of water bodies such as rivers, lakes, and canals is not much different. In a fish pond, the number of rotatoria is up to 96,500 organisms/m3. In these water bodies, people often use organic wastes and other domestic wastes to feed the fish. This adds to the heavy organic pollution (Alpha-mesosaprobic, corresponding with diversity index D = 1.7).

In the 2 survey points, one is a canal for irrigation and the other canal for field drainage, the density of zooplankton changes towards the increase due to the higher content of organic in discharge water than intake water. However, the diversity index (D) did not significantly change. This shows that the concentration of organic substances in waste water is still within the tolerance of the species of zooplankton, and this water is not contaminated with organic substances.

In general, the types of water bodies for the survey are quite rich in species composition and stable regarding the density, with relatively high diversity index (D). However, still existed a number of water bodies such as ponds and fish lakes show signs of the phenomenon of over fertilization and organic contamination with domestic waste water and exceeding food supply for fish. In addition, the duck breeding in the area also partly affected the surface water quality. In these water bodies, there is no water exchange with river and stream water, therefore, organic waste of the ducks can become a source of pollution.

Zoobethos

Through the survey in the water bodies in the area of the Hanoi - Hai Phong Highway Project and the surrounding area, 20 species of the zoobethos belonging to groups of insect larvae, small silk worms, shrimps, crabs, oysters and snails were identified. The crayfish of Macrobrachyum found in rivers and lakes. Only one species of S. sinensis crabs found in the edges of rice fields. Species of oysters, mussels and snails are found mainly in Sat River.

The results of analysis of the zoobethos identified over 30 species of fresh /brackish

water oysters and snails belonging to 12 families, 22 varieties. In particular, the families of Viviparidae and Unionidae have the largest number of species. Followed are Thiaridae, Corbiculidae with five species. These are all common species of freshwater oysters and snails in water bodies of Vietnam.

The zoobethos in general and mollusks in particular are included in the used to evaluate water quality in the inland water bodies. Species of Thiaridae and Corbiculidae are included in the scoring system BMWP, which is the system used to evaluate water quality in running water bodies of Vietnam. Species of shrimp and crab species are all common one widely distributed in the tropical areas.

In the zoobethos, the group of water insects has only been studied for the past 5-6 years. Due to limited materials and experts, the survey results only limited in level of families and varieties.

Composition of species of fish and fishery

With the abundance of various types of water bodies, including several tributaries of the Red River flows through the system, components of fish in the research area is relatively rich.

The statistical analysis of the system of freshwater fish in the project area of Hung Yen, Hai Duong, Hai Phong and Hanoi (Gia Lam district) showed that most fish are natural and common in the Tonkin Delta such as carp, mud carp, Mylopharyngodon piceus, hypophthalmichthys, Anabas tetudineus, catfish, and eel. Some species of fish are bred such as Ctenopharyngodon idella, hypophthalmichthys, and tilapia mosambica.

Table 2.25. Composition of species of fish in the project area

No.	**Common name**	**Scientific name**
	Cá mương	*Hemiculter leucisculus*
2	Cá ngạnh	*Cranoglanis sinensis*
3	Trê đen	*Clarias fuscus*
4	Lươn	*Fluta alba*
5	Rô đồng	*Anabas tetudineus*
6	Cá chuối	*Ophiocephalus striatus*
7	Cá diếc	*Carassius auratus*
8	Cá trôi	*Cirrhina molitonella*
9	Cá chép	*Cyprinus carpio*

10	Trắm	*Mylopharyngodon piceus*
11	Đuôi cờ	*Macropodus opercularis*
12	Đòng đong	*Puntlus semifascilatus*
13	Rô phi	*Tilapia mosambica*

2.1.5.4. Soils and soil resource

1) Hanoi city

According to the Statistical Yearbook 2004, Hanoi City has a total natural area of 92.1 thousand ha of which agricultural land 41.8 thousand hectares, accounting for 45.4%, forest land 6.6 thousand ha, accounting for 7.2%, 22.6 thousand hectares of land for special use accounts for 24.5% and 11.6 thousand hectares of land for residential, accounts for 12.6%.

2) Hai Duong province

The natural area of Hai Duong is 164.8 thousand hectares, of which agricultural land is 104.1 thousand hectares, accounting for 63.2%, forest land is 9.1 thousand ha with forests accounts for 5.5%; land for special use 28.1 thousand hectares, accounting for 17.1%; 11.3 thousand hectares of land for residential, accounting for 6.9%.

Land is divided into two main groups:

- ❖ Delta land, accounting for 89% of natural land.
- ❖ Hilly and mountainous land, accounting for 11% of natural land.

3) Hung Yen province

The natural area of Hung Yen is 92.3 thousand ha, of which agricultural land is 62.6 thousand hectares, accounting for 67.8%, no forest land with forests; land for special use 16.2 thousand hectares, accounting for 17.6%; 7.4 thousand hectares of land for residential, accounting for 8.0%.

The area of agricultural land, ponds, and lakes decreased due to urbanization, industrialization, expanding new residential areas, towns, townships, expansion and upgrade and renew of many roads, construction of offices, etc. Land in Hung Yen is alluvium of Red River, Luoc River and Duong River; therefore, its quality is generally even, and fertile for intensive agriculture.

4) Hai Phong city

The natural area of Hai Phong is 152.6 thousand ha, of which agricultural land is

71.2 thousand ha, accounting for 46.7%, forest land is 22.0 thousand ha with forests accounts for 14.4%; land for special use 22.9 thousand hectares, accounting for 15.0%; 6.8 thousand hectares of land for residential, accounting for 4.5%.

The land for agriculture of Hai Phong has some unique characteristics:

- Due to complex terrain, the delta alternating with hills and limestone mountains, and bordering on the sea, the soils with sialite content often become saline. The coastal land affected by tides, river flows in the system, etc. often have erosion and silt deposition, which results in soil loss or leveling up of the ground. Simultaneously the influence of tide, there is salt water intrusion into rivers in Hai Phong. This is one of the causes of saline pollution of the agricultural land.
- The topography is slightly tilted towards the sea, which is easy for surface irrigation. However, due to the tangled river and sea dyke systems, after a long time, the alluvial accumulated, causing some flooding area such as Doan Xa - Hong Duc (Kien Thuy.)
- The soil on dyke become saline, the soil in the fields was reclaimed to reduce acidity and salinity and increase fertility.
- Saline soil with mangroves and wetlands concentrated in Cat Hai, Bac, Thuy Nguyen, Dinh Vu Island (An Hai), Doan Xa (Kien Thuy).

2.2. SOCIO-ECONOMIC STATUS

2.2.1. The socio-economic status of the project area in Hanoi

The place directly receiving project is Thach Ban Ward, Long Bien district and Da Ton, Kieu Ky commune, in Gia Lam District. The main socio-economic features are as follows.

Long Bien district – Hanoi city

The starting point of the project line is in Long Bien district on the Ring Road III of Hanoi. The project would go through a ward, i.e., Thach Ban ward. Thach Ban has the natural area of 479.7 ha, of which agricultural land area is 278.3 ha. In 2006, the ward had 1,415 households, 5,942 people, number of poor households decreased compared to that of 2005 by 12 households, the percentage of cultural households reached 98.6%.

Gia Lam District – Hanoi City:

Sharing the with economic growth of Hanoi, Gia Lam district is having steps of stable development and continuously maintaining the fairly high growth rate. Thanks to the economic structure shifting, the value of key economic sectors in the

district in 2005 reached more than VND1.5 trillion, increasing by 30 times compared to that in 1985. The proportion of industry and services – commerce accounting for 77% of the economic structure of the district (increasing by 25 times compared with that in 1985). The growth of the industries – home crafts increased by 17% - 20.4%. So far, the number of industrial enterprises of the district has increased two times compared with that in 2004 (over 100 enterprises). Gia Lam has spent nearly 107 hectares for the development of the industry. Number of business developed strongly concentrating primarily in the handicraft villages. Agriculture-forestry and aquatic products annual growth rate reached from 4% to 4.2%. The structure of agricultural-forestry-fishery shifted to the plants and animals with high economic value so that the production value of 1 ha of cultivated land in the district reached 56 million, forming the specializing large farms: cows: Phu Dong, Duong Ha; pigs: Yen Thuong, Van Duc; fresh vegetables: Dong Du, Dang Xa; high-yield rice: Trau Quy, Yen Thuong ... Value from operating commercial services to date has increased by 15.1%.

The project line goes through two communes in Gia Lam district: Da Ton and Kieu Ky. This is the 2 major communes for agricultural production and small trading. The lives of the people are gradually improved (Table 2:26). The income per capita reaches VND 3 - 3.5 million / person / year. 100% of households in the communes have drilled wells, the number of households with motor reaches 65%, have television/cassette players 95%, and telephone 51.07%. 80% of the village roads are tiled and concreted. The number of cultural households reached 82-85%. Although they are agricultural communes, the education is paid proper attention. The lower secondary education is completed. The students have no manifestations of social evils. All communes have their own clinics, vaccination and inoculation against six diseases completed, vaccination for 100% pregnant women, examination and allocation of free medicines for children under 5 years old. Cultural activities and sports are now grown in popularity in the hamlets, attracted the participation of people of different ages, which contributes to improve the physical and spiritual conditions and consciousness of people.

Table 2.26. Socio-economical statistics of the communes in the project area

No.	Da Ton	Kieu Ky	Whole district
area (km^2)	7.22140	5.61019	114.79
Population (people)	10651	9854	208705
Population density (people/km^2)	1475	1756	1818
Number of children born (people)	180	191	3485
Number of people die (people)	53	36	877
Private production units (units / labors)	33/91	23/434	2170/12455 (VND 337590 million)
Commerce, hotels, and restaurants (units / labors)	8/86	4/19	109/1337
Agriculture: - area (ha)/ productivity (quintals/ha)/ output (tons) - output of food equivalent to paddy (tons)	735.0/54.6/4014.1	580.0/48.5/2813.0	7046.2/46.7/ 32909.5

	6969.1	2813	40369.1
Kindergarten (school/teachers/students)	1/39/553	1/25/511	23/403/8156
Primary school (school/teachers/students)	1/26/785	1/30/672	24/629/15068
Lower Secondary School (school/teachers/students)	1/29/696	1/26/582	23/669/13636
Health: units/number of beds (items)/medical staff (people)			44/44/118

Source: Statistics yearbook of Gia Lam district 2005

2.2.2. Socio-economic status of project area in Hung Yen province

2.2.2.1. Van Giang district

Van Giang district has 11 wards and communes and towns. Van Giang district's area is 71.79 km2. In 2004, the district's total population is 958,820, of which the female is 49.58 thousand people, density is 1.336 people/km2. The rate of natural population growth of the region is relatively stable and with the growth rate decreased: in 2000 the natural growth rate is 15.58%, 2004 is 15.02%. The project line goes through the territory of three communes: Cuu Cao, Long Hung and Tan Tien.

Agriculture - Fisheries: Tan Tien commune has the rice productivity of the fifth-month crop 63.9 quintals / ha, and winter crop 61.05 quintals / ha, average 124.9 quintals / ha; the value of rice production in 2006 reached VND 20,893 million. The main perennial plants are sweet orange, Vinh orange, kumquat and decorative plants, etc. with production value reached VND 21,344 million. Aquaculture area is 62.7 ha with production value in 2006 of VND 5443 million.

Breeding: Thank to the instructions at all levels of prevention and vaccination against the diseases, Tan Tien commune managed to keep its livestock and poultry stably, bringing the value of livestock production in 2006 of VND 32,622 million. The total production value of agriculture in 2006 was VND 80,302 million.

Industry and handicraft: Tan Tien is an agricultural commune without any traditional handicraft; secondary vocation is less developed; the transportation system has not met the requirements for industrial and handicraft development. Some households develop small secondary vocation, without combination and expansion of production scale. The production value in 2006 reached VND 20,125 million.

Education, health, and culture: Tan Tien commune was recognized to have education generalization at the right age. The rate of preschool-age mobilized is 79.5% with 708 children. 100% children have primary school education.

Health facilities: the prevention and treatment for people are more focused;

preventive health programs are implemented effectively; 100% of children in the ages vaccinated, 100% of children under 6 years of age are granted health insurance cards for free medical treatment (the town of Van Giang, Tan Tien, Cuu Cao, Long Giang commune, etc.)

2.2.2.2. Yen My district

In the area of **Yen My district,** the highway goes through Hoang Long, Yen Phu, Viet Cuong, Minh Chau, Thuong Kiet and Tan Viet commune.

Tan Viet commune in 2006 had economic growth of the whole year 17%, of which agriculture 10%, handicraft 11.4% increasing 0.9%, business and services 21.6% increased by 3%, average income per capita 6 million / year, the rate of population growth 0.87%;

Hoang Long commune had economic growth rate of 15% increasing 6 billion compared to 2005; per capita income reached 6.1 million / year, the rate of population growth of 0.9 %;
The economic growth rate of Minh Chau was 15% with total revenue of 35.409 billion, gaining 90.37% of the plan; the average income per capita 7.868 million/year, the rate of natural population growth 1.36%;

Yen Phu had the total income in 2006 of 80.984 billion, the economic growth 14.5%;

Viet Cuong commune had the economic growth rate of 8-9%, the total social product GDP of 15.4 billion, 22 poor households remaining.

Agricultural production: Tan Viet commune has a total area of 304 hectares for the cultivation of rice with productivity of 12 tons / ha, total food production of the year 3,648 tons, Yen Phu had a total cultivated area of 552 hectares (39 hectares of gardens), 199 ha of fruit trees, crops of all kinds 539 ha, the income from farming reached 27.55 billion; Ly Thuong Kiet commune had a total cultivated area of 1960 ha, annual rice productivity of rice 12.5 tons per ha, the total rice output reached 4,500 tons, bringing the value of agriculture of 32 billion, etc.

Breeding: Tan Viet commune had 171 buffaloes and cows; pigs: 2,500 and poultry: 240,500; Viet Cuong commune: 152 cows, 4700 pigs; Hoang Long commune: 220 buffaloes and cows; 2700 pigs, 8801 poultry; Ly Thuong Kiet had 5055 pigs, 186 buffaloes and cows, etc.

Aquaculture was quite developed. Tan Viet commune had 14 ha of aquaculture,

estimated output of 28 tons and value of fishery production of VND 280 million; Ly Thuong Kiet commune apart from the shifting project, still remained some small and medium farms with the model of VAC bringing revenue in 2006 of VND 5.5 billion; Yen Phu has expanded the area of aquaculture with an area of 19 ha increasing 2.5 ha over the same period, revenue reached VND 13.1 billion, etc..

Handicrafts: the main handicrafts are clothing, carpentry, masonry, interior decoration, furniture which are largely private. Estimated income from handicrafts in Tan Viet was 4 billion; Hoang Long Commune VND 5 billion; Ly Thuong Kiet VND 10.5 billion; Viet Cuong commune VND 770 million, etc.

Education and health: the education and health across the district were more concerned, there were no students dropping out, 100% of children had primary school at the right age. Regarding health, despite many difficulties, the communal clinic managed vaccination for 100% of children.

2.2.2.3. An Thi district

An Thi district has An Thi town and 20 communes with the area of 128.22 km2, population of 130.701 thousand, 67.698 thousand women, population density 10.19 people/km2. The rate of natural increase was 12.49 ‰. Van Du commune is cut through by the project line.

Agriculture: Van Du commune had the rate of economic growth in 2006 reached 10.3% increased by 0.3% over the same period, rice productivity 12 tons / ha; total paddy output 4600 tons; total income of cultivation reached VND138,000 million.

Livestock: Total poultry reached nearly 60,000

Fisheries: The total aquaculture area reached approximately 16 ha with a total output estimated at 17 tons.

Education, health, and culture

Socialization in education continued to be maintained; facilities are gradually improved, generalization of primary school education reached 100%. Health: Epidemic was controlled, examination and treatment for 4641 people, six health care programs implemented for the people.

2.2.3. The socio-economic status of the project area in Hai Duong

2.2.3.1. Binh Giang district

Binh Giang district has 17 communes and 1 town with an area of 104.7 km2; average population of 105,470; population density 1,007 people/km2. The Hanoi - Hai Phong Highway goes through 4 communes: Thai Duong, Thai Hoa, Thai Hoc,

Co Bi.

Agriculture: Thai Duong commune had 417 hectares for cultivation, an area of 60ha of winter crops, food production of 5342 tons. The total value of agricultural production was 16,727 million; total cultivated area in the year of Thai Hoa was 1089.2 ha; total food production output of the year 5718.3 tons, production value reached 18.777 billion, increased by 4% compared to 2005. In Co Bi commune, agricultural production met some difficulties due to the rats, brown hoppers at the end of the year affecting seriously the productivity of rice in 2006. The total value of agriculture reached VND 22.523 billion, etc.

Breeding: Thanks to the timely vaccination, there was no disease of cattle and poultry in the district. Thai Duong Commune: 3200 poultry, 250 buffaloes and cows, 1800 pigs; Thai Hoa Commune: cattle - 237, pigs - 2702, poultry - 31.5 thousand; Thai Hoc: cattle - 52, pigs - 4972, poultry; Co Bi commune: 45,000 poultry, pigs 5300, and 400 buffaloes and cows, etc.

Fisheries: Thai Hoc had many households taking advantage of the water ponds and the area shifted to aquaculture with 36 ha in 2006 reached 204.12 tons of fish of all kinds. In Co Bi commune, the fisheries was enhanced to have high fish productivity, the output estimated of 320 tons/80ha,

Industry: In the recent year, the activities in the fields of handicraft of Thai Duong commune had regular development to meet the needs of people and gained VND4037 million; Thai Hoc commune often concerned and support people with loans, receiving projects, poverty alleviation with preferential interest rates to boost economic development and industries such as mechanics, electronics repair, civil electricity, services, business, husking, etc. Within the town there were 1152 households with over 1,700 employees working in handicraft industries, services, business, and trade, etc.

Education, health, and culture

Education quality had been paid more attention by authorities at all levels as well as community, which resulted in the improvement of education quality. The promotion of education and talents as well as socialization of education is better. The percentage of students going to colleges and universities increased.

Health: communal clinics had well executed communications for family planning and prevention of diseases in the whole district. 100% of children were vaccinated.

2.2.3.2. Gia Loc district

There are 24 communes and 1 town with an area of 122.2 km2, average population

of 150,800, population density 1,234 people/km2. The district has the following communes cut through: Yet Kieu commune, Phuong Hung commune, Gia Loc town, Gia Khanh and Hoang Dieu commune

Agriculture: Gia Khanh had food crops area of 585 hectares, reaching 118% of the plan year, the rice area 502 hectares, industrial crops 17 hectares, 139 hectares of food crops, grains and other annual crops 32.5 ha, etc. Total food production: 3245 tons, production value of cultivation reached 15,589 million, achieving 99% of the plan for the year, equivalent to 101% of 2005; Yet Kieu Commune with total natural area of 441 ha, of which area of rice 264 ha, perennial trees 26.7 ha, industrial crops 0.5 ha, crops 62 hectares. Productivity of the year reached 125.2 quintals / ha, the output was 3243 tons, increased by 0.3% compared with that of 2005. The value of agricultural production reached VND10,101.800 million. For Gia Loc town, the area cultivated was 636.3 ha, the total food output 3167 tons, of which rice output 3160 hectares; production value of cultivation reached 6616 million. Phuong Hung commune had a total area of 147.4 ha of agricultural land, cultivated area 122.8 ha, 292.5 ha for planting, total food output 1415.6 tons; agricultural production value reached VND 9693 million.

Livestock: mainly cattle and poultry. Gia Khanh commune had a total of 7385 pigs; cattle 356; poultry 32,150. Phuong Hung commune: cows and calves 71, buffaloes and buffalo calves 3; pigs 1749. Total meat output reached 279.6 tons. Gia Loc Town had 4495 pigs, 48 buffaloes and cows and 39,500 poultry.

Fisheries: In Yet Kieu Commune, the movement of fish farming had been maintained and developed, the area converted to ponds 55.51 ha, with productivity 5200-5500 kg / ha. Fish production reached 303 tons, with a value of 4 billion 448 million. Phuong Hung commune had a total area of 15.1 ha of fish breeding, production reached 72 tons, on average 101kg/person, fisheries value reached VND 3469 million. Fish farming area in Gia Khanh commune was 25.32 hectares; production estimated at 139.3 tons; fisheries value was VND 7053 million.

Industry: Yet Kieu commune had some traditional professions such as business and services. The number of handicraft households was maintained with 312 households, 632 people, and reached the value of VND 15,450 million. Rattan village in Cham hamlet of Phuong Hung commune still maintained and developed, mainly for goods markets in and outside the province, which attracted and gave jobs to many labors with stable income. The total value of production is 7030 million increased by 14.3% over 2005. In Gia Khanh commune, there were several production units with significantly increased value such as mechanical repair, welding, mounding, and electricity, etc. The Electric Service Cooperative had overcome difficulties and kept the electricity price stable, reduced power loss

compared to many years ago. Handicraft production value reached 5510 million. In Gia Loc Town, there were some industries developed such as repairs, mechanics, and carpentry, with handicraft value of VND41,363 million.

Education, health, and culture

The education of the communes in the district were more concerned, there were no students dropping out, 100% of children had primary school at the right age. Regarding health, despite many difficulties, the communal clinic managed vaccination for 100% of children.

2.2.3.3. Tu Ky district

There are Tu Ky Town and 27 communes. Average area of the district is 168.1 km2; population of 168,195 people; population density of 1.001 people/km2 (following the district Statistical Yearbook 2004). The rate of natural population increase had a descending trend: 8.67% in 2003 and 7.92% in 2004. The total number of labors in the district was 89,811 people (2004).

The line cuts through the area of Ngoc Ky, Dong Ky, and Tu Xuyen.

Agriculture: Tu Xuyen Commune has an area of 240 hectares, with 1400 tons of food production output, reaching 56% of the plan, average productivity 62ta/ha and bringing the total value of agricultural production VND5.98 billion. Dong Ky commune had rice area of 330 ha, average productivity 114 quintals per hectare, the value of agricultural production VND8585 million. Ngoc Ky has cultivated area per year of 338.62 ha, of which summer crop 162.81 ha with productivity 67 quintals / ha; winter crop 175.81 ha, productivity 55 quintals / ha), estimated reached VND14,733 million.

Breeding: Dong Ky commune had 39 buffaloes, 103 cows and goats, 2540 pigs and 14,530 poultry, estimated value of 2240 million VND, reached 92.5% plans. Ngoc Ky commune had 1500 pigs, 157 buffaloes and cows, estimated production value of VND 5540 million. Tu Xuyen commune had income from breeding of VND 2.4 billion with 55 buffaloes, 283 cows, 2100 pigs and 24,650 poultry.

Fisheries: Dong Ky commune had many households investing to build cages, ponds and lakes to promote livestock development of high economic value such as tortoise, unisexed Tilapia, and hybrid carp. The whole commune had 30.5 ha of aquaculture, production estimated 108 tons. Tu Xuyen commune had 25.27 hectares converted to pond area and 17.88 ha change in residential areas, bringing the total income of VND1.6 billion. Ngoc Ky commune had 24.76 hectares of aquaculture with production 4 tons / ha, bringing the production value of VND1800 million.

Industry: In 2006, Ngoc Ky commune strongly developed handicraft industries and

the private economic sectors, such as husking, welding, embroidery, carpentry, etc. which had put the income of 1100 million, increasing 37% compared with the plan. Industry – handicrafts and construction in the commune of Tu Xuyen had relatively fast growth, but focus mainly in the scale of households. It was difficult for business types to form and develop. Business was still in a state of spontaneous with low quality of products. The value of industry - – handicrafts and construction for the first 6 months reached VND1.8 billion, reaching 49% of the plan. In general, the handicrafts in Dong Ky commune still had slow development, with low income and difficult to meet the requirements of the economic development today.

Education, health, and culture

Education in the communes of the district continued to grow. The socialization of education is promoted. The encouragement of education and talents was enhanced into residential areas, social organizations, which had significantly contributed to the training and development of human resources for the society.

Health: the communal clinics often maintain and execute medical examination and treatment for people, and in collaboration with other organizations in prevention of disease, environmental sanitation against diseases in humans and cattle and poultry.

2.2.3.4. Thanh Ha district

Thanh Ha district: There are 24 communes and 1 town with area of 158.9 km^2, average population 162,042 people, and population density 1.020 people/km^2. The communes cut through by the project line: Thanh Hong, Thanh Cuong, and Vinh Lap.

Agriculture: Thanh Cuong commune had a total area of 130 ha, reached 100% of the plan, productivity 9.1 tons to 10 tons / ha, output reached 1193 tons. Fruit tree area: 241.7 hectares, output estimated 100-150 tons, agricultural production value reached 4.1 billion VND. Thanh Hong commune had a total cultivated area 571.5 ha, of which rice 119.5 ha, productivity 110 quintals per hectare, total food production 1364.5 tons, area of sedge 50 ha, productivity 110 quintals per hectare, output 550 tons; jute area: 9.58 ha, productivity 40 quintals / ha, output 38.3 tons. Total cultivation income VND12,968.9 million. Vinh Lap commune in 2006 the rice productivity reached 107 quintals / ha, decreased by 300 kg / ha compared to 2005. Total food production equivalent to paddy reached 1958 tons. The total value of agricultural production reached VND 10,796 million.

Breeding: Thanh Cuong commune in 2006 had 4540 pigs, 11 cattle, 30,000 poultry; production value estimated VND 1.2 billion. Thanh Hong commune had 6600 pigs, 220 buffaloes and cows, 50,000 poultry, total breeding income VND 7493 million.

Vinh Lap commune had 120 buffaloes, 190 cows, 650 pigs, and 25,000 poultry.

Fisheries: Vinh Lap commune had the surface area of aquaculture 23.7 ha, including: fish, shrimp and other aquatic products with the aquatic production value of VND 660 million. Thanh Cuong commune had 29 hectares of aquaculture, output estimated from 46-48 tons, value estimated at VND 0.8 billion.

Industry: Vinh Lap commune had the value of handicrafts - construction of VND 2158 million, increased by VND 1042 million, equivalent to 29.19% over 2005. Thanh Hong commune handicraft reached VND 3729 million, achieving 124.5% compared to the plan, increasing 32.6% compared to 2005.

Education, health, and culture

Although there are still many difficulties in facilities, the teaching and learning of the three levels had achieved the requirements set forth. Vinh Lap commune in academic year 2005 - 2006, high school graduation rate reached 96.7%. In Thanh Hong commune, the schools had implemented the plan of 2006 - 2007, socialization of education and effective community learning centers.

Health: the communal clinic often maintain and execute medical examination and treatment for people, and in collaboration with other organizations in prevention of diseases, environmental sanitation against diseases in human, especially aged people.

2.2.4. The socio-economic status of the project area in Hai Phong

2.2.4.1. An Lao district

An Lao district: Has 1 town and 16 communes with an area of 114.9 km2, population of 123,255 people, population density of 1.027 people/km2 (2004). The rate of natural population growth of the district increasing by the year: 2000: 0.75%, 2003: 0.75%, 2004: 0.79%. Total number of people in of working ages: capable: 71,857 people, lost working capacity: 2662 persons (2004).

The project line cut through the territory of: Quoc Tuan, Quang Trung, My Duc, and An Thai commune.

Agriculture: My Duc commune had 487 ha of rice, productivity reached 104.5 quintals / ha, 100 hectares of vegetables and crops, mainly peanuts, potatoes, sweet potatoes, vegetables and melons of all types, estimated farming income reached VND 15.5 billion. An Thai had a total area of cultivation 626 ha, average productivity of 55.8 quintals / ha; 55ha of vegetables n crops, 9 ha of industrial crops such as tobacco, 8 ha peanuts, 7 ha soybeans. Quoc Tuan commune had a total area of cultivation 926 ha, average productivity 110.45 quintals / ha, vegetables area 8.57 ha.

Breeding: Quoc Tuan Commune had 4912 pigs, increased over the same period by

14.6%, buffaloes - 154, cows 45, poultry 32,578 increased 34.4% over the same period. My Duc commune had 5700 pigs, buffaloes - 118, cows - 140 and poultry - 52,000, estimated revenue from the livestock sector reached VND 12.5 billion. An Thai commune had 4500 pigs, buffaloes - 115, cows and goats - 45.

Fisheries: Quoc Tuan commune had a total area of aquaculture 32 ha, productivity 70.5 tons, decreased 6% over the same period last year, mainly farming area of freshwater fish. My Duc commune had 70 ha of aquaculture, estimated production reached 180 tons. Quang Trung Commune had 18.85 hectares of aquaculture with total production 80 tons. An Thai commune had 35 ha of aquaculture, reaching 100.5% of the plan, equal with the same period in 2005, production estimated 150 tons.

Industry: These are mainly agricultural communes far from business center. There are no enterprises in the area. The services are autarky and only for the local people's lives such as carpentry, noodles, clothing, husking and repairing, etc. Particularly An Thai commune had 2 companies of leather shoes in Thach Luu village, attracting nearly 300 local workers.

- Education, health, culture

Education: 100% of the communes has been recognized to eliminate illiteracy and generalize primary school education.

Health: The communes generally implemented successfully national health programs, expand immunization, food safety and hygiene, medical treatment was paid proper concern.

2.2.4.2. Kien Thuy district

Kien Thuy district have Nui Doi town and 24 communes with natural area of 165.80 km^2, including 46,892 households, population is 177,739 people (women: 91,731); population density 1072 nguoi/ km^2 (in 2004). The rate of population growth of the district in 2003: 0.78%, 2004: 0.84%.

The number of people at working age is 89,224, including 88,852 people capable of working and 372 incapable.

The communes have roads cutting through: Huu Bang, Nghia Hoa, Dai Dong. The socio-economic characteristics are as follows (Table 2.27):

Table 2.27: Socio-economic norms of the communes

Norms	Huu Bang Commune	Quang Trung Commune	Hoa Nghia Commune

Natural area (ha)	665,56	667,29	650,63
Total income of the year (million VND)	67880	28918	
Economic growth rate (%)	11,6		
Per capita income (million VND/person/year)	9,1	3,6	
Population (people)	7560		
Natural population growth rate (%)	0,96		
Value of agricultural production (million VND/ha)	47,6		
Rice area (ha)	388,2	304,4	1140
Rice productivity (quintals/ha)	118,84/ha	114	95
Aquaculture area (ha)	39	17	85,6
Productivity (quintals/ha); output (tons)	32; 120	80	250
Total state income (million VND)	2.497,05	1.659,484	3.141,674
Total state spending (million VND)	2.497,05	1.659,489	3.141,374
Primary school (school/teachers/students)	1/35/513	1/26/524	
Lower Secondary School (school/teachers/students)	1/30/573	1/29/448	

Source: Socio-economic report 2006 of Huu Bang, Hoa Nghia, and Quang Trung.

- Agriculture: these are the 3 agricultural communes; agriculture is the main production (the area of agricultural land taking 65.70% of natural land area). Rice productivity of the year reached 95-118.84 quintals / ha, the rice output 3690-4614 tons.
- Breeding: this is the general strength of the agricultural communes; number of pigs from 4700 - 5708 increased on average by 10.8% compared to 2005, the rate of vaccination was 50%. The poultry though affected by the poultry flu re-outbreak, still the number of poultry has increased (from 21000-77423). Nghia Hoa has the highest number of 77,423, with an average increase of 5% compared to 2005.
- Aquaculture: this is not the strength of three communes, however the area of aquaculture has increased on average 8% / year, the average yield reached 32quintal/ha, bringing substantial revenues to farmers
- Industry: Mainly agricultural commune far from center and without any enterprises in the area, the services are autarkic for people's lives in the commune such as carpentry, noodles, clothing, grinding, repairing, etc.
- Education: Every commune in the district has a nursery school, a primary school, a lower secondary school; the teachers are constantly trained and improved; the quality of learning and teaching enhanced; 100% children

level up and graduated. However, there are still children dropping school, typically in Huu Bang commune with 7 secondary school students (making 0.87%)

- Health and culture: All communes have a communal clinic and have executed national health program such as health care for mothers and children, expanded vaccination, medical examination and treatment, enough vaccination for children, cooperation with veterinary to spray for poultry epidemic prevention and general prevention during epidemic period, successful implementation of the inspection of food hygiene and safety in the area of the communes.

2.2.4.3. Hai An District

Trang Cat ward of Hai An district in 2006 achieved VND 40.3 billionof socio-economic value, equal to 99.3% of its plan for the year, and increased by 12% compared to the plan of 2005. Especially, it had a total of 217 hectares of cultivated land for agricultural production with 190 hectares for rice planting, yielding 66 quintals / hectare on average and total output of 1,254 tons of paddy, gaining an estimated turnover of 3.1 billion VND, reaching 76% of the plan for the year; 28 hectares for vegetable production, yielding an estimated value of VND 1.8 billion, reaching 90% of the plan. With regard to breeding: the whole ward had 125 cows, 17 buffaloes and 2600 pigs, 30,000 poultry in total, including ducks, chicken, geese…, which brought about the total value of VND 4.1 billion, reaching 102. 5% of the yearly plan.

Regarding aquaculture and fishery, in 2006 the Ward gained VND 24.8 billion in value, achieving 103% of the yearly plan. Out of it, fishing and maritime production gained VND 3.8 billion, fresh seafood VND 1.5 billion, gracilaria VND 7 billion (8 tons), and shrimp, crabs, freshwater fish VND 12.5 billion. Trade, services and handicraft industry gained VND 6.5 billion.

Regarding education: all schools have well completed the education programs; teachers have a strong professional qualification, and education quality has been improved.

Public health stations in the Ward always well maintained the business of examination and treatment for patients and did vaccinated 100% children in vaccinated age and pregnant women. Besides, they performed well the inspection of food safety hygiene, the propaganda campaign of disease and epidemic prevention to avoid the break-up of the diseases within whole locality.

2.2.5. Current traffic status at the traffic intersections

Hanoi - Hai Phong Highway is designed according to standards of highways type A. On the whole route, there are 7 united traffic intersections of VD3, QL39, QL38B, QL10, TL353, Tan Vu, Dinh Vu; and the remaining ones are direct intersections.

Status of traffic intersections on the whole line is as follows:

- The Ring Road III at Section of Nam Thanh Tri - Sai Dong has 4 lanes; the first phase has width Bn = 25m, and phase 2 Bn = 50m.
- Provincial Road (PR) No.179 has subbase width of 6.5 m and surface width of 5m
- PR207B has subbase width of 5.5m, and surface width of 3.5 m, road surface structure is asphalt and stone. Road standard is of delta level IV.
- PR207C has subbase width of 5.5m, and surface width of 3.5 m, road surface structure is asphalt and stone. Road standard is of delta level IV.
- PR206 has subbase width of 7.5m, and surface width of 5.5 m, asphalt road. Road standard is of delta level III.
- PR199 has subbase width of 5.5m, and surface width of 3.5 m, aggregate road. Road standard is of delta level IV.
- The national road (NR)39, at section of Hung Yen, is of delta level IV with subbase width of 6-6,9 m, and surface width of 8-9 m, road surface structure is asphalt road
- PR200 is of delta level III with subbase width of 7.5 m, and surface width of 5.5 m, road surface structure is aggregate and asphalt stone.
- NR38 at section in Hai Duong province is of delta level III with subbase width of 3.5 m, and surface width of 6.5-7.5 m, road surface structure is asphalt stone.
- PR20 is of delta level III with subbase width of 7.5 m, and surface width of 5.5 m, asphalt road.
- NR38B has some bad sections, while the demand of traveling for economy - culture - tourism development has increased strongly. Currently NR38B was put to the list of upgraded road for level III road improvement with (subbase of 12m, surface of 11m) through the Project WB4 with loans from World Bank (it is same grade project of improving road network);

- PR17A is of delta level III road with subbase width of 7.5 m, and surface width of 5.5 m, road surface structure is asphalt.
- PR191 is of delta level III road with subbase width of 7.5 m, and surface width of 5.5 m, asphalt road;
- PR190B is of delta level III road with subbase width of 7.5 m, and surface width of 5.5 m, asphalt road, and ballast.
- NR10, at the section of Hai Phong, is of delta level III road with subbase width of 11.0 m, and surface width of 12 m, asphalt concrete road.
- Road 306 is of delta level IV road with subbase width of 5-7 m, and surface width of 3-5 m, asphalt road.
- Road302 is of delta level III road with subbase width of 12 m, and surface width of 9 m, asphalt road.
- Road354 is of delta level III road with subbase width of 7.5-9m, and surface width of 5.5-7m, road surface structure is asphalt.
- PR210 (401) has subbase width of 6.5-9m, and surface width of 3.5- 8m, asphalt road; which meets the standard of delta level III road.
- PR353 has subbase width of 36m, and surface width of 30m, asphalt road.

CHAPTER 3. ASSESSMENT OF ENVIRONMENT IMPACT

3.1. SOURCES OF IMPACTS

In general, the impacts on environment originate from the operations during the development of the Project. The development of the Project is divided into three major stages, namely:

- Pre-execution (pre-construction);
- Execution (construction);
- Operation.

The impacts from the Project vary in different stages. The vast majority of considerable impacts take place in the execution stage, however, these impacts will occur in a short time. As a rule, the impacts in the execution stage may be reduced if the proper solutions are worked out and observed. Potential impacts in the pre-execution stage of the Project mainly include the impacts on social aspects as a result of land acquisition and involuntary relocation and resettlement matters. The impacts which results from the operation stage are not very serious but they will occur for a long term..

3.2. IMPACTS OF THE PROJECT IN THE PRE-EXECUTION STAGE

3.2.1. Impacts resulted from acquisition of residential land, involuntary relocation and ressetlement

Aim of the Project is to minimize the encroachment to the residential land and historic and cultural monuments such as pagodas, shrines, etc. The total households to be resettled is about 900, the total housing land area to be permanently appropriated is 54,015 m^2 (Table 3.1, 3.2, 3.3, 3.4, 3.5), which mainly occurs in the residential areas of Gia Lam district, Hanoi city; Van Giang, Yen My, An Thi districts of Hung Yen province; Gia loc, Tu Ky of Hai Duong; An Lao, Kien Thuy, Hai An districts of Hai Phong city. The households to be relocated will face several difficulties for a time, spend their money on construction of new houses and make acquainted with the new locations. Those households who are running business at the residential land will seek for suitable locations in conformity with their business lines. They may also face difficulties in looking for new jobs as appropriate in the new residential areas. In general, the daily lives of the households to be relocated will be disordered, their spychology is puzzled; their income may be reduced, event may be lost, etc. However, these impacts may be reduced in the event of the communities and local authorities' attention to facilitate such households to carry

out their instant production and seeking for suitable jobs.

Several reasonable adjustments have been made to reduce the acquisition of residential land under the Hanoi-Haiphong Expressway, however, the total area of land to be acquired along the route as a whole is large. The acquisition of residential land always results in the resettlement of the local people, migration of the livestock, etc. The main impacts will include:

- Disturbance of the residence habits of the indigenous people.
- Destruction of the scenery created by the local people.
- Change of living and working conditions of the population on both sides of the Expressway.
- Change of the conditions for exchange among communities, etc.

1) The section across the Hanoi city

The Hanoi - Haiphong Expressway crosses the Hanoi city within a length of 6 km. It crosses mainly dry crop cultivation areas of: Thach Ban ward (Long Bien district), Da Ton, Kieu Ky communes (Gia Lam district), and the area adjacent to Hung Yen province. It also crosses the Bao Dap population area in which there exists a relatively high population density in the territory of Hanoi city. There will be strong impacts by the acquisition of residential land and involuntary resettlement of households in Kieu Ky commune. The quantities of properties to be removed and land to be acquired in the territory of Hanoi are as follows::

Table 3.1. **Quantities of residential land to be acquired and residential houses to be removed in Hanoi city**

No.	Items	Unit	Quantity
1	Three-story houses (m^2)	m^2	100
2	Two-story houses (m^2)	m^2	150
3	Flat roof houses (m^2)	m^2	288
4	Tile-roof houses (m^2)	m^2	1,260
5	Temporary galvanized steel- roof, houses (m^2)	m^2	0
6	Residential land (m^2)	m^2	35

Source: HECO - 2007

2) The section across Hung Yen province

The Hanoi-Haiphong expressway crosses Hung Yen province within a length of 26.8 km. It crosses the territories of Van Giang, Yen My and An Thi districts. It crosses mainly the rice fields and dry crop land, some of its sections cross sparse population areas, consisting mainly of temporary houses and 4th class houses. The main quantities of houses to be removed and land to be acquired are as follows

Table 3.2. Quantities of land acquisition in the section across Hung Yen province

No.	Items	HungYen		
		Van Giang	Yen My	An Thi
1	Three-stories houses (m^2)	0	420	0
2	Two-stories houses (m^2)	240	200	120
3	Flat roof houses (m^2)	168	440	625
4	Tile-roof houses (m^2)	1,330	1,088	4,814
5	Temporary galvanized steel- roof, houses (m^2)	0	0	336
6	Residential land (m^2)	24,308	2,148	0

Source: HECO - 2007

3) The section across Hai Duong province

The Hanoi-Haiphong Expressway goes through Hai Duong province within a length of 40.2 km. It crosses mainly dry crop, fruit tree growing land areas of Binh Giang, Gia loc, Tu Ky, Thanh Ha districts; some sections will cross the marginal parts of villages, but the number of houses to be removed is inconsiderable. Within the territory of Hai Duong province, the largest residential land area acquired under the Project will be that of Tu Xuyen commune, Tu Ky district.

The main quantities of houses to be removed and land to be acquired are as follows:

Table 3.3. Quantities of houses to be removed and land to be acquired in the section crossing Hai Duong province

No.	Items	Hai Duong			
		Binh Giang			Binh Giang
1	Three-story houses (m^2)	0	0	0	0

2	Two-story houses (m^2)	223	0	220	103
3	Flat roof houses (m^2)	620	0	623	3,758
4	Tile-roof houses (m^2)	3,384	197	520	3,457
5	Temporary galvanized steel- roof, houses (m^2)	0	0	130	2,165
6	Residential land (m^2)	0	0	0	25,350

Source: HECO - 2007

4) The section across Hai Phong city (32.65 km)

The section goes through Hai Phong city, two options of alignment have been researched by the Consultant:

Option 1 (for comparision): the alignment conforms to the pre-feasibility study, i.e the Expressway goes through Cot Co mountain root, crossing the residential areas of Kien An and Kien Thuy districts and then goes along the planned road of Hai An district. Under this Option, the quantities of land acquisition will be very considerable given a fact that the population density is quite crowded. In addition, most of land area has been acquired for industrial parks along the PR355. Quantities of land acquisition under Option 1 are as follows:

Table 3.4. Quantities of residential land to be acquired and houses to be removed in the section passing through Hanoi city under Option 1

No.	Items	Unit	Area
1	Residential land	Ha	15.84
2	Houses	m^2	98,238

Source: HECO - 2007

Option 2 (proposed Option): The route is proposed by the People's Committee of Hai Phong city in official letter No. 2712/UBND-GT. It is directed to the south of Da Do river, through the territory of An Lao, Kien Thuy, Hai An districts. The volume of land acquision from houses and other structures of Option 2 is much lower than that of Option 1. The main quantities of houses to be removed and land to be acquired of Option 2 are as follows:

Table 3.5. Quantities of houses to be removed and land to be acquired in the section across Hai Phong city under Option 2

No.	Items	Haiphong		
		An Lao	Kien Thuy	Hai An
1	Three-story houses (m^2)	0	0	0
2	Two-story houses (m^2)	1,484	2,433	1,477
3	Flat roof houses (m^2)	2,321	226	0
4	Tile-roof houses (m^2)	8,175	8,142	2,778
5	Temporary Galvanized steel- roof, houses (m^2)	0	0	0
6	Residential land (m^2)	25,171	130,798	71,514

Source: HECO - 2007

The total number of households to be resettled is about 900, the total area of housing land to be permanently acquired is 54,015 m^2. This impact on the people within the area affected by the Project is very great. Especially for the household living on trade and production in their residential land area, when they are resettled it will be very difficult for them to find a new place to run their business as appropriate. They almost have no income in such period.

It can be seen that the impacts of land acquisition and resettlement under the Project will be very great. The reasonable compensation policies for resettlement must be observed to minimize impacts as such.

3.2.2. Impacts on agricultural economy

The Hanoi - Haiphong Expressway goes through 4 cities and provinces in the Red river delta. In this area, the population density is relatively high. In the area, other than the agricultural land area, there is no more waste land. Land is used to the maximum for settlement, cultivation and animal husbandry.

The aim of the Project is to minimize the encroachment to the residential land and historic and cultural monuments such as pagodas, shrines, etc. Therefore, the route is designed to mainly pass through agricultural land area. Given the width of carriageway of 35m, the land area to be acquired in the whole route of over 100km is very considerable. The agricultural land area to be acquired is shown in **Error! Reference source not found.**

Error! Reference source not found.: The agricultural land area to be acquired under the Project

No.		Rice field	Fruit trees growing land	Number of timber trees	Number of fruit trees
		m^2	m^2	Tree	Tree
Hanoi		571,029	107,467	0	15,006
	Van Giang	659,357	0	1,860	2,740
	Yen My	686,833	31,866	175	3,600
Hung Yen	An Thi	796,038	3,200	161	300
	Binh Giang	1,350,790	1,360	107	47825
	Gia Loc	846,958	50,613	27	49,190
	Tu Ky	780,512	14,487	457	500
Hai Duong	Thanh Ha	565,013	515,760	2,595	45,207
	An Lao	1,207,911	30,020	376	496
	Kien Thuy	1,032,331	90,822	355	1,675
Hai Phong	Hai An	444,400	126,709	0	0

Source: HECO - 2007

The whole Project will acquire 10,145,388 m^2 of agricultural land and water-filled land, equivalent to about 70% of the total land area acquired. Thus many farming households will be deprived of rice fields or ponds used for agricultural production, this means they will loose forever their land for cultivation and aquaculture, this also means that they will be deprived of their traditional profession and their income will be seriously affected. Thus the people will have to look for a new profession to earn the income to feed their family. As a result, due attention to vocational guidance and professional training for the households who loose 100 % of their land should be paid to.

In Trang Cat ward, Hai An district, Hai Phong city, 03km of the route is designed to pass through the shrimp cultivating lakes and the land area to be acquired thereof is 19.5ha. In addition to the impact on acquisition of cultivation land during the execution of the Works, the impacts on surface water environment may occur, thus causing bad effect to the shrimp cultivating land area along two sides of the Expressway in the event of falure to observe the proper minimizing measures.

The area of agricultural land to be acquired by the Project is 8,941,172 m^2 (89,412 ha) mainly used for rice cultivation, with average rice yield in the area reaching 11,884 tons/ha/year (according to the socio-economic report of communes in 2006 and statistical yearbooks of districts in 2006), the annual decrease of rice equivalent product due to the land acquisition of the Project is about 89,412 ha x 11.884 tons/ha/year = 1,062.6 tons.

With the average rice price of 3,200 VND/kg according to the price tariff of the Ministry of Agriculture and Rural Development (MARD), the annual loss will be about VND3,400 million. This is a quite big amount of money for the farmer households, as most of them have low income. If comparing this amount to the benefits that the Expressway will bring, the loss thereof can be considered as insignificant. However, the impacts on the humanitarian environment will be significant, as the people here live mainly on agriculture. Many farmer households have not been prepared for changing their way of production, they are not trained and not provided with the opportunity to get suitable job and they will have no means for living when they loose their land, specially those in Long Bien, Gia lam, Van Giang, districts and other districts of Hai Phong city as the land budgets of these districts have become limited. There must be a special policy of creating jobs and professional training for the people especially for young people in these districts.

The Project will acquire 1,038,638 m^2 (approximately 10.39 ha) of orchard land and 172,689 fruit trees and timber trees must be cut down, of which mainly are fruit trees (166,539 trees). Thus, the farmers will deprive of a considerable income for their families. The loss will be greatest in Thanh Ha district, Hai Duong province as here most of rice cultivation land has been converted to litchi growing land (the land area acquired by the Project will be 515,760 m^2, with 47,028 fruit trees and timber trees). However the local people and local authorities were consulted, 100 % of consented with the Project and wished that the Project would be soon implemented.

Obviously, the impacts on the agriculture will be considerable, therefore policies must be adopted to compensate for the farmer households as reasonable, with

special attention to areas of Hanoi, Van Giang - Hung Yen, Hai Phong where the land budget for agriculture is very limited.

3.2.3. Impacts on the public infrastructure

In a general view, the Project will bring many social benefits, especially for the strategy of economic development in the Northern region and in the national scale. In local, village scale the Project will also bring many benefits in terms of economic development. However, in the village scale, the Project will also exert many negative impacts such as:

- Breaking of the land use plan of the locality, dissection of the land of villages and commune. The Expressway will be a boundary dividing the population clusters crossed by it.
- Impact on and breaking of irrigation systems, in particular blocking the flow of canals and filling of lakes and ponds, relocation of irrigation and drainage pumping stations. Through the whole route, only one pumping station in Tu Ky district, Hai Duong province is relocated.
- The Expressway will become a rigid boundary obstructing the communication between schools, health stations and population clusters, etc in the event of failure to work out proper preventive measures.

The above factors will break the land use plans of the localities and will be great impacts on the socio-economic development of the communes.

At Station Km4+300, the Expressway goes through the southwest of Kieu Ky Rubbish dump of Gia Lam district, occupying a part of deposit reservoir and bio-lake with a length of 180m thereof and an area of approx 1ha. The passage of the Expressway thereon causes impact on post-processing drainage system for the Rubbish dump to Cau Bay river. During the execution stage, the impact on operation of the Rubbish dump may occur. Proper measures must be worked out to minimize such impact.

The Project will take away a large number of public facilities such as electrical poles, pumping stations, canals, etc., the quantities thereof are presented in Table 8. These impacts will affect greatly the transport, production and economic development of the people within the Project area during the construction process.

Table 3.6: Quantities of public facilities to be relocated

No	Items	Unit	Hanoi	Hung Yen	Hai Duong	Hai Phong

1	High voltage electric poles	Pole	0	11	12	11
2	Medium voltage electric poles	Pole	10	21	0	0
3	Low voltage electric poles	Pole	10	20	74	188
4	Telephone poles	Pole	0	1	19	20
5	Pump stations	Station	0	0	1	0
6	Transformer stations	Station	0	0	1	1
7	Earth canals	M	0	0	385	25,000
8	Lined canals	M	0	0	3,312	8,625
9	Petrol stations	Station	0	0	0	1
10	River	m^2	0	0	10,000	20,000

Source: HECO – 2007

Thus, the impacts due to the land acquisition will affect some sectors such as: agriculture, forestry, telecommunication, fuel supply, water supply and transport. These impacts will affect greatly the living and working habits of the people during the process of construction. However, these impacts can be settled by taking mitigation measures as stated in the next chapter.

3.2.4. Impacts on cultural and spiritual values

The Hanoi-Haiphong expressway Project will not affect any pagoda or temples. For the purpose of the Project implementation, 633 masonry tombs and 64 earth tombs must be relocated. Details are presented in the following table (Table 3.7).

Table 3.7: Number of graves to be relocated

Province	Districts	Number of soil tombs	Number of masonry tombs
Hung Yen	Yen My	0	12
	An Thi	6	83
Hai Duong	Binh Giang	3	54
	Gia Loc	5	151
	Tu Ky	0	38

	Thanh Ha	31	56
Hai Phong	An Lao	19	136
	Trang An	0	0
	Kien Thuy	0	103

Source: HECO – 2007

The relocation of graves to new places will be very complicated and costly. The cost of relocation not only include the cost of digging, transportation and building new tombs, but also the cost of offering and awaiting of the right date for burying ceremony depending on the spiritual life of each locality. The relocation of such graves without attention to this matter and compensation not in accordance with the actual situation, will cause not only social impacts but also conflicts between the affected people and the civil constructors, even extend the time of land acquisition.

The land acquisition needs harmonious coordination of various agencies, especially the Fatherland fronts of communes and wards. Persuasion must be in the first place.

3.2.5. Impacts on the change of land price

The creation of the Expressway will make contribution to the improvement of the traffic and transport and in the future urban areas and industrial zones will be formed along the Expressway. Many people will desire to build their houses along the road sides for running business. Thus, land on the two sides of the Expressway will be inter-transferred, which makes the land price increase. Within the Hanoi-Haiphong Expressway route, the land price will change drastically in the areas where there are other roads intersecting with the Expressway, such as the area of Thach Ban ward (Long Bien district), Da Ton commune (Gia Lam district), Gia Loc township (Hai Duong province), An Lao, Hai An districts (Hai Phong) which are very sensitive to the urbanization process.

In addition, prices for compensation of land and houses, etc in various provinces and cities are different from one another thus causing unsatisfaction to the affected people with several arisen problems. As a result, the land acquisition and progress may be delayed. Proper solutions must be worked out for this matter.

3.2.6. Impacts on the biodiversity and bio-resources

For the purpose of the Project implementation, 172,698 trees must be felled, including 166,539 fruit trees and 6,150 timber trees. Besides the impacts on the economy as above mentioned, the felling of trees will also have adverse impacts on

the biodiversity and bio-resources of the localities.

As the Project area mainly covers agricultural ecosystem, with low biodiversity coefficient, therefore the impacts of the Project on the natural ecosystem will be inconsiderable.

3.3. IMPACTS OF THE PROJECT IN THE CONSTRUCTION STAGE

The impacts of the Project in the construction stage can be divided into 5 categories as follows:

- Transportation and assembling of construction materials such as sand, stone, gravel from the quarries;
- Embankment filling. As the Expressway requires avoidance of invasion from the road sides into the roadway, the embankment of the Expressway must be built with the minimum height of 3m. The total volume of soil to be supplied for such embankment for 105 km of the Expressway will be very large;
- Construction of service facilities (two service facilities are Projected, each will consist of a supermarket, a toilet and a petrol station);
- Installation of control facilities for the operation of the Expressway;
- According to the results of detailed survey on the Site, the impact levels of the Project in relation to the execution of the Works are shown in following table (Table 3.8).

Table 3.8. Summary of impacts in the construction stage

Intersection	General features	Society						Natural environment						Types of pollution			
		1. Settlement 2. Economic activities 3. Traffic//material facilities for daily life 4. Community separation. 5. Historical relics 6. Water 7. Sanity 8. Rubbish 9. Disaster 10. Traffic accidents						1. Geology 2. Soil erosion 3. Underground water 4. Water quality of river, lake 5. Fuana and flora system 6. Landscape						1. Air pollution 2. Water pollution 3. Noise and vibration		
			FRC	HTC		FRC	HTC		FRC	HTC		FRC	HTC		FRC	HTC
1	Intersection: Ring Road III at Km Km 0+00 Passing through: agricultural land. Neighbouring villages with farming and production at small scale. Quality of the local road: good. Areas to be urbanized.	1	C	B	6	C	C	1	C	C	6	C	B	1	B	B
		2	C	C	7	C	C	2	C	B				2	B	C
		3	C	C	8	B	B	3	C	C				3	B	B
		4	C	B	9	B	C	4	C	C						
		5	C	C	10	B	B	5	C	C						
2	Intersection: District road at Km 4+121	1	C	B	6	C	B	1	C	C	6	C	B	1	B	B
		2	C	C	7	C	C	2	C	B				2	B	B

Intersection	General features	Society						Natural environment						Types of pollution			
		1. Settlement 2. Economic activities 3. Traffic//material facilities for daily life 4. Community separation. 5. Historical relics 6. Water 7. Sanity 8. Rubbish 9. Disaster 10. Traffic accidents						1. Geology 2. Soil erosion 3. Underground water 4. Water quality of river, lake 5. Fuana and flora system 6. Landscape						1. Air pollution 2. Water pollution 3. Noise and vibration			
			FRC	HTC		FRC	HTC		FRC	HTC		FRC	HTC		FRC	HTC
	Agricultural land. From Hanoi to Haiphong, Kieu Ky Waste Processing Area is on the left side; kumquat garden area is on the right side	3	C	C	8	B	B	3	C	C				3	B	B
		4	C	B	9	B	C	4	C	B						
		5	C	C	10	B	B	5	C	C						
3	Intersection: PR179 - Km6+609.7 - Residential area of Cuu Cao commune. Passing through: agricultural land. Quality of the local road: good.	1	B	B	6	C	C	1	C	C	6	C	B	1	B	B
		2	C	C	7	C	C	2	C	B				2	B	B
		3	C	C	8	B	B	3	C	C				3	B	B
		4	B	B	9	B	C	4	C	C						
		5	C	C	10	B	B	5	C	C						
4	Intersection: PR 207B – Km8+321.25 – Flyover on	1	C	B	6	C	C	1	C	C	6	C	B	1	B	B

Intersection	General features	Society						Natural environment						Types of pollution			
		1. Settlement 2. Economic activities 3. Traffic//material facilities for daily life 4. Community separation. 5. Historical relics 6. Water 7. Sanity 8. Rubbish 9. Disaster 10. Traffic accidents						1. Geology 2. Soil erosion 3. Underground water 4. Water quality of river, lake 5. Fuana and flora system 6. Landscape						1. Air pollution 2. Water pollution 3. Noise and vibration			
			FRC	HTC		FRC	HTC		FRC	HTC		FRC	HTC		FRC	HTC
	the Expressway Passing through: agricultural land. Quality of the local road: good. There exists a Plastics Processing Company near the intersection	2	C	C	7	C	C	2	C	B				2	C	C
		3	C	C	8	B	B	3	C	C				3	B	B
		4	C	B	9	B	C	4	C	C						
		5	B	C	10	B	B	5	C	C						
5	Intersection: PR 207C – Km12+007 – 250m-Flyover on the Expressway. Passing through: agricultural land.		FRC	HTC		FRC	HTC		FRC	HTC		FRC	HTC		FRC	HTC
		1	C	C	6	C	C	1	C	C	6	C	B	1	B	B
		2	C	C	7	C	C	2	C	B				2	B	B
		3	C	C	8	B	B	3	C	C				3	B	B
		4	C	C	9	B	C	4	C	C						

Intersection	General features	Society						Natural environment						Types of pollution			
		1. Settlement 2. Economic activities 3. Traffic//material facilities for daily life 4. Community separation. 5. Historical relics 6. Water 7. Sanity 8. Rubbish 9. Disaster 10. Traffic accidents						1. Geology 2. Soil erosion 3. Underground water 4. Water quality of river, lake 5. Fuana and flora system 6. Landscape						1. Air pollution 2. Water pollution 3. Noise and vibration			
			FRC	HTC		FRC	HTC		FRC	HTC		FRC	HTC		FRC	HTC
	Quality of the local road : good.	5	C	C	10	B	B	5	C	C							
6	Intersection: PR 206 – Km14+839.25Km	1	C	B	6	C	B	1	C	C	6	C	B	1	B	B
	Two bridges over the river are expected to be constructed with length of 250m and 41m respectively.	2	C	C	7	C	C	2	B	B				2	B	B
		3	C	C	8	C	B	3	C	C				3	B	B
		4	C	C	9	B	B	4	C	B						
	Passing through: agricultural land.	5	C	C	10	B	B	5	C	C						
7	Intersection: PR 199+Km15+273	1	C	B	6	C	C	1	C	C	6	C	B	1	B	B
	Passing through: Agricultural land	2	C	C	7	C	C	2	C	B				2	C	C
		3	C	C	8	C	B	3	C	C				3	B	B

Intersection	General features	Society						Natural environment						Types of pollution			
		1. Settlement 2. Economic activities 3. Traffic//material facilities for daily life 4. Community separation. 5. Historical relics 6. Water 7. Sanity 8. Rubbish 9. Disaster 10. Traffic accidents						1. Geology 2. Soil erosion 3. Underground water 4. Water quality of river, lake 5. Fuana and flora system 6. Landscape						1. Air pollution 2. Water pollution 3. Noise and vibration			
			FRC	HTC		FRC	HTC		FRC	HTC		FRC	HTC		FRC	HTC
	Quality of the local road: quite good.	4	C	B	9	C	C	4	C	C							
		5	C	C	10	B	B	5	C	C							
8	**Interchange with NH39** – Ly Thuong Kiet Interchange – Km 20+264. Impact on resettlement of the local residents will occur Passing through: agricultural land and residential area near Hung Yen Shoes Factory and and Leather Shoes Processing Zone	1	A	A	6	C	C	1	C	C	6	C	B	1	A	B
		2	B	B	7	C	C	2	C	B				2	C	C
		3	B	B	8	C	B	3	C	C				3	B	B
		4	B	A	9	C	C	4	C	C						
		5	B	B	10	B	B	5	C	C						
9	Intersection: PR200- Km 26+68.09		FR	HT		FR	HT		FR	HT		FR	HT		FR	HT
		1	B	B	6	C	C	1	C	C	6	C	B	1	B	B
		2	B	B	7	C	C	2	C	B				2	C	C

Intersection	General features	Society						Natural environment						Types of pollution			
		1. Settlement 2. Economic activities 3. Traffic//material facilities for daily life 4. Community separation. 5. Historical relics 6. Water 7. Sanity 8. Rubbish 9. Disaster 10. Traffic accidents						1. Geology 2. Soil erosion 3. Underground water 4. Water quality of river, lake 5. Fuana and flora system 6. Landscape						1. Air pollution 2. Water pollution 3. Noise and vibration			
			FRC	HTC		FRC	HTC		FRC	HTC		FRC	HTC		FRC	HTC
	Passing through: agricultural land and densely residential area of Van Du commune. Resettlement for local residents will be affected	3	B	B	8	C	B	3	C	C				3	B	B
		4	B	B	9	C	C	4	C	C						
		5	B	B	10	B	B	5	C	C						
10	Intersection with NH38 (Ramp 1): km 29+322.29 Passing through: agricultural land and residential area of Tan Phuc commune. Resettlement for local residents will be affected.	1	A	B	6	C	C	1	C	C	6	C	B	1	B	B
		2	B	B	7	C	C	2	C	B				2	B	B
		3	B	B	8	C	B	3	C	C				3	B	B
		4	B	B	9	C	C	4	C	C						
		5	B	B	10	B	B	5	C	C						
11	Intersection: NH38 (former) km 29+820 – Flyover NH38	1	C	B	6	C	C	1	C	C	6	C	B	1	C	C
		2	C	C	7	C	C	2	C	B				2	C	C
		3	C	C	8	C	B	3	C	C				3	B	B
		4	C	B	9	C	C	4	C	C						

Intersection	General features	Society						Natural environment						Types of pollution			
		1. Settlement 2. Economic activities 3. Traffic//material facilities for daily life 4. Community separation. 5. Historical relics 6. Water 7. Sanity 8. Rubbish 9. Disaster 10. Traffic accidents						1. Geology 2. Soil erosion 3. Underground water 4. Water quality of river, lake 5. Fuana and flora system 6. Landscape						1. Air pollution 2. Water pollution 3. Noise and vibration			
			FRC	HTC		FRC	HTC		FRC	HTC		FRC	HTC		FRC	HTC
	Passing through: agricultural land	5	C	C	10	B	B	5	C	C						
12	Intersection: TL20-Km39+600 Passing through: agricultural land, inserted by densely residential area of Thai Hoc commune, Nhan Quyen.	1	B	B	6	C	C	1	C	C	6	C	B	1	B	B
		2	B	C	7	C	C	2	C	B				2	C	C
		3	C	C	8	C	B	3	C	C				3	B	B
		4	C	B	9	C	C	4	C	C						
		5	C	C	10	B	B	5	C	C						
13	**Interchange with NH38 km 48+744** Passing through: agricultural land, inserted by various villages. Quality of the road: good,		FRC	HTC		FRC	HTC		FRC	HTC		FRC	HTC		FRC	HTC
		1	B	B	6	C	C	1	C	C	6	C	B	1	B	B
		2	B	B	7	C	C	2	C	B				2	C	C
		3	B	B	8	C	B	3	C	C				3	B	B
		4	B	B	9	C	C	4	C	C						

Intersection	General features	Society						Natural environment						Types of pollution			
		1. Settlement 2. Economic activities 3. Traffic//material facilities for daily life 4. Community separation. 5. Historical relics 6. Water 7. Sanity 8. Rubbish 9. Disaster 10. Traffic accidents						1. Geology 2. Soil erosion 3. Underground water 4. Water quality of river, lake 5. Fuana and flora system 6. Landscape						1. Air pollution 2. Water pollution 3. Noise and vibration			
			FRC	HTC		FRC	HTC		FRC	HTC		FRC	HTC		FRC	HTC
		5	B	B	10	B	B	5	C	C						
14	Intersection: PR 17A km50+160.79 Passing through: agricultural land, inserted by various villages of Gia Loc town. Construction of the intersection	1	C	B	6	C	C	1	C	C	6	C	B	1		B
		2	C	C	7	C	C	2	C	B				2	C	C
		3	C	C	8	C	B	3	C	C				3	B	B
		4	C	B	9	C	C	4	C	C						
		5	C	C	10	B	B	5	C	C						
15	Intersection: PR191-km58+100	1	C	B	6	C	C	1	C	C	6	C	B	1	C	C
		2	C	C	7	C	C	2	C	B				2	C	C
		3	C	C	8	C	B	3	C	C				3	B	B

Intersection	General features	Society						Natural environment						Types of pollution			
		1. Settlement 2. Economic activities 3. Traffic//material facilities for daily life 4. Community separation. 5. Historical relics 6. Water 7. Sanity 8. Rubbish 9. Disaster 10. Traffic accidents						1. Geology 2. Soil erosion 3. Underground water 4. Water quality of river, lake 5. Fuana and flora system 6. Landscape						1. Air pollution 2. Water pollution 3. Noise and vibration			
			FRC	HTC		FRC	HTC		FRC	HTC		FRC	HTC		FRC	HTC
	Passing through: agricultural land, near Tu Ky Tree Seed enterprise	4	C	B	9	C	C	4	C	C						
		5	C	C	10	B	B	5	C	C						
16	Intersection: PR 190B Km69+432 Passing through: Agricultural land, Vinh Lap commune, Thanh Ha district, 0.8km far from Thanh Hong bridge towards Hanoi. Quality of the road: quite good, part of it has been	1	C	B	6	C	C	1	C	C	6	C	B	1	C	C
		2	C	C	7	C	C	2	C	B				2	C	C
		3	C	C	8	C	B	3	C	C				3	B	B
		4	C	B	9	C	C	4	C	C						
		5	C	C	10	B	B	5	C	C						
17	**Interchange with NH10 – Cat Tien bridge km 74+431.5**		FR	HT		FR	HT		FR	HT		FR	HT		FR	HT
		1	A	A	6	C	C	1	C	C	6	C	B	1	C	C
		2	B	B	7	C	C	2	C	B				2	C	C

Intersection	General features	Society						Natural environment						Types of pollution			
		1. Settlement 2. Economic activities 3. Traffic//material facilities for daily life 4. Community separation. 5. Historical relics 6. Water 7. Sanity 8. Rubbish 9. Disaster 10. Traffic accidents						1. Geology 2. Soil erosion 3. Underground water 4. Water quality of river, lake 5. Fuana and flora system 6. Landscape						1. Air pollution 2. Water pollution 3. Noise and vibration			
			FRC	HTC		FRC	HTC		FRC	HTC		FRC	HTC		FRC	HTC
	Passing through: agricultural land, inserted by residential area of Cam Van village. Cat Tien Flyover is expected to be constructed.	3	B	B	8	C	B	3	C	C				3	C	B
		4	B	B	9	C	C	4	C	C						
		5	B	B	10	B	B	5	C	C						
18	Intersection: Flyover at PR 306 km 82+344.16 - Passing through: agricultural land, inserted by residential area of Thai Son commune.	1	B	B	6	C	C	1	C	C	6	C	B	1	C	C
		2	B	B	7	C	C	2	C	B				2	C	C
		3	B	B	8	C	B	3	C	C				3	C	B
		4	B	B	9	C	C	4	C	C						
		5	B	B	10	B	B	5	C	C						
19	Intersection: Phu Lien bridge, with the length of 260m – km 84+170.2	1	A	A	6	C	C	1	C	C	6	C	B	1	C	C
		2	B	B	7	C	C	2	C	B				2	C	C

Intersection	General features	Society						Natural environment						Types of pollution			
		1. Settlement 2. Economic activities 3. Traffic//material facilities for daily life 4. Community separation. 5. Historical relics 6. Water 7. Sanity 8. Rubbish 9. Disaster 10. Traffic accidents						1. Geology 2. Soil erosion 3. Underground water 4. Water quality of river, lake 5. Fuana and flora system 6. Landscape						1. Air pollution 2. Water pollution 3. Noise and vibration			
			FRC	HTC		FRC	HTC		FRC	HTC		FRC	HTC		FRC	HTC
	Passing through: residential land, densely residential areas adjacient to Tuberculosis Hospital and Functional Rehabilitation Hospital of Hai Phong.	3	B	B	8	C	B	3	C	C				3	C	B
		4	B	B	9	C	C	4	C	C						
		5	B	B	10	B	B	5	C	C						
20	Intersection: Tran Tat Van Flyover, 198m long – Km 84+45 Passing through residential area of Trang Minh ward Quality of the road: good.	1	A	A	6	C	C	1	C	B	6	C	B	1	C	B
		2	B	B	7	C	C	2	C	B				2	C	B
		3	B	B	8	C	B	3	C	C				3	B	B
		4	B	B	9	C	C	4	C	C						
		5	B	B	10	B	B	5	C	C						

Intersection	General features	Society						Natural environment						Types of pollution			
		1. Settlement 2. Economic activities 3. Traffic//material facilities for daily life 4. Community separation. 5. Historical relics 6. Water 7. Sanity 8. Rubbish 9. Disaster 10. Traffic accidents						1. Geology 2. Soil erosion 3. Underground water 4. Water quality of river, lake 5. Fuana and flora system 6. Landscape						1. Air pollution 2. Water pollution 3. Noise and vibration			
			FRC	HTC		FRC	HTC		FRC	HTC		FRC	HTC		FRC	HTC
21	Intersection: Flyover at PR401 – Km401 km88+241 Passing through:. Agricultural land, Quality of the road: good.		FR	HT		FR	HT		FR	HT		FR	HT		FR	HT
		1	C	B	6	C	C	1	C	B	6	C	B	1	B	B
		2	C	C	7	C	C	2	C	B				2	C	C
		3	C	C	8	C	B	3	C	C				3	B	B
		4	C	B	9	C	C	4	C	C						
		5	C	C	10	B	B	5	C	C						
22	**Interchange: PR 353 km 96+700** Passing through: agricultural land, Quality of the road: good.	1	C	B	6	C	C	1	C	B	6	C	B	1	B	B
		2	C	C	7	C	C	2	C	B				2	C	C
		3	C	C	8	C	B	3	C	C				3	B	B
		4	C	B	9	C	C	4	C	C						
		5	C	C	10	B	B	5	C	C						
23	Intersection: Lach Tray approach bridge Km96+700	1	C	C	6	C	C	1	C	B	6	C	B	1	C	B

Intersection	General features	Society						Natural environment						Types of pollution			
		1. Settlement 2. Economic activities 3. Traffic//material facilities for daily life 4. Community separation. 5. Historical relics 6. Water 7. Sanity 8. Rubbish 9. Disaster 10. Traffic accidents						1. Geology 2. Soil erosion 3. Underground water 4. Water quality of river, lake 5. Fuana and flora system 6. Landscape						1. Air pollution 2. Water pollution 3. Noise and vibration			
			FRC	HTC		FRC	HTC		FRC	HTC		FRC	HTC		FRC	HTC	
	Passing through: agricultural land. Quality of the road: good.	2	C	C	7	C	C	2	C	B				2	C	C	
		3	C	C	8	C	B	3	C	C				3	B	B	
		4	C	B	9	C	C	4	C	C							
		5	C	C	10	B	B	5	C	C							
		2	C	C	7	C	C	2	B	B				2	B	B	
		3	C	C	8	C	B	3	C	C				3	B	B	
		4	C	B	9	B	C	4	C	B							
		5	C	C	10	B	B	5	C	C							
		1	C	B	6	C	C	1	C	C	6	C	B	1	C	C	
		2	C	C	7	C	C	2	C	B				2	C	C	
		3	C	C	8	C	B	3	C	C				3	B	B	

Intersection	General features	Society						Natural environment						Types of pollution		
		1. Settlement 2. Economic activities 3. Traffic//material facilities for daily life 4. Community separation. 5. Historical relics 6. Water 7. Sanity 8. Rubbish 9. Disaster 10. Traffic accidents						1. Geology 2. Soil erosion 3. Underground water 4. Water quality of river, lake 5. Fuana and flora system 6. Landscape						1. Air pollution 2. Water pollution 3. Noise and vibration		
			FRC	HTC		FRC	HTC		FRC	HTC		FRC	HTC		FRC	HTC
		4	C	B	9	C	C	4	C	C						

Notes: *FRC: Construction of interchange/flyover;*

HTC:Construction of Hanoi – Hai Phong Expressway;

Impact level: A-serious impact; B- moderate impact; C- Non-impact

3.3.1. Impacts on the air quality

Air quality is usually an environmental problem considered as very important for population areas, trade areas along the two sides of the roads, especially in urban areas, socio-economic centers with high density of construction.

The pollutants generated in the process of land acquisition, excavation, excavation and backfilling, gathering of construction machinery, transportation of road embankment building materials, operation of asphalt and concrete mixing stations; gas emission from equipment using diesel oil, from construction plant; impacts which can be recognized at a leeward distance of 200 - 300 m.

The execution of the Expressway and transportation of construction materials will have several impacts on air quality. Transportation of soil and stone may cause partial impacts due to dust, noise and vibration of pile driving in the construction areas. The seriousness of these impacts depends on construction location and transportation distance.

For construction of the road and the intersections in the Project, a huge volume of soil will be excavated, embanked and transported.

- Embankment backfilling: 8,155,329.26 m^3;

- Excavation and disposal: 3,033,897.84 m^3 of soft soil.

In average excavation and embankment building of one m^3 of soil in the normal climatic condition will generate 1.5 kg of dust, which includes 0.15 kg of suspended dust. Thus, the 18,155,329.26 m^3 of soil being embanked in the Project will generate 27,858 tons of dust including 2,785.8 tons of suspended dust.

According to the data of the Project, the transportation and disposal of soft soil with the average distance of 10 km will generate a specifict amount of dust and toxic gases. As the soil being removed is mainly of high moisture content, the dust generated due to the excavation will be inconsiderable.

The construction stage will require a large volume of concrete, including asphalt concrete and cement concrete. To meet this requirement, a series of batch concrete mixing stations must be arranged near the major intersections. The operation of these concrete mixing stations and other related activities in the site will always generate an amount of toxic gases which may decrease the air quality. Dust pollution is serious, therefore, the proper solutions must be worked out and observed to minize such impact.

The burning of wastes other than wood, dry leafs, such as plastic bags, rubber, PVC, oil rags, organic matters or some domestic wastes, etc. in the open air with temperature not more than 900^{o}C usually generate toxic dioxin gas causing harm to people and ecosystem.

a) Forecast of air pollution caused by operations of asphalt concrete mixing station

Four asphalt concrete mixing stations will be arranged at the interchanges in the whole route as follows:

- Station 1: located in NH QL 39 (km20+264)
- Station 2: located in NH38 (km 48+744)
- Station 3: located in NH10 (km 74+431)
- Station 4: located in PR353 (km 96+700)

The above stations are designed with operating capacity of 100T/h and far from population communities.

❖ Forecast of gas emission and dust amount**:**

- Emission factors – A/C mixing station**;**

Sequence	***Emission factors (kg/ton of asphalt concrete)***					
1. Batch mixing	***PM10***	***Reliability hs***	***NOx***	***SO2***	***VOCs***	***CO***
Used by gas:						
- Unfiltered	2.2	E	0.013	0.0025	0.0072	0.17
- Filtered	0.0098	D				
Used by oil:						
- Unfiltered	2.2	E	0.084	0.12	0.02	0.035
- Filtered	0.03	D				
2. Continuous mixing						
Used by gas:						
- Unfiltered	2.2	D	0.015	0.0017	0.022	0.028

- Filtered	0.0041	D				
Used by oil:						
- Unfiltered	2.2	D	0.038	0.028	0.03	0.018
- Filtered	0.015	D				

Source: NP*i* Australia

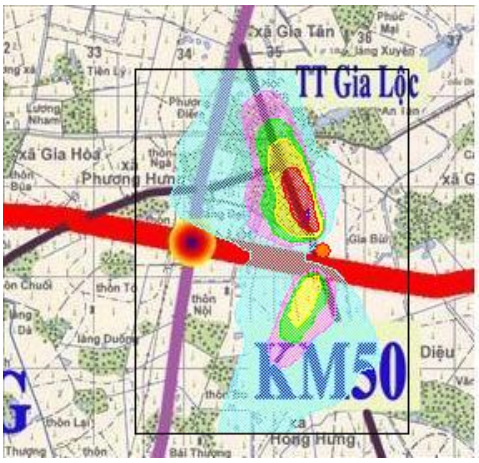
Forecast of gas emission from A/C mixing station with capacity of 100t/h**:**

Gas emission from concrete mixing station using oil

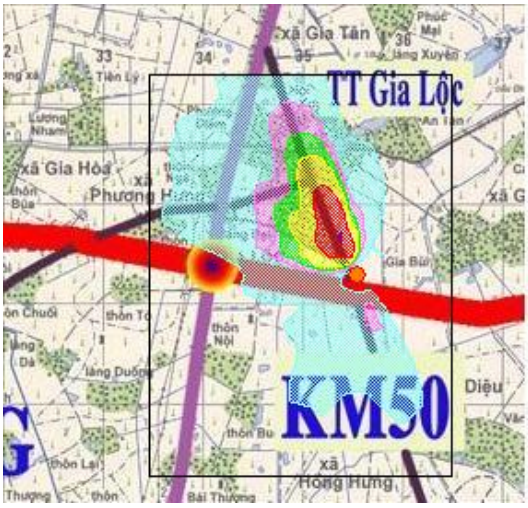
	t/h	***PM10***	***NOx***	***SO2***	***VOCs***	***CO***
Capacity	**100**					
Unfiltered	Factor	2.2	0.038	0.028	0.03	0.018
	Gas volume (kg/h)	220	3.8	2.8	3	1.8
Filtered	Factor	0.015				
	Gas volume (kg/h)	1.5	3.8	2.8	3	1.8

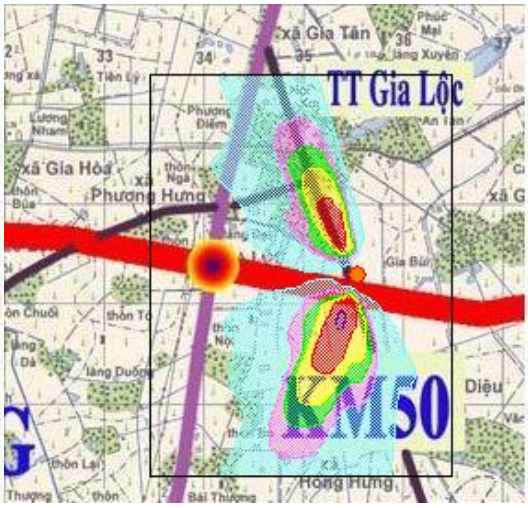
b) Forecast of air quality

- Around A/C mixing station;

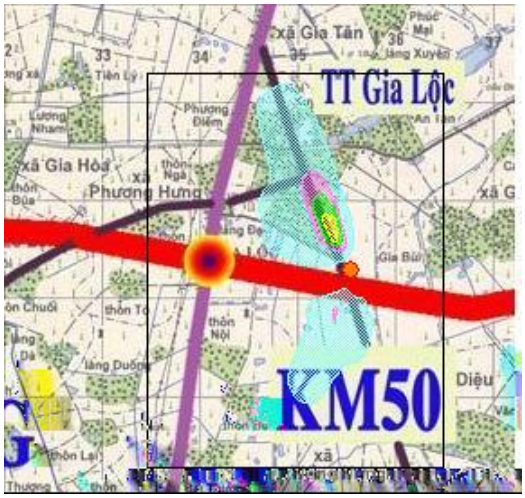


Distribution of SO2_Avarage_Year

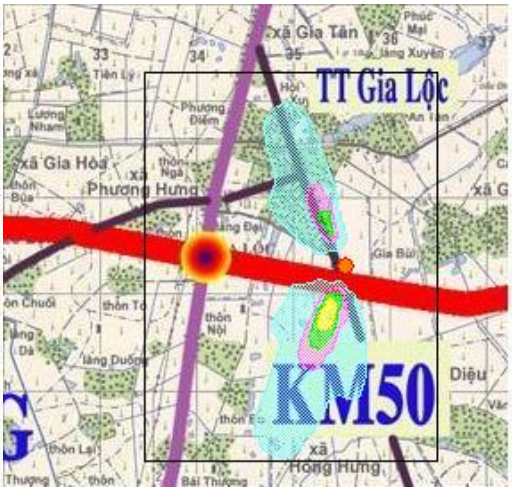




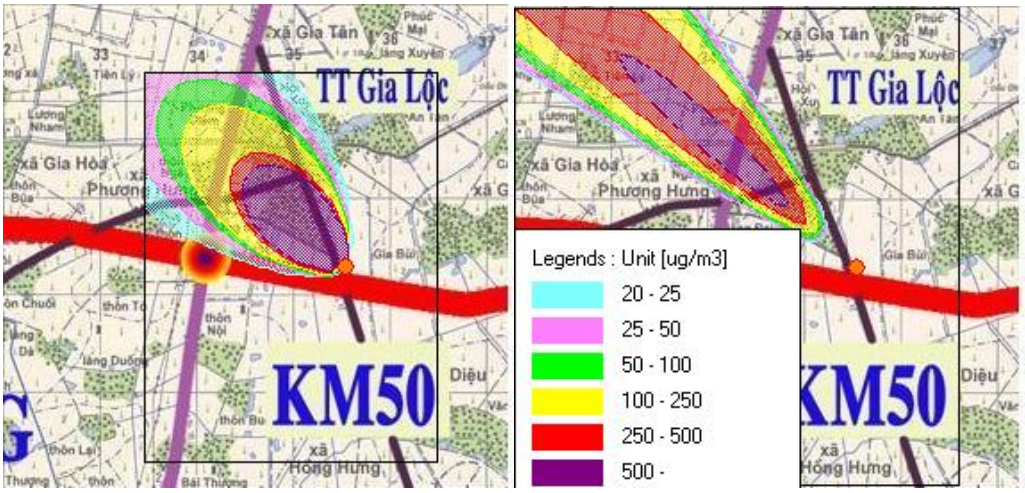
Distribution of SO2_Avarage_Summer - Distribution of SO2_Avarage_Winter



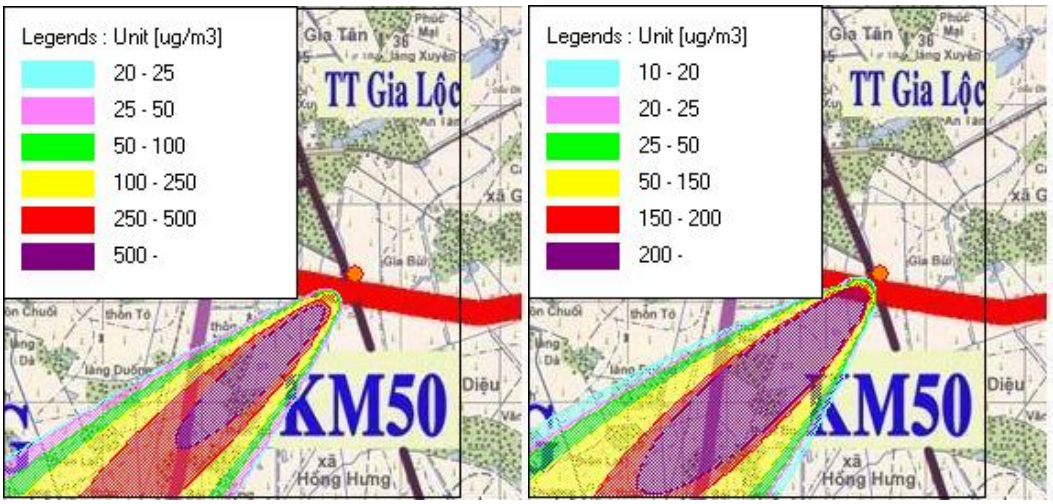
Distribution of PM10_Average_Year



Distribution of PM10_Average_Summer Distribution of PM10_Average_Winter



Average_hour-summer-day time - Occurrence of dust filter Avarage_hour- summer-night time



Winter night time -Average_hour -Occurrence of dust filter - Average_hour-day

Obviously, content of toxic gases and dust is forecasted to cause partial pollution arisen from the A/C mixing stations.

3.3.2. Impacts of noises and vibration

3.3.2.1. Impacts of noise

The causes of noise include:

Trucks carrying construction materials, construction machinery, concrete mixing stations, pile driving machines, bulldozers, power generators.

The level of noises generated by construction machinery are listed by the US Federal Highway Administration in Table 3.9.

Table 3.9. Levels of noise generated by construction machines

Machines and equipment	Noise level at distance of 15 m from the sources (dBA)	US standard (dBA)
Pile driving machine	90-104	95
Drop hammer	76-99	75
Truck	70-96	75
Crane	72-96	75
Road-roller	72-88	75
Tractor	73-96	75
Bulldozer	77-95	75-80
Asphalt spreader	82-92	80
Concrete mixer	71-90	75
Power generator	70-82	75
Vibro-rammer	70-80	75

The noise levels in construction operations are evaluated as follows:

a) Concrete mixing operation:

The maximum noise level at distance of 15 m from a concrete mixing station is 90dBA in the condition without shielding cover, then every time the distance is double the noise level is reduced by 6dBA. Thus the noise level at the distance of 30m, 60m, 120m from the concrete mixing station will be 84dBA, 78 dBA and 72 dBA respectively.

b) Pile driving operation:

Pile driving operation may cause noises exceeding 105 dBA within 15 m from the sources of noise.

c) Excavation, embankment building and site grading operations:

Excavation, embankment building and site grading operations require some machines and equipment as follows: excavators, bulldozers, tractors, graders and trucks. These equipment may cause noise level of 90 dBA at a distance of 15 m. If they are operate at the same time together the noise level will be consonant, for example 6 machine working together may cause a noise level of 97- 98dBA

d) Power generators:

The noise level created by a power generator can reach 82 dBA at a distance of 15m m. Thus the maximum noise level at the distance of 60 will be about 70dBA.

In the construction site, the machines will generate high noise level, causing adverse impacts on the health of the workers working near the power generators. These impacts are evaluated as adverse impacts, but they are only local and temporary as the high noise can be reduced rapidly before they reach the population areas.

3.3.2.2. Impacts of vibration

As stated in Chapter 2, vibration values which are measured at the Site have smaller vibration acceleration than TCVN 7210: 2002 applicable to population communities (**Table 2.14**).

The use of heavy trucks for carrying construction materials and construction machinery and equipment such as road rollers, vibro-rammers cranes, etc., will not only cause noise pollution but also a considerable vibration in the construction sites as well as neighboring areas during the period of road and bridge construction.

- U-shaped joint-sheet piles with lengths of 5- 7.5m will be driven to the necessary depth forming an integrated steel wall. A 8-ton drop-hammer with an input capacity of about 80KJ can cause vibration of 12.9mm/s^2 at a distance of 10 m.
- The driving of piles into the muddy soil with the initial impulsive force of about 30JK can cause a vibration of 4.3mm/s^2 at a distance of 10m.
- A diesel drop-hammer driving a pile in clayey soil can generate a vibration of 7mm/s^2 at a distance of 10m

Table 3.10. Permissible vibration acceleration in construction activities

TCVN-6962 :2001 *Unit: dBA (*m/s^2)

Khu vực	7h-19h	19h-7h
Special silence areas: hospital, library, sanatoria, kindergarten, etc)	75 (0,055m/s^2)	Background level
Residential area, hotel, resort, office	75 (0,055m/s^2)	Background level
Residential areas alternated with trade, service, production areas	75 (0,055m/s^2)	Background level

During the process of construction of bridges, pile driving and material transportation are the two main sources of vibration.

Thus, with a distance of 100 m or more, the impacts by vibration of the operations on the residential areas will be inconsiderable.

3.3.3. Impacts on the surface water environment

All construction activities at the Site may have direct or indirect impacts on the water environment. Table 3.11. shows the impacts from 6 main sources identified in the execution of the Project with 4 types of pollution of the surface water environment in the area. The results of establishing this relationship shows that the oil pollution is evaluated as considerable for the surface water in the area.

Table 3.11. Relationship between potential pollution sources and types of water environment pollution in the construction stage

Sources	Type of pollution			
	Water turbidity		Water turbidity	
Excavation and embankment backfilling	0	0	+	+
Construction of bridge piers and abutments	+	0	++	+++
Means of transport	0	0	0	++
Domestic waste	0	+	+	0
Overflowing rainwater	+	0	0	+
Site operation	0	0	0	+
Overall evaluation	**+**	**+**	**++**	**+++**

Notes: +++: High ++*:* Moderate +*:* Low *0:*Inconsiderable

Creation of an Expressway in the delta terrain will cause multi-faceted impacts on natural and social aspects, in which water environment is also affected by the pollution in a serious manner and for a long term. The primary concern is the treatment of wastes from the workers' temporary houses, avoiding their direct discharge into the water bodies. The hazardous wastes include residual oil and grease of machines, domestic wastes of workers' temporary living quarters.

The construction activities will disturb the land surface and change the landform. Excavation and backfilling for development of ditches and slopes also change the flow regime and water quality.

- ***Water turbidity, organic mater and solid wastes***

Turbidity is considered as the most intensive impact factor; aquatic environment will be polluted for a prolonged period because the execution period of the Project is 36 months. The primary cause stems from excavation and embankment activities, the surface water flows and construction of bridges and culverts.During the execution of the Works, several areas will be arranged to store the waste (organic soil, excavated and removed soil) and materials. The soil erosion in form of flushing will occur during heavy rain. The calculations show that in the framework of the Project the total volume of embankment is about 18 million cubic meters of soil and sand, and volume of excavation is about 1.75 million cubic meters of unsuitable soil. Thus, total volume of embankment and excavation is approximately 20 million cubic meters. If 0.2% of the volume turned into alluvial substances the water will contain 4,000 tons of silt and sand. The turbidity increases because of rainy water flows. As a result, the turbidity of the river water will strongly increase during execution period. Flow of silt and sand will become Suspended substances, thus causing increase of turbidity of the river water and decrease the water quality.

The domestic waste from those who work in the river mainly contain dreg, suspended substances (SS), organic compounds (BOB/COD), nutritious substances (N, P) and microorganism that are poured into the river, causing pollution to the aquatic environment.

According to WHO's calculations and statistics, amount of daily polluted substance poured by each person into the environment (in the event of non-treatment) in the developing countries is shown in following table (Table 3.12).

Table 3.12: amount of polluted substance poured by each person/day

No.	Pollutants	Amount
1	BOD_5	45 – 54
2	COD (Dicromate)	72 – 102
3	Suspended substance (SS)	70 – 145
4	Oil and grease	10 – 30
5	Total nitrogen	6 – 12
6	Amoni	2.4 – 4.8
7	Total phosphorus	0.8 – 4.0
8	Total Coliform (MPN/100ml)	106 – 109

On average, 100 liters of water/day-night are used by one person, total amount of wastewater is 32 m^3 in one day (approx 80% of used water volume). Concentration and weight of the pollutants in the domestic wastewater of 400 workers under this Project are shown in Table 3.13 and Table 3.14.

Table 3.13: Concentration of pollutants in the domestic wastewater

No.	Pullutant	Concentration of pollutants (mg/l)		
		Untreated	Treated by selt-digestion system	TCVN 6772 - 2000 (Level 3)
1	BOD_5	1052-1350	200 - 400	40
2	COD	1800-2250	360-720	-
3	SS	1750-3624	160 - 320	60
4	Cooking oil	250-750	-	20
5	Total Nitrogen(NO_3^-)	150 - 300	40 - 80	40
6	Amoni	60-120	10-30	-
7	Total phosphorus (PO_4^{3-}	20-100	-	10
8	Total Coliform	$2.10^2 – 2.10^6$	10^4	5.10^3

Comparision of concentration of the main pollutants in domestic wastewater which have been treated by self-digestion tank with wastewater standard (TCVN 6772 - 2000) shows that: Content of BOD_5 of domestic wastewater before treatment is 25-30 times higher than that of standard, SS is 30-60 times higher than that of standard. After treatment by the above system, the pollutants are considerablely decreased, however, they remain 5-10 times higher than permitted.

Nevertheless, the surface water within the Project area is abundant, whereby the dilution and self-cleaning is big, the harmful impact level is considerably decreased.

As estimated, each worker/staft who works within the Project area will discharge from 0.3 – 0.5 kg of domestic rubbish per day. Domestic rubbish of some 400 workers in one day is estimated as follows: 400 people/day x 0.4 kg/person = 160 kg/ day. Despite minor solid domestic rubhish amount is small, if collection measure to transfer it to the land for treatment is not observed and the rubbish is directly poured into the river, the biologically non-decomposable substances, e.g. plastics, glass, metal bags at the river section under the Project will be accumulated after two year of execution. Propellers of small ships will be rolled up by plastic bags, thus causing obstruction and failure to the operations of the ships.

Table 3.14: Quantity of pollutants in the domestic wastewater

No.	Pollutant	Weight of pollutant (kg/day)
1	BOD_5	20. 24 – 24.30

2	COD	32.40 – 46.0
3	SS	31.5 – 72.0
4	Oil & grease	5.0 – 14
5	Total nitrogen	2.7 – 5.4
6	Amoni	1.08 – 2.16
7	Total Phosphorus	0.36 – 1.8

- ***Waste oil***

Within framework of the Project, the waste oil originates from two main sources: the equipment for construction of abutments and piers, and other construction plant and vehicle such as trucks, bulldozers, excavators, loaders, graders, pavers, etc. During operation, specific amount of oil and grease will be leaked from them... It is difficult to collect the oil leaking from such equipment, and as a result, it will cause pollution to the river water and soil. For the purpose of construction of piers and abutments, several plant working in the water bodies (e.g barges, towing vessel, etc). In addition to the oil leaked from the propellers, the oil-contained wastes without management and collection will be a considerable pollution source for irrigation canals. The pollution of river water not only causes impacts on the ecological system in the Project areas, but also on the whole environmental eco-system. It is necessary to take proper measures to control and minimize the reverse impacts.

However, the factors causing water pollution in the construction stage for 9 bridges and main road are temporary; given the self-refeshing of water is high, in six months to one year after completion of the Project execution, the water quality will be gradually recovered as before execution. The harmful impacts of waste oil in the construction stage is not significant provided that appropriate minimizing measures are observed.

3.3.4. Impact on underground water environment

Các nguyên nhân cơ bản tác động đến chất lượng nguồn nước ngầm trong quá trình thi công, xây dựng cụ thể như sau:

The main pollution sources affecting quality of underground water during the execution of the Works include:

Surface water is supply source of underground water; if the surface water is polluted, the underground water is polluted, too.

During the execution of the Works, excavation, boring, pile driving, etc ...for construction of abutments and piers will create holes in the surface land, leading polluted surface water into aquifers, causing pollution thereto.

Excavation, leveling, grading may cut open the aquifers located near the surface, and the polluted surface water and rainy water may be mixed with the underground water thus causing pollution thereto.

The changes in flow systems may cause changes of flowing rules, thereby groundwater table may be lowered or raised depending on the changes of surface flow, and this may affect on quality and flow rate of underground water.

3.3.5. Impacts of bridge construction

Under the selected Option 2, the total number of bridges to be constructed is 30, including 9 big bridges, 21 medium bridges. The abutments and piers of these bridges will be constructed by bored pile method.

Bored pile technology: this is one of the technologies which have been widely applied for construction of bridge foundation and pier of the transport works. Under such technology, the risk of polluted surface water penetrating into groundwater is very high. It is impossible to avoid the impact resulted from construction of bored piles for bridge foundation and pier.

The Expressway crosses over six major rivers, e.g. Bac Hung Hai, Thai Binh, Thanh Hong, Van Uc, Da Do and Lach Tray rivers. The excavation, backfilling and piling for construction of the bridges and culverts have great impact on surface flow, causing erosion and collapse that increase the turbidity of the water flow. The turbidity of surface water system will be affected in the heaviest way; at the locations near the flows or at the construction site, the turbidity may reach over 10 times higher than required. The turbidity is so high that it may kill all the animals in the river bed. In the rainy and stormy season, a large area in the downstream will be also affected by such turbidity.

During construction of the bridges, some oil and grease may leak from the equipment such as bulldozers, excavators, loaders, graders, pavers, pile-drivers, barges... It is difficult to collect this oil, and it may infiltrate into aquifers, causing pollution to groundwater, especially during construction of big bridges crossing over the rivers of Bac Hung Hai, Thai Binh, Van Uc, Lach Tray. It is necessary to take measures to minimize this impact.

3.3.6. Impact on soil

The construction of the new Expressway may cause changes in groundwater table, and may supply addition of undesired elements such as Al, Fe to the soil, impeding activities of microorganism, decreasing fertility of the soil, degrading the soil. The waste materials, especially sand, gravel, concrete grout, waste water with high concentration of alkali and cement dregs from concrete mixers may affect seriously on crop growing soil if the management measures are not strictly observed.

Consequently, the said impacts may cause changes in physico-mechanical properties of the soil, the soil become harder, agglomerate. The impacts may also cause changes in chemical properties of the soil, increasing alkalinity, content of heavy metals, etc, leading to the depression of the soil and its fertility.

In general, the impacts of the Project to soil environment are not significant; however, it is necessary to take proper measures to minimize the impacts.

3.3.7. Assessment of environment occurence

The construction of abutments in the downstream of the bridges crossing the rivers of Bac Hung Hai, Thai Binh, Van Uc, Lach Tray may cause erosion and land falls. In rainy reason, the construction plant and equipment, materials, fuel may be at risks of failure thus causing negative impacts on the environment. Consequently, it is necessary to work out and observe appropriate measures for prevention, control and protection of the works, stores, workshops, camps, etc during the execution of the Works, especially in the rainy & stormy season..

3.3.8. Causing flood

The hydrological conditions of the Project areas depend on hydrological conditions of Red river-Thai Binh river system. Although the irrigation system (Bac Hung Hai system) has been increasingly developed, the Project areas may still be flooded if heavy rain continues for many days in the flood areas (flooded), as happened in 1984, 1985, 1994 for the section from Station Km0 to Station Km65; in 1975, 1978, 1990 for the section from Station Km65 to Station Km72; in 1978, 1990 for the section from Station Km75 to Station Km95. Obviously, the Project areas are still at risk of flood, especially in the event of heavy rain for a long time, etc.

The construction of a new Expressway of more than 105 km, with the higher grade as against initial schedule, crossing many big rivers which play roles of drainage for Hanoi, Hung Yen, Hai Duong, and crossing several channels, lakes and ponds will cause local limitation of drainage of surface water in the relevant areas. Increase of pavement elevation, closure of natural flow for site grading and construction of

service roads, the construction of bridges, culverts and channels will affect the natural flows, leading to flood and water stagnancy. The flooded areas and flood period may change, creating new water reservoirs, leading to gleization, salinization and loss of cultivating land area, pollution of aquatic, soil and sediment environment. Flood-causing impact is serious matter that requires effective minimizing measures.

3.3.9. Impacts on economy and life quality

*3.3.9.1. **E**conomic activities*

The Project will take an area of 101.5 ha of farming land. The concentration of a huge amount of materials, means, motorbikes and manpower for execution of the Works will cause not only pollution of air, water and soil, leading to impact on development of plants but also hinder production, care activities and harvest, i.e. agricultural activities will be affected during the execution of the Expressway.

The route under the Project will cross several existing roads, and 22 junctions, including 7 interchanges, of which six grade-separated interchanges are located at the beginning sections of Ring Road 3, NH39, NH38B, NH10, PR353, Tan Vu Interchange and 01 Intersection in Dinh Vu; the remaining includes 17 flyovers in the provincial and district roads. The construction of those junctions will affect the traffic flows in the said routes.

3.3.9.2. Separation

***T**he new Expressway will cross 12 districts, 37 communes. Construction activities in these areas will cause traffic jam. Furthermore, the road with average elevation of 3m will separate the communes and villages, affecting the relationship among the communities. The commune of Tu Xuyen will be affected most seriously, where about 40 households whose residential land is acquired will be directly affected by the Expressway; in addition, more than 100 households near the Expressway will be also affected by other impacts in stages of construction and operation. Some parts of population will be separated from their fields and schools, affecting pupils and residents' travel to schools and fields respectively and other daily activities of the local residents. It is required to observe proper measures to minimize such impacts.

*3.3.9.3. L*oss of means of livelihood

10,145,388 m^2 of agricultural land and surface water land will be acquired for the Project, which means a part of population will lose farming land, they must change their occupation. It is difficulty, especially for the areas of Hanoi, Van Giang district (Hung Yen province) where the land for agricultural development is very limited.

3.3.9.4. Impacts on public health and traffic accidents

General impacts on living quality of the residents and workers in the crowded population communities will increase. The great impacts as such include dust content, noise level, vibration level, and toxic gases that may be discharged from the construction equipment.

The concentration of a large number of vehicles and construction plant, e.g. bulldozers, graders, rollers, asphalt pavers, etc, especially a huge number of trucks transporting waste and construction materials (as preliminarily estimated, number of trucks for transportation of soil reaches some 106,946 turns) ... will increase the risk of accidents due to great concentration of vehicle, especially in the residential areas. The greatest impact is perhaps the construction of big junctions such as with highways No.10, No.29, No.38B and Thanh Tri bridge end.

The proper measures must be worked out and observed to minimize such impacts.

3.3.10. Impacts on historic and cultural relics

*M*ost pagodas, temples, relics are located outside the landmarks of the Project area; therefore the construction will hardly impact on these objects.

3.3.11. Impacts on biological diversity and biological resources

*T*he construction stage is considered as the stage thay may cause different reverse impacts on ecological environment, biological diversity and biological resources. The main sources of pollution include:

- Many workers in the route,
- A mass of vehicles and equipment,
- Transportation activities in both day and nigh time,
- Materials for construction of the road, bridges, culverts and other auxiliary facilities.

It takes a long time for execution of the Works, which will cause the unquietness and affect the fauna and flora of the areas. The impacts may include followings:

- Damage to several gardens and orchards in the residential areas;
- Damage to flora including plants in the agricultural land;
- Damage to habitats of several species,
- Impacts on food sources of some animal;

- Pollution of living environment of some species, especially aquatic plants and animals.

In general, the Project is mainly executed in the agricultural ecological system, the impacts are not significant because most of plants and animals are farmed.

3.4. IMPACTS OF THE PROJECT DURING THE PERIOD OF OPERATION

After the Expressway has been put in operation, traffic thereon will increase gradually, leading to increase of noise level, content of dust and toxic gases, risk of accidents. The impacts this stage are not clearly and strongly shown as in construction stage, however, the potential impacts may arise, causing damage to the environment during operation period. The impacts in the operation period are summarized in the Table below.

Table 3.7.

Table 3.15. Summary of impacts of the Project during operation

Impacts of the Project on Environmental factors		*Impact level*
Impacts on natural environment	1. Impact on land (including subsidence)	C
	2. Impact on water sources and hydrological conditions	C
	3. Impact on water quality	C
	4. Impact of noise	B
	5. Impact of vibration	C
	6. Impact on air quality	B
	7. Impact of waste	C
	8. Impact on public health and safety	B
	9. Impact on local traffic and roads	C
	10. Impact of local land use and other plans	C
	11. Impact on ecological system	B
Impact on socio-	12. Impact on local economic activities	(A)
	13. Impact on existing traffic and public services	(A)
	14. Impact on culture	C
	15. Impact on community health	B
	16. Risks and danger	B

Note:

A- Serious reverse impact; B- medium reverse impact, C- insignificant reverse impact.

The letter put in parenthesis means favorable impact.

In the following sections, impacts on physical, ecological, social and human environment will be analysed in detail

3.4.1. Impacts on Air quality

3.4.1.1. Forecast for the toxic gas contamination

METI_LIS dispersion model is the type of Gaussian dispersion model formed on the basic of ISC model by the US Environmental Protection Agency (EPA). ISC constitutes the model of regulations widely used in the world.

Since 1996, Japan Ministry of Economy, Trade and Industry – METI) has developed and put into use this model, at the time that air pollution problem was included in Air Pollution Prevention Act in Japan.

A number of experiments in dynamic air tube and in-situ place with this model were carried out under the sponsorship of METI and the METI_LIS pilot version was introduced in 2001. METI_LIS 2.02 – the next version software in 2005 was improved with both updated appearance and content and more user-friendly tools.

In fact, traffic polution is of road pollution type. For the purpose of simplification, unlimited roads and elevations equal to the ground were taken into consideration. General solution of Gaussian model for the continuous point source is shown as:

(1)

For the inspection point right at the ground (z ≅ 0), concentration of contaminated substance shall be calculated based on the formula (1) as follows:

$$q(x,y) = \frac{M}{\pi u \sigma_y \sigma_z} \exp\left[-\frac{1}{2}\left(\frac{y^2}{\sigma_y^2} + \frac{H^2}{\sigma_z^2}\right)\right] \qquad (2)$$

Practically, many modifications were made from this model in order to apply for the dispersion calculation for the typical case (traffic road source).

For a road assumed to be continuous and unlimited pollution source (when x x →

∞), with wind blowing perpendicular to road surface, we shall determine Boundary condition to put into this equation (1):

$\sigma_y \to 1$ when $|y| \to \infty$ when $z=0$

When $y \to 0$ then $\text{Lim}[\exp(-1/2(y2/\sigma^2_y)] = 2\sqrt{2\pi}$

Solution of average contaminated substance concentration in the air derived from the last continuous emission road source shall be in the form:

$$C(x,z,h) = \frac{0.8\,M}{U\,\sigma_z}\left[\exp(-1/2(z+h)^2/\sigma^2_y) + \exp(-1/2(z-h)^2/\sigma^2_z)\right] \quad (1a)$$

Where,

M (or E) is the amount of pollutant emission from the road source (g/m/s)

u: average wind velocity (m/s) normally measured at the elevation of 2m.

h: the height of road surface in comparison to the the adjacent ground

z : the height of point to be calculated for concentration (m).

σ_z (m): vertically diffusion coefficient, z means the function of distances xi and atmosphere stability ABCDEF.

Most simply, the method of Gibert M. Masters (1991) was taken into account, then the pollutant concentration at the distance of x far from the road at the end of wind direction shall be determined by the formula as follows: With a road assumed to to be continuous and unlimited emission source (when $x \to \infty$) with wind blowing perpendicularly to the ground and calculated height near the ground surface h=z=0. Solution of average pollutant concentration in the air derived from the last continuous emission road source shall be in the form

$$C(x) = \frac{2E}{\sqrt{2\pi}.\sigma_z.U}$$ or equally converted to $C(x,0,) = 0.8\,M/\,\sigma_z\,U$ (1b)

a) Forecast to emission amount from the HN-HP Expressway operation:

Fuel used for traffic vehicles:

Table 3.16: echnical specifications of FO oil

(According to product specification of PETROLIMEX):

Content\oil type	unit	No1	No2A	No2B	No3
- Sulfur	% kl	2.0	2.0	3.5	3.5
- Ash	% kl	0.15	0.15	0.15	0.35
- Water	% tt	1.0	1.0	1.0	1.0
- Contaminant	% kl	0.15	0.15	0.15	0.15
Total without carbon					5%
- Temperature value is not less than	cal/g	9800	9800	9800	9800
- Carbon Conradson contaminant	% kl	6	16	16	22

Table 3.17: Technical specifications of DO oil:

(According to product specification of PETROLIMEX)

No.	**Criteria**	**Unleaded gasoline**		
		90	**92**	**95**
1	Octan value according to study method of RON, no less than	90	92	95
2	Content of …, g/l, no more than	0,013		
3	- 10% of volume, ^{0}C, no more than	70		
	-50% of volume, ^{0}C, no more than	120		
	90% of volume, ^{0}C, no more than	190		
	- End boiling point, ^{0}C, no more than	215		
	- Terminal residue, % of volume, no more than	2,0		
4	Corrosion of copper piece at 50^{0}C/3h, no more than	1		
5	Actual plastic content (……), mg/100ml, no more than	5		

No.	Criteria	Unleaded gasoline		
		90	**92**	**95**
1	Octan value according to study method of RON, no less than	90	92	95
6	Oxidation stability, minute, no less than	240		
7	Sulfur content, % of quantity, no more than	0,15		
8	Steam pressure (Reid) at 37.8^0C, kPa	43 - 80		
9	Benzen content, % of volume, no more than	5		
10	External vision	Transparency, without suspended substance		

Table 3.18: Technical specification of auto gasoline::

(According to product specifications of PETROLIMEX)

No.	***Name of criteria***	***Level***		
		DO 0,05%S	***DO 0,25%S***	***DO 0,50%S***
1	*Cetane index, no less than*	*45*	*45*	*45*
2	*Sulfur content, % of quality, no more than*	*0,05*	*0,25*	*0,5*
3	*Distillation temperature, ^{0}C, 90% of volume, no more than*	*370*	*370*	*370*
5	*Kinematical viscocity at 40^0C, cSt (mm2/s)*	*1,6 - 5,5*	*1,6 - 5,5*	*1,6 - 5,5*
6	*Carbon residue of 10 of distillation residue, % of quantity, no more than*	*0,3*	*0,3*	*0,3*
7	*Solidification point, ^{0}C, no more than*	*9*	*9*	*9*
8	*Ash content, % of quantity, no more than*	*0,01*	*0,01*	*0,01*
9	*Content of water and mechanical impurities, % of volume, no more than*	*0,05*	*0,05*	*0,05*
10	*Corrosion of copper piece at 50^0C, 3 hours, no more than*	*1*	*1*	*1*

b) Determination of gas exhaust from the traffic vehicles

Coefficient applied for air exhaust calculation from traffic vehicles:

Table 3.19: Coefficient applied for air exhaust calculation from traffic vehicles:

Emission coefficient from traffic vehicles (EURO2)			
1. Car			Unit: g/km
No.	Pollutant	Gasoline engine car	DO oil engine car
1	CO	0.00220	0.00220
2	NOx	0.00022	0.00022
3	PM10	-	0.00008
4	V OCs	0.00020	0.00020
5	SO2	0.00004	0.00004
2. Pick-up truck, 12-seat passenger car		unit: g/km	
No.	Pollutant	Gasoline engine vehicle	DO oil engine vehicle
1	CO	2,2-5,0	1,0-1,50
2	NOx	0,5-0,7	0,7-1,20
3	PM10	-	0,08-0,17
4	V OCs	0,5-0,7	0,7-1,20
5	SO2	0.00006	0.00007
3. Lorry		unit: g/km	
No.	Pollutant	Gasoline engine lorry	DO engine lorry
1	CO	0.00400	0.00400

2	NOx	0.00700	0.00700
3	PM10	0.00015	0.00015
4	V OCs	0.00110	0.00110
5	SO2	0.00017	0.00036

(Source: EU – EURO 2)

c) Amount of air emission under the project operation in 2010, 1020:

	Projected amount of emission in 2010					
	Road route	CO	NOx	PM10	VOC	SO2
I	No 5 National road					
	Hanoi – Hai Duong					
	g/km/24h	32102.950	13920.020	380.400	5488.350	1031.647
	g/m/h	1.338	0.580	0.016	0.229	0.043
	Hai Duong - Hai Phong					
	g/km/24h	21866.250	9790.760	260.490	3716.150	716.645
	g/m/h	0.911	0.408	0.011	0.155	0.030
II	HN – HP Expressway					
	Hanoi – Hai Duong					
	g/km/24h	43980.200	19074.520	521.250	7519.500	1413.518
	g/m/h	1.833	0.795	0.022	0.313	0.059
	Hai Duong - Hai Phong					
	g/km/24h	37069.400	16602.220	441.720	6300.600	1215.087
	g/m/h	1.545	0.692	0.018	0.263	0.051
III	Ring road III/IV					
	g/km/24h	32102.950	13920.020	380.400	5488.350	1031.647

	g/m/h	1.338	0.580	0.016	0.229	0.043
IV	Cross national road					
	g/km/24h	8025.738	3480.005	95.100	1372.088	257.912
	g/m/h	0.334	0.145	0.004	0.057	0.011
	Projected amount of emission in 2020					
	Road route	CO	NOx	PM10	VOC	SO2
I	National road No.5					
	Hanoi – Hai Duong					
	g/km/24h	62978.050	27311.340	746.340	10767.250	2023.993
	g/m/h	2.624	1.138	0.031	0.449	0.084
	Hai Duong Hai Phong					
	g/km/24h	43194.150	19343.860	514.680	7341.550	1415.786
	g/m/h	1.800	0.806	0.021	0.306	0.059
II	HN-HP Expressway					
	Hanoi – Hai Duong					
	g/km/24h	107429.700	46589.300	1273.170	18367.400	3452.617
	g/m/h	4.476	1.941	0.053	0.765	0.144
	Hai Duong - Hai Phong					
	g/km/24h	95372.750	42710.060	1136.340	16209.550	3126.011
	g/m/h	3.974	1.780	0.047	0.675	0.130
III	Ring road III/IV					
	g/km/24h	62978.050	27311.340	746.340	10767.250	2023.993
	g/m/h	2.624	1.138	0.031	0.449	0.084
IV	Crossing National road					
	g/km/24h	15744.513	6827.835	186.585	2691.813	505.998

	g/m/h	0.656	0.284	0.008	0.112	0.021

d. Projected amount of vehicles and traffic distribution scenarios in the future

Results for projection of traffic flow in the Hanoi –Hai Phong centre line are as follows (vehicles/day)

No.	List	2005	2010	2015	2020	2025
I	Low Plan					
1	Section 1	33,063	48,516	68,724	96,339	128,899
2	Section 2	26,807	39,461	56,238	79,571	107,474
II	Medium Plan					
1	Section 1	33,063	50,070	73,162	106,023	146,377
2	Section 2	26,807	40,794	60,051	87,907	122,522
III	High Plan					
1	Section 1	33,063	51,651	77,820	116,557	165,917
2	Section 2	26,807	42,166	64,094	97,036	139,460

The selection of maximum trafic capacity

For Hanoi- Hai Phong Expressway and National Road No.5: the selection of average daily designed traffic volume in the future according to Standards of Vietnam (TCVN273-01) with the service level equal to the nearly-saturated vehicle stream shall more closely match with the reality.

Average daily traffic volume for the future years is equal to the levels of Expressway as follows:

(Unit: PCU/day)

National Highway No.5	Hanoi –Hai Phong Expressway		
4 lanes	4 lanes	6 lanes	8 lanes
43 090	54 545	81 818	109 090

Scenario of vehicle volum distribution in the future years on Hanoi – Hai Phong Expressway.

Traffic flow on the Hanoi-Hai Phong Expressway shall be forecast in two sections:

- Section 1: from Ring road III of Hanoi (Km0) to Hai Duong (Km55).

- Section 2: From Hai Duong to Hai Phong.

Results of traffic flow forecast on the Hanoi-Hai Phong road centre line in the two sections are based on servey of existing traffic flow in National road No.5 (Forecast of traffic flow until 2025 from Hanoi to Hai Phong). When the Expressway is still not put into operation, total caculated traffic flow will be on the National road No.5, when the Expressway will be put into service, the traffic flow from National road No.5 will be gradually moved to Expressway. Three solutions (low, medium and high) shall be used for forecast and traffic flows on the Expressway. However, this construction with total large initial investment capital and collecting charges requires minimum of risks and closely matches with economic development, so that the calculation will be of low growth solution.

Subject to calculation of traffic flow in the future years and data counted for vehicles on National road No.5, the scenarios of traffic flow on the Expressway shall be as follows:

In order to serve for the calculation of traffic flow, the Expressway is expected to be fully completed at the end of 2010 and shall be put into operation and charge collection. Therefore, the projected traffic flow shall be calculated annually and some kind of vehicles are supposed not to used or restricted to run on the Expressway as follows:

- Non-motorized vehicles are prohibited to run on the Expressway, wheel-type motors are restricted to run on this Expressway, therefore, this vehicle flow accounts for a small scale, mainly running in the interior of the city.
- The Expressway, after the completion, will mostly serve for cars, small-size buses, big-size buses, long-run trucks. Other small vans will mainly run in the interior of city.
- Vehicle classification is based on the differential of vehicle amount at the cross-sections. Depending on the calculation, Consultant classifies vehicles as follow: Lorry accounts for 72-78%, car for 68-77%, passenger car for 62-67%, pick-up truck for 34-51%.

Hanoi-Hai Phong Expressway running through cities of Hanoi, Hung Yen, Hai Duong, Hai Phong have been invested for construction with the following technical specifications:

Starting point of road line: located on the ring road III of Hanoi, 1025 m far from the north abutment of Thanh Tri Bridge, 1420 m toward Bac Ninh far from Red River dike, belongs to Thuong Hoi village, Thach Ban precinct, Long Bien district – Hanoi. The starting point is directly connected to Long Bien and Thach Ban street with 40m width and set to angle of $78^0$00’ with the ring road III.

The ending point of road line: located in Dinh Vu dam – Hai An district – Hai Phong city.

Scope of investment: Hanoi – Hai Phong Expressway is designed according to standards of class A Expressway with the designed speed of 120 Km/h.

e) Calculation and forecast of the air quality:

Calculation method:

Hanoi – Hai Phong Expressway has length of over 100 km, so the model to be applied for calculation of diffusion of pollutants content shall be carried out at three different grid level responding to each section with the maximum length of 30 km:

- The mesh of 500 x 500 m or 250 x 250 m for each section of the project with a view to catching a comprehensive overview,
- At the intersection, the calculation shall be carried out in the mesh of 100 x 100m;
- At some cross sections along the road line, the calculation shall be carried at the mesh of less than 50m in order to have exact dispersion, the results of calculation remain the foundation for the comparision with allowable standards of Vietnam standards (TCVN).
- Other concerned substances serving for the calculation of traffic sources remain NOx, SO2, PM10 and CO.

Meteorological data:

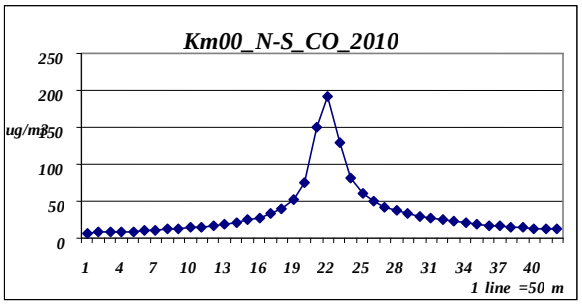
- Meteoroligical data recieved from meteorological stations of Hung Yen, Hai Duong, Phu Lien (Hai Phong) shall be used relatively for sections in calculations;
- The given Meteoroligical data stand for 2001 – 2005 period and is devided relatively for 2 seasons: Winter and Summer;
- In case of failure of dust filter from bitummious concrete mixing station, typical meteorological characteristics for 1 hour, winter, summer, day and night shall be used for simulated calculation.
- The given Meteoroligical data is neccessary for determining input coefficients of METI_LIS model: Wind direction, wind velosity, level of cloud covering, kinds of cloud, solar altitude, temperature of all daily observational period of the concerned period.

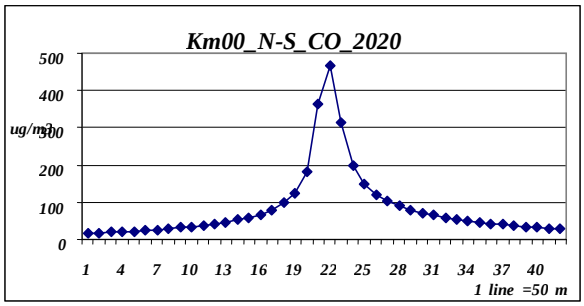
***Results of calculations and forecast*:**

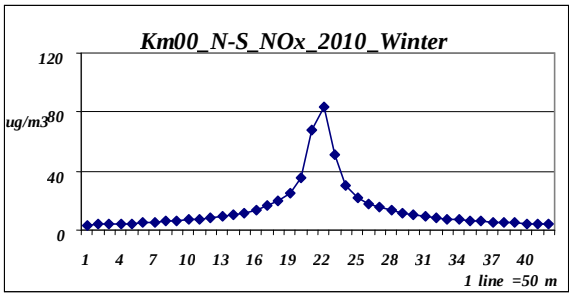
Results of calculations and forecast to 2010 and 2020:

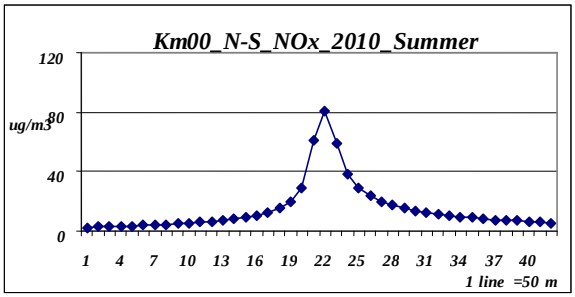
Results of calculations and forecasts to gas contents on the Hanoi- Hai Phong for year 2010 and 2020 are shown in the ditribution map attached to the annex, along with the following South – North sections, details at some intersections of the roadline give more details to the forecast value of substance distributed in the space – these values rapidly decrease by distance from the road centreline.

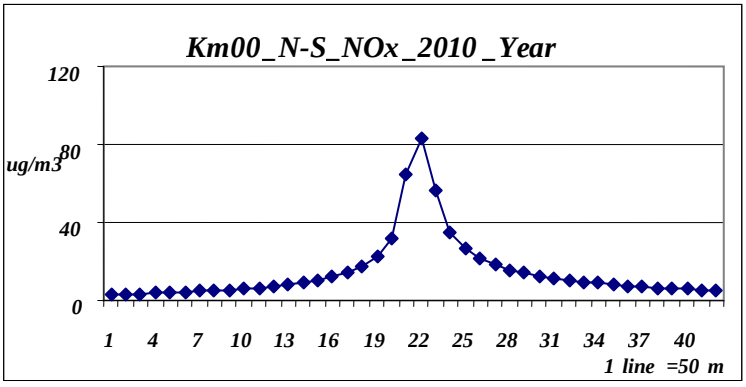
.

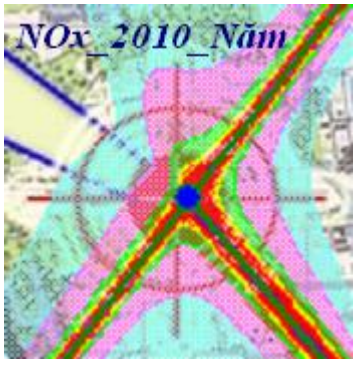


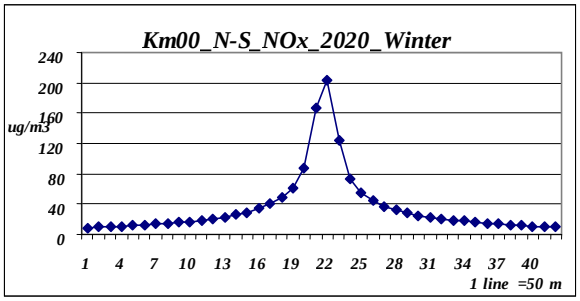


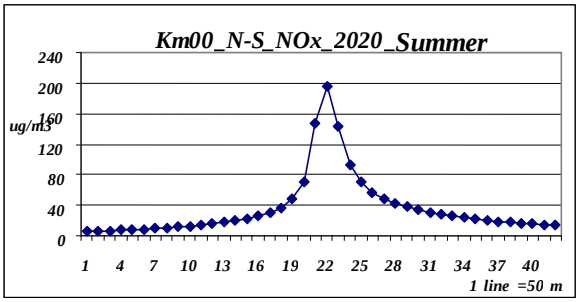


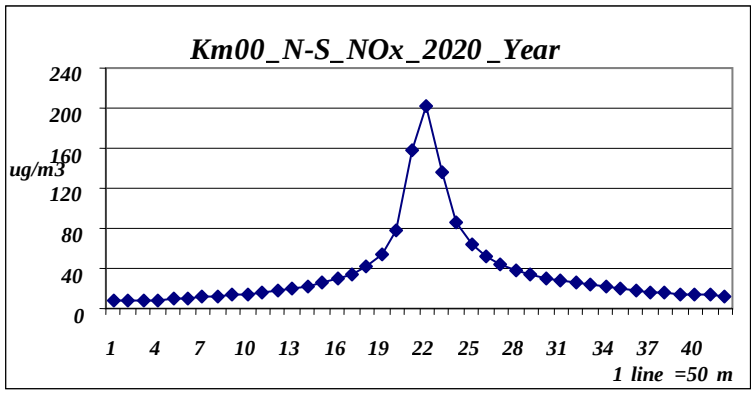


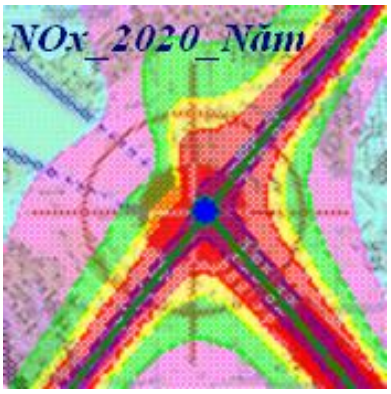


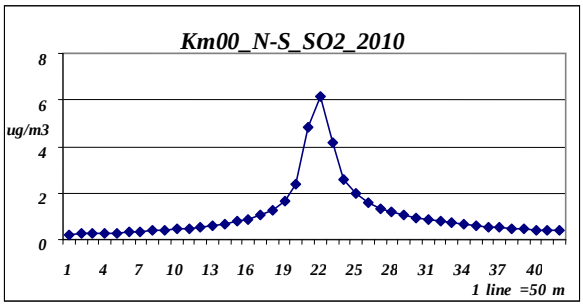


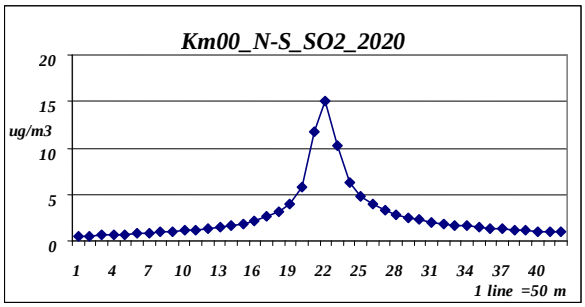

Km00_N-S_NOx_2020_Winter
240
200
160
120
80
40
0
ug/m3
1 4 7 10 13 16 19 22 25 28 31 34 37 40
1 line =50 m

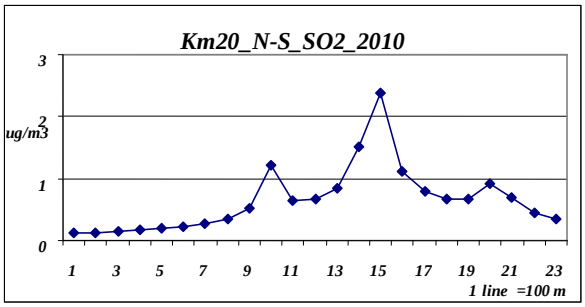

Km00_N-S_NOx_2020_Summer
240
200
160
120
80
40
0
ug/m3
1 4 7 10 13 16 19 22 25 28 31 34 37 40
1 line =50 m

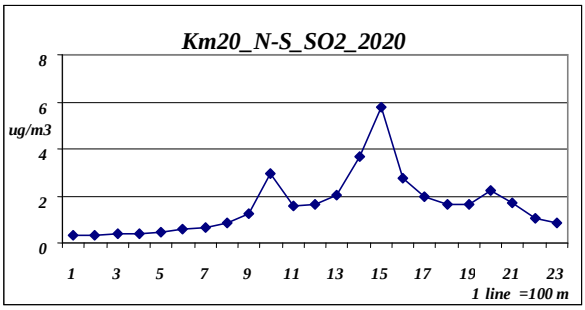

Km00_N-S_NOx_2020 _Year
240
200
160
120
80
40
0
ug/m3
1 4 7 10 13 16 19 22 25 28 31 34 37 40
1 line =50 m

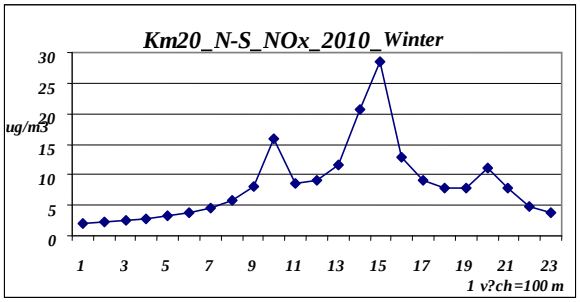

NOx_2020_Năm

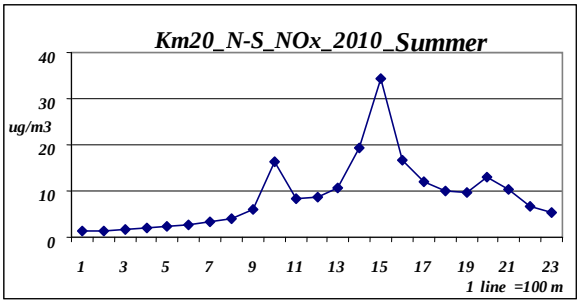

Km00_N-S_SO2_2010
8
6
4
2
0
ug/m3
1 4 7 10 13 16 19 22 25 28 31 34 37 40
1 line =50 m

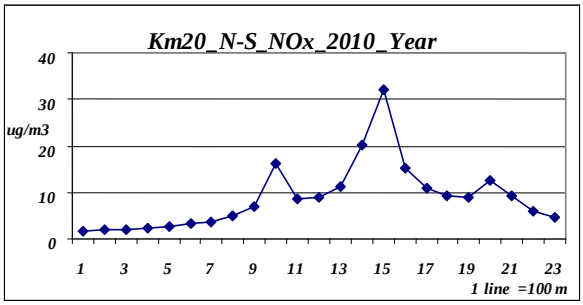

Km00_N-S_SO2_2020
20
15
10
5
0
ug/m3
1 4 7 10 13 16 19 22 25 28 31 34 37 40
1 line =50 m

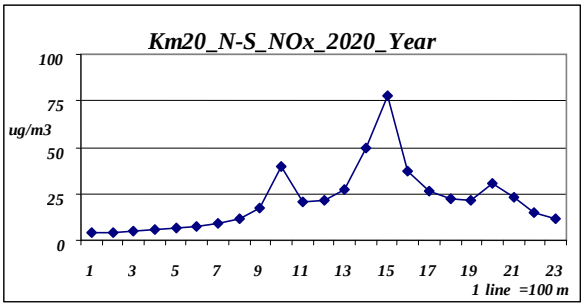

Km20_N-S_SO2_2010
3
2
1
0
ug/m3
1 3 5 7 9 11 13 15 17 19 21 23
1 line =100 m

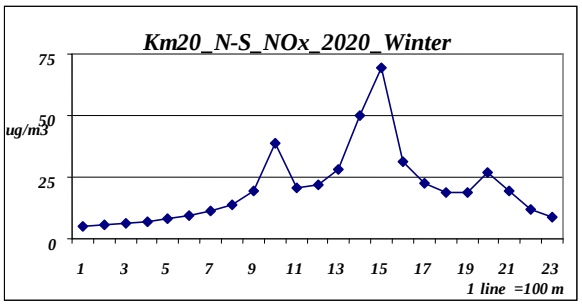

Km20_N-S_SO2_2020
8
6
4
2
0
ug/m3
1 3 5 7 9 11 13 15 17 19 21 23
1 line =100 m

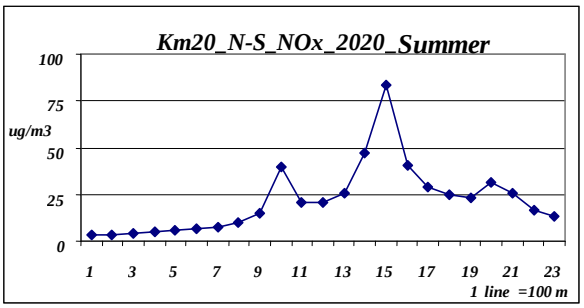

Km20_N-S_NOx_2010_Winter
ug/m3
0
5
10
15
20
25
30
1 3 5 7 9 11 13 15 17 19 21 23
1 v?ch=100 m

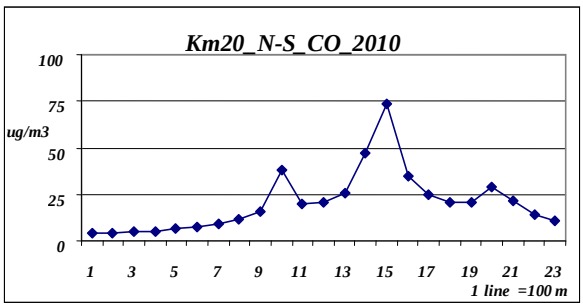

Km20_N-S_NOx_2010_Summer
ug/m3
0
10
20
30
40
1 3 5 7 9 11 13 15 17 19 21 23
1 line =100 m

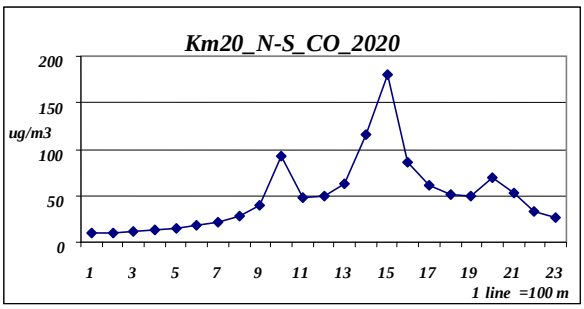

Km20_N-S_NOx_2010_Year
ug/m3
0
10
20
30
40
1 3 5 7 9 11 13 15 17 19 21 23
1 line =100 m

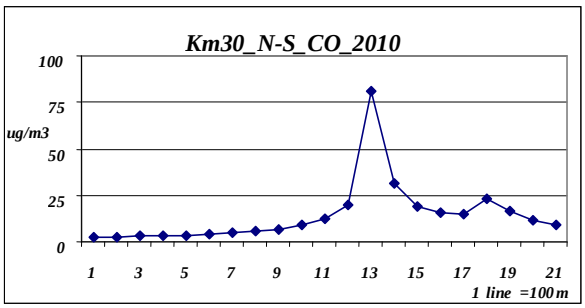

Km20_N-S_NOx_2020_Year
ug/m3
0
25
50
75
100
1 3 5 7 9 11 13 15 17 19 21 23
1 line =100 m

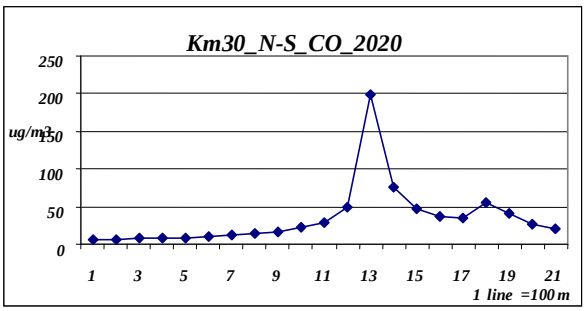

Km20_N-S_NOx_2020_Winter
ug/m3
0
25
50
75
1 3 5 7 9 11 13 15 17 19 21 23
1 line =100 m

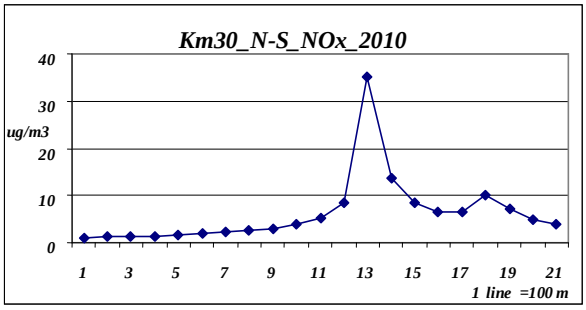

Km20_N-S_NOx_2020_Summer
ug/m3
0
25
50
75
100
1 3 5 7 9 11 13 15 17 19 21 23
1 line =100 m

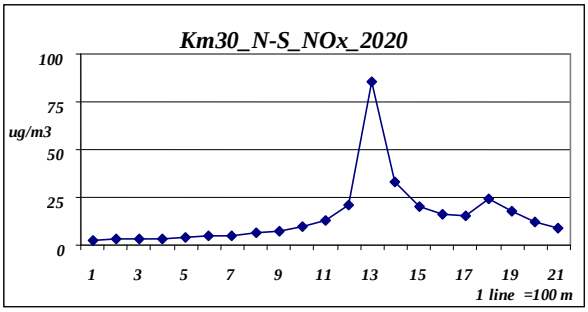

Km20_N-S_CO_2010
ug/m3
0
25
50
75
100
1 3 5 7 9 11 13 15 17 19 21 23
1 line =100 m

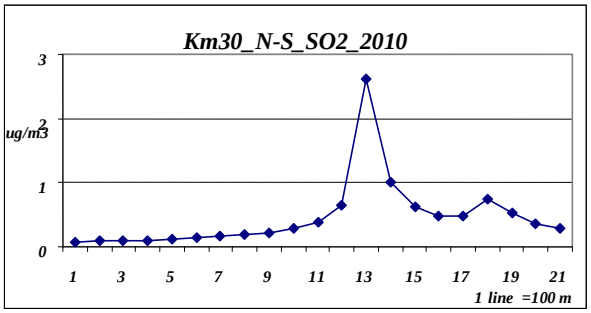

Km20_N-S_CO_2020
ug/m3
0
50
100
150
200
1 3 5 7 9 11 13 15 17 19 21 23
1 line =100 m

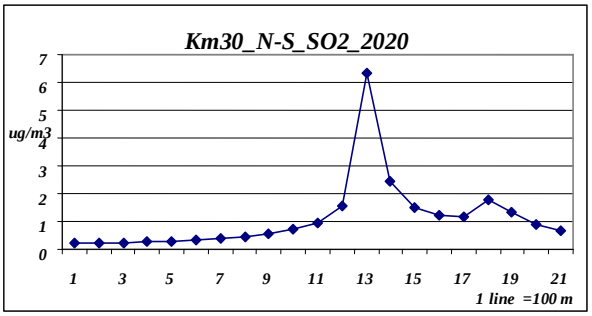

Km30_N-S_CO_2010
ug/m3
0
25
50
75
100
1 3 5 7 9 11 13 15 17 19 21
1 line =100 m

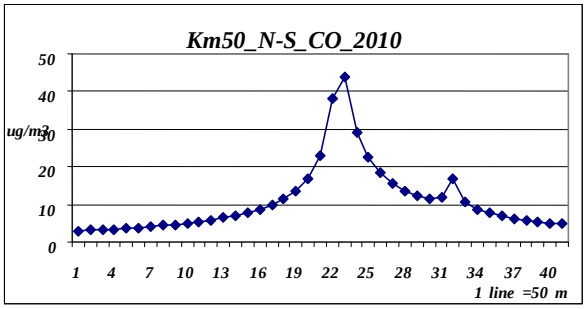

Km30_N-S_CO_2020
ug/m3
0
50
100
150
200
250
1 3 5 7 9 11 13 15 17 19 21
1 line =100 m

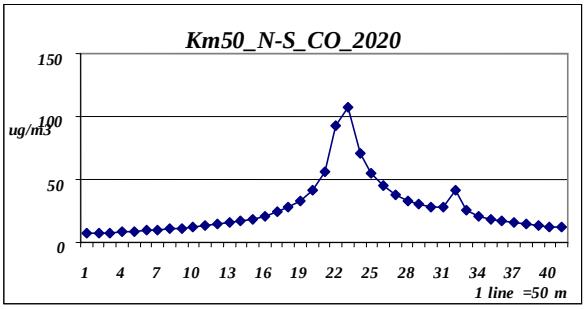

Km30_N-S_NOx_2010
ug/m3
0
10
20
30
40
1 3 5 7 9 11 13 15 17 19 21
1 line =100 m

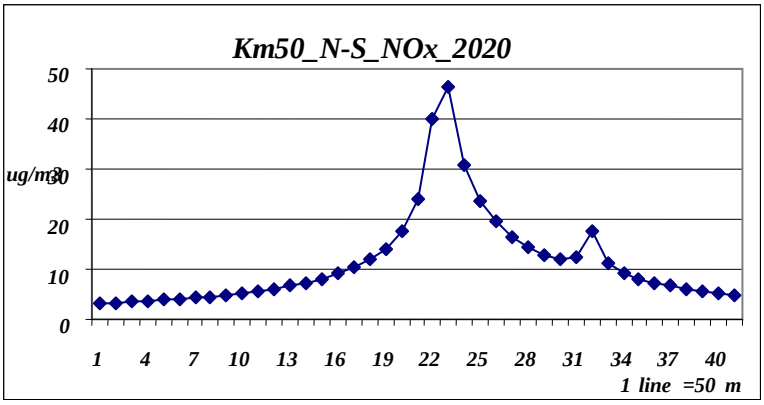

Km30_N-S_NOx_2020
ug/m3
0
25
50
75
100
1 3 5 7 9 11 13 15 17 19 21
1 line =100 m

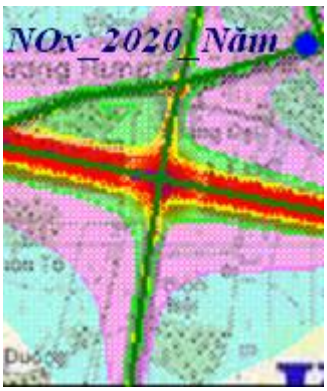

Km30_N-S_SO2_2010
ug/m3
0
1
2
3
1 3 5 7 9 11 13 15 17 19 21
1 line =100 m

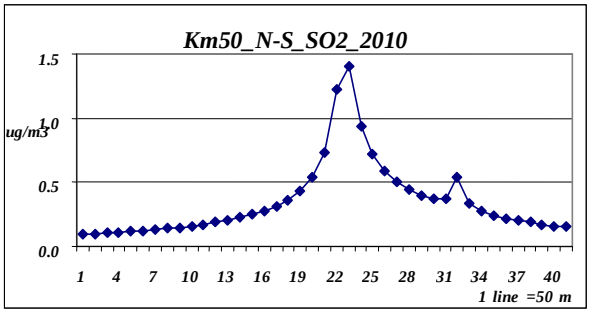

Km30_N-S_SO2_2020
ug/m3
0
1
2
3
4
5
6
7
1 3 5 7 9 11 13 15 17 19 21
1 line =100 m

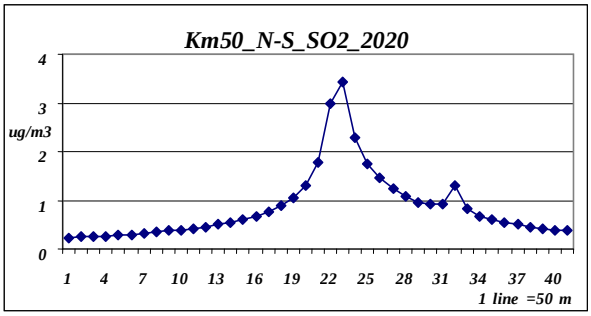

Km50_N-S_CO_2010
ug/m3
0
10
20
30
40
50
1 4 7 10 13 16 19 22 25 28 31 34 37 40
1 line =50 m

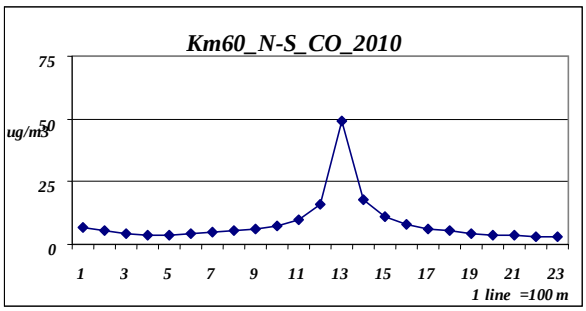

Km50_N-S_CO_2020
ug/m3
0
50
100
150
1 4 7 10 13 16 19 22 25 28 31 34 37 40
1 line =50 m

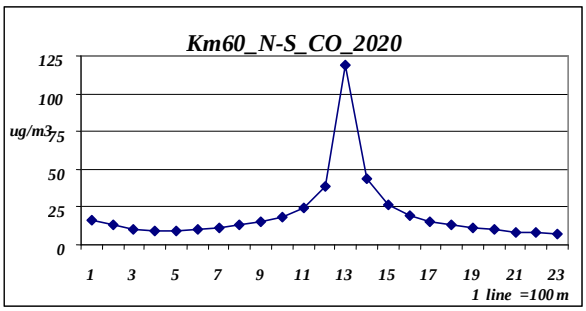

Km50_N-S_NOx_2020
ug/m3
0
10
20
30
40
50
1 4 7 10 13 16 19 22 25 28 31 34 37 40
1 line =50 m

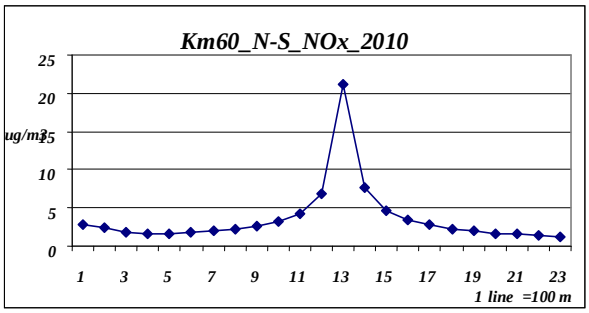

NOx_2020_Năm

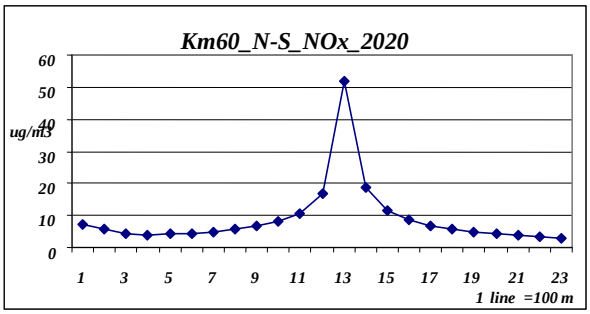

Km50_N-S_SO2_2010
ug/m3
1.5
1.0
0.5
0.0
1 4 7 10 13 16 19 22 25 28 31 34 37 40
1 line =50 m

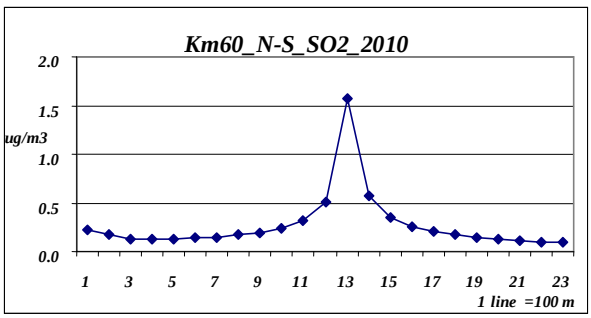

Km50_N-S_SO2_2020
ug/m3
4
3
2
1
0
1 4 7 10 13 16 19 22 25 28 31 34 37 40
1 line =50 m

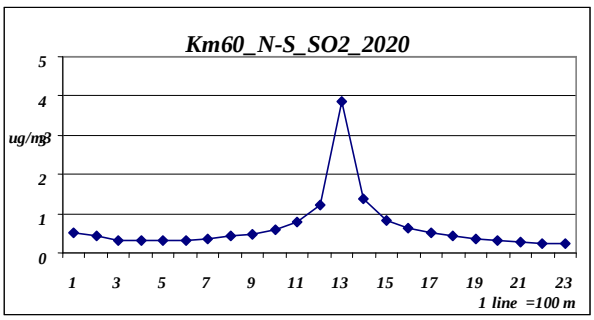

Km60_N-S_CO_2010
ug/m3
75
50
25
0
1 3 5 7 9 11 13 15 17 19 21 23
1 line =100 m

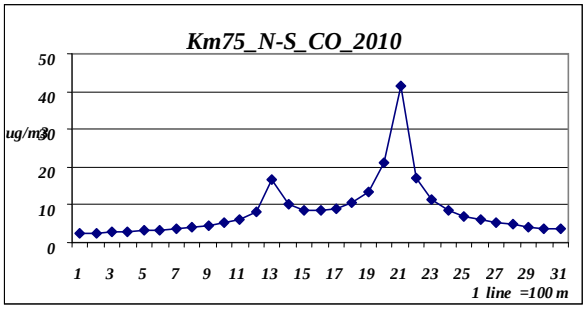

Km60_N-S_CO_2020
ug/m3
125
100
75
50
25
0
1 3 5 7 9 11 13 15 17 19 21 23
1 line =100 m

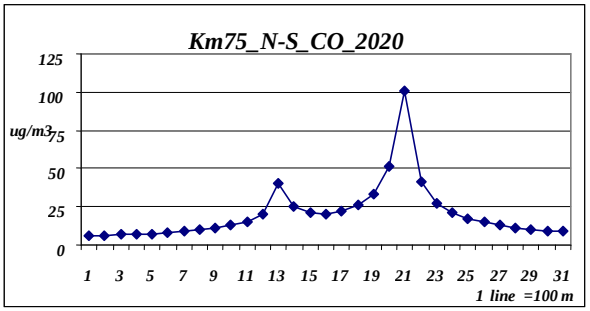

Km60_N-S_NOx_2010
ug/m3
25
20
15
10
5
0
1 3 5 7 9 11 13 15 17 19 21 23
1 line =100 m

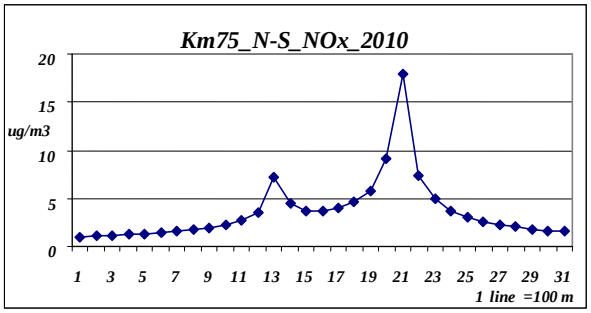

Km60_N-S_NOx_2020
ug/m3
60
50
40
30
20
10
0
1 3 5 7 9 11 13 15 17 19 21 23
1 line =100 m

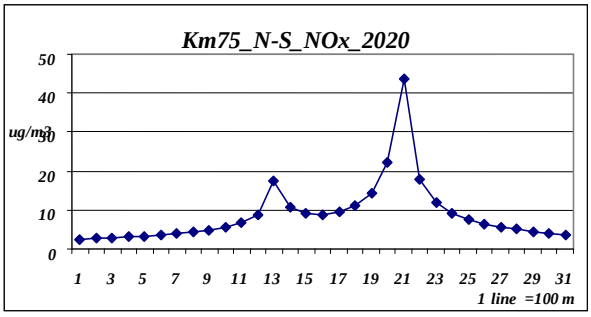

Km60_N-S_SO2_2010
ug/m3
2.0
1.5
1.0
0.5
0.0
1 3 5 7 9 11 13 15 17 19 21 23
1 line =100 m

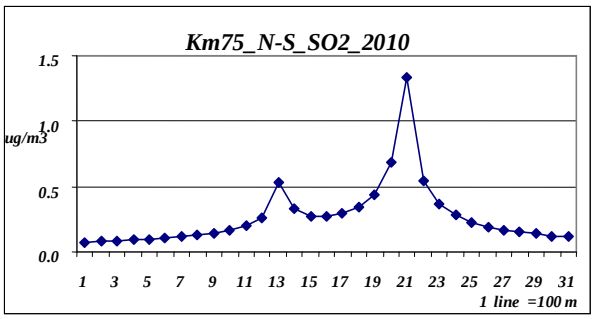

Km60_N-S_SO2_2020
ug/m3
5
4
3
2
1
0
1 3 5 7 9 11 13 15 17 19 21 23
1 line =100 m

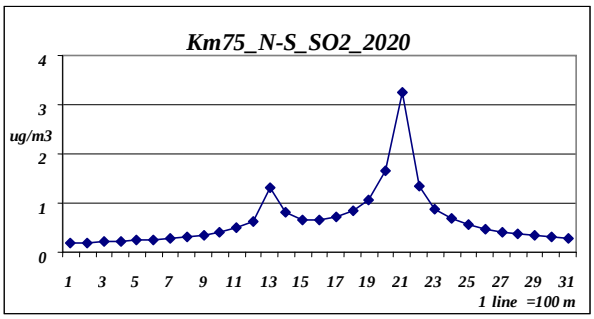

Km75_N-S_CO_2010
ug/m3
50
40
30
20
10
0
1 3 5 7 9 11 13 15 17 19 21 23 25 27 29 31
1 line =100 m

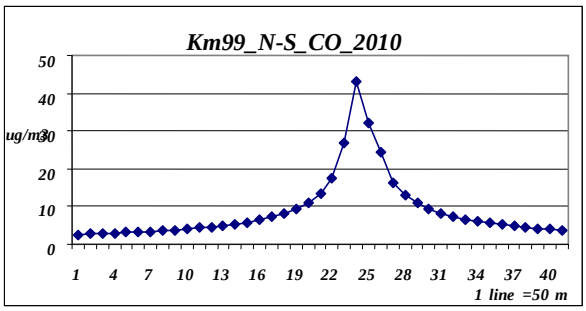

Km75_N-S_CO_2020
ug/m3
125
100
75
50
25
0
1 3 5 7 9 11 13 15 17 19 21 23 25 27 29 31
1 line =100 m

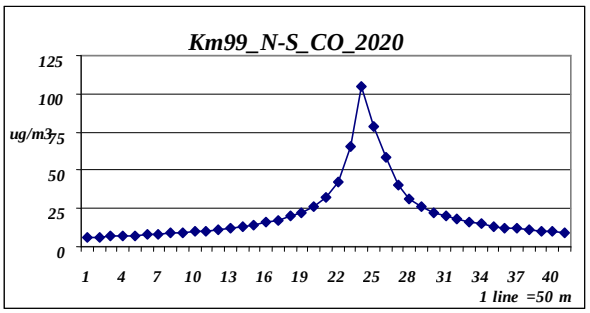

Km75_N-S_NOx_2010
ug/m3
0
5
10
15
20
1 3 5 7 9 11 13 15 17 19 21 23 25 27 29 31
1 line =100 m

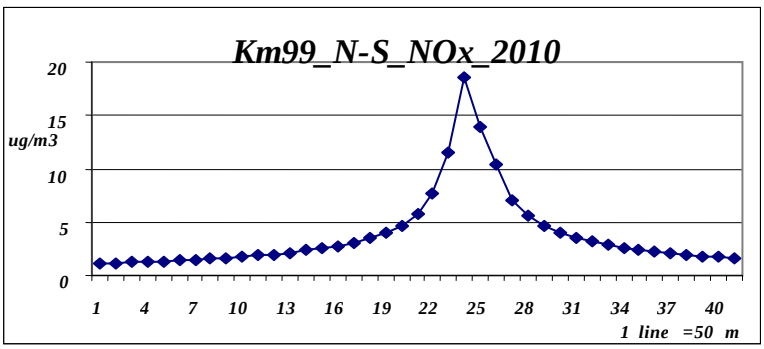

Km75_N-S_NOx_2020
ug/m3
0
10
20
30
40
50
1 3 5 7 9 11 13 15 17 19 21 23 25 27 29 31
1 line =100 m

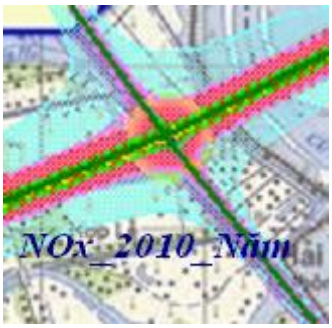

Km75_N-S_SO2_2010
ug/m3
0.0
0.5
1.0
1.5
1 3 5 7 9 11 13 15 17 19 21 23 25 27 29 31
1 line =100 m


Km75_N-S_SO2_2020
ug/m3
0
1
2
3
4
1 3 5 7 9 11 13 15 17 19 21 23 25 27 29 31
1 line =100 m


Km99_N-S_CO_2010
ug/m3
0
10
20
30
40
50
1 4 7 10 13 16 19 22 25 28 31 34 37 40
1 line =50 m


Km99_N-S_CO_2020
ug/m3
0
25
50
75
100
125
1 4 7 10 13 16 19 22 25 28 31 34 37 40
1 line =50 m


Km99_N-S_NOx_2010
ug/m3
0
5
10
15
20
1 4 7 10 13 16 19 22 25 28 31 34 37 40
1 line =50 m


NOx_2010_Nam

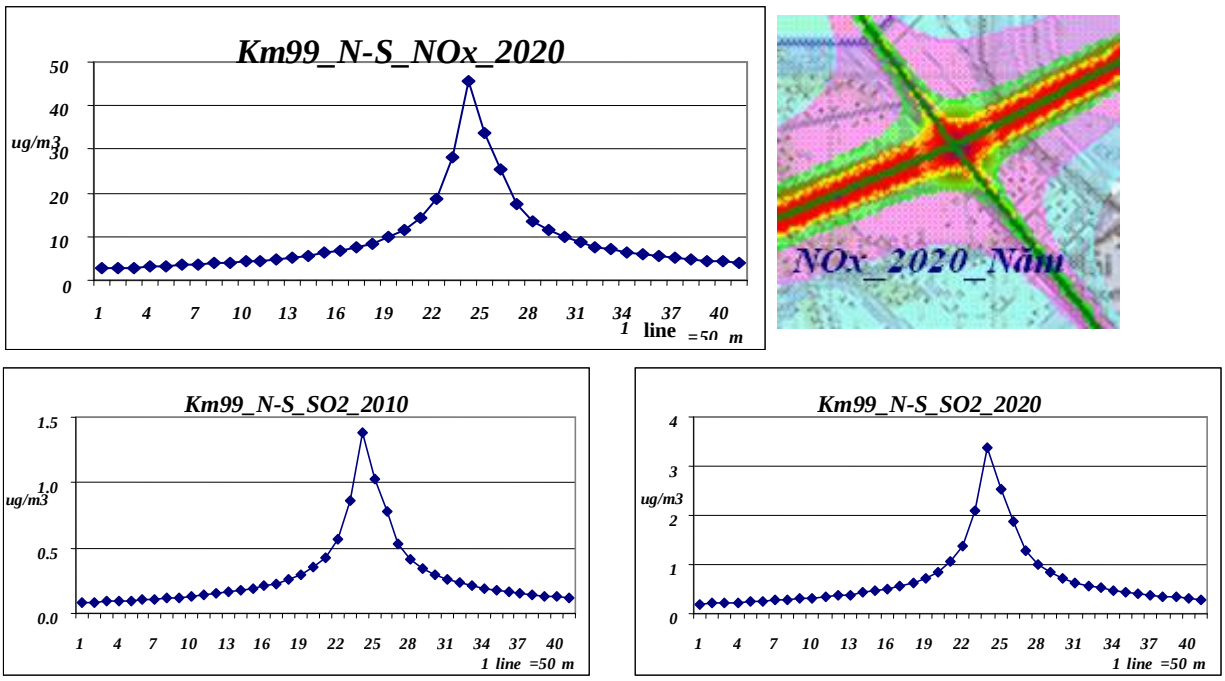


Figure 3.1: Map on distribution of NO_x content forecasted for 2010

Figure 3.2: Map on distribution of NO_x content forecasted for 2020

Figure 3.3: Map on forecast of CO; SO_2 content in 2010 and 2020

f) Comments on impact level of the Project

- Substances of CO, SO2: lower than those specified in Vietnamese Standards (TCVN), even in operation period for maximum traffic flow on the Expressway in 2020.
- Content of NOx, at the beginning section of the route in Hanoi, will exceed the maximum permittable content as forecasted in the event that the crossroads are intersections.
- Content of PM_{10} exceeds the maximum permittable volume under the Vietnamese Standard (TCVN) in forecast of 2010 and 2020 at several intersections and along the route. It is necessary to carry out the road surface cleaning and watering measures to minimize the dust flying from the road surface as the vehicle runs thereon.

3.4.1.2. Forecast of dust pollution PM10

Forecast of dust content is conducted on basis of emission volume forecasted in the route. The forecasted emission volume is calculated according to forecast of vehicle volume and emission coefficients. At present, no guideline or regulation on these coefficients are available in Vietnam – in which case, coefficients used in developed countries may be adopted. However, these coefficients are not suitable with the actual conditions in Vietnam. This is the most difficult matter in forecast of dust emission of the route and is a work of risk. Nevertheless, emission coefficients of USA are adopted as follows:

Dust emission coefficients generated from road surface under the conditions of USA (vehicle of 2.4 ton***)***

No.	***Type of road***	***Coefficient (lb/VMT)***	***Ratio as against Expressway***
1	Freeway	*0.000574*	*1*
2	Arterial, Collector	*0.000826*	*1.438655*
3	Local road	*0.003479*	*6.06274*
4	Rural road	*0.009903*	*17.25845*

Source: PMSJVPavedRoadMethod2003(pdf) VMT: vehicle of transportation over 1 mil.

Under the actual conditions in Vietnam, two Options are adopted:

High option: - In the event of very poor sanitation conditions of road surface

- 2 levels lower than the conditions in USA.

Plan I: Forecast of PM10 dust emission in the route of Hanoi – Hai Phong

2010 _PM10 emission volume in the route of Hanoi – Hai Phong				
Route	***Unit***	***2010***		
	g/m/h	***Winter***	***Summer***	***Year***
1/ National Highway 5				
Section 1- Medium Plan	*Generated dust*	*1.36*	*0.91*	*1.13*
Hanoi - Hai Duong	*Dust generated from motor*	*0.02*	*0.02*	*0.02*
	Total	***1.37***	**0.92**	**1.15**
Section 2- Medium Plan	*Generated dust*	*1.15*	*0.79*	*0.97*
Hai Duong - Hai Phong	*Dust generated from motor*	*0.01*	*0.01*	*0.01*
	Total	***1.16***	***0.80***	***0.98***
2/ Hanoi – Hai Phong Exp				
Hanoi - Hai Duong	*Generated dust*	*2.99*	*2.04*	*2.51*
	Dust generated from motor	*0.02*	*0.02*	*0.02*
	Total	***3.01***	***2.06***	***2.54***
Hai Duong - Hai Phong	*Generated dust*	*2.40*	*1.64*	*2.02*
	Dust generated from motor	*0.02*	*0.02*	*0.02*
	Total	***2.42***	***1.66***	***2.04***
3/ Ring Roads III,IV	*Generated dust*	*1.93*	*1.32*	*1.62*
	Dust generated from motor	*0.02*	*0.02*	*0.02*

	Total	***1.94***	***1.34***	***1.64***

2020 _ PM10 emission volume in the route of Hanoi – Hai Phong				
Route	***Unit***	***2020***		
	g/m/h	***Winter***	***Summer***	***Year***
1/ National Highway 5				
Section 1- Medium Plan	*Generated dust*	*1.89*	*1.32*	*1.60*
Hanoi - Hai Duong	*Dust generated from motor*	*0.03*	*0.03*	*0.03*
	Total	**1.92**	**1.35**	**1.64**
Section 2- Medium Plan	*Generated dust*	*1.49*	*1.04*	*1.26*
Hai Duong - Hai Phong	*Dust generated from motor*	*0.02*	*0.02*	*0.02*
	Total	***1.51***	***1.06***	***1.28***
2/ Hanoi – Hai Phong Exp				
Hanoi - Hai Duong	*Generated dust*	*3.79*	*2.64*	*3.21*
	Dust generated from motor	*0.05*	*0.05*	*0.05*
	Total	***3.84***	***2.69***	***3.27***
Hai Duong - Hai Phong	*Generated dust*	*3.06*	*2.14*	*2.60*
	Dust generated from motor	*0.05*	*0.05*	*0.05*
	Total	***3.11***	***2.19***	***2.65***
3/ Ring Roads III, IV	*Generated dust*	*3.23*	*2.22*	*2.72*
	Dust generated from motor	*0.03*	*0.03*	*0.03*
	Total	***3.26***	***2.25***	***2.76***

Low option: - In the event of poor sanitation conditions of road surface

- 1 level lower than the conditions in USA.

Plan II: *Forecast of PM10 dust emission in the route of Hanoi – Hai Phong*

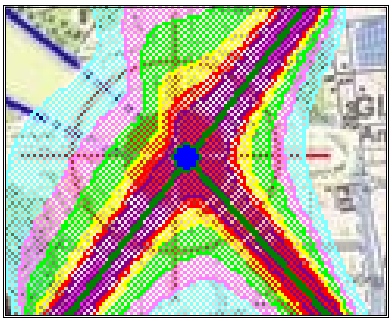
2010 _ PM10 dust emission volume in the route of Hanoi – Hai Phong				
Route	*Unit*	*2010*		
	g/m/h	*Winter*	*Summer*	*Year*
1/ National Highway 5				
Section 1- Medium Plan	*Generated dust*	*0.33*	*0.22*	*0.27*
Hanoi - Hai Duong	*Dust generated from motor*	*0.02*	*0.02*	*0.02*
	Total	***0.34***	**0.23**	**0.29**
Section 2- Medium Plan	*Generated dust*	*0.28*	*0.19*	*0.23*
Hai Duong - Hai Phong	*Dust generated from motor*	*0.01*	*0.01*	*0.01*
	Total	***0.29***	***0.20***	***0.24***
2/ Hanoi – Hai Phong Exp				
Hanoi - Hai Duong	*Generated dust*	*0.72*	*0.49*	*0.60*
	Dust generated from motor	*0.02*	*0.02*	*0.02*
	Total	***0.74***	***0.51***	***0.63***
Hai Duong - Hai Phong	*Generated dust*	*0.58*	*0.39*	*0.48*
	Dust generated from motor	*0.02*	*0.02*	*0.02*
	Total	***0.59***	***0.41***	***0.50***
3/ Ring Roads III,IV	*Generated dust*	*0.46*	*0.32*	*0.39*
	Dust generated from motor	*0.02*	*0.02*	*0.02*
	Total	***0.48***	***0.33***	***0.41***

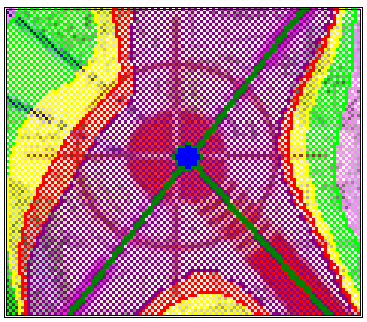
2020 _Dust emission volume of PM10 in Hanoi – Hai Phong Route				
Route	*Unite*	*2020*		
	g/m/h	*Winter*	*Summer*	*Year*
1/ National Highway 5				

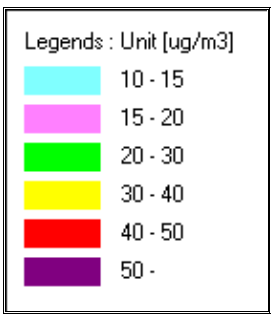
Section 1- Medium Plan	*Generated dust*	*0.45*	*0.32*	*0.39*
Hanoi - Hai Duong	*Dust generated from motor*	*0.03*	*0.03*	*0.03*
	Total	**0.48**	**0.35**	**0.42**
Section 2- Medium Plan	*Generated dust*	*0.36*	*0.25*	*0.30*
Hai Duong - Hai Phong	*Dust generated from motor*	*0.02*	*0.02*	*0.02*
	Total	***0.38***	***0.27***	***0.32***
2/ Hanoi – Hai Phong Exp				
Hanoi - Hai Duong	*Generated dust*	*0.91*	*0.63*	*0.77*
	Dust generated from motor	*0.05*	*0.05*	*0.05*
	Total	***0.96***	***0.69***	***0.82***
Hai Duong - Hai Phong	*Generated dust*	*0.73*	*0.51*	*0.62*
	Dust generated from motor	*0.05*	*0.05*	*0.05*
	Total	***0.78***	***0.56***	***0.67***
3/ Ring Roads III,IV	*Generated dust*	*0.78*	*0.53*	*0.65*
	Dust generated from motor	*0.03*	*0.03*	*0.03*
	Total	***0.81***	***0.56***	***0.68***

Plan I_High

Intersection Km00

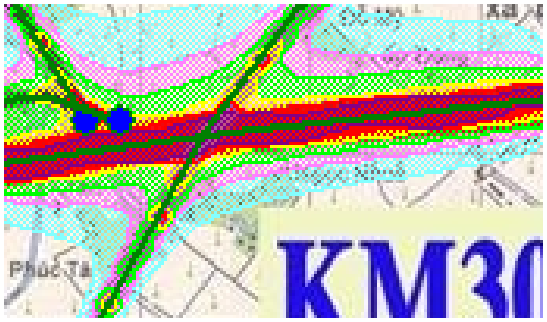


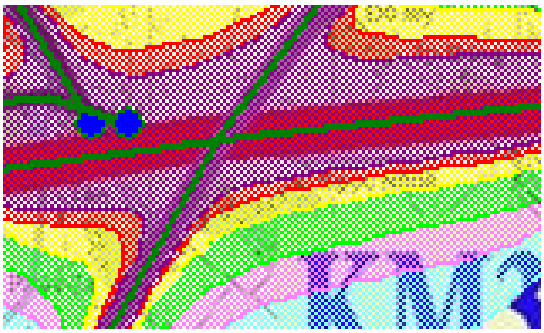




2010_PM10 ***2020_PM10***

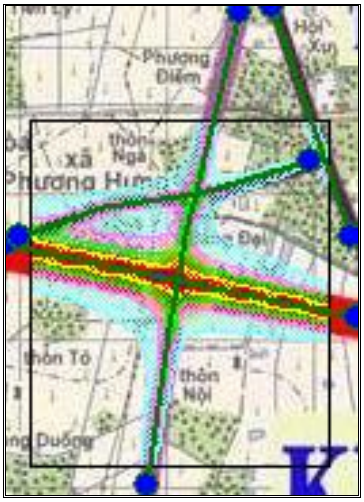
Intersection Km30

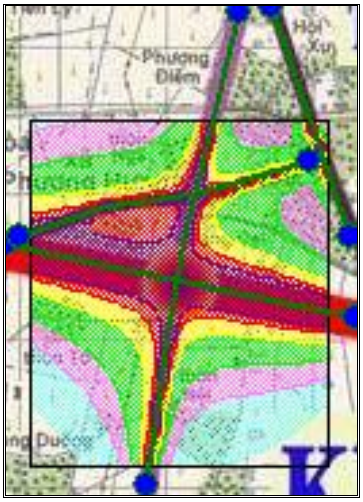


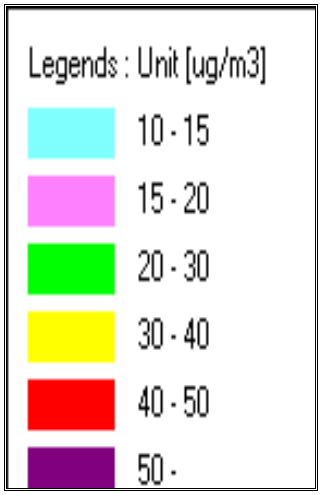


2010_PM10 ***2020_PM10***

Intersection Km50

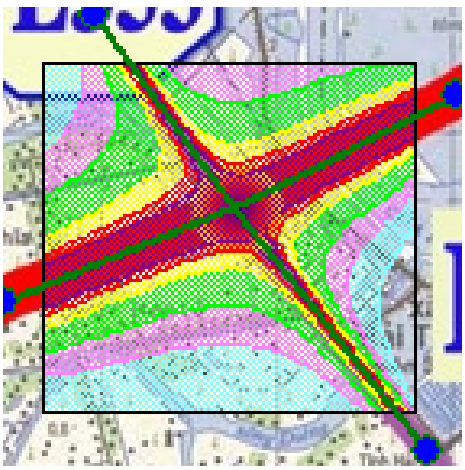






2010_PM10 ***2020_PM10***

Intersection Km99



2010_PM10 ***2020_PM10***

Under Plan I:

At Intersection Km00, max content as forecasted 2010 Cmax=271 ug/m3

2020 Cmax=850 ug/m3

At Intersection Km20, max content as forecasted 2010 Cmax=181.0 ug/m3

2020 Cmax=568.0 ug/m3

At Intersection Km30, max content as forecasted 2010 Cmax=162.0 ug/m3

2020 Cmax=507.0 ug/m3

At Intersection Km50, max content as forecasted 2010 Cmax=62.1 ug/m3

2020 Cmax=195.0 ug/m3

At Intersection Km60, max content as forecasted 2010 Cmax=65.6 ug/m3

2020 Cmax=207 ug/m3

At Intersection Km75, max content as forecasted 2010 Cmax=68.5 ug/m3

2020 Cmax=217.0 ug/m3

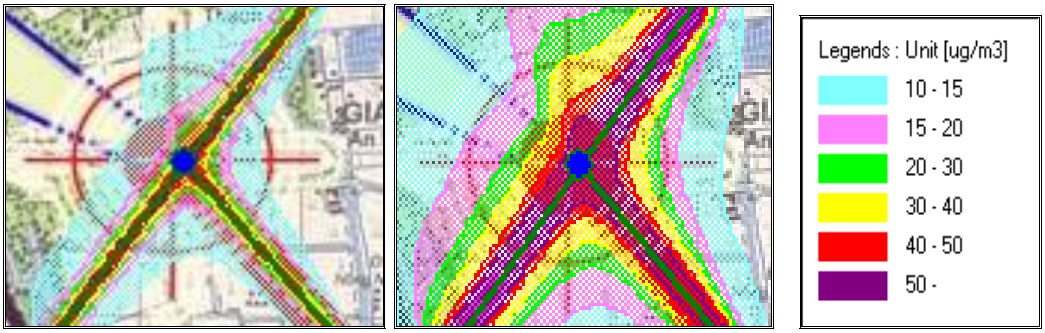
At Intersection Km99, max content as forecasted 2010 Cmax=60.2 ug/m3

2020 Cmax=191.0 ug/m3

Comment: According to Plan I, at all the intersections, the dust content exceeds permittable volume (TCVN 5937:2005) of 50ug/m3 in forecast period 2010, and of as many times as this standard in 2020.

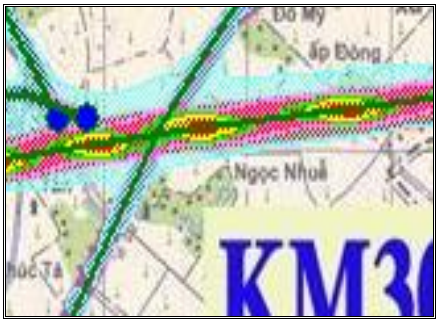
Plan II_Low

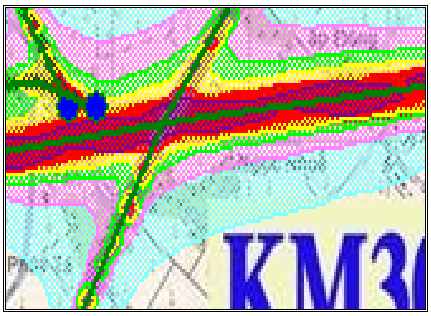
Intersection Km00



2010_PM10 ***2020_PM10***

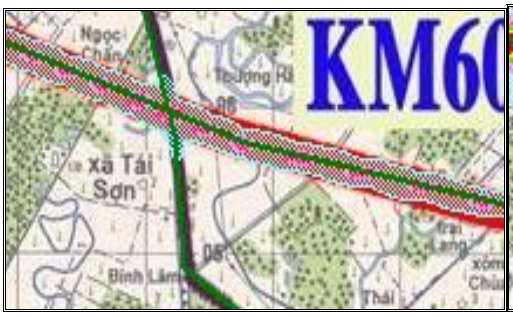
Intersection Km30

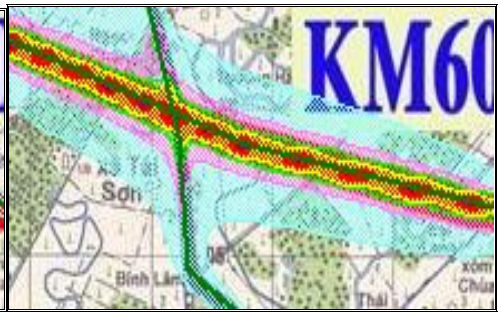




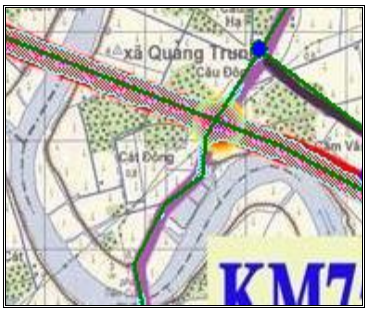
2010_PM10 ***2020_PM10***

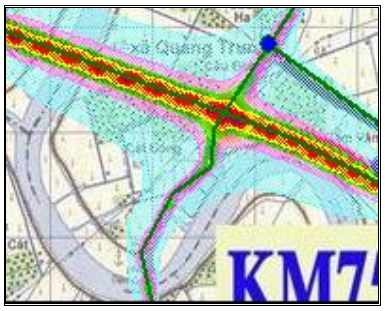
Intersection Km60

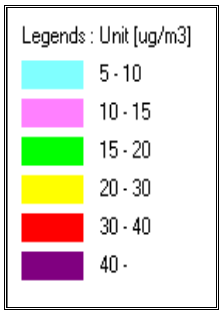




2010_PM10 ***2020_PM10***







2010_PM10 ***2020_PM10***

Under Plan II_Low:

At Intersection km00, max content as forecasted 2010 Cmax=65.0 ug/m3

2020 Cmax=204.0 ug/m3

At Intersection km20, max content as forecasted 2010 Cmax=43.4 ug/m3

2020 Cmax=136.0 ug/m3

At Intersection km60, max content as forecasted 2010 Cmax=15.7 ug/m3

2020 Cmax=49.7 ug/m3

At Intersection km75, max content as forecasted 2010 Cmax=16.4 ug/m3

2020 Cmax=52.1 ug/m3

Comment: According to Plan II, at the intersections forecasted to 2010:

- At the intersections in the section of Hanoi – Hai Duong, dust content exceeds permittable volume (TCVN 5937:2005) of 50ug/m3 in forecast period 2010, and of as many times as this standard in 2020.
- At the intersections in the section of Hai Duong - Hai Phong, dust content is lower than the maximum permittable volum (TCVN 5937:2005) of 50ug/m3 in forecast period 2010, and exceeds this standard in 2020.

3.4.2. Impact of noise

1) Method of forecast

The method adopted for forecast of noise is that used in UK to calculate sound isolation for buildings to be built and to prepare plan for construction and assessment of noise impacts in traffic.

This method adopts distance for calculation of standard noise of 10m from the roadside and 1.2m height from the standard road surface. Equation for forecast is as follows:

$$Lep\ (1h) = 101\,g\,Q + 331\,g\left(V + 40 + \frac{500}{V}\right) + 101\,g\left(1 + \frac{5\,p}{V}\right) - 30.6 \quad \text{(dBA)}$$

In which:

Q = vehicle volume (vehicle/hour).

V = average speed of vehicle flow (km/hour).

p = % of heavy trucks out of vehicle flow.

This method is applicable to roads whose pavement structure is good and slope is low. The advantage is that upon combination with other transmittal calculations, relatively accurate noise intensity is forecasted in the target location, because of having regard to effects of sound transmission, e.g. impacts of distance, foundation, protective screen and reflection. This method is good for crossroads and roads with complicated sections. For the purpose of forecast of noise in the Project area, the input data is taken as follows:

Slope of road: 0 %

Average speed of vehicle flow: V= 120 km/h

2)Forecast outcomes of noise generated by the traffic vehicle

Upon operation of the Expressway, it will share the traffic flow with National Highway 5 and more vehicle will increase on the Expressway from period of 2010 to 2020. Rate of heavy trucks (major source of noise) in the transportation flow will increase accordingly and is estimated by 15% (2010) -20% (2020). Average speed of vehicle on the Expressway is 70km/h. Suppose that the road pavement is smooth, reverberation pavement is asphalt concrete (coefficient a = -0.1). According to the above formula, outcomes of noise forecast for the sections in the years given in the following table (Table 3.20).

Table 3.20. Outcomes of equivalent noise forecast Leq(dBA) for various sections in Hanoi – Hai Phong Expressway

Route	Vehicle flow (vehicle/h)		Noise level (dBA)	
	2010	2020	2010	2020
NH No.5 –Km00	1855	5,283	78.4	83.6
Expressway at Sta.Km00	1876	5,305	78.4	83.6
Section intersecting with PR 206	2484	7,069	79.6	84.9
Section intersecting with NH38 Km42+500	2039	5,808	78.8	84
Section intersecting with PR190 at km69+391	1919	5,466	78.5	83.7
Section intersecting with Planned Road km103+557	1799	5,129	78.2	83.5

If typical noise level is measured at height of 1.2-1.5m from the road surface at a location far from the noise source by a given distance r1 (m) ("r1" often refers to 1m for industrial noise source and 7.5m for noise source of traffic vehicle flow), then noise level at the distance of r2>r1 will be lower than that at the distance of r1 by a numeric value ΔL (dB) under the following formula:

For noise source of a lotation: $\Delta L = 20\log (\frac{r_2}{r_1})^{1+a}$ (dB)

For noise source of the road: $\Delta L_d = 10\log (\frac{r_2}{r_1})^{1+a}$ (dB)

In which:

a refers to factor affected by ground terrain to noise absorption and reflection,

a = - 0.1 for asphalt and concrete road,

a = 0 for ground without trees,

a = 0.1 for ground covered with grass.

Results of equivalent noise forecast Leq (dBA) which decreases in accordance with different distances from the roadside for various sections in Hanoi – Hai Phong Expressway are shown in Table 3.21.

Table 3.21. Noise level at various distances

Distance from the roadside		10m	20m	30m	40m	50m	60m	70m	80m	90m	100m
NH 5 –Km00	2010	78.4	75	73.26	72.07	71.16	70.42	69.8	69.28	68.8	68.4
	2020	83.6	80.2	78.46	77.27	76.36	75.62	75	74.48	74	73.6
NH 5 – km100	2010	78.4	75	73.26	72.07	71.16	70.42	69.8	69.28	68.8	68.4
	2020	83.6	80.2	78.46	77.27	76.36	75.62	75	74.48	74	73.6
Section intersecting with PR206	2010	79.6	76.2	74.46	73.27	72.36	71.62	71	70.48	70	69.6
	2020	84.9	81.5	79.76	78.57	77.66	76.92	76.3	75.78	75.3	74.9
Section intersecting with NH38	2010	78.8	75.4	73.66	72.47	71.56	70.82	70.2	69.68	69.2	68.8
	2020	84	80.6	78.86	77.67	76.76	76.02	75.4	74.88	74.4	74
Section intersecting with PR190	2010	78.5	75.1	73.36	72.17	71.26	70.52	69.9	69.38	68.9	68.5
	2020	83.7	80.3	78.56	77.37	76.46	75.72	75.1	74.58	74.1	73.7
Section intersecting with Planned Road Km103+557	2010	78.2	74.8	73.06	71.87	70.96	70.22	69.6	69.08	68.6	68.2
	2020	83.5	80.1	78.36	77.17	76.26	75.52	74.9	74.38	73.9	73.5

The above results show that the noise pollution occurs within 100m (from the Expressway) and it is necessary to work out and observe effective mitigation measures for the sections passing through the residential areas in Hoa Muc village, Hoan Long commune, Yen My district and Vuc village, Tu Xuyen commune, Tu Ky district.

3.4.3. Impact on quality of surface water

Once the Expressway is put into operation, production and service establishments will grow along either side of the road, industrial zones will be developed, residential and urban areas, restaurants, hotels, motels, etc will be formed... and impacts from production and domestic waste will become a big issue. The waste will cause reverse impacts on surface water, groundwater, soil, sediment and the life of the people living between these two national strategic highways. It is necessary to map out a scheme to control the industrial and domestic wastes, preventing pollution of local environment.

3.4.4. Impact on quality of groundwater

The strongest potential impact on groundwater comes from the changes in hydrological conditions and quality of surface water that infiltrates into the groundwater. The surface water may be polluted when it penetrates through waste building materials, waste areas, toxic substances e.g. insecticide, waste oil. The groundwater may also be affected by the changes in water drainage system because of construction of the Expressway. In the geological section along the route there is a fine clay layer (layer No.1), 1 to 2 m thick, distributed near the surface, forming a good impermeable roof. Therefore, the impact on groundwater is not significant.

3.4.5. Impacts on economy and society

There will be changes in usage and price of land along the Expressway; new residential areas, unplanned markets, trading and service spots for passer-by will be developed and formed. In addition, planned areas will be developed for the purpose of socio-economic development in the localities. The usage of land along highway in general and along the Hanoi-Haiphong Expressway in particular will change in a rapid and complicated manner if the strategy for usage of land for long term is not worked out and observed.

Development of traffic system will faciltate development of industries, attracting more investment, creating more employment and reducing unemployment. The development of service and tourist networks will contribute to improve all types of traffic in the region and enhance the urbanization and industrialization process.

After the Expressway is put into operation, a significant part of agricultural land will be converted into other forms of use, e.g. use for trading purpose, industrial zones or residential areas. The uncontrolled conversion may result in ineffective usage of the land.

The forecast of urban and residential area development along the Expressway that may arise in some year after the Expressway is put into operation is as follows:

- Changes in labor and employment structure;
- Improvement of public infrastructure;
- Changes in land prices;

The environment may be polluted by dust, waste; the land may be degraded, the cultivation becomes ineffective and the yield may be poorer.

There will be resettlement along the route due to redistribution of working forces and population becomes to increase (However, according to the design, the Expressway has safety fences along both sides; these impacts will only affect specific sections).

However, the great density and speed of vehicle on the Expressway may cause some obstructs for the exchange and communication among the villages and communes that will be separated by the Expressway. The risk of traffic accident will be higher.

3.4.6. Impact on historic relics and cultural structures

The historic relics and cultural structures along Hanoi - Haiphong Expressway such as pagodas, temples, shrines, churches, cemeteries in the villages and communes will be affected indirectly in following ways:

The areas may become noisy because of development of industrial zones or population areas; some cultural traditions of the local people may be affected too.

Polluted air, noise, vibration during operation period may affect the cultural life of the local people.

3.4.7. Impact on biodiversity and bio-resources

Upon completion of the Expresway and its official operation, the main factors having continuous and long-term impact on biodiversity and bio-resources in the region are as follows:

The flow, load and speed of vehicle running on the Expressway will cause a lot of

discharged gases, dust, noises and oil-grease pollution to the environment (especially for the water environment of rivers) thus impacting the ecological environment of the aquatic creatures.

For the plant, the dust pollution process will have impact on the photosynthetic process, pollination leading to reduction of the plant productivity. Some discharged gases like SO2, NO2… may cause the fall of flowers and leaves, thus having a strong impact on the plant productivity. The increase of turbidity of water is the cause impeding the development of the aquatic creatures. However, this impact is not significant.

3.4.8. Increase of traffic accidents

During the operation course, the traffic accidents may be increased on the new Expressway as well as in the Project region for the following reasons:

Due to the increase of traffic density,

Due to the increase of engine speed.

The above mentioned impacts will have a considerable consequence if the proper preventive and mitigation measures will not be taken. The said minimizing measures are proposed in Chapter 4.

CHAPTER 4. MEASURES FOR SETTLEMENT AND MITIGATION OF BAD IMPACTS ON ENVIRONMENT

For the purpose of minimizing negative impacts of the Project on environment and maximisation of adaption as a result of development of the Expressway to the Environment, the measures therefor are considered primary concern. The minimizing measures will be worked out and observed in such a way to take full use of the positive role of the Project to reach the final objective, i.e. effectiveness and usefulness and minimize bad and unexpected impacts. Accordingly, minimizing measures will be paid due attention to during the execution of the Works and in operation period in the future at the aim of eliminating most of bad impacts on the Environment in short and long terms.

4.1. IMPACT MINIMIZING MEASURES IN THE PRE-CONSTRUCTION STAGE

4.1.1. Measures for minimizing the impact on social-economy and people migration

Early in the Stage of alignment selection, the Employer and the Design Consultant agreed on the rule that the route must be designed in such a way to detour the dense population areas, historical and cultural relics, schools and hospitals, etc. Selection of Option II for the alignment reduces approximate 2,000 households subject to land acquisition or relocation. This alignment is also far from Hai Phong Tuberculosis Hospital and Military Orthopedic Centre in Kien An – Hai Phong.

A resettlement plan of the Project will be studied and proposed by the Project Management Board. The following principles will be considered so as not to cause any social problem due to the eviction of dwelling land and farming land.

Resettlement policy:

The general framework about resettlement and compensation shall be in compliance with the applicable laws policies of the State and with Decision No. 3037/QD- of the Ministry of Transport providing regulations and guidelines for procedures of land acquisition for construction of transport work Projects, etc. Land acquisition and resettlement policy of Vietnam has approached the basic principle of ensuring the non-voluntary resettled people to have their lives at least at the same level as before being moved to the new place.

Resettlement action plan:

The Resettlement Plan must ensure that all the persons to be relocated will be fully compensated for the property losses due to the land acquisition for the Project, and that any means needed for migration service will be supplied and economic reconstruction will be supported for populated area within the Project scope.

Legal aspect:

"*Damaged people*" are persons whose land has been unwillingly withdrawn, leading to their compulsory move away, their loss of property or ability of accessing to property; or loss of income source or means of subsistence which may cause negative effect to their livelihood.

Land User Right Certificate, household register, house-land tax bills, etc are official papers confirming land use right. Evacuated person who don't have such legal house-land documents, but has lived for a certain period in the Project area will receive a reconstruction support instead of land compensation and compensation for crop, house and other property loss. Any person transgressing the road building demarcation line after the boundary markers have been set, will not be entitled to any compensation or other reconstruction supports. Such person will be asked to dismantle his works, and in case of necessity will be forced to move away.

Institutional aspect:

The Compensation Committees will be established at the district level to help the Project Management Board in every activity related to the Resettlement Plan. Among members of these District Compensation Committees, there are at least 3 representatives of the damaged people from each commune, including representative of evacuated households and Chairmen of People's Committee of communes having evacuated households

Community participation and consultation:

The damaged people will be informed and consulted properly so that they could actively participate in working out and realizing the Resettlement Plan. The Project Management Board will be responsible for carrying out the Community Information Campaign and preparing the Project Information Handbook for supplying to the damaged people.

Claim and denunciation:

The Project will ensure that the damaged people will have access to effective mechanism for claim and denunciation settlement. The procedures for settling claim and denunciation are explained in the Public Information Handbook supplied to the damaged people. In short, each damaged people can submit for settling any complaint and denunciation at any time, first to the (Ward) Commune People's Committee. If the damaged people are not satisfied with the decision of the commune People's Committee and the Commune (Precinct) is unable to solve the matter, they can lodge the claim to the District People Committee, then Province People Committee, and at last, to the People's Court of any level. Independent supervision and evaluation will also confirm that the damaged people's complaint are properly treated in conformity with Resettlement Plan and applicable policy.

For the Hanoi – Haiphong Expressway, its route does not go through the sensitive ecological areas, natural forests or bio-diversified zones. Therefore, the determination of the alignment aims to reduce the potential impacts on the environment during the execution and operation of the Expressway in the future.

In order to minimize the impact of land acquisition and resettlement, based on proposal of the Consultant, the Employer has agreed with local authorities, namely the Haiphong People's Committee, to choose Option 2 (to avoid Kien An District). In comparison with Option 1 (passing through Kien An District), the Option 2 Road line reduces the number of evacuated households from 3437 to 1093 (reduced by 1344 households).

4.1.2. Resettlement Policy and Action Plan of Hanoi, Hai Phong cities, Hung Yen, Hai Duong provinces

The Hanoi-Haiphong Expressway Project passes through Hanoi City, Hung Yen, Hai Duong provinces, Haiphong city- within downstream of Red River delta, where the population density is relatively high. Beyond the land fund allotted for agriculture almost no unused land is left. Land is used in maximum for residential and cutivating purpose.

- Ressettlement

Resettlement is the measure for stabilizing the life of evacuated households affected by the Project when their land is fully or partly acquired:

There are three forms of resettlement:

+ Concentrated resettlement;

+ Dispersed resettlement,

+ Self-migration.

Given the fact that the Project is designed on the principle of minimizing the withdrawal of population's land and houses, on the whole route there is scarcely any place where many households must moved out. Normally fewer than 10 households must move out at a site, and most of them are in rural or suburban areas. As the localities are not too short in land fund, the Project has selected together with local authorities the option of on-the-spot dispersed resettlement for the whole route. This option is in accordance to the will of most of affected people. The land area allotted to the dispersed resettlement households is in compliance with the new dwelling land allotment norm issued by Province (City) People's Committee.

Depending on the location of allotted land the resettled households are given additionally an area rating about 1 to 1.3 for access way and green trees planting. Each evacuated household is given an aid of 2.2 million VND each, and each person is given an aid of 100,000 VND.

Other supporting measures are taken in compliance with the Decree No. 197/2004/ND-CP of the Government and Circular No. 116/TT-BTC of the Ministry of Finance. The supporting policies for the Project include:

+ Support for stabilizing population life and production activities. Households having business registration are given a maximum aid of 30% of after-tax income.

+ Support for professional change and job creation.

+ If the locality is not able to organize job training, the aid will be supplied in form of cash.

+ Aid to the tenants of the houses which are not owned by the State: households and persons having permanent residence registered in the locality of tenancy where the land is acquired by the State and subject to change their residence, will be given an aid for relocation purpose.

Besides the above supports, depending on local actual conditions the Chairman of Province People's Committee can decide other supporting measures for ensuring the stabilization of life and production operation of the damaged people.

- Compensation for loss of land:

The different categories of land legally owned by the people, which are subject to acquisition for construction of the Hanoi-Haiphong Expressway will be compensated in compliance with the State policy. The unit price will be applied depending on the land category and locality.

In Hanoi City (Gia Lam District) the price of dwelling land is VND650,000 /m^2, rice field land: VND74,000/m^2, and fruit tree land: VND84,000/m^2.

In Hung Yen province, the land price applied for each district is as follows: For Van Giang District, the price of dwelling land is VND700,000/m^2; rice field land – VND29,300/m^2; fruit tree land – VND32,760/m^2. For Yen My District, the price of dwelling land is VND500,000/m^2; rice field land – VND25,400/m^2; fruit tree land – VND28,080/m^2. For An Thi District, the price of dwelling land is VND100,000/m^2;

rice field land – VND25,400/m^2; fruit tree land – VND28,080/m^2.

In Hai Duong province, the price of dwelling land is from VND500,000/m^2 (Thanh Ha District), to VND600,000/m^2 (Tu Ky District), and 800,000 VND/m^2 (Gia Loc, Binh Giang District). For all these four districts the compensation price of rice field land is VND27,000/m^2, and fruit tree land VND36,000/m^2.

In Haiphong City the compensation price for dwelling land is VND1,000,000/m^2; for An Lao District – VND800,000/m^2; rice field land – VND52,000/m^2; fruit tree land – VND55,000/m^2.

Total amount of money for land compensation of the whole road line is VND646,367,240,700.

- ***Compensation for property damages:***

Dwelling houses, architectural works and structures associated to the land are compensated at their current value, which is determined by multiplying the percentage (%) of the structure remaining value by new construction price in compliance with the norm set by Province (City) People's Committee under the State regulation.

In case remaining value of the house and auxiliary structures is too low, and the compensation rate is not enough for building a new house with the same technical standard as that of the dismantled house, its owner can be given additional compensation but the total amount of compensation must not exceed the new construction price set by the local authority for the house of the same technical standard.

In respect of houses, architectural works or structures which can be dismantled and transported to the new place for re-assembling, the compensation will be for covering the costs of dismantling, transporting and material loss during transporting and re-assembling course. The maximum level of compensation will not exceed by 10% standard price of the house of the same technical standard set forth by the Province (City) People's Committee, and every family to be relocated will be given aid for moving use.

The housing compensation price for each province is as follows:

For Hanoi City: three-story house – VND1,330,000/m^2; two-story house – VND1,330,000/m^2; house with concrete flat roof – VND910,000/m^2; tile-roofed house – VND710,000/m^2.

For Hung Yen Province: three-story house – VND950,000/m^2; two-story house – VND910,000/m^2; house with concrete roof – VND597,000/m^2; tile-roofed house – VND580,000/m^2, metal sheet-roofed house – VND344,000/m^2.

For Hai Duong Province: two-story house – VND1,108,000/m^2; house with concrete roof – VND1,207,000/m^2; tile-roofed house – VND771,000/m^2, metal sheet-roofed and temporary house – VND655,000/m^2.

For Haiphong City: two-story house – VND1,269,112/m^2; house with concrete roof – VND1,009,724/m^2; tile-roofed house – VND689,828/m^2.

- Compensation for relocation of grave

For the relocation of grave, the compensation amount for such relocation is calculated for the whole cost covering exhume, transportation and construction of grave to the current status.

The compensation amount for tombs relocation applied for each province-city is as follows:

For Hung Yen province:

Built grave – VND1,000,000/grave; land grave – VND600,000/grave

For Hai Duong province:

Built grave – VND1,000,000/grave; land grave – VND500,000/grave

For Haiphong City:

Built grave – VND750,000/grave; land grave – VND300,000/grave

- Compensation for damage of the plants/trees

The timber trees and fruit trees on the area to be withdrawn will be compensated with following price:

Hanoi City: fruit tree – VND20,000/tree

Hung Yen province: Fruit tree – VND15,000/tree; timber tree – VND25,000/tree

Hai Duong province: Fruit tree – VND150,000/tree; timber tree – VND30,000/tree

Haiphong: Fruit tree – VND120,000/tree; timber tree – VND30,000/tree.

The above compensation price and aid will help the owners subject to acquisition of

land to forthwith stabilize their lives in the new dwelling places.

4.1.3. Measures for minimizing the impacts on security and social status

The undesired social impacts during the construction course can appear under such form like disagreement, conflict between residents and workers who carry out execution in the route, especially due to appropriation of working means and tools of the construction units by local juvenile, youth or residents. For this reason the Employer and the Contractors will closely associate with the local authorities in educating local people and building workers at the construction Site on discipline and protection of public properties. The Project Management Board and contractors will perform well the public relations in order to get the help and support from the local people and authorities.

Though the social evils like drug addiction, prostitution, etc are not the evident consequence but there is a risk of their occurrence, thus it is necessary to have a close combination with local authorities at every level, especially the regional security forces for timely prevention and solutions.

In order to prevent and minimize the risk to and impact on the health of the construction workers, the Employer and contractors will popularize the knowledge on occupational disease prevention and labor safety measures, and will supply them with labor protection means like helmet, mask, light reflecting clothing, signaling lamp, signaling flag, individual labor protection means everywhere the risk of accident is rather high. Attention is paid to the food and drink hygiene and other labor hygienic conditions, especially to the clean water supply for living needs during the road construction course.

4.2. MEASURES FOR REDUCING POLLUTION DURING THE CONSTRUCTION COURSE

4.2.1. Measures for mitigation of air pollution

Detailed plan and measures will be prepared for the soil-carrying trucks in order to limit the dust emission during the transporttion and earth work process. The road surface must be regularly watered in dry season, especially for the road section through populated areas. In any case, construction site must be cleaned and preserved in natural status when the construction work is over. Each contractor must have a team (3 to 5 persons) to perform the said work.

The Employer, through contractual provisions and terms, will oblige the construction units to use vehicles and building equipment and machinery in compliance with the Vietnamese Standard (TCVN) on toxic gas emission. The

regular and close inspection and supervision must be performed during the whole construction course.

The use of standard equipment that causes less impact on environment, less smoke, toxic gases and noises is encouraged to be used.

The roads for transportation must be watered and the material falling down onto them must be limited.

The material carrying vehicles must be covered tightly by canvas.

The asphalt concrete mixing station will be located at broad and airy place far from populated areas, and convenient for transportation. Other type of machinery like stone crushing machine, mobile concrete mixing station, etc must have their local dust protection system.

On the whole route, 04 asphalt concrete mixing stations are arranged at following interchanges:

- Station 1: on NH39 (km20+246)
- Station 2: on NH38 (km48+744)
- Station 3: on NH10 (km74+431)
- Station 4: on PR 353 (km96+700)

All the locations of the said concrete mixing stations must be far from densely populated areas (by 300 m to 500m). These concrete mixing stations must be of technical standard and have dust sucking equipment during its operation.

Unused materials or waste at concrete mixing stations must be collected and disposed to the assigned landfill with the consent of local authority.

Place for asphalt heating must be arranged at the downstream of wind direction and far from populated areas (by at least 150m).

It is strictly banned to use timber or rubber as fuel for asphalt heating.

4.2.2. Measures for minimizing of noise and vibration

Mechanized vehicle, heavy trucks, construction equipment used for the Project will be checked by the competent agency on noise emission in compliance with Vietnamese Standard. This is also a bidding condition required by the Project Management Board to construction equipment suppliers.

Calculation will be made for locating the construction equipment (if possible) at places so that the noise amplitude at populated areas, cultural-administration centers

near the Project site, will lower than permitted one. If this cannot be realized, temporary noise protection wall (for construction site) will be set at the distance of some meters to the stationary equipment, and 5m – to the mobile equipment. Construction activities near the polulation area will be boosted in the daytime. Such regulation will reduce the noise at night when the permitted noise level is lower than that of daytime. The performance of construction at suitable locations and time will considerably reduce the construction noise and costs, even can avoid additional cost, namely:

- Only operate the well maintained equipment at construction site; to carry out regular equipment maintenance during the whole construction course.
- To use and maintain the sound reducing and noise blocking devices; Turn-off the machines working discontinuously (if not neccessary), to reduce the accumulated noise to the lowest level.
- Workers who work near to the great noise source must use sound protection helmet; large building worker collectivity living for long time in Project area will be considered as a new populated area and be located far from construction site by at least 250m.

Supervision over noise is part of construction supervision; the supervision will be required not only to areas having highly noisy equipment (pile driving ground and area with great noise equipment), but also to places near the populated areas during the whole construction course. The above measures will be expressly stated in the contractual terms and conditions.

For the concrete mixing stations, it is necessary to carry out the dumping of stone, sand, gravel and containers in daytime; the loading and unloading works for trucks, mortar mixing and pumping work – must be carried out in daytime, or far from populated areas.

4.2.3. Measures for reducing water pollution

In order to protect the water quality of the rivers and canals, the Employer must oblige the contractors to fulfill the duty of water environment protection during the whole construction course (stated in the contracts):

- Not to dump solid wastes (construction waste, stone, sand…) and oil waste derived from equipment into water stream; every type of waste must be collected, sorted and disposed to the designated locations. Before carrying out the construction work, the Project Management Board and Contractors will agree with Urban Environment Company of Province where the Project

will pass through, on the location of waste dump and method of waste sorting.

- The waste materials are considered as solid waste, thus they will be disposed to designated location in accordance with instruction of site engineer with consent of local authority.

In order to prevent and reduce the oil pollution from building site, building equipment and fuel stations, following measures are proposed:

- Places for gathering construction equipment will be located far from river and water pools to prevent the waste oil from penetration directly into water sources in case of water overflowing.
- The oil containing waste will be collected, treated and buried far from water sources.
- During the construction of bridge piers and abutments, the oil sludge will be collected and disposed to the assigned landfill in compliance with instruction of the site engineer upon obtaining consent of local authority.
- Fuel storage shall not be located near river bank; Fuel must be stored at locations considered to be safe and far from water sources by at least 200m.
- To clean up and reinstate the storage location to its original status.

The other issues, e.g. restriction of causing water turbidity, prevention from water pollution, location of storage ground, construction site… will be stated in the contracts with contractors to ensure that the impact on water sources during the construction course is acceptable and will not leave behind long-term influence on the water sources.

The domestic wastewater at the workers' dwelling sheds the contractors' offices will be collected and transferred to common septic tank at each area. The toilet wastewater is treated in individual septic tanks before discharge into common septic tank. The built septic tank consists of 3 compartments: compartment for first sedimentation and anaerobic degradation, continued sedimentation compartment and filtration compartment. The operating principle of such tank is sludge sedimentation and anaerobic degradation. The effectiveness of treating the suspended substances reaches 65-70%, and BOD is reduced by 60-65%. As almost the workers' sheds are not near to populated areas and are arranged along the route, and the volume of waste water is not large, domestic wastewater after treatment by septic tank system will reduce considerably the pollution of water environment in the Project area.

- Upon completion of construction of bridges, the river bed must be cleaned up by following operations: to remove building materials, steel, bamboo, concrete

piles on the ground and in the river. At location of bridge construction if river banks have been ruined or smashed during the construction course, they must be backfilled stoned up, materials fallen into the river and canals must be taken out, the river must be re-put to their original status.

For the bridge approach ends and Da Do river, during the execution of the bridge, special measure will, in connection with the aforesaid measures, be adopted to protect the water environment in Da Do river (one of the domestic water supply sources for Hai Phong city) where the Project goes through:

- Store yard will not be arranged along the river;
- The workers' sheds and offices must be constructed in such distance of at least 300m;
- Domestic wastewater shall not be directly discharged to the river from the septic tanks.
- Domestic rubbish shall not be discharged and buried near the river bank.

With regard to Kieu Ky rubbish dump, following measures will be adopted for the purpose of miminizing bad impacts on the operations of rubbish dump:

- Agree with Gia Lam Urban Environment Company (management unit of the rubbish dump) as to plan for enlargement of deposit lake and conditioning reservoir in conformity with the working capacity of the rubbish dump and allocated land area.
- Before construction of the road, the concrete embankment along the land acquisition landmark with a length of 180m through the reservoir and with a height of 2m at least as against its existing water level.
- Pile culverts of diameter 150m and 250m length will be constructed for the purpose of drainage from the bio-reservoir to Cau Bay river.
- All the buried waste and rubbish within the land acquision landmark will be dredged and re-buried in the rubbish dump. It is strictly probihited to discharge the rubbish into the surrounding areas.

4.2.4. Measures for reducing solid waste pollution

The contractors will be responsible for treatment of domestic waste. The contractors must agree with local authorities on waste collection and landfill for burying domestic waste to ensure the hygiene of the construction site, dwelling shed area and surrounding environment. It is not allowed to affect environment of populated area. The contractors are responsible for collection of waste and must agree with local authorities on places for collecting and burying wastes. In localities where the local environment services are available, the contractors must sign contract with

them for collecting and treating domestic waste during the construction course.

+ In case waste from the workers' sheds is not collected by the urban sanitation company, it must be collected and buried in assigned place of each shed area. Landfill hole must be arranged at the downstream of wind direction from the dwelling shed site, and at a distance of at least 300m, at the same time, far from the nearest water source by 500m. Waste must be collected and treated by *anaerobic degrading technology*. Depending on volume of waste to be treated, the tank can be built with different size: width from 1 to 2.5m; length from 2 to 10m; depth from 1 to 1.2m. The tank can be built with half over the ground and half under the ground, but the tank wall must be higher than the surrounding ground surface by at least 0.1 to 0.2m to prevent the entrance of water. Two locally manufactured products PM-6 and P2 will be used for treatment.

4.2.5. *Measures for reducing impact on cultural and historical relics*

Education of population on preserving cultural and historical relics must be widely implemented. Noise-proof walls and green tree system must be set up around cultural and historical relic area.

4.2.6. Measures for reducing impact on biodiversity and bio-resources

During Project operation period, in order to reduce impact on biodiversity and bio-resources, following programs must be implemented.

- Education of local students and residents on elementary knowledge of environment in order to improve their awareness of environment and environment protection.
- To organize environment-related programs for local population to take part in good conservation of local environment.
- To periodically check living conditions of aquatic bio-system in local area.
- To perform maintenance of ditches and drainage system.
- To plant green trees and to conserve natural grass coverage

4.2.7. Measures for minimizing ground collapse and erosion

In order to ensure required ground residual settlment and consolidation, settlement speed and to stabilize the ground slide so that the Expressway can operate with admissible data, following measures must be applied.

- To arrange vertical water drain system such as sand drain or pre-fabricated vertical drain/pre-fabricated horizontal drain; carry our excavation of soft soil and backfilling or surcharge for settlement; for increasing slide stability of embankment during construction and operation process, at sections where slide

stability coefficient Fs < 1.4, Reinforcement geotextile fabric must be used and counterweigh structure must be filled up on both sides; embankment must be carried out in different phases, between two phases there must be a sufficient interval for consolidation of lower ground layer.

- For the whole road line, quick construction method must be applied for each section. After surface layer has been completed, side slopes must be covered with grass. Slope sections with high risk of collapse and erosion e.g. bridge ends, culvert inlet, must be covered with stone or cemented bricks. Surface of road side slope to be covered with grass amounts to 804,938m^2.
- In order to stabilize road side slope for preventing erosion, different types of slope must be properly designed for water draining. Technical methods must be used for preserving slope in following cases: unstable slope due to great height or sharpness, erosion risk due to local cracks or hard water draining process, excavation volume that must be reduced due to restricted width of road section… In such cases, following technical solutions can be used:
    - To stabilize digging line by development of water collection ditches at the top and foot of slope. Water gutter and spillway are normally used for control of water flow on slope surface;
    - To make steps for reducing gradient;
    - To cover with stone or to insert stone among trees planted on slope surface for creating blocking wall; to strengthen blocking wall ground by driving anchors into ground, injecting concrete or using geo-textile fabric.

  Following additional measures can also be considered for application:

    - To choose the best construction period (by avoiding rainy season) for reducing erosion risk; to arrange appropriate place for storage of organic earth for re-using it later;
- Rain water from outside building area must be directed for flowing beyond construction site and its flow must be separated from the drainage system from the site.
- For the whole route, period when the earth is left openly bare: after leveling and compacting work is completed, bitumen paving work must be immediately carried out (for the pavement) and grass growing or stone covering must be soon implemented (for the slope). Construction work must strictly comply with technical regulations on soil excavation, filling quantity; location, quantity and size of drainage ditches; location and size of water reservoir near to the Expressway.

For road section alongside the river (Quang Trung commune, An Lao district, botanical water drains will be built. They can be created by development of draiange ditches of 5 to 8cm depth with the depth increased toward far side from the

road, and of 50cm width. Ditch surface is not paved with cement, but covered with waterproof grass, so that water can be drained while road side erosion can be avoided.

+ In the event of emergency flood or storm, the construction unit must revise the progress or stop execution as appropriate. Construction plant and material must be transferred to the safe places; the workshops and storehouses must be firmly braced. A number of workers may be evacuated to safe places if necessary.

4.2.8. Measures for minimizing flood and stagnation

Implementation of preventing measures against flood and stagnation as presented in paragraph 4.2.2. will play a role of prevention against water flood and stagnation for construction stage as well as operation stage.

Hydrological calculation alongside the road line

Hydrological calculation alongside the road line for designing purpose has been made with frequency P1 = 1% and P10 = 10% on the basis of the water rise level inside field area.

Design water level alongside the road line is calculated by formula:

$$H_{p\%} = H_{max\ DT} + K(X_{p\%} - X_{max\ DT})$$

In which

$H_{p\%}$: water level corresponding to design frequency P%;

$H_{max\ DT}$: investigated water level corresponding to investigating year;

K : coefficient;

$X_{p\%}$: Rainfall of 1, 3, 5, 7 peak days corresponding to P%;

$X_{max\ DT}$: Rainfall of 1, 3, 5, 7 peak days actually gauged at the station.

Hydrological calculation of culvert

Current drainage culverts across the road line are culverts for irrigation use and for draining purpose under management of local authorities. Draining aperture was designed according to requirements of local authorities. On the whole line, 293 pile culverts of diameter from 1.25 to 2m and 181 box culverts of 1 x 1m to 6 x 4m are arranged. In case of high water level (flood), 124 unpasses can efficiently take part in water drainage. In such situation the flood risk caused by the Expressway is very low.

Table 4.1. Summary of hydrological calculation results of bridges

No.	Name	Station	Navigation clearance			Hydrological data					Remarks
			Height (m)	Width (m)	Elevation of culvert bottom	Q_{TK} (m^3/s)	$H_{1\%}$ (m)	$H_{5\%}$ (m)	V_c (m/s)	L_o (m)	
1		Km0+078.00					4.71				Flyover in canal
2		Km1+613.60					4.37			21x33	Canal+road DS
3		Km3+121.00					4.39			1x21	Canal+road DS
4		Km5+767.50				75	4.65			4x38,6	Bac Hung Hai river
5		Km6+609.70					3.74			5x33	Approach canal+road
6		Km7+895.30								1x21	Canal TBH3+DS
7		Km8+683.00								1x21	Canal D3B+DS
8		Km9+600.00					3.53			1x33	Canal D3+DS
9		Km10+614.50					3.74			1x15	Canal BTH9
10		Km14+839.25					4.43			1x33	Cross over PR206+River
11		Km16+748.00					4.43			2x21	River
12		Km20+264.00				206	3.59		1.37	47	Cross over NH39+River
13		Km21+823.00					2.79			1x21	Canal+road

											DS
14		Km22+490.00					2.96			3x21	Canal+DR
15	Dao Duong	Km28+900.54	3.5	15		6.25	2.40	2.36	0.13	20	Tam Do river
16	Bai Say	Km32+615.79	3.5	25		116	3.21	2.36	0.52	69.7	Tay Ke Sat river
17	Co Bi	Km43+088.79				11.2	2.50		0.22	20	Irrigation canal
18	O Xuyen	Km44+741.84	5.0	40		222	3.11	2.86	0.41	121	Dinh Dao river
19	Khuong Phu	Km45+840.21				7.64	2.50		0.16	20	Irrigation canal
20	Ngoc Ky	Km54+044.34	3.5	25		20	2.86	2.50	0.17	52.2	Tu Ky river
21		Km64+744.00				1217	3.90	3.01	1.57	400	Thai Binh river
22	Thanh Ha	Km72+800				3862	3.07	2.80	1.07	337.72	Tam Do river
23	Tan Vien	Km78+800	5.00	25		111	1.50	1.00	0.18	110.51	Da Do river
24		Km94+337.06				867.5	2.27	2.11	0.93	489.27	Lach Tray river
25		Km95+431.23					1.67	1.30		38	Hoa Binh canal

Source: HECO - *2007*

Table 4.2. Summary of hydrological calculation results of bridges (section Km75-Km102 PAII)

No.	Name	Station	Navigation clearance	Hydrological data	Remarks

			Height (m)	Width (m)	Elevation of culvert bottom	Q_{TK} (m^3/s)	$H_{1\%}$ (m)	$H_{5\%}$ (m)	V_c (m/s)	L_o (m)	
1	Ba La	Km80+339.04	5	25		28		1.50		51.55	Ba La river
2		Km90+956.00	5	25		111		1.50		80	Da Do river
3	Lach Tray	Km97+157.00	7	50			3.70	2.10			Lach Tray river

Source: HECO - *2007*

4.2.9. Measures for minimizing traffic accidents

The increase of vehicle traffic on crossroads in areas where very few vehicles ran in previous time, will cause traffic accidents. Attention must be especially paid to children and students in rural areas. For this purpose, guards for guiding vehicles should be posted and indicating and warning boards must be added. Education of population can be implemented with participation of mass organizations such as; Association of Veterans, Association of Old People, Women Union, Youth League, in order to remind them and their families of traffic situation and traffic accidents which may occur. Besides, in order to restrict traffic accidents following works must be developed.

a. Signaling and warning board system

Signaling and warning board system must be designed according to Regulation on Road Signals TCN 237-01. These signal boards will be made from steel sheet coated by reflective paint.

b. Green trees

For dealing with eye dazzling effect caused by headlight of cars running on opposite direction by night time, green trees must be planted on median strip. These trees must be of evergreen type with foliage and planted at interval of 3m. On the whole line, 2,327 trees and 46,010m^2 of grass will be planted on median strip.

c. Lighting system

Lighting lamps installed alongside Expressway line will include 8,759 simple lamp

posts according to standard of highway category…

d. Protection balustrade

On both sides of median strip, protection balustrade made from corrugated steel sheet will be installed with total length of 418,781m.

e. Steel net fence

On both sides of the Expressway, 2m high - steel net fence will be installed from each slope foot by 3m, with corner bar as supporting post stretched over by B40 steel net and total length of 119,762m.

f. Road marking paint

Lane separating line will be drawn with reflective paint. Separating line pattern: 0.2m wide continuous line type.

4.2.10. Safety measures during construction process

Employer will require construction contractors to ensure absolute safety to people, machinery, equipment and materials by applying technical and organizational measures, including:

- To set up site labor safety committee, including a permanent chairman, semi-permanent members sent by construction units with one member by unit. Each working shift will have one person in charge of safety.
- To compile and promulgate site work regulations, including regulations on site entry and exit, on labor protection facilities, on using lifting equipment, electric safety, traffic safety, fire and explosion safety, etc.
- To educate workers on such regulations by various forms such as, to display those regulations on site information board, canteen, worker shed; to organize training course and test on regulations, to broadcast through loundspeaker, to inspect site work and remind workers on such regulations.
- To follow up labor accidents, timely identify their causes in order to apply remedying measures for prevention of accident from re-occuring.

a. Safety measures for operation of lifting equipment

- To check driving licenses of lifting equipment operators, which must be issued by competent authorities.
- To thoroughly check technical specification and safety conditions of lifting equipment before operation.
- To put passage interdiction board at working area of lifting equipment.
- To appoint guard and commander for lifting equipment operation.

b. Safety measures for operation of mechanized equipment

- To check driving license of vehicle driver and mechanized equipment operators, which must be issued by competent authorities.
- To periodically check safety conditions of vehicle and mechanized equipment. To stop operation of vehicle and mechanized equipment without certificates issued by registration agency.
- To set up traffic safety signaling and indicating board in construction site.

c. Fire and explosion safety measures

- To apply fire prevention standards during design of temporary works. To reasonably arrange and build storehouses according to technical requirements and in such a convenient way for fire fighting (if occuring).
- To compile and observe regulations on fire prevention and fighting.
- To install fire interdiction board at fire risk exposed area (fuel warehouse, chemical warehouse, flammable material warehouse, transformer station, etc).
- To equip fire fighting equipment at warehouse (fume extinguisher, CO2 extinguisher, sand, water tank, pulling device …).
- To educate workers on fire prevention and fighting regulations and examine application of those regulations at warehouse and worker shed of construction units.

d. Safety measures for use of electricity

- To cover electric connections with isolating materials.
- To check concordance of equipment capacity with power supply loading capacity.
- To set up guard and warning board at area under electric repair.
- Workers operating with electric power must have certificates issued by competent authorities.
- To compile and promulgate regulations on electric power safety.
- To educate workers on electric power safety and to periodically check application of electric power safety regulations.

e. Labor protection facilities

- To provide workers with sufficient and appropriate labor protection facilities.
- To strengthen the check of labor protection facilites used by workers. To categorically stop any work in case of lack of labor protection facilities.
- To compile and put into application regulations on labor safety and protection for all of operations in the construction site, including regulations on deep hole excavation in avoidance of settlement and collapse.

- To educate workers on electric power safety and to periodically check application of electric power safety regulations.

f. Organization of health care at construction site

- To set up construction site medical station for treatment of normal illness and grant medicaments to workers.
- To organize treatment of light labor accident and first aid to heavy accident before transferring victims to hospital.
- To provide first aid device and medicine bags to building units.
- To set up permanent emergency ambulance in construction site.

g. Control of harmful waste

Measures for control and restriction of impacts from harmful substances e.g. oil, grease, bitumen, toxic gas, etc are included in the measures for minimizing impacts on air, water and creatures. However, for the purpose of strict control and supervision of risks of generation of harmful waste, the Employer will, in connection with environmental management units at different levels and environment supervision consultants, carry out periodical inspection and ad-hoc inspection in the locations and work items with potential generation of harmful waste.

4.3. MEASURES FOR MINIMIZING POLLUTION DURING PROJECT OPERATION

4.3.1. Measures for minimizing impact on air quality

Air pollution in operation stage will be minimized by plantation of trees on two road sides with a width of 5 to 10m on each side. Total of trees to be planted will be of 58,263 trees. Employer will associate with local environment managing agencies (Natural resources and environment departments of Hanoi and Haiphong cities as well as Hung Yen and Hai Duong provinces) for managing and monitoring air environment quality through a pollution control program of the whole region. Monitoring air pollution due to traffic will be part of this program.

4.3.2. Measures for minimizing pollution due to noise and vibration

Noise and vibration minimizing is a factor directly related to vehicle flow quality. Along the route, some sections of the Expresway go through the population areas, including the sections passing through residential area of Hoa Muc village, Hoan Long commune, Yen My district, Hung Yen province and residential area of Vuc village, Tu Xuen commune, Tu Ky district, Hai Duong province where there exits considerable population density. The remaining sections cross some scattered

houses. With regard to Hoa Muc and Vuc villages as aforesaid, noise-proof walls will be constructed to minimize noise generated from the vehicles on the Expressway.

The noise-proof walls will be made of concrete with height of 5m and located along the route in such a way to ensure good noise-proof for two population areas below:

With regard to the section passing through Hoa Muc village, the noise-proof walls will be developed along the two sides of the Expressway. From Hanoi to Haphong, a 200m noise-proof wall will be constructed on the right side and at section from Sta.Km14+200 to Sta.Km14+400; on the left side of this section, there remains the agricultural land area, it is therefore unnecessary to develop the noise-proof wall.

As to the section passing through Vuc village, the noise-proof wall will be constructed along the two sides of the Expressway. From Hanoi to Hai Phong, a 800m noise-proof wall will be developed on the right side at the section from Sta.Km63+900 to Km94+700; on the left side, a 400m noise-proof wall will be developed at the section from Sta.Km63+900 to Sta.Km64+300.

Figure 4.1. Diagram of noise-proof wall structure

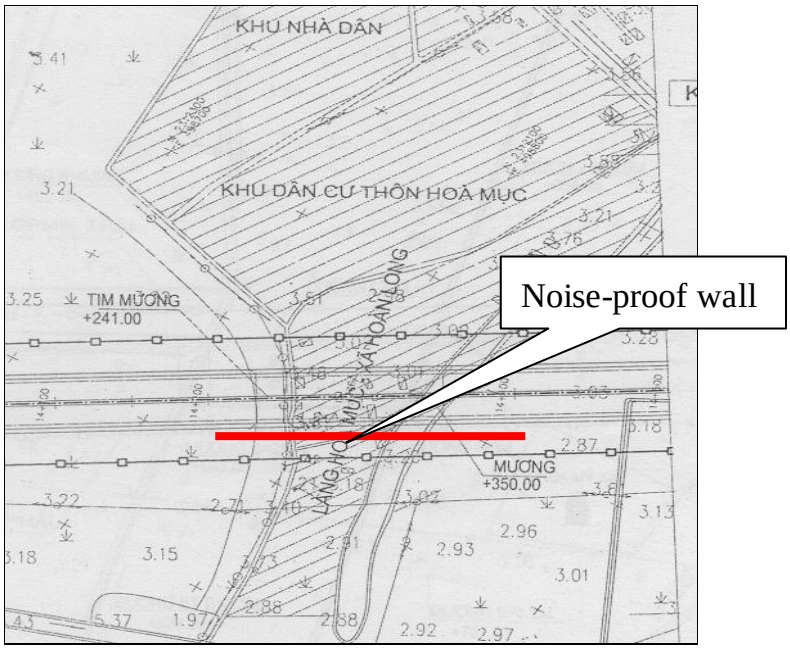


Figure 4.2. Location of noise-proof wall in the section passing through Hoa Muc village

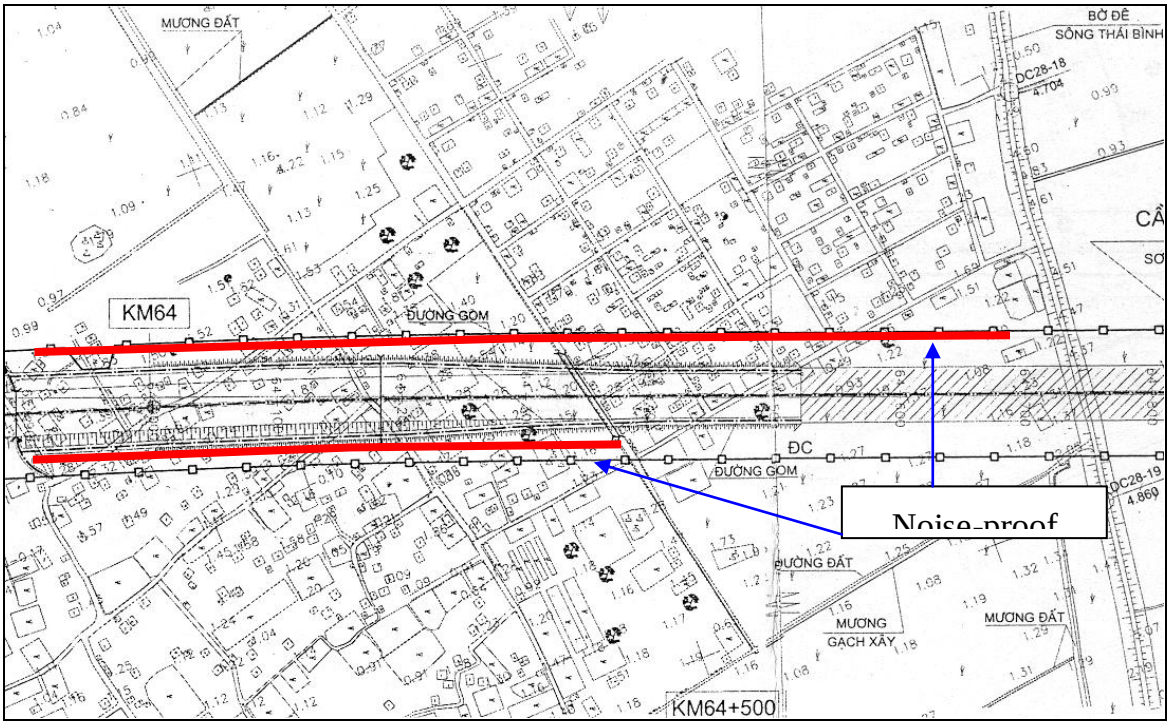


Figure 4.3. Location of noise-proof wall in the section passing through Vuc village

4.3.3. Measures for minimizing pollution of water sources

Rain water drainage system must be checked and maintained on a periodical basis, especially drainage ditch system, collecting system and settling basins must be

regularly repaired so that water drainage will be ensured. In order to minimize impact on water quality, the most efficient measure is to apply periodical monitoring regime, so that water polluting cause can be soon detected and removed even from it first appearance.

Upon coming into operation, urbanization and industrialization along either side of the Expressway will accordingly occur. Therefore management of environment must be closely controlled in order to ensure sustainable economic development

4.3.4. Measures for minimizing traffic accidents

To guide local population, especially children, on how to avoid traffic accident, how to deal with accident once it has occurred, and on road traffic law. In this stage, population must be educated on traffic safety measures, and on protection of public traffic safety works such as balustrade system, traffic signaling and warning board system, lighting system.…

CHAPTER 5. COMMITMENT TO OBSERVE ENVIRONMENT PROTECTION MEASURES

Project negative impacts on environment are unavoidable. They have been identified and assessed. During Project execution and operation, the Employer undertakes to apply efficient minimizing measures mentioned in chapter 4 in an exhaustive way to limit to lowest level any Project negative impacts on natural and social environment, and to submit himself to supervision of competent authorities over environment management and protection in all stages of the Project.

Although Project may cause negative impacts on environment, but it will bring huge interests to economic and social development by contributing to the perfection of infrastructure to different localities and national roadway network.

Employer undertakes to closely associate with environment management agencies of different localities for the best implementation of environment monitoring and protection during pre-execution, execution and operation stages of the Project. The natural environment features will be sustaintially preserved within permittable limitations under the applicable Vietnamese Standard (TCVN).

During Project execution and operation stages, Employer pledges to fully apply following measures for minimizing negative impacts:

5.1. MINIMIZING THE IMPACT OF EVICTION AND RESETTLEMENT

Principles of land acquisition, resettlement and land compensation will be considered carefully so that eviction of agricultural land and dwelling land will not raise social problems.

Besides application of policies stated in above minimizing measures section, in order to reduce damages of moving off households, the resettlement is implemented on basis of following main principles:

- To propagandize widely, publicly among all walks of life in Project areas so that community consensus can be ensured;
- To observe compliance with applicable policies of Vietnam in such a way to ensure reasonable satisfaction of population desires;
- To assist households in relocation operations;
- To give additional support to households in difficulties;
- To give incentives to households who comply with land acquisition by handing over evicted land, households in difficulties, households under business operation in their current residence.

To arrange new dwelling places for people before acquisition of their land.

5.2. MINIMIZING IMPACT ON AIR ENVIRONMENT AND NOISE

Bidders of each bidding package will be bound by contract provisions to absolute implementation of measures for minimizing impact on air and noise environment during work execution as stated in chapter 4. To actively and promptly deal with any noise and air pollution caused by construction work, affecting surrounding environment and people life.

Air pollution and noise during warranty period will be minimized by co-operation with local environment agencies for managing and monitoring air environment quality through pollution control program of whole area.

5.3. MINIMIZING IMPACT ON HYDROLOGICAL STAUS

Construction of Expressway may affect flood level and water flow speed to the extent that it may cause negative effect to current drainage status. In order to minimize unfavorable impacts on water drainage mechanism, solutions will be synergically applied to alignment design, bridge design, transversal and longitudinal drainage system by reinforced concrete pile and box culverts of different sizes.

5.4. MINIMIZING IMPACT ON WATER ENVIRONMENT

In order to ensure water quality of rivers and canals, during work execution, the contractors will be required (through contract provisions) to fully and seriously implement measures for minimizing impacts generated from the Project activities, especially in the stage of construction, in order to protect water environment in the Project areas.

After construction of bridges has been completed, construction units must clear up river-bed by implementing works stated in contracts, including: removal of building materials, iron, bamboo or concrete piles from river bank and river-bed. If bridge construction has caused ground collapse, damaged part must be filled back and covered with stone, river and canals initial status must be reinstated.

5.5. MINIMIZING IMPACT ON SOCIO-ECONOMIC DEVELOPMENT, QUALITY OF LIFE, TRAFFIC AND OTHER MATTERS.

The Employer will, in combination with the construction units seriously comply with measures stated in Chapter 4 and be subject to supervision of environment protection competent authorities.

CHAPTER 6: ENVIRONMENTAL TREATMENT WORKS, ENVIRONMENTAL SUPERVISION AND MANGEMENT PROGRAMS

6.1. LIST OF ENVIRONMENTAL TREATMENT WORKS

6.1.1. Waste treatment works.

- Waste water from daily activities at workers tents and management offices are collected to the general self-disintegration tank at each area. The waste water of the toilets must be separately treated in a separate self-disintegration tank before being poured to the general self disintegration tank. The self-disintegration tank is constructed with three compartments: anaerobic disintegration depositing compartment, next depositing compartment and filtering compartment.

- Garbage from daily activities at workers tents and management offices are collected and treated by *anaerobic disintegration technology*. Depending on the treatment garbage amount, the tank can be constructed with various sizes: width from 1 to 2.5m, length from 2 to 10m, depth from 1 to 1.2m. Half of the tank may be underground and half on the ground but the tank wall must be at least 0.1 to 0.2m high on the ground to prevent water penetration. Two biological products such as PM-6 and P2 are used in the treatment process. These two products are produced in Vietnam.

Such above works must be simultaneously constructed as constructing management offices and worker tents.

6.1.2. Other environmental treatment works

Table 6.1: Items of environmental treatment works

No.	Items	Unit	Quantity
1	***Grass growth on two slope sides***	m^2	2,108,753.46
2	***Longitudinal water drainage sewer***		
2.1	*Reinforced concrete longitudinal ditch*		
2.1.1	Sump pit connecting horizontal sewers (U shape ditch reinforcing)	pit	5,266.00
2.1.2	Reinforced concrete U shape ditch	m	195,179.06

2.2	*Drain of center separation range*		
2.2.1	Prefabricated cement concrete ditch M150, depth of 15cm	m	131,562.71
2.2.2	Sump pit of horizontal sewers of Highway	pit	282.00
2.2.3	Small ditch digging between two Highways	m^3	27,850.69
2.2.4	Sump pit to collect rain water	pit	525.00
2.3	*Slope drain*		
2.3.1	U shape brick step-ditch for surface water drainage of the Highway	m	59,411.71
3	***Horizontal water drainage sewer***		
3.1	Round sewer (Φ1.25 - Φ2.0)	sewer	293
3.2	Box sewer (1x1 - 6x4m)	sewer	181
4	***Single lamp-post (standard for Highway)***	Lampp	875.00
5	***Shrubs and verdure growth on roadsides***	tree	58,263.00
6	***Noise proof wall (length 1,400m x height 5m)*** m2	m2	7.000
7	***Wave corrugated iron handrails protection***	m	418,781.84
8	***Height of steel net fence is 2.5 m***	m	199,762.58
9	***Water inlet sluice (4x2.7 – 6.5x3.2m)***	sluice	124

Such above works should be simultaneously constructed with involved construction items. The environmental protection works belonging items from 4 to 8 in the table 6.1 will be constructed by a separate contract package at the end period of road ground and surface execution.

6.2. ENVIRONMENTAL MANAGEMENT AND SUPERIVSION PROGRAMS

An environmental management and supervision program should be established and implemented to discover the potential environmental impacts, and evaluate the impact of the solutions to minimize negative impacts on the environment of the project during the preparation, execution and operation periods.

6.2.1. General principles of environmental management and supervision

programs

The environmental protection objectives of the project will be identified on the basis of the environmental requirements as follows:

- To follow commitments on the signed environmental protection;
- To manage the project to maintain the technical parameters in appropriateness with environmental, safe and health requirements as well as financial, production and commercial requirements of the project;
- To prevent the pollution and maintain the environmental improvement activities;
- To continue looking for the best technological solutions to achieve high results on the financial effect and environmental protection;

Environmental management program will ensure:

- To supply information related to the organization, regulations and instructions necessary to implement the environmental improvement and protection activities;
- To establish and implement an environmental control and supervision program, and audit the waste to make sure that the environmental control plan is appropriate;
- To fully follow the applicable laws to make strong foundation for discussing with environmental management authority and partners;

To strictly co-operate with other industrial parks in this area

6.2.2. Environmental management program

Environmental management program of the Hanoi – Hai Phong Highway Project will be summarized in Table 6-2.

6.3. ENVIRONMENTAL SUPERVISION PROGRAM

6.3.1. Mechanisms of feedbacks, modification and improvement

The Investor is in charge of the environmental supervision and the environmental supervision will be done by the environmental supervision and consulting unit. The supervision results must be continuously reported to the project owner (Vietnam Development Bank). The project owner will often report to the state environmental management authority and the community on the environmental quality of the project area during the execution and operational periods. If the supervision results show any inappropriateness of the solutions to minimize the negative impacts on the

environment, the project owner will re-consider the chosen solutions and may take additional measures. The Government and people may give their opinions on the solutions.

Following environmental factors will be strictly supervised for each period of the Hanoi – Hai Phong Highway Project:

- During the preparation period: the ground clearance and resettlement, the stabilization of the lives of the directly impacted communities.

- During the execution period: dust, vibration, water, traffic in the execution area, environmental problems, life environment of resettlement people and employment change.

- - Operational period: dust, noise, ground settlement and traffic accidents.

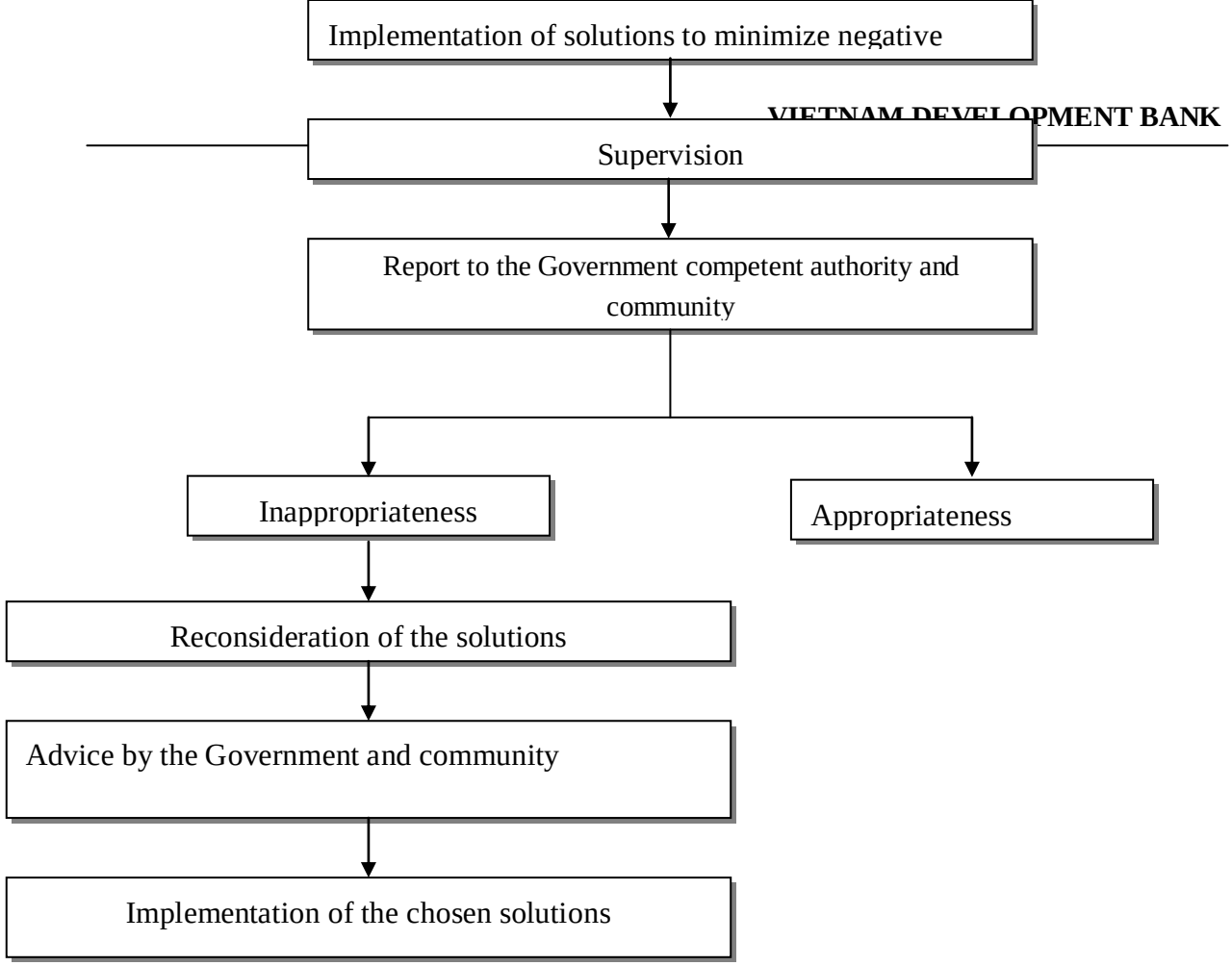


Figure 6.1. Chart of steps in the mechanism of feedbacks, modification and Improvement

6.3.2. Environmental supervision program

Environmental supervision program will be carried out by the project owner to re-check the environmental factors as estimated in the execution and operational periods. The environmental supervision activities during the execution and operational periods will help evaluate the pollution level and discover any environmental factors that exceed the standards. This helps the project owner and contractors adjust or prevent negative impacts of the construction and operation activities on the social and natural environments.

The environmental supervision contents are as follows:

Air quality supervision (once per three months during the execution time and once per six months during the operational period at 12 locations as stated in the Chapter 3) is done in accordance with TCVN 5937:2005.

Surface water quality supervision (once per three months during the execution time and once per six months during the operational period at 6 locations as stated in the Chapter 3) is done in accordance with TCVN 5942:1995

Underground water quality supervision (once per three months during the execution time and once per six months during the operational period at 9 locations as stated in the Chapter 3) is done in accordance with TCVN 5944:1995

Noise and vibration supervision (once per three months during the execution time and once per six months during the operational period at 12 locations as stated in the Chapter 3) is done in accordance with TCVN 5949:1998 and TCVN7210:2002 Soil quality supervision (once per six months during the execution and operational periods at 10 locations as stated in the chapter 3) is done in accordance with TCVN 7209: 2002.

Supervision of the progress and the implementations of the solutions to minimize negative impacts on the water, air quality, noise and vibration during the construction period is done.

Supervision of the habitat and organisms natural resource change (once during the execution time and once during the operational period at locations stated in the Chapter 3) is done.

Supervision of the ground settlement during the operational period at the weak land areas; the section of km20-21; km60-61 and km75-76 is done. The ground settlement will be measured once per six months from the execution to consecutive three years.

Supervision of the land erosion and landslide and flood risks (once during the execution time and once during the operational period at the areas in risk of erosion, landslide and flood along with the Highway);

Socio-economic supervision (once during the execution time and once during the operational period at areas impacted by the project and resettlement area);

Supervision of health, labor safety of staff and workers constructing bridges and roads is done once per six months during the execution time.

The Project management board will annually report the results of the environmental supervision and submit to the state and local environmental management authorities to have objective evaluations on the negative impacts of the project to the surrounding environment during the execution and operation periods.

Expenses for environmental supervision

Table 6.2. Explanation of the environmental supervision programs for the Hanoi – Hai Phong Highway Project during preparation, execution and operational periods.

Table 6.2. Summary of the environmental management plan of the Hanoi – Hai Phong Highway Project

Impact periods		Affected Areas	Impacts type	Solutions to minimize negative impacts	Implementation cost	Implementation time	Unit or organization in charge
Preparation period							
Social Environment	Resettlement	Along with HN-HP Expressway	About 900 households must be removed	Planning on details and strict implementation of the resettlement emigration program (RAP).	VND 367,223 million (The amount is taken from the emigration and resettlement cost)	Only after signing the investment	Vietnam Development Bank, local authority and Government
	Land acquirement	Along with HN-HP Expressway	A large number of land (10,424,895m2) is acquired	As such above	VND 641,379 million (The amount is taken from the emigration and resettlement cost)	As such above	Vietnam Development Bank, local authority and Government
	Historical monuments		Near to the ground clearance milepost	Designing and construction of HN-HP Expressway must be far from the relic a definite distance	It is not great	Detail design period	Vietnam Development Bank
Construction period							

Social environment	Sub region Division	The whole HN - HP Expressway	The local separation is indispensable as constructing the HNHP Expressway.	The underground electricity and water boxes will be constructed at each path	VND 27,298 million (This amount is taken from the construction cost)	The construction of the underground electricity and water boxes must be simultaneously with the construction of HN-HP Highway	Vietnam Development Bank
	Waste	The whole HN - HP Expresswat All paths	Waste from construction materials and lands are still along with the HN- HP Expressway.	Planning and pouring waste and land at appropriate areas	VND 5,875 million (This amount is taken from the construction cost)	From the beginning to the end of the HNHP Highway construction and the paths improvement	Vietnam Development Bank
	Traffic accidents	The whole HN - HP Expressway and all paths	Traffic accidents due to big trucks carrying materials, construction land and other vehicle for the construction	Contractors establish and implement the plans of carrying construction materials and soil safely	VND 500 million (This amount is taken from the construction cost)	From the beginning to the end of the HNHP Highway construction and the paths improvement	Vietnam Development Bank
	Hire local employees	The whole HN - HP Expressway and all paths	Increase the local community income	Priority to hire local Employees	VND 306,037 million (This amount is taken from the construction cost)	From the beginning to the end of the HNHP Highway construction and the paths improvement	Vietnam Development Bank

	Accident at work	The whole HN - HP Expressway and all paths	Accidents due to heavy construction machinery and equipment, fire and Explosion	Strictly follow labor Law Establish the labor safety management board Raise awareness on labor safety	VND 5,000 million (This amount is taken from the construction cost)	From the beginning to the end of the HNHP Highway construction and the paths improvement	Vietnam Development Bank
Nature Environment	Separation and covering of terrain	The whole HN - HP Expressway	Lose rice fields and Crops	Grow cash crops and other potential trees after leveling and covering the ground	VND 2,937 million (This amount is taken from the construction cost)	After leveling and covering the ground	Vietnam Development Bank
	Land Erosion	The whole HN - HP Expressway	The road covering area will be eroded by heavy rains	Protect the working area from the land erosion Upgrade the eroded road sections	VND 35,200 million (This amount is taken from the construction cost)	From the beginning to the end of the HNHP Highway construction	Vietnam Development Bank

	Actual conditions of rivers	All bridges on the HN- HP Expressway	Change the actual condition of rivers and increase the risks of flood due to constructing bridge pillars on rivers, especially bridges on Bac Hung Hai River, Thai Binh River and Lach Tray River and Van Uc River	Designing and constructing the bridge pillars how to avoid changing the actual conditions of rivers and increasing the water level in the flood	VND 7,669 million (This amount is taken from the construction cost reason)	From the beginning to the end of the HNHP Highway construction	Vietnam Development Bank
	Landscape	The whole HN - HP Expressway	Reduce the traditional rural landscape beauty	Designing and covering the roads to be appropriate with the rural landscape	VND 2,720 million (This amount is taken from the construction cost)	From the beginning to the end of the HNHP Highway construction	Vietnam Development Bank
Pollution	Air Pollution	The whole HN - HP Expressway and all paths	Air pollution is increased due to the construction materials affecting to the residential areas, especially areas near to the roads that are used to carry soil, sands for construction.	Use heavy industrial machinery that meets gas emission standards for the construction. Construct a good road for carrying soils and sands only.	Cost is mainly for measuring environmental parameters and criteria (See the estimate in Table 6-2)	From the beginning to the end of the HNHP Highway construction	Vietnam Development Bank

	Water Pollution	All bridges on the HNHP Expressway	Construct bridges on Bac Hung Hai River, Thai Binh River, Lach Tray River, and Van Uc River. The water quality of rivers and channels will be identified at the section flowing water of each bridge construction area	Planning and protecting to prevent dirty water from the construction area to flow to rivers (e.g. construction of dirty water containing ponds, etc.).	Cost is mainly for measuring environmental parameters and criteria (See the estimate in Table 6-2)	From the beginning to the end of the HNHP Highway construction	Vietnam Development Bank
	Noise and vibration	The whole HN - HP Expressway and Paths	The noise and vibration due to using heavy construction equipment will impact on the nearby residential areas.	Use construction materials that cause small noise and vibration.	Cost is mainly for measuring environmental parameters and criteria (See the estimate in Table 6-2)	From the beginning to the end of the HN-HP Highway construction and after improving the paths	Vietnam Development Bank
Opeation stage							
Social environment	Waste	The whole HN - HP Expressway and Paths	Garbage disposals by travelers on the HN-HP Expressway. The paths are gone through to areas that there are many households, shops and factories so they will be impacted by the garbage disposals from these areas.	Prohibit disposing garbage on the Highway	VND 1,000 million (The amount is taken from the cost for road management and maintenance)	Periodic garbage Collection	Vietnam Development Bank, local authority and Government

	Risk	Junction Roads	The paths may be flooded, especially as the paths are river dykes	Protect paths from being destroyed by flood Construct water inlet sluices at the areas that are impacted by flood Upgrade weak structure dykes due to flood	VND 22,822 million (The amount is taken from the cost for road management and maintenance)	Must periodically and often check the eroded sections in the flood season as the water level is high	Vietnam Development Bank, local authority and Government
	Traffic accidents	The whole HN - HP Expressway and Paths	Traffic accidents will be increased because he traffic flow and the velocity of traffic means are improved	Planning and implementing solutions on traffic safety in accordance with traffic law	VND 3,105 million (This amount is belonged to the traffic safety program)	Everyday	Vietnam Development Bank, local authority and Government
Natural environment	Land Erosion	The whole HN - HP Expressway	Land erosion is occurred at road sections of the weak land structure as there is heavy rain	Upgrade eroded road sections	VND 2,050 million (The amount is taken from the cost for road management and maintenance)	The patrol team will do the survey during the whole rainy season	Vietnam Development Bank
	Landslide	The whole HN - HP Expressway	The severe feeling is occurred as the road covering must be done	Grow trees along with the road to reduce the severe feeling	VND1,000 million (This amount is taken from the construction cost)	From the end of the construction period to the improvement period and the landscape should be appropriate with rural area.	Vietnam Development Bank

	Air pollution	The whole HN - HP Expressway and Paths	＋Identify the air pollution near to inter-traffic sections and paths plus the pollution due to traffic means on the street	Grow trees near to the traffic sections and the residential areas near to the path No. 5 to reduce the pollution from the traffic means due to the dust and CO2 absorption of verdure Often and periodically observe the air pollution	Cost is mainly for measuring environmental parameters and criteria (See the estimate in Table 6-2)	Quarter air pollution observation during three years in the operational period at the boundary mark.	Vietnam Development Bank
	Water pollution	All rivers and bridges along with HN-HP Expressway	The water quality of river will be identified by the water quality (non-treatment) flowing from the HNHP Expressway	Designing and implementing the appropriate drain system to collect dirty water flowing from the Highway	Cost is mainly for Measuring environmental parameters and criteria (See the estimate in Table 6-2)	Quarter water quality supervision during three years in the operational period at the boundary mark	Vietnam Development Bank
	Land Erosion	The whole HN - HP Expressway	Land erosion is occurred at road sections of the weak land structure as there is heavy rain	Upgrade eroded road sections	VND 2,050 million (The amount is taken from the cost for road management and maintenance)	The patrol team will do the survey during the whole rainy season	Vietnam Development Bank

Figure 6.2. Diagram of environment monitoring

Table 6.3. Cost estimate for environmental supervision of the Hanoi – Hai Phong Highway Project

No.	Items	Unit	No.	Price unit	Amount
A	PREPARATION PERIOD				261,021,740
A1	Air quality supervision (12 locations x 4 samples/location =48 samples)				**63,840,000**
1	CO	sample	48	300,000	14,400,000
2	NO_2	sample	48	300,000	14,400,000
3	SO_2	sample	48	300,000	14,400,000
4	Total suspending dust (TSP)	sample	48	75,000	3,840,000
5	VOC	sample	48	300,000	14,400,000
6	Business trip expense (2 working days/location-day x 12 locations = 24	working day	24	100,000	2,400,000
A2	Noise supervision (12 locations x 12 measurements/location =144				28,320,000
1	Leq (temporary noise)	measurement	144	30,000	4,320,000
2	L50 (temporary noise)	measurement	144	30,000	4,320,000
3	L90 (temporary noise)	measurement	144	30,000	4,320,000
4	Vibration frequency	measurement	144	45,000	6,480,000
5	Vibration acceleration	measurement	144	45,000	6,480,000
6	Business trip expense (2 working days/location-day x 12 locations = 24	working day	24	100,000	2,400,000
A3	Water quality supervision (6 locations x 1 hydro-section/location x 3 samples				35 400,000
1	pH	sample	18	30,000	540,000
2	DO	sample	18	60,000	1,080,000
3	COD	sample	18	70,000	1,260,000
4	BOD_5	sample	18	80,000	1,440,000
5	TSS	sample	18	50,000	900,000
6	NO_2^-	sample	18	50,000	900,000
7	NO_3^-	sample	18	50,000	900,000
8	NH_4^+	sample	18	50,000	900,000
9	Total phosphorus (PO_4^{3-})	sample	18	60,000	1,080,000
10	Total remaining amount of pesticides	sample	18	600,000	10,800,000

No.	Items	Unit	No.	Price unit	Amount
11	Oil	sample	18	300,000	5,400,000
12	Total Coliform	sample	18	60,000	1,080,000
14	Hg	sample	18	80,000	1,440,000
15	As	sample	18	80,000	1,440,000
16	Cd	sample	18	60,000	1,080,000
17	Pb	sample	18	60,000	1,080,000
18	Zn	sample	18	60,000	1,080,000
19	Cu	sample	18	60,000	1,080,000
20	Business trip expense (2 working days/ 3 locations x 6 locations = 4	working day	4	80,000	320,000
	Hire vehicle to survey two-ways of HN-HP	day	2	800,000	1,600,000
A4	Underground water quality (9 wells x 1 sample/well = 9 samples)				10,471,740
1	Water temperature measurement	sample	9	46,860	421,740
2	pH	sample	9	30,000	270,000
4	COD	sample	9	70,000	630,000
5	BOD_5	sample	9	80,000	720,000
6	TSS	sample	9	50,000	450,000
7	Cl	sample	9	50,000	450,000
8	NO_2^-	sample	9	50,000	450,000
9	SO_4^{2-}	sample	9	50,000	450,000
10	Total phosphorus	sample	9	60,000	540,000
11	Total nitrogen	sample	9	50,000	450,000
12	Coli bacteria under Fecal type	sample	9	60,000	540,000
13	Total Coliform	sample	9	60,000	540,000
14	Hg	sample	9	80,000	720,000
15	As	sample	9	80,000	720,000
16	Cd	sample	9	60,000	540,000
17	Pb	sample	9	60,000	540,000
18	Zn	sample	9	60,000	540,000
19	Cu	sample	9	60,000	540,000
20	Business trip expense (2 working days/9 wells x 9 wells = 2 working days)	working day	2	80,000	160,000

No.	Items	Unit	No.	Price unit	Amount
	Hire vehicle to survey two-ways of HN-HP	day	1	800,000	800,000
A5	Soil quality supervision (10 locations x 1 sample/location = 10 samples)				15,230,000
1	dry pH	sample	10	10,000	100,000
2	wet pH	sample	10	10,000	100,000
3	EC	sample	10	10,000	100,000
4	Total nitrogen	sample	10	25,000	250,000
5	Total phosphorus	sample	10	25,000	250,000
6	Total Fe	sample	10	25,000	250,000
7	Al^{3+}	sample	10	22,000	220,000
8	Remaining amount of pesticide	sample	10	900,000	9,000,000
9	Hg	sample	10	80,000	800,000
10	As	sample	10	80,000	800,000
11	Cd	sample	10	60,000	600,000
12	Pb	sample	10	60,000	600,000
13	Zn	sample	10	60,000	600,000
14	Cu	sample	10	60,000	600,000
15	Business trip expense (2 working days/ 10 locations x 10 = 2 working	working day	2	80,000	160,000
	Hire vehicles to survey two-ways of Hanoi	day	1	800,000	800,000
A6	**Survey of the ecosystem along with the route**				19,460,000
	Terrestrial flora and fauna survey	working day	30	95 500	2,400,000
	Survey of the vegetation cover change	working day	30	95,500	2,400,000
	Aquatic flora and fauna survey	working day	30	95,500	2,400,000
	Pisciculture survey	working day	30	95,5000	2,400,000
	Hire vehicles to survey two-ways of Hanoi – Hai	day	10	800,000	8,000,000
A7	Supervision of socio-economic indexes				78,300,000
1	Survey households to be impacted by the project	household	220	300,000	66,000,000
2	Survey of other socio-economic criteria	working day	60	80,000	4,800,000
	Hire vehicles to survey two-ways of Hanoi – Hai	day	15	500,000	7,500,000
A8	Report the environmental supervision results	working day	100	100,000	10,000,000
B	CONSTRUCTION PERIOD				1,976,860,880
B1	Air quality supervision				766,080,000

No.	Items	Unit	No.	Price unit	Amount
	(12 locations x 16 samples/location-year x 3				
1	CO	sample	576	300,000	172,800,000
2	NO_2	sample	576	300,000	172,800,000
3	SO_2	sample	576	300,000	172,800,000
4	Total suspending dust (TSP)	sample	576	300,000	172,800,000
5	VOC	sample	576	80,000	46,080,000
6	Business trip expense	working day	288	100,000	28,800,000
	(8 working days/location x 12 locations/year x 3				
B2	Noise supervision (12 locations x 48 measurements/location x 3 years				339,840,000
1	Leq (temporary noise)	measurement	1728	30,000	51,840,000
2	L50 (temporary noise)	measurement	1728	30,000	51,840,000
3	L90 (temporary noise)	measurement	1728	30,000	51,840,000
4	Vibration frequency	measurement	1728	45,000	77,760,000
5	Vibration acceleration	measurement	1728	45,000	77,760,000
6	Business trip expense (8 working days/location x 12 locations/year x 3	working day	288	100,000	28,800,000
B3	Water quality supervision (6 locations x 12 samples/location-year x 3years =				316,800,000
1	pH	sample	216	30,000	6,480,000
2	DO	sample	216	60,000	12,960,000
3	COD	sample	216	70,000	15,120,000
4	BOD_5	sample	216	80,000	17,280,000
5	TSS	sample	216	50,000	10,800,000
6	Total nitrogen	sample	216	50,000	10,800,000
7	Total phosphorus	sample	216	60,000	12,960,000
8	Total remaining amount of pesticides	sample	216	600,000	129,600,000
9	Oil	sample	216	300,000	64,800,000
10	Total Coliform	sample	216	60,000	12,960,000
11	Business trip expense (8 working days/3 locations-year x 3 years = 48	working day	48	80,000	3,840,000
	Hire vehicles to survey two-ways of Hanoi – Hai	day	24	800,000	19,200,000
B4	Underground water quality (9 wells x 4 samples/well-year x 3 years = 108				666 260,880

No.	Items	Unit	No.	Price unit	Amount
1	Water temperature measurement	sample	108	46,860	5,060,880
2	pH	sample	108	30,000	3,240,000
4	COD	sample	108	70,000	7,560,000
5	BOD_5	sample	108	80,000	8,640,000
6	TSS	sample	108	50,000	5,400,000
10	Total nitrogen	sample	108	50,000	5,400,000
11	Total phosphorus	sample	108	60,000	6,480,000
12	Coli bacteria under Fecal type	sample	108	60,000	6,480,000
13	Total Coliform	sample	108	60,000	6,480,000
20	Business trip expense (8 working days/ 9 well-year x 9 wells x 3 years=	working day	24	80,000	1,920,000
	Hire vehicle to survey on two ways of HN - HP	day	12	800,000	9 600,000
B5	Soil quality supervision				10,980,000
	(10 locations x 2 samples/location-year x 03 years				
1	dry pH	sample	60	10,000	600,000
2	wet pH	sample	60	10,000	600,000
3	EC	sample	60	10,000	600,000
4	Total nitrogen	sample	60	25,000	1,500,000
5	Total phosphorus	sample	60	25,000	1,500,000
6	Total Fe	sample	60	25,000	1,500,000
7	Al^{3+}	sample	60	22,000	1,320,000
15	Business trip expense (4 working days/10 locations-year x 10 locations x	working day	12	80,000	960,000
	Hire vehicles to survey two-ways of Hanoi – Hai	day	3	800,000	2,400,000
B6	**Survey of the ecosystem along with the route**				17,600,000
	Terrestrial flora and fauna survey	working day	30	80,000	2,400,000
	Survey of the vegetation cover change	working day	30	80,000	2,400,000
	Aquatic flora and fauna survey	working day	30	80,000	2,400,000
	Pisciculture survey	working day	30	80,000	2,400,000
	Hire vehicles to survey two-ways of Hanoi – Hai	day	10	800,000	8,000,000
B7	Supervision of depositing - river banks				360,000,000
1	River bank depositing - erosion (90 section /year x	m/section	270	1,000,000	270,000,000
2	landslide (20 km/year x 3 years)	km	60	1,500,000	90,000,000

No.	Items	Unit	No.	Price unit	Amount
B8	Supervision of socio-economic indexes(once/3 years)				69 300,000
1	Survey households to be impacted by the project	household	150	300,000	45,000,000
2	Survey of other socio-economic criteria	working day	60	80,000	4,800,000
	Hire vehicles to survey two-ways of Hanoi – Hai Phong	day	15	500,000	7,500,000
B9	Report the environmental supervision results	working day	300	100,000	30,000,000
C	OPERATIONAL PERIOD				867,870,440
C1	Air quality supervision (12 locations x 8 sample/location-year x 3 years=288 samples)				383,400,000
1	CO	sample	288	300,000	86,400,000
2	NO_2	sample	288	300,000	86,400,000
3	SO_2	sample	288	300,000	86,400,000
4	Total suspending dust (TSP)	sample	288	80,000	23,040,000
5	VOC	sample	288	300,000	86,400,000
6	Business trip expense (4 working day/location x 12 locations/year x 3 years= 144 working days)	working day	144	100,000	14,400,000
C2	Noise supervision				169 920,000
	(12 locations x 24 measurements/location-year x 3 years=864 measurements)				
1	Leq (temporary noise)	measurement	864	30,000	25,920,000
2	L50 (temporary noise)	measurement	864	30,000	25,920,000
3	L90 (temporary noise)	measurement	864	30,000	25,920,000
4	Vibration frequency	measurement	864	45,000	38,880,000
5	Vibration acceleration	measurement	864	15,000	38,880,000
6	Business trip expense (4 working day/location-year x 12locations x 3 years= 144 working days)	working day	144	100,000	14,400,000
C3	Water quality supervision (6 locations x 6 sample/location-year x 3 years= 108 samples)				158 400,000
1	pH	sample	108	30,000	3,240,000
2	DO	sample	108	60,000	6,480,000
3	COD	sample	108	70,000	7,560,000
4	BOD_5	sample	108	80,000	8,640,000

No.	Items	Unit	No.	Price unit	Amount
5	TSS	sample	108	50,000	5,400,000
6	Total nitrogen	sample	108	50,000	5,400,000
7	Total phosphorus	sample	108	60,000	6,480,000
8	Total remaining amount of pesticides	sample	108	600,000	64,800,000
9	Oil	sample	108	300,000	32,400,000
10	Total Coliform	sample	108	60,000	6,480,000
11	Business trip expense (4 working day/ 3 locations-year x 6 locations x 3 years= 24 working days)	working day	24	80,000	1,920,000
	Hire vehicles to survey two-ways of Hanoi – Hai Phong	day	12	800,000	9 600,000
C4	Underground water quality				33 270,440
	(9 wells x 2 sample/well-year x 3 years= 54 samples)				
1	Water temperature measurement	sample	54	46,860	2,530,440
2	pH	sample	54	30,000	1,620,000
4	COD	sample	54	70,000	3,780,000
5	BOD_5	sample	54	80,000	4,320,000
6	TSS	sample	54	50,000	2,700,000
10	Total nitrogen	sample	54	50,000	2,700,000
11	Total phosphorus	sample	54	60,000	3,240,000
12	Coli bacteria under Fecal type	sample	54	60,000	3,240,000
13	Total Coliform	sample	54	60,000	3,240,000
20	Business trip expense (4 working days/ 9 wells-year x 9 wells x 3 years= 12 working days)	working day	12	100,000	1,200,000
	Hire vehicles to survey two-ways of Hanoi – Hai Phong	day	6	800,000	4,800,000
C5	Soil quality supervision (10 locations x 2sample/location-year x 3 years= 60				13,380,000
1	dry pH	sample	60	10,000	600,000
2	wet pH	sample	60	10,000	600,000
3	EC	sample	60	10,000	600,000
4	Total nitrogen	sample	60	25,000	1,500,000
5	Total phosphorus	sample	60	25,000	1,500,000

No.	Items	Unit	No.	Price unit	Amount
6	Total Fe	sample	60	25,000	1,500,000
7	Al^{3+}	sample	60	22,000	1,320,000
15	Business trip expense (4 working day/ 10 locations-year x10 locations x 3 years= 12 working days)	working day	12	80,000	960,000
	Hire vehicles to survey two-ways of Hanoi – Hai	day	6	800,000	4,800,000
C6	**Survey of the ecosystem along with the route** (once /3 years)				17,600,000
	Terrestrial flora and fauna survey	working day	30	80,000	2,400,000
	Survey of the vegetation cover change	working day	30	80,000	2,400,000
	Aquatic flora and fauna survey	working day	30	80,000	2,400,000
	Pisciculture survey	working day	30	80,000	2,400,000
	Hire vehicles to survey two-ways of Hanoi – Hai	day	10	800,000	8,000,000
C7	Supervision of socio-economic indexes(once/3				61 800,000
1	Survey households to be impacted by the project	household	150	300,000	45,000,000
2	Survey of other socio-economic criteria	working day	60	80,000	4,800,000
	Hire vehicles to survey two-ways of Hanoi –Hai	day	15	800,000	12 000,000
C8	Report the environmental supervision results	working day	300	100,000	30,000,000
	TOTAL				3,108,752,620

Remarks: *This estimate is established basing on the Circular No. 83/2002/TT-BTC and 216/MTg-H; Circular No. 114/2006/TTLT-BTC-BTNMTT; and Circular No. 23/2007/TTBTC*

CHAPTER 7: COST ESTIMATE FOR ENVRIOMENTAL WORKS

SUMMARY OF THE COST FOR ENVIRONMENTAL PROTECTION WORKS

Unit: VND

No.	Items	Cost estimate by province/city				Total
		Hanoi City	Hung Yen Province	Hai Duong Province	Hai Phong City	
1	Waste water and garbage treatment (estimate)	12,000,000	20,000,000	35,000,000	28,000,000	95,000,000
2	Longitudinal water drainage sewers	7,250,300,000	25,350,000,000	25,560,500,000	12,750,000,000	70,910,800,000
3	Horizontal sewers with small aperture	5,124,002,133	24,422,877,702	23,704,849,317	11,932,186,408	60,059,913,427
4	Horizontal sewers with big aperture + water outlet sewers	73,529,415,109	292,516,804,952	375,789,291,021	248,103,734,344	989,939,245,426
5	Shrub growth	144,204,253	865,886,538	1,749,843,495	591,023,869	3,350,958,155
6	Verdure growth	6,137,040,603	31,693,847,122	46,114,290,506	35,702,870,179	119,648,048,410
7	Grass growth	87,830,766	483,966,327	715,702,939	554,231,560	1,841,731,592
8	Individual lighting lamp-post	10,500,000,000	48,780,000,000	64,140,000,000	49,240,000,000	172,660,000,000
9	Handrails and steel net	12,262,747,855	64,324,543,244	86,328,127,251	65,927,824,571	231,750,055,921
10	Noise proof wall			4,300,000,000		4,300,000,000

ITEM: LOCAL SEWER (KM 32 – KM61)

No.	Unit price Code	Item	Unit	Volume	General unit price before Tax	Amount
		Construction cost				**155,256,135,849**
1	TH 14	Sewer wall concrete, partition edge C30	m^3	17,215.60	1,312,737	22,599,559,080
2	TH 17	Wall steel rods, partition edge	Ton	2,289.63	12,000,991	27,477,828,100
3	TH 5	Buffering concrete C10	m^3	1,377.70	8,959,919	1,234,307,227
4	TH 37	Buffering macadam	m^3	2,755.40	279,803	770,969,780
5	TH 4	Zinc steel handrail	m^2	1,237.82	1,209,723	1,497,418,937
6	TH 9	Direction concrete C30	m^3	2,951.25	1,148,676	3,390,031,503
7	TH 12	Direction steel rods	Ton	339.4	11,529,377	3,913,070,699
8	TH 9	Sewer formwork	m^2	53,368.36	92,593	4,941,521,458
8	TH 29	Water proofing layer	m^2	6,848.50	190,029	1,301,415,610
9	TH 32	Foundation earth excavation	m^3	23,698.00	19,383	459,343,409
10	TH 35	Drain earth excavation	m^3	161,086.70	118,804	19,137,779,774
11	TH 16	Pillar 40 × 40	m	75,092.00	910,661	68,383,335,413

11	DGD	Signal	Signal	78	1,917,370	149,554,860

ITEM: LOCAL SEWER (KM 75 + 300 – KM 86 + 560)

No.	Unit price code	Item	Unit	Volume	General unit price before tax	Amount
		Construction cost				**45,984,897,389**
1	TH 14	Sewer wall concrete, partition edge C30	m^3	6,778.00	1,229.39	8,332,803,326
2	TH 17	Wall steel rods, partition edge	Ton	904.32	10,867.98	9,828,128,030
3	TH 5	Buffering concrete C10	m^3	571	856,672	489,159,466
4	TH 37	Buffering macadam	m^3	1,142.00	270,287	308,667,371
5	TH 4	Zinc steel handrail	m^2	340	1,106,964	376,367,716
6	TH 9	Direction concrete C30	m^3	1,098.00	1,146,609	1,258,976,380
7	TH 12	Direction steel rods	Ton	126	10,399,594	1,310,384,903
8	TH 9	Sewer formwork	m^2	19,078.00	91,482	1,745,300,386
8	TH 29	Water proofing layer	m^2	6,611.00	190,029	1,256,283,653
9	TH 32	Foundation earth excavation	m^3	5,898.00	19,383	114,322,197
10	TH 35	Drain earth excavation	m^3	13,775.00	122,951	1,693,646,130
11	TH 16	Pillar 40 × 40	m	22,992.00	836,155	19,224,876,951
11	DGD	Signal	Signal	24	1,917,370	46,016,880

ITEM: IRRIGATION SEWER (KM 75 + 682.44 – KM 86 + 560)

No.	Unit price code	Item	Unit	Volume	General unit price before tax	Amount
		Construction cost				**38,537,930,821**
1	TH 14	Sewer wall concrete, partition edge C30	m^3	4,256.00	1,229,390	5,232,282,525
2	TH 17	Wall steel rods, partition edge	Ton	569	10,867,976	6,183,878,328
3	TH 5	Buffering concrete C10	m^3	338	856,672	289,554,991
4	TH 37	Buffering macadam	m^3	675	270,287	182,443,499

5	TH 4	Zinc steel handrail	m^2		1,106,964	
6	TH 9	Direction concrete C30	m^3	1,098.00	1,146,609	1,258,976,380
7	TH 12	Direction steel rods	Ton	126	10,399,594	1,310,348,903
8	TH 9	Sewer formwork	m^2	19,078.00	91,482	1,745,300,386
8	TH 29	Water proofing layer	m^2	6,611.00	190,029	1,256,283,653
9	TH 32	Foundation earth excavation	m^3	5,898.00	19,383	114,322,197
10	TH 35	Drain earth excavation	m^3	13,775.00	122,951	1,693,646,130
11	TH 16	Pillar 40 × 40	m	22,992.00	836,155	19,224,876,951
11	DGD	Signal	Signal	24	1,917,370	46,016,880

CHAPTER 8. PUBLIC OPINION POLL

Hanoi – Hai Phong Highway Project is implemented in 4 provinces and cities: Hanoi city, Hung Yen province, Hai Duong province and Hai Phong city.

In Hanoi city, the project route crosses Thach Ban precinct (Long Bien district) and Da Ton, Kieu Ki communes (Gia Lam district)

In Hung Yen province, the project route crosses Cuu Cao, Long Hung, Tan Tien communes (Van Giang district), Hoang Long, Yen Phu, Viet Cuong, Minh Chau, Thuong Kiet, Tan Viet communes (Yen My district) and Van Du commune (An Thi district)

In Hai Duong province, the project route crosses Thai Duong, Thai Hoa, Thai Hoc, Co Bi commune (Binh Giang district), Yet Kieu, Phuong Hung, Gia Khanh, Gia Xuyen communes and Gia Loc town (Gia Loc district), Ngoc Ky, Dong Ky, Tu Xuyen communes (Tu Ky district), and Thanh Hong, Thanh Cuong, Vinh Lap communes (Thanh Ha district)

In Hai Phong city, the project route crosses Quang Trung, Quoc Tuan, My Duc, An Thai communes (An Lao district), Huu Bang, Nghia Hoa communes (Kien Thuy district), and Trang Cat precinct (Hai An district)

During the establishment of the report on Environmental Impact Evaluation, the Owner and consultancy agencies worked directly with the People Committee of the districts (in 2005), the People Committee and Fatherland Front of the precincts and communes (in 2005 and 2007). The written opinion of 35 People Committees and Fatherland Fronts of the precincts and communes was collected in the report appendix.

The consultants also interviewed and gathered the opinion of 114 individuals and household's representatives. The opinion focuses on the following aspects:

In terms of the policy on the project investment and route.

The leaders and people in the areas with the project route agreed on the project, considered it a sound policy, meeting the people's expectation. Hanoi – Hai Phong high way makes favorable condition for the traffic of the vehicles, and the socio-economic development of the provinces and cities where apply the project.

In terms of the task of cite clearance, re-settlement and support for the cite clearance.

One of the important stages that make the project feasible is the task of cite

clearance and re-settlement. This is the first stage to start into the construction process, and if it is in good condition, the project will be implemented right after that; however, if it is in bad condition, the project will be delayed. Therefore, the cite clearance task must be implemented quickly and meets the people's expectation. Clearing site, finding place for people to re-settle down, and supporting for the land acquisition task are the urgent requirement for ensuring the existing as well as long-termed life for the inhabitants and boosting up the construction progress of the project.

The people committees of the precincts (communes) where the project is implemented have the following opinions:

The land acquisition task must be quickly implemented have the following opinions:

The land acquisition task must be quickly implemented, with the re-settlement area and support for the people in order to ensure the stability and order in their lives.

In addition, there are also other opinions:

The People Committee of Cu Khoi precinct – Long Bien District – Hanoi has the contributive opinion that: The compensation and compensation price by the state must be satisfactory, transparent, clear, and avoid causing damage for the people. The re-settlement task must be implemented as soon as possible so that the people can quickly settle down.

The People Committee of An Thi district – Hung Yen proposed to construct the connected road for the commune.

The People Committee of Yen My district – Hung Yen said that: the high-way project crosses the first area of Viet Cuong commune, which is a poor one, with no trade village, and in which the inhabitants mainly live on agriculture; therefore, the compensation policy must be satisfactory and it is necessary to implement vocational training and open vocational classes to create the opportunity of changing jobs for those who lost their rice fields.

According to the People Committee of Thai Hoc commune – Binh Giang – Hai Duong: the project can affect the two traditional trade villages: thread making trade village and comb making trade village in the area. In addition, the project is likely to cross the temple to Dr Nhu Dinh Hien; therefore, the land acquisition task must be implemented carefully and in proper procedure, avoid posing negative effect on the sensitive areas.

In terms of the flood prevention task when the route is completed.

The flood prevention task is to ensure the safety for the inhabitants, and the water source for daily activities and production. Therefore, the leaders and people all agreed that: It is necessary to have the drainage sewer and ditch system – to avoid flood in the road route, affecting traffic activities and people's lives.

The People Committee of Gia Lam district – Hanoi proposed the state to support the commune with clean water source and infrastructure.

The People Committee of Thai Hoa commune – Binh Giang – Hai Duong said that the Project Management Board should create normal condition of the traffic and irrigation works during the construction stage.

In terms of natural environmental protection task (air, noise, surface water and ecosystem).

The project of constructing Hanoi – Hai Phong high way will create favorable condition for the socio-economic development. However, the parties also pay attention to the environmental problems which occur during the project deployment as well as the project implementation process and find out the solution to bad effects.

Waste, dust, dirty water discharged during the construction process are required to be treated, and minimized in direct discharge to reduce environment pollution.

The authorities of all levels and inhabitants propose that regular watering is required at the joint with the existing traffic road and the points near the populous area to minimize dust.

Noise: not construct at night in the areas near populous regions.

Other opinions

Some other opinions of the authorities and people:

The People Committee of Gia Lam district – Hanoi: During the project implementation, the co-operation and report in advance with the province, precinct and commune authorities and people are required.

The People Committee of An Lao district – Hai Phong: in the bidding stage, the authorities are expected to choose the Owners of good qualification. Promptly construct, avoid delaying, or discontinuing the construction that affect the inhabitants' lives and activities on the route.

The People Committee of Tu Ky district – Hai Duong: The project is required to be implemented early.

It is possible to divide the project into many bidding packages, quickly implement

the early disbursement to make good condition for the people in finding their accommodation, settling and create the belief of people and state.

Opinions of the households who are likely to be affected.

They all agree and support the project.

Most of the inhabitants in the route area know the existence of the project but without specific information.

The households are all ready to hand over their land for the Project when they are compensated properly and according to the policy.

The households all agree to move to new accommodation area when implementing the land acquisition but within the same hamlet or neighboring one.

Opinion of the Project Owner

The project owner acknowledges that all the opinions of the localities' leaders and people along the project route are mainly appropriately and rooted from the spirit of co-operation and contribution. The above issues are mainly stated in chapter 4 and commitment of the owner in chapter 5.

Some ideas of Gia Lam district about providing clean water and constructing infrastructure for the communes which are parts of the project route; of Yen My district about opening vocational training class for the poor commune Viet Cuong; of An Thi district about constructing the connected road system for the communes will be considered, planned into project, and admitted to the authorized agencies for solution and proposed according to the inhabitants' benefit.

CHAPTER 9. INSTRUCTING THE SOURCE OF FIRGURES, DATA AND METHOD OF ENVIRONMENTAL IMPACT EVALUATION

9.1. SOURCE OF FIRGURES AND DATA

9.1.1. Source of reference data:

- Data about the natural condition which are collected in the Department of Natural Resource and Environment of Hung Yen, Hai Duong provinces and Hanoi, Hai Phong cities includes the reports on the existing environmental condition of these areas in 2003 – 2006.

- Technical data includes the report on the stage of investment in constructing the project "Hanoi – Hai Phong automobile highway" established by the Transportation design Survey and Consultancy Joint stock Company – Ministry of Transportation in September, 2005 and April, 2007;

- Meteorological and hydrographical data provided by National Meteorology and Hydrographic Forecast Centre, Meteorology and Hydrographic Centre of the Meteorology and Hydrographic Institute.

- Statistical yearbook of Hung Yen province in 2004, 2005, 2006

- Statistical yearbook of Hai Phong city in 2004, 2005, 2006

- Statistical yearbook of Hai Duong province in 2004, 2005, 2006

- Statistical yearbook of Gia Lam, Van Giang, An Thi, Yen My, Gia Loc, Thanh Ha districts in 2004, 2005

- Report on the socio-economic condition in 2006 and the first six months of 2007 of the communes along the project route.

9.1.2. Source of material and data for implement

The materials on surveying and investigating the natural environment and socio-economic condition of the project area implemented by the owner and environmental consulting agency in September, 2005 included:

- *Air quality.*

Through surveying, measuring and sampling, checking the air environment quality status at the project area, we implemented 17 air measuring station at 17 points at the populous areas and those which cross the highways belonging to the Project route: Continuously measuring for 24 hours, sampling 01 time after 1 hour.

Table 9.1. The criteria and equipment used for observing and analyzing the air quality

Ordinal number	Analysis criteria	Analysis/measurement equipment
1	Dust	OSK 14410- JAPAN, sampling the dust sum continuously in 1 hour, with absorbing velocity of 67m^3/h.
2	$N0_2$	Model 9841A, MONITORLAB firm – USA, photometer method.
3	$S0_2$	Model 9850, MONITORLAB firm – USA, non-spreading infrared spectrum method.
4	$C0_2$	Model 9830, MONITORLAB firm – USA, non-spreading infrared spectrum method.
5	Lead dust (Pb)	Model 2000PM10&TSP- ECOTECH firm-AUSTRALIA, sampling for 24 hours to define lead, at the absorbing velocity of 70m^3/h.

- *Noise, vibration level*

The equivalent noise level (LAeq) was measured at the points for the air quality measurement. Measuring once for 1 hour continuously in 24 hours. The noise measuring equipment QUEST –USA.

- *Water environment*

Collecting the materials belonging to the report on the water environment research in the years 2000 – 2006.

Surveying the surface water environment: Measuring and sampling the water of the rivers, ditches along side the project route. Taking one surface water sample at each source.

Investigating and surveying and sampling the underground water at the bored well and drug well of the inhabitants along the Project route.

Table 9.2. The equipment for analyzing water environment parameters

Parameter	Unit	Method	Equipment
Water temperature	t^oC	On-site measurement	SURVEYOR (America)

Ph		On-site measurement	SURVEYOR (America)
DO	mg/l	On-site measurement	SURVEYOR (America)
COD	mg/l	Chemistry	BOD cabinet
BOD_5	mg/l	Chemistry	HACH DR/2000
NH_4^+	mg/l	On-site measurement	SURVEYOR (America)
NO_3^-	mg/l	Chemistry	HACH DR/2000
PO_4^{3-}	mg/l	Chemistry	HACH DR/2000
Cu	mg/l	Chemistry	HACH DR/2000
Fe	mg/l	Chemistry	HACH DR/2000
Zn	mg/l	Chemistry	HACH DR/2000
Pb	mg/l	Chemistry	HACH DR/2000
TS	mg/l	Weight, drying at 105ºC	
Oil sum	mg/l	Infrared spectrum, extracting by CCl_4	
Ecoli	NMP/100ml	Counting at 37ºC, 24 hours.	

- *Cultivated land quality, sediment quality*

During the time for surveying and establishing the report on Environmental Impact Evaluation, we took and analyzed the soil and sediment samples at the fields and gardens on the Project route.

The samples were taken at the depth of 25 – 50cm depending on the soil profile from the cultivated land surface. The criteria analyzed includes 9 criteria in the following table:

Ordinal number	Analysis criteria	Analysis equipment
1	Cu	Atom absorbing on Perkin-Elmer machine (Analyst 200)
2	Pb	Atom absorbing on Perkin-Elmer machine (Analyst 200)

3	Zn	Atom absorbing on Perkin-Elmer machine (Analyst 200)
4	Hg	Atom absorbing on Perkin-Elmer machine (Analyst 200)
5	Ni	Atom absorbing on Perkin-Elmer machine (Analyst 200)
6	Cd	Atom absorbing on Perkin-Elmer machine (Analyst 200)
7	Cr	Atom absorbing on Perkin-Elmer machine (Analyst 200)
8	As	Atom absorbing on Perkin-Elmer machine (Analyst 200)
9	Oil	Infrared absorbing spectrum meter

- *Socio-economy*

The Project is implemented within the area of Hung Yen, Hai Duong provinces and Hanoi, Hai Phong cities; therefore, the socio-economic materials used in the report include the statistical yearbooks in the years 2003, 2004, 2005, 2006 of the provinces, cities and districts of the 4 provinces where the Project is applied.

The owner and consulting agency worked directly with the leaders of the People Committee and Fatherland Front Committee of the precincts and communes along the project route. They also investigated and interviewed 114 individuals and households in the localities along the route.

General evaluation: The materials were mainly collected from the specialty agencies; therefore, they are of high quality and reliability.

9.2. METHOD APPLIED DURING THE PROCESS OF RESEARCHING THE ESTABLISHMENT OF THE REPORT

9.2.1. Methodology

The establishment of the report on Environmental Impact Evaluation of a project is to research, analyze scientifically the possibly positive or negative impacts on the human socio-economic environment, and organism resource at the areas where the development activities are implemented. Through that process, analyze the impacted factors, property, scale, intensity of the impacts, change over time and space, and the relationship among the factors to offer the treatment methods to reduce the negative impact on the environment generally and on bio-diversity specifically.

9.2.2. Evaluation method

Statistical method: Is the simplest method but very necessary in the preliminary

evaluation of the environmental impact in order to define the characteristics of the resource – environment figures, through:

- Investigating, surveying, sampling on-field and analyzing the samples in the laboratory, defining the parameters about the quality status of the air environment, water environment, soil, noise, vibration level alongside the route; comparing the measurement and survey results with Vietnam Environment Standard to assess the pollution status;

- The sociological investigation is implemented by interviewing the local leaders and inhabitants alongside the route, establishing the environmental survey tickets in order to choose the main parameters relating to the economy – society of the area where to implement the project;

- Establishing statistics, analyzing and evaluating according to the constituents of the ecosystem relating to the development activities of the project area, and choosing the basic parameters that affect the bio-diversity according to the anticipated methods;

Matrix method: is the method which combines to list the actions of the development activities with the environmental factors that are likely to be affected into the matrix to evaluate the impact level posed on the environment of the project;

Mathematical model method: Is used to forecast the level and scale of air environment and noise pollution;

Geographical information - remote sensing method (GIS): Deciphering the satellite image combining with the on-field survey figures to establish the vegetation cover map according to the classification frame, inhabitant distribution map, flooded area map … to define the impact level of the project at the route tracks on the environment.

CONCLUSION AND PETITION

When constructed, Hanoi – Hai Phong highway project will not only be a great dynamic for the development of the economy, culture and education of Hai Duong, Hung Yen provinces, and the peripheral districts of Hai Noi, Hai Phong cities but also contribute to boost up the socio-economic development process of the northern provinces and meet the demand for cultural and economic exchange of the citizen in the region with the whole country.

In the past, the Eastern Sea Project Management Board and currently called Vietnam Development Bank co-operated closely with some scientific agencies, local authority and management agencies to implement the researches to evaluate the positive and negative impacts on the environment. The detailed forecast and research results on the project environment was mentioned in Chapter 4. Some main impacts on the environment are as the followings:

During the pre-construction stage:

The negative impacts are almost inconsiderable. The land acquisition is the important task in this stage. About 2500 houses need removing for the road construction, without religious or historical works that have to move. According to the surveying result at 36 communes along the route, the people are willing to move if they get proper compensation; therefore, the emigration task for re-settlement of the project will not get into difficulty.

During the construction stage:

The Project will create direct jobs or indirect opportunities for the local labors to increase their income and contribute to improve their living level.

The project can cause the division of the inhabitant community and traffic, conflict between construction workers and local inhabitants; increase social diseases, epidemic and social evil.

The project can increase traffic accidents, accident/traffic jam, and the risk of fire and explosion.

In all farms, especially at the populous areas, noise and air pollution, vibration level and water are of important issues. In the project areas with sensitive points such as those which near to Hanoi University of Agriculture 1, Research Institute for Food and Vegetables, Tuberculosis Hospital, Hai Phong Orthopedic Hospital will be directly affected by the impact of the noise, air and vibration pollution.

The concrete pile driving in the rivers for bridge construction will cause strong

disorder of the mud and sand at the river bed and cause pollution at the construction site and can affect the surrounding areas. It can increase the turbidity, BOD and reduce the dissolved oxygen amount in water, and the penetration of the sun shine.

The impacts on soil environment, causing soil erosion and landslide, flood are inconsiderable.

The project does not cross the natural preservation are, national forest or any other sensitive ecosystem areas. The project does not either has much impact on the bio-diversity of the area, or affect the natural ecosystem in the area because most of them area the agricultural ecosystems with generally poor bio-diversity.

During the implement stage:

Most of the negative impacts relate to the increase in traffic vehicles. This results in the increase in air, noise pollution, shaking, and traffic accidents.

The anticipated results show that: at the tracks: belt 3 km00 and the intersections Highway 38, the concentration of NO_x, VOC and CO in 2020 generally exceeds Vietnam Environmental Standard applied for the surrounding air quality at the distance of 40 m from the road centerline. However, the majority of the pollutant concentration does not much exceed the Standard; with the noticeable noise pollution within the distance of 50 m from the road centerline, the noise level in this area exceed Vietnam standard.

The negative impacts on organism resource, socio-economy and historical and cultural monuments in the project area are inconsiderable.

The impacts of the project on the environment can be considered as inevitable; however, Vietnam Development Bank will implement the methods to reduce this impacts, and the plan of environment management and inspection are clearly stated in Chapter 5 and Chapter 6; order the contractors to apply the effective methods to reduce environment pollution at the points near the University of Agriculture 1, near the populous area and other environmentally sensitive points.

Vietnam Development Bank will closely co-operate with the state managing agencies, the concerned agencies, authorities of all level and local inhabitants in order to enhance the effectiveness of the environmental protection task of the project.

Vietnam Development Bank, owner agency commit to strictly implement the regulations on environmental protection; absolutely apply the methods to reduce pollution, problems affecting the environment and inhabitant community; implement the methods of observing, inspecting the environment quality properly according to the content stated in the report on environmental impact evaluation.

Hanoi – Hai Phong highway project is absolutely feasible in terms of the environment. Vietnam Development Bank propose the Ministry of Natural Resource and Environment to early assess and approve this Report on environmental impact evaluation so that Vietnam Development Bank has enough legal basis to submit the Project for approval.

REFERENCES

1. Nguyen Khac Cuong. Environment in construction, Ho Chi Minh national University, 2003
2. Report on the environment October 26, 1993. Red river delta master plan project. Binnie and partners, smec, aacm international pty ltd, delft hydraulics.
3. Hanoi statistics department, 2004. Hanoi statistics yearbook in 2004
4. Nguyen Van Dan, Nguyen Thi Dung, 2004. Hanoi underground water contamination status. Geological magazine No. 280/1-2/2004, page.21-31, Hanoi.
5. Tran Anh Hoang, Bui Thi Bao Anh, 2004. The stability of geological environment in Hanoi city and the its change during the urbanization process. Geological magazine No. 7-8/2004, page.49-56, Hanoi.
6. Nguyen Kiem Son, 1998. Content and categories of fish generation in the Red river delta.
7. Vu Trung Tang.1988. Gen source of fresh water fish in Hanoi area. Aquiculture magazine 1/1988. page 5-11.
8. Tong Ngoc Thanh, 2004. Underground water status in the Northern delta area. Geological magazine No. 280/1-2/2004, page.21-31, Hanoi.
9. Mai Dinh Yen,1978. Categorizing fresh fish in the northern provinces of Vietnam. Publisher of science and technique. Hanoi, 340 pages.
10. Mai Dinh Yen,1994. The biodiversity of freshwater fishes and different measures applied for its conservation in Vietnam. Rep.Suwa hydrobiol.9,13-18,1995. Proceedings of the 7-th international sympóium on river and lake environments,1994, Matsumoto.
11. Ministry of Aquiculture (1996). *Vietnam Aquiculture Source of Income.* Agricultural publisher

12. Ho Thanh Hai, 2003. *Overview about the aquatic organism in the Red river system.* Material of the Institute of Ecosystem and Organism Resource.

13. Ho Thanh Hai and nnk, 2003. *Result of additional investigation of the aquatic organism in typical aquatic areas in Hanoi.* Material of the Institute of Ecosystem and Organism Resource.

14. Nguyen Kiem Son, 2005. Diversity in fish category in Hanoi. Material of the Institute of Ecosystem and Organism Resource.

15. Dang Ngoc Thanh, Ho Thanh Hai, Duong Duc Tien, Mai Dinh Yen, 2002. *Aqua-biology of the aquatic fresh water area in Vietnam.* Publisher of Science and Technique

16. Mai Dinh Yen, Nguyen Van Hai, Pham Bau, 1971. *Some data on the form and classification of fry (larva) and young fish caught in the Red river in Hanoi.* Investigation of the fresh water aquaculture source of income. Collection, episode I. Hanoi Publisher of Science and Technique, 1971: 63-83.

17. Mai Dinh Yen, 1978. Categorizing the fresh water fish in the northern provinces of Vietnam. Hanoi Publisher of Science and Technique, 339 pages.