SOCIALIST REPUBLIC OF VIETNAM
HANOI PEOPLE'S COMMITTEE
TRANSPORT & PUBLIC WORKS SERVICE
HANOI URBAN TRANSPORT DEVELOPMENT
PROJECTS MANAGEMENT UNIT
HUTDPMU

HANOI URBAN TRANSPORT DEVELOPMENT PROJECT

PREPARATION OF INVESTMENT PROJECT REPORT

INVESTMENT PROJECT REPORT
Volume 4-2 - Executive Summary of EIA

MVA ASIA LIMITED

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Hanoi Urban Transportation Development Project
Environmental Impact Assessment
EXECUTIVE SUMMARY

I. INTRODUCTION

Over the past decade, Hanoi, the national capital of Vietnam, has been experiencing rapid urbanization with expansion into numerous new urban areas including Linh Dam, Dinh Cong, Trung Hoa and Nhan Chinh. In the same period, the old city districts of Giang Vo, Kim Lien, and Thanh Xuan have also been improved with substantial new construction and redevelopment. In this rapid urbanization process however, the urban transportation system has lagged behind the overall development pace, limiting sustained development and improvement of standard of living for the city’s residents.

The transportation system in Hanoi consists of different types of motor vehicles and some non motor vehicles and is used 85% for passengers and the remaining, goods. The overall road density in the city is 5 km/km², meeting in general the national requirement. However, the road network is not evenly distributed in the city, road width in many parts of the city is not wide enough to accommodate the rapidly growing traffic, and roads in the newly developed areas accounts for less than 5% of the total area. The lack of maintenance also worsens physical conditions of the roads. As a result, many transportation bottlenecks in the city core and around the city have formed, seriously affecting the efficiency of the city’s transportation system. The insufficient road infrastructure in the suburb and newly developed areas has impeded the overall urban development and expansion.

As part of its effort to upgrade the city’s transportation system, Hanoi City People’s Committee (HPC) plans to obtain a loan from International Development Association (IDA)/World Bank to partially finance this Hanoi Urban Transportation Development Project (HUTDP or the Project), which consists of road development, bus rapid transit (BRT) system, air quality management (AQM), technical assistance and training components. The objective of the Project is to increase urban mobility in targeted areas in Hanoi by increasing the use of public transport in two existing and one new corridors [thereby increasing corridor capacity]; and reducing travel times by all modes between the city center and the west and northwest sections of the city (west of west lake). The specific project scope has been defined in the project feasibility study report prepared by Transport and Urban Projects Management Unit (TUPMU or PMU) of the Hanoi Transport and Urban Public Works Service (TUPWS), the executing arm and day to day project management agency of HPC, with the assistance of MVA as consultant. The total investment of the Project is estimated at USD 305 million, of which the amount from the World Bank loan is USD 155 million.
This document is a concise summary of the key findings and conclusions of the project environmental impact assessment (EIA) report and environmental management plan (EMP), prepared by Centre for Environmental Engineering of Towns and Industrial Areas (CEETIA) of the University of Civil Engineering (HUCE), collectively known as EA documents. These EA documents have been prepared in accordance with Governmental Decree № 80/CP dated 09/08/2006, Circular № 08/2006/TT-BTNMT dated 09/08/2006 of the Ministry of Natural Resource and World Bank’s Operating Policy 4.01 (OP4.01) and other applicable safeguard policies (see Figure 1-1 for EA procedure). The primary objective of the EA documents is to identify and conduct a quantitative and qualitative analysis of various potential environmental impacts from the Project and to develop mitigation measures and management plan to avoid, reduce, minimize or otherwise compensate for the impacts to acceptable levels. The original EIA report has been reviewed by the Ministry of Natural Resources and Environment (MONRE).

**Figure 1-1. Procedures of Environmental Assessment and Management**
The EA work of a transport project is conducted in accordance with the working procedure stipulated in the “Technical Guideline of Environmental Impact Assessment” issued by the MONRE. The EIA includes environmental baseline investigation through field monitoring work and information review, forecast of potential impacts in both the construction and operation phases by relevant mathematical models and assessment methods, development of effective and feasible mitigation measures in compliance with the applicable standards and environmental management plans.

II. PROJECT DESCRIPTION

Hanoi Urban Transport and Development Project components are summarized in Table 2-1.

Table 2-1. Description of Hanoi Urban Transport and Development Project

<table>
<thead>
<tr>
<th>Components</th>
<th>Contents of construction</th>
<th>Investment (million USD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>BRT system</td>
<td>BRT routes</td>
<td>2 routes: Lang Ha - Giang Vo (16.5 km and Giai Phong (12.1 km)</td>
</tr>
<tr>
<td></td>
<td>Bus Interchanges and bus stops</td>
<td>6 interchanges and 46 bus stop points</td>
</tr>
<tr>
<td></td>
<td>Bus Terminals</td>
<td>One terminal, one depot</td>
</tr>
<tr>
<td>Road construction</td>
<td>Interchanges</td>
<td>3 interchanges</td>
</tr>
<tr>
<td></td>
<td>New Road</td>
<td>Part of second ring road (including two cross sections) with a total length of app. 6.1 km. CT1 Resettlement site</td>
</tr>
<tr>
<td>Institutional Development</td>
<td>Air quality management; road transport regional control system (ATC) of city proper; enhancement of traffic management and safety, project monitoring; strengthening of public transport management and traffic management capabilities, etc.</td>
<td>10.49</td>
</tr>
</tbody>
</table>

Considering the actual impacts and depth of the environmental assessment work, the EA for this Project will focus on the sub-components with physical and civil works including new roads, road upgrading and widening, and road maintenance as well as the public transit component. Other components such as transport management system, which will not involve physical works and thus little impacts to the natural environments, are not covered in the EA.

The choice of BRT routes was based on an extended study of Hanoi’s key transport corridors and reflects a balance of both demand (for travel, and for public transport travel) and supply (availability of road space, alternative public transport plans under development). Two
routes were identified: Lang Ha- Giang Vo and Giai Phong corridors (see Figure 2-1). Following a detailed analysis of these alternatives from engineering, transportation and socio-economic and environmental considerations, a closed BRT system trunk and feeder BRT system with special-buses running primarily on a network of exclusive bus routes was chosen. In addition to the chosen alternative simple bus priority measures (rejected because of their relatively little success in environments similar to Hanoi where there is the potential for significant problems of non-observance and enforcement) and open BRTs such as in Seoul, Kunming and Taipei where a variety of buses and access and egress from the exclusive lane system (rejected because of the potential for control problems leading to excessive bunching) were considered.
Figure 2-1. BRT Route Alignment
The road component includes construction of a section of ring road 2 which has been identified as a main urban arterial in the Planning of Hanoi by 2020. The proposed section of Ring Road N°2 - RR2 (approximately 6.1 km) starts from the ending point of Nhat Tan bridge (new bridge across the Red river) at Phu Thuong to Cau Giay (Nhat Tan – Buoi- Cau Giay section) is main Class I street with design speed of 80km/h. This section plays an important role in the transport network of the City. The component will also finance the construction of resettlement housing at the site CT1, located near the 3rd ring road. The location of proposed road component is shown in Fig. 2-2.

Fig. 2-2. The location of Ring Road N°2 and the proposed CT1 resettlement site

III. DESCRIPTION OF BASELINE ENVIRONMENT IN PROJECT AREAS

3.1. Natural Setting

Hanoi City is situated on the upper part of the Red River delta with precise location of 20°57" to 21°25" of north latitude and 105°35" to 106°01" of east longitude. The city belongs to the alluvial flat lowland of the delta with an average elevation of around 10 m above the sea. Hanoi is about approximate 100 km north and 30 km east to west with a total area of 927.39 km2. The Red River flows from northwest to southeast in the southern part of the city. (Figure 3.1). The city’s topography is gradually sloped from north to south and from west to east with a total differential height of about 15 m. The major topography of Hanoi is delta terrain with river and other bodies.
The project area has the tropical monsoon climate. There are two seasons in a year: summer or raining season (from April to October) and winter or dry season from November to March. The geology in Hanoi is metalloid clay, metalloid sand and sand with Alluvia sediments intermittently. Alluvia sediments can be found in lakes and covered with modern sediment with the thickness of 0.5m-6.0 m.

Hanoi City has a dense network of rivers, creeks and other surface water bodies with rivers of 0.5-1 km/km² of total area. The main rivers are Red River and Thai Binh River and their tributaries including four small rivers crossing city: To Lich, Kim Nguu, Lu and Set rivers. These rivers service as natural drainage of the urban area and as a result of random discharges from the city, heavily polluted. The underground water sources in Hanoi area is mainly from two aquifers Holoxen (Q2) and Pleistoxen (Q1). The groundwater is the major source of water supply for Hanoi city and feeds 22 water treatment plants in the city. The extraction rate is 450 000 m³/day (including 420 000 m³/day from several well fields).

Hanoi is divided into nine urban and five suburban districts with the inner-urban population of 2.0 million and the suburban population, 2.5 million.

Fig. 3-1. Project and Hanoi City Location
The municipal water supply through a watermains network covers most parts of the city. However, in some places such as newly proposed site for BRT terminal in Ha Tay and the new road extension in this Project (Xuan La- Xuan Dinh), water supply is provided from shallow wells at the depth of 20-40 m. The sewerage is a combined system carrying both the domestic wastewater and storm water in the same pipes. Sewerage is collected in the sewer system and mostly discharged directly in the city’s lakes and rivers.

3.2. Existing Situation of Environmental Quality

a) Baseline Water Environment
During the preparation of this EIA, water quality in proposed project areas was monitored by CEETIA in July and again October 2005. Main receiving water bodies concerned or related to this project (as they are located in the project areas and would receive runoff and discharges from the project) are To Lich river and Nhue river. The water quality in Nhue river is heavily polluted due to the direct wastewater discharges from the city. The urban sections of To Lich, Kim Nguu, Set, Lu rivers are nearly flows of wastewater with high concentrations of various pollutants. The concentrations of organic matter are 5-10 times in comparison with permissible values in Standard (TCVN 5942-1995, Column B). The concentrations of pollutants in the ponds and lakes also exceed higher the applicable standards. The monitoring data show that COD was 1.2-4.8 times higher, coliform, 2.3-4.3 times higher, when compared with TCVN 5942 – 1995, column B.

As some of the project activities may affect groundwater quality, such as construction of bus terminals in the BRT component and road component, baseline groundwater quality was monitored through sampling and analysis water quality in shallow wells in the potential affected locations. The results show:
- Most of the samples with quality within permissible values in TCVN 5944-1995.
- High concentrations of coliform in all samples showing groundwater contamination by domestic wastewater.
- Generally good quality in area groundwater except bacteria contamination which need disinfection for domestic uses.

b) Baseline Air Quality
In order to better understand baseline air quality on both sides of the proposed BRT system of Hanoi City this EA conducted air quality monitoring from 14-16 July 2005 and again from 20-21 July 2005.

According to the monitoring results show the following air quality features in the BRT component area:
- The air pollutant concentrations (NO₂, SO₂, CO and Total HC) in 16 monitoring locations were lower than permissible values (TCCP) according TCVN 5937-2005.
The concentration of TSP in most monitoring locations were higher than permissible values (TCCP) except two locations in Quang Lai Station- Van Dien and Me Tri, where the TSP concentration was within permissible values (TCCP) according TCVN 5937-2005. The main sources of air pollution (TSP) were clearly the transportation activities along the bus routes in these areas.

The monitoring results of air quality in the Road Component area shows:
- The concentration of pollutants (NO₂, SO₂, CO and Total HC) in 9 monitoring locations were lower than permissible values (TCCP) according TCVN 5937-2005.
- The concentrations of TSP in most monitoring locations were 1-2 times higher than permissible values (TCCP) according TCVN 5937-2005, except two points in Cau Dien railway station and Cau Dien Primary School. These two locations are located away from roads and traffic, including again road transportation activities are primarily responsible for the elevated TSP concentrations in the air.

The full monitoring results are presented in the project EIA report.

c) Baseline Noise
Monitoring of noise levels along the proposed road and sensitive receptors was conducted during EA preparation, in accordance with the Regulation of the Environmental Monitoring and Monitoring Data Management issued by Viet Nam Environment Protection Agency (VEPA) and Vietnam Standard TCVN 1995. The results of noise monitoring conducted during 14 July to 21 July 2005 shows higher noise levels in areas near road sides, while those monitored away from the road side had low noise levels. This indicates the main noise sources in the urban area is traffic and other activities along the city roads.

d) Baseline Soil Environment
As stated above, land in project area is mainly used for agriculture. In general, land is now in normal condition which is suitable for cultivation and has not been affected by domestic activities and agricultural cultivation. Contents of heavy metals in the studied areas are rather low and results of soil component analysis in the monitored area shows that soil is at present not polluted with heavy metals or other pollutants.

e) Baseline conditions related to solid waste management
Hanoi Urban Environmental Company (URENCO) under the management of Department of Transport and Public Works (TUWPWS) is the key organization to provide environmental sanitation services. The company comprises eight member enterprises and two vehicle brigades which are in charge of waste collection and transportation for the city, as well as the right bank of the South of Red river (urban area). At present, the collected solid waste is ranging from 2,600-2,800 tons of municipal and construction waste with a collection ratio of 80% of the total generated. Collected solid waste is transported from Hanoi to Nam Son waste treatment area - Soc Son (app. 55km) and land filling is the major method for waste disposal.
IV. ASSESSMENT OF ENVIRONMENTAL IMPACTS OF THE PROJECT

4.1. Summary of Major Impacts

As per description in previous sections, Hanoi Urban Transport and Development Project consist of two key components: BRT system development and new road construction. The road widening construction of a terminal, depot and other activities in the BRT component would involve some land acquisition, resettlement, and land clearance (although the new land acquisition for this component is minimal (see Project RAP)). The operational phase would involve impacts from the anticipated increased and faster bus traffic. The road construction and operation would require substantial land acquisition and resettlement and thus significant environmental and social impacts arisen from these activities. The traffic introduced to the area by the new roads to the currently green field would increase air emissions, noise and safety concerns, impacting the residents in the project areas. The key environmental impacts, from a screening process, of each component are summarized in Table 4-1.

<table>
<thead>
<tr>
<th>Component</th>
<th>Identification and screening of environmental impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Roads and interchange</td>
<td>It is basically located in the jointing area between city and country; it belongs to agricultural ecological environment or half-agricultural and half-industrial mixed environment. Environmental sensitive receptors include natural habitats and ecosystem such as the East Lake and engineering quantity is large, so the scope and extent of environmental impact is wider and deeper. During the period of construction, it will cause stronger impact on vegetation, water environment, ambient air (construction dust) and acoustic environment. During the period of operation, it raises higher requirements for planning of two sides of road.</td>
</tr>
<tr>
<td>Urban trunk road</td>
<td>It mainly is located in the established area of the city with more environmental sensitive receptors and ordinary engineering quantity, medium scope and extent of environmental impact. During the periods of construction and operation, it will cause stronger impact on ambient air and acoustic environment. At the same time, it causes a certain impact on community, transport, landscape and vegetation</td>
</tr>
<tr>
<td>Pedestrian viaduct</td>
<td>Environmental impact is mainly at the construction stage, which is in the aspects of construction dust, construction noise, spoil. Engineering quantity is small, and impact scope and extent is limited. During the period of operation, it has bigger function for improving pedestrian transport.</td>
</tr>
</tbody>
</table>
There will be two BRT Routes. It will take active function for organizing mass transit line scientifically and providing better service for passengers; it can minimize congestion of mass transit vehicles, maintaining smooth running of mass transit vehicles, which is of great advantage for improving environmental quality of Hanoi city.

They are mainly set up along street, the lines that will be 41 new stops and 6 interchanges were proposed. The frequency bus passing every 5 minutes at each stop. It improves the congestion problem with many stopping lines and stopping frequencies at the existing stop effectively. There are many commercial shops around the stops, so environmental sensitive receptor is fewer, and it has small impact on environment.

Three terminal site were proposed. Of which 01 is located in the city; 01 is located in sub-urban (Thanh Tri) and 01 is belonging to other province (Ha Tay). Civil construction engineering quantity is small, but after it is implemented, it will take active function for organizing mass transit line scientifically and providing better service for passengers; it can minimize congestion of mass transit vehicles, maintaining smooth running of mass transit vehicles, which is of great advantage for improving environmental quality of Hanoi city.

For some projects, such as improvement of pedestrian transport system, improvement of bicycle transport system, optimization of mass transit, canalization of crossing traffic, road traffic area control system (ATC) in city proper, road transport safety, propaganda and education of road users, the civil construction engineering quantities of these projects are small and they cause small disturbance to environment. Environmental impact during the process of construction mainly is disturbance to transport. During the process of operation, it has great function for ordered and scientific urban transport and for realizing rational configuration of road resources, at the same time; it is of great advantage for improving of urban environmental quality.

According to the identification and screening results in Table 4.1, physical construction works will cause negative, as well as positive, impacts to the environment, while non physical works will bring obvious positive benefits to the community. In the physical works, the negative environmental impact from road construction, road maintenance, and public transit development including terminal construction will have most of the adverse environmental impacts. However, bus stops, and intersection canalization in traffic control and safety engineering will also have some minor adverse impacts but mostly benefits to the people and/or the environment. Because of the nature for each component with regard to their relationships to environmental impacts, this EA will focus most of its effort on road
construction, road maintenance and bus terminal components as these are the components which would have most project adverse impacts to the natural and socio-economic environments.

4.2. Prospect Benefit and Positive Impacts

*From the BRT Component:* The establishment of BRT system in Hanoi City will contribute to improving the level of public transportation management and service and to ensuring the priority policy in public transport development.

BRT system will also significantly contribute to reducing number of individual vehicles such as motorbikes and small passenger automobiles by offering the city’s residents an efficient, convenient and inexpensive transportation means. When BRT system is in place, together with improvement of other elements in the city’s public transportation system, in the long term, it is estimated that 30%-50% of motorbike and 5%-10% of car owners/drivers are expected to opt to switch to public transport for their regular and daily transportation needs. The reduced motor vehicles on the roads, together with the reduced traffic jam and improved motor vehicle driving efficiency, will significantly reduce air emissions from motor vehicles and help improve ambient air quality in Hanoi.

To the community, the public transport in general and BRT in particular as probably the least expensive motorized transportation will benefit the city’s poor as well as the general public as the affordable transportation becomes more efficient and convenient. The improved public transport service will also help contribute to community development by attracting investments, services and commerce to the areas, benefiting the people along the routes. On a city wide basis, an effective and efficient public transportation system with BRT will help the city enhance its competitiveness, help improve the standard of living for its citizens and visitors and help make the city a more livable place.

*From Road Component:* The completion and operation of the Ring Road No2 will contribute to reducing traffic jams and improving overall traffic efficient, reducing transport time, increasing motor vehicle operation speeds and reducing motor vehicle emissions. The new road and extension road will create more advantages for transportation activities, increase the urbanization and other indirect profits such as:

- Contribution to transfer the capital’s economic development, moving from agricultural economy to industrial economy following the utilization of land use, better utilization of the available land and infrastructure resources and bringing higher productivity for goods and services.
- Strengthening of the management on environmental protection.
- The infrastructure development in the area will boost the city’s residents their spirit and their attachment to the city.
Support the sustainable economic development of the city by the efficient transportation infrastructure.

The implementation of new roads and BRT system will alleviate traffic jams which may affect urban transport effectiveness, efficiency, living standards and socio-economic development of Hanoi City. The road and bus system will be formulated and developed to provide the service for new residential areas. The BRT and road alternatives have been appropriately selected and will bring the socio-economic benefits as well as significantly contribute to improve the air quality for Hanoi City and to minimize the adverse impacts.

4.3. Impact during the Construction Phase

Construction works for the BRT component will include:
- Earth work: soil excavation below the existing vegetation, pavement or existing ground to create the BRT lanes;
- Surface road pavement: pavement of BRT lane surface (totaling 181,856 m²) includes a concrete layer with thickness of 30 cm and a macadam foundation layer of 25 cm, pavement of road surface for other vehicle lanes include a concrete asphalt layer (totaling new surface of 323,362 m² and existing surface of 62,848 m²) or a simple asphalt layer for the serve lane (totaling 37,326 m²);
- Drainage: construction of new sewerage system (concrete pile 75cm-150cm in diameter totaling 3008 m long), additional catch basins (totaling 267) and manhole (totaling 535), drainage converts 100x100 cm (totaling 15,843 m) and improvement of the underground infrastructures and modern drainage system;
- Transportation system: signals, reflecting light painting, and the fence for pedestrian;
- Utilities system: concrete paved lane for disabled people, underpass for pedestrian, lighting, electricity, etc.;
- Construction the stations, depot, terminals including: concrete foundation, cover, floor structure, door, ventilation system, drainage, wastewater treatment station, and the chlorinate station for depot.

Construction works for new roads will include:
- Site clearance and temporary land acquisition.
- Construction materials and demolition waste transportation.
- Excavation and embankment of road beds and road surface
- Activities of asphalt and concrete mixing stations
- Road and bridge construction activities;
- Activities of site workers

Impacts on Air Quality: During the construction period, the transportation vehicles will cause airborne dust. The impact scope may reach about 50 m from the sources. The entry and exit of earth loading trucks is a particular strong source as trucks at these places bring dirt along with
their tires. The activities of excavation and embankment of the roads as well as the activities of Concrete and Asphalt Mixing Stations will also create dust and air emissions to pollute the air environment.

Experience from other urban transport projects show that large urban transport projects could cause major and city wide traffic jams as construction activities occupied and reduced the capacity of the existing roads. Air pollution, from air borne dust to motor vehicle emissions are expected to worsen compared with the pre-construction time. This phenomenon could occur in Hanoi as the current project components will mostly take place in the existing major urban roads.

Construction machines and transportation vehicles which burn gasoline, diesel or other fuels will create emissions near the construction site. Construction sites are generally located at the sections with busy traffic and thus strong baseline emissions, however. The air emission from construction equipments and vehicles are not expected to have significant incremental increase in total air emissions in those areas. Impacts from these sources to the surrounding air environment can be well controlled by good maintenance programs for construction equipments and vehicles.

*Impacts of Construction Noise:* Construction noise will be primarily from construction machinery and heavy duty construction trucks. Based on the noise intensity and compounded effect of simultaneous operation of multiple machines, it is expected that noise impacted areas will be approximately 50 m from the noise sources where day time noise standard will be exceeded by about 3-9 dB(A). The night time (22:00 to 7:00) construction in urban built up areas will be banned. But the past urban project experience shows there is always the possibility of night construction due to the demanding schedule and/or technical reasons (e.g., continued concrete pouring for bridges and railway crossings). In case night time construction occurs, it would produce high noise exceeding the standards by 5-30 dB(A) if located 50 m from the construction sites. While night time construction activities are prohibited in general, it would have the high noise impacts to the residents and hospitals, if in case occur.

*Impacts on Water Environment:* The construction period for the project may last for 2-3 years. The wastewater produced during the construction phase of this project is mainly from the slurry water produced by excavation operation particularly those near water bodies or in shallow groundwater area, cleaning water from construction machinery and transport vehicles, domestic sewage produced from construction camps, and the surface runoff produced from disturbed soil. Workers at construction sites normally have to stay in temporary houses with insufficient infrastructure and necessary sanitation conditions. Therefore, wastewater and domestic waste badly affect the living environment and surrounding water environment. Beside domestic waste water from the temporary camps at the site, there will also be some wastewater from washing machinery and equipment.
The drilling for foundation preparation and piling may impact to the strata and groundwater quality. Moreover, if technical measures are not followed and progress cannot be pushed up, wastewater and runoff would infiltrate and cause bad impacts to groundwater. The level of impacts depends on the compliance with implementation methods and would be minimized if those are strictly followed.

**Impacts on Flora and Vegetation:** Road widening, construction material stacking and new road construction will invade roadside vegetation such as grass, trees and bushes. The roadside vegetation will be impacted to various degrees. In particular, a number of trees will be cut to give a way to road widening and new road construction.

**Impacts spoiled soil and construction waste:** As mentioned above, the construction period will generate a large amount of solid waste such as earthwork, silts, waste concrete, demolition waste and household rubbish. Contractors will not be allowed to random dump the waste which will occupy valuable land, causing pollution to the environment, and impact the landscape. In additional, during the construction period household rubbish will be generated produced by the workers at construction camps. If this solid waste is not managed according to the sanitary way, it will cause the pollution situation for the area.

**Impacts on Community and Traffic:** During construction, a large amount of houses, offices and small workshops will be demolished and land occupied. This will seriously interrupt the normal life of the residents who have to relocate. They may need to resettle to a different community or neighborhood, change living conditions although they any such changes should not result in a reduced standard of living, the level of services and housing conditions according to project RAP. Together with the demolition, road side vegetation including lawns and trees will be damaged or removed. This will affect the community appearance and causing adverse visual impacts. In addition, construction machines, materials storage, and construction waste will also have negative visual impacts to the communities in the project area. The road widening, maintenance, and upgrading will take place on the existing roads, reducing the road transportation capacity. In addition, construction materials and waste transportation will also increase traffic on the roads. All will increase the burden of the existing transportation system and many residents may find it would take a longer time than now for the same journey in the city during the peak construction phase.

**Impact to Cultural Relics during Construction:** The vibration from construction machinery and heavy duty construction vehicles will affect the Dong Co Temple (Dong Co: Ancient Bronze), in Buoi Ward, Tay Ho District of Hanoi, was built in Ly dynasty in the eleventh century to honor the Spirit of the Bronze Drum. The temple was built like a place with two stories and an eight - gable roof. The wooden parts were from four tree species. Devout pilgrim reach Dong Xa village by Thuy Khue road. They cross the bridge over the To Lich
River. On the grounds they see a three-door gate, and a rock garden. The temple is composed of several small chapels and an inner sanctum which houses three large 200 year old thrones of red hat with metallic decoration of the Dong Co god grace these thrones. The temple is located approximately 50 m from the link road between Hoang Hoa Tham and Thuy Khue. But, since the temple was rebuilt in 1990 with modern construction technology and there is no heavy vibration operation such as piling near these facilities, the vibration impacts are limited. In addition, the dust and noise from construction activities will also impact these cultural relics, primarily for cultural relics maintenance and to the visitors to the sites.

4.4. Environmental Impact during the Operation Phase

**Socio-economic Impacts:** The affected area will be covered 16 wards/neighborhood communities. The average income of the residents is ranging from 500,000-1,200,000 VND/Household/month. The main occupations of household owners in the project impacted area are small business owners (65%), farmers (28%) and others (7%, such as retired and government staff). The total relocated and resettled units will be 730 households. With average house size of four persons in one family, the total number of affected people will be 2920. The permanent land occupation will be about 311,470 square meters of which about 31,500 square meters is special use land, and about 204,255 square meters is agricultural land and the rest is garden and ponds area.

The most vulnerable people affected by project resettlement have been given a special attention. These include urban population who live below the poverty line. Hanoi People Committee and the project executing agency plan to offer special helps and support to these fragile or otherwise disadvantaged population during the resettlement to mitigate the impacts. The details of the mitigation, compensation and rehabilitation measures to the vulnerable groups as well as the all affected by the project are presented in the project RAP.

**Impacts on Air Environment:** A modeling of impacts of the project operation to air quality has been conducted during EA and the results show that under the annual average meteorological conditions, air quality will meet applicable standards at all project interchanges. But under the unfavorable meteorological conditions, the air quality standard may exceed the standards. In 2010 and 2020, with the implementation of more stringent motor vehicle emission control standards of EURO 2 and EURO 3 in Hanoi, air quality in the surrounding areas of project roads and terminals is expected to improve. From the city wide perspective, as the project will help reduce motorbike traffic, alleviate traffic jams in city center, and improved urban transport system efficiency, the total motor vehicle emissions would be reduced, and thus better air quality, comparing with the conditions if there were no this project.

**Noise Impacts:** After the completion of this project, road infrastructure facilities will be improved greatly, traffic control will be more scientific and modernized and distribution of
traffic flow will be more rational. As a result, traffic flows along the project roads will increase accordingly and so will be vehicle speeds, increasing traffic noise along the project roads. The bus terminal sites are currently green field and the operation of the terminals will increase the noise levels in the areas. In general, environmental noise impact along project roads and surrounding project sites will increase, particularly the green field sites for new roads and terminals where incremental increase in noise will be significant. In some local built up areas, however, noise impact will decrease because of reduced acceleration and, particularly, honing as a result of smoother traffic (Hanoi currently has no honing control program). As traffic has been attracted to project roads, the parallel road traffic is expected to decrease, reducing noise levels in these adjacent roads.

V. MITIGATION MEASURES

5.1. Mitigation Measures during Planning and Designing

_planning of second ring road_: In order to mitigate impacts of urban traffic pollution, the following measures would be carried out:

- The design of cross section should be wide and spatial enough to avoid traffic jam and make it easy for pollutant to be dispersed in the atmosphere;
- Large pavements and the long distance from houses and building to the roads;
- Asphalt surface roads and regular cleaning and watering in sunny days to minimize dust;
- Traffic system is arranged in combination with trees, grass and parks along man made lakes.

**Mitigation of Noise Impacts:** Mitigation measures at the design stage are those which are considered during and/or incorporated into the design. Table 5-1 lists the commonly used noise mitigation measures for roads in urban areas, including the effectiveness, advantages/disadvantages, and estimated costs.

<table>
<thead>
<tr>
<th>Measure</th>
<th>Noise reduction</th>
<th>Advantage/disadvantage</th>
<th>Estimated cost (10^3 VND)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Absorbent noise barrier</td>
<td>2-20 dB(A)</td>
<td>• Effective in open area&lt;br&gt;• Minimum noise reflection&lt;br&gt;• Potential sunlight and visual impacts&lt;br&gt;• Effective only to certain heights&lt;br&gt;• Limited effectiveness for multiple layer roads</td>
<td>800-1000 per m²</td>
</tr>
<tr>
<td>Reflective noise barrier</td>
<td>5-20 dB(A)</td>
<td>• Lower sunlight impact&lt;br&gt;• Potentially increase noise intensity due to the reflection</td>
<td>800 per m²</td>
</tr>
</tbody>
</table>
In general, the noise barriers are most effective to three to six floors of the buildings targeted for protection, with average noise reduction of about 2 to 4.7 dB(A). Higher floors are generally beyond the noise barrier protected area and have no measurable noise reduction. Noise barriers may be installed in some interchanges and other elevated sections of the road component. The lower floors on the other hand, are mostly impacted by the noise from the ground level traffic for which the noise barriers mounted on the elevated viaduct have no effect. The lessons learnt from some urban areas in the world as well in Vietnam and other Asian countries shown that noise can be reduced by 26-27 dB(A) when the windows are closed. When the windows are open, the reduction is about 6-10 dB(A) compared with the noise levels one meter outside the same windows.

Double glazed windows at the sensitive receptors along the BRT routes will be installed in the following locations:

- Along the Nguyen Thai Hoc street, a bus stop of BRT route will be located near Primary school where there is a 3 stories classroom building. The first and second floor of the building will be mostly offices whereas the classrooms are on the third and fourth floor. There are a total of 10 classrooms on these two floors with a total window area of 120 m².
- The first row of buildings of University of Civil Engineering and Hanoi University of Polytechnic located approximately 100 m from the proposed BRT Giai Phong corridor.
- Bach Mai hospital is about 50 m from the proposed BRT road. But it is located near railway station. The effected noise level in this area caused by train is more than by the BRT. Nevertheless, it is recommended that the first building of the hospital shall be installed with double glazed windows with an estimated area of 120 m².
Mitigation of Vibration: The following measures will be taken in engineering design to reduce the potential influences of vibrating:

- Potential vibration caused by the expansion seals/joints between pre-fabricated concrete plates and between concrete plates and bridge columns of the interchanges will be given sufficient considerations during the design. The support column design will also affect the vibration which will be considered in the design as well.
- Greater improvement in the materials spread on the pavement of the road and the plan ness of the road will be made. The asphalt will be adopted as the surface material. The smoothness of road surface will be strictly controlled, because 1 mm decreasing of smoothness contributes to 4 dB reduction of vibration level.
- The land use along the project roads will be properly arranged. The vibration sensitive buildings will not be placed within 40 m along project roads. Such considerations have been incorporated into the Mater Plan of Hanoi City and will be carried out by and under the supervision of Hanoi Architectural and Planning Institute.

Mitigation of Air Quality: To facilitate the dispersion of motor vehicle tail emission, the new high-rise buildings to be built along the project roads will be located outside 20 m of the red line. Other than this measure, emission control and air quality is not a just project issue, but rather involve many sectors and all parts of the city. The project includes an Air Quality Management (AQM) component with a series of measures, programs and policy initiatives, backed by investments from the part of the project loan proceeding and bilateral grants from foreign governments, to address the air quality issues particularly those related to the city’s motor vehicle emissions with an integrated approach. These measures include equipment procurement, technical assistance and training including a motor vehicle inspection and maintenance (I/M) program.

Mitigation of Water Quality: Domestic sewage from the bus terminals and depots will be drained into the municipal sewage pipeline from the onsite septic tanks. Wastewater from vehicle cleaning and maintenance operation at the depots/terminals in Quang Lai, Ba La, and Van Dien will be discharged after treated onsite which include mainly oil water separation and grit removal.

Landscape Design: Considering environmental beautification and landscape design in engineering design, making the road, viaduct and bus depots coordinate with others. In the design of road reconstruction and expansion, make utmost efforts to protect the trees and the green belt at both sides of the road; as for the place that must be occupied, the trees that can planted in another place must be planted in the another places as much as possible. According to Hanoi Urban Green Regulations, as for the ratio that green land in this project accounts for in the total area of the land, the road with the width of under 40 m is not less than 20 per cent,
the road with the width between 40–50 m is not less than 25 percent, the road with the width of over 50 m is not less than 40 percent and the bus depots is not less than 25 percent.

5.2. Mitigation Measures before the Construction Phase

The main mitigation immediately prior to construction is compensation to the affected land owners and resettlers. On the basis of compensation unit rate specified in the Decision No. 98/2004/QD-UB of Hanoi city People’s Committee and market prices, land and housing compensation has been determined in the project RAP following a detailed investigation of the project impacted areas and affected population. The affected land and other properties which will be compensated are summarized in Tables 5.2 and 5.3.

Table 5.2 Affected Land

<table>
<thead>
<tr>
<th>Land type</th>
<th>Area (m²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Residential / Housing lands</td>
<td>71,536.50</td>
</tr>
<tr>
<td>Garden/pond surrounding houses.</td>
<td>1,068.00</td>
</tr>
<tr>
<td>Agricultural Land</td>
<td>204,255.10</td>
</tr>
<tr>
<td>Special used Land (shops/kiosk)</td>
<td>34,512.00</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>311,471.60</strong></td>
</tr>
</tbody>
</table>

Table 5.3. Summarized scope of resettlement impacts of the HUTDP

<table>
<thead>
<tr>
<th>No</th>
<th>Name of works</th>
<th>Total number of DPs (HHS)</th>
<th>Total number of relocated HHs, individuals</th>
<th>Number of HHs having non-farm income sources affected</th>
<th>Number of DPs losing &gt;30% of HH’s land holding</th>
<th>Number of reorganized DPs losing residential land</th>
<th>Number of marginally DPs losing crops/trrees impacted only</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Second Ring Road</td>
<td>966</td>
<td>344</td>
<td>8</td>
<td>445</td>
<td>105</td>
<td>157</td>
</tr>
<tr>
<td>2</td>
<td>Buoi-Cau</td>
<td>270</td>
<td>173</td>
<td>3</td>
<td>133</td>
<td>0</td>
<td>91</td>
</tr>
<tr>
<td>3</td>
<td>Nhat tan</td>
<td>696</td>
<td>171</td>
<td>5</td>
<td>312</td>
<td>105</td>
<td>66</td>
</tr>
<tr>
<td>4</td>
<td>Buoi Interchange</td>
<td>408</td>
<td>309</td>
<td>6</td>
<td>147</td>
<td>0</td>
<td>33</td>
</tr>
<tr>
<td>5</td>
<td>BRT</td>
<td>228</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>6</td>
<td>RS CT5</td>
<td>82</td>
<td>77</td>
<td>1</td>
<td>11</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td><strong>1,684</strong></td>
<td><strong>730</strong></td>
<td><strong>15</strong></td>
<td><strong>611</strong></td>
<td><strong>105</strong></td>
<td><strong>194</strong></td>
</tr>
</tbody>
</table>

The total cost for site clearance was estimated and compensation for damages was estimated in Table 5-4.

Table 5-4. Estimated Cost for Compensation and Resettlement
5.3. Mitigation Measures during the Construction phase

The construction activities will inevitably cause the adverse effects to the environment such as vibration, noise level, air quality, water quality, fauna and flora etc. Though these impacts are immediately and can be mitigated but the assessment of those impacts are necessary and proposal for mitigation measures are important.

**Acoustic Environment:** Although the noise produced in construction is inevitable entirely, the impact from the noise on the environment around it can be mitigated to some extent. The Constructor must to make the noise in construction site meet the requirements of Permitted noise level in Construction Site.

The following measures to reduce the noise will be performed by the Contractor:

- Prohibit using the equipment with high noise at night (22:00–6:00), such as pile driver, crusher, bulldozer, excavator, compactor, generator, electric sew, concrete electric vibrator and so on. Any operations extended beyond these timeframe as may be required by the construction needs must apply and receive approval from relevant authority. This requirement will be strictly enforced in the RR No2 and Hoang Quoc Viet road construction which will basically eliminate the noise impacts at night, as well as the after lunch nap time.

- Use the machinery with low noise or the equipment equipped with sound eliminator or sound insulation cover for example, generator used in construction site will be supplied with sound eliminator or according to the environmental situation around the construction sites.

- Arrange construction time and equipment reasonably to make the construction which may produce larger noise avoid the sensitive receptors and time of sound environment and maintain equipment regularly to keep its good working state. As for the construction sites with a little larger noise, install temporary sound barrier.

- As for the large construction structures, especially those used in many viaducts in this project, they will be prefabricated outside the construction sites and then will be transported to the construction sites to erect.

- As for the construction which is necessary to be performed at night, the Contractor must submit it to the People's Government of Hanoi City for approval in advance of construction. The Project Construction Office will install sound insulation windows at the impacted sensitive receptors according to the requirements of this environment.

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### Table: Resettlement Costs

<table>
<thead>
<tr>
<th>Works</th>
<th>Description</th>
<th>Cost (USD Millions)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resettlement</td>
<td>Project's Components</td>
<td>60 - 80</td>
</tr>
<tr>
<td>Removing</td>
<td>CT 1 and CT5</td>
<td>30</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td><strong>90 - 110</strong></td>
</tr>
</tbody>
</table>
management plan ahead of 15 days before construction and release its construction report on the newspaper before 2 days. The telephone numbers for complaint will be given on the newspaper and in the construction sites.

- Where possible, columns will be installed using excavated holes and onsite casting. If steam, turbine or hammer style drilling machines must be used for column construction, the contractors must apply to PMU first and these drilling activities will be restricted to certain hours of the day (primarily morning and afternoon while evenings and nap time at noon will be strictly prohibited from using such drillers).

According to the above assessment, Dong Xa ward, and Xuan La commune will have the most seriously impacted sensitive receptors during construction. The specific mitigation measures have been designed and will be taken at these places which are included: install double-glazed windows to the first row of the residential housing in Xuan La commune locations for reduce or avoid the long term impacts as well as during operation phase.

**Mitigation Measures to Reduce Vibration Impacts:** In order to reduce the vibration impact in the construction phase from this project, the following measures will be taken together mitigation measures for noise control:

- Arrange layout of the construction site, make the vibrating equipment far away from the sensitive buildings to the extent possible;
- Strengthen construction management, with orderly construction activities, and arrange working time reasonably and sensitively.
- Avoid conducting construction operation with strong noise and vibration at night wherever possible;
- Use the construction equipment with lower noise and vibration as much as possible during construction;
- Request the contractors to consult the public regularly and ahead of the high vibration operation to receive public understanding and public opinions.

**Mitigation Measures to Air Impacts:** The mitigation measures for environmental protection at construction sites shall be:

- Dust generated during construction can be controlled by watering. Auxiliary method for reduction of dust is regular watering water around the sites. In hot days and when the wind velocity higher the 3rd grade during the dry period, the watering shall be conducted twice per day: one in the morning and once in the afternoon right after the noon break.
- Materials will be stored in appropriated places and will be compacted where possible; for bulk materials which cannot be compacted well, water spray or cover will be applied to minimize dust;
- All construction and demolition waste will be promptly removed from the sites, daily if possible. Before leaving construction sites, trucks wheels will be washed to clean the dirt which would otherwise be carried away to the streets;
- Asphalt and concrete mixing plants will be located in the area at least 500 m leeward.
from the nearest residential or other sensitive receptors to ensure that the emission from these facilities will impact the sensitive receptors. The asphalt plants will be required to equip with effective emission control facilities to meet the emission standards in relevant state and provincial air emission standards. Mixing machines which produce dust with the concentration of 50 mg/m³.

- Workers should be provided with mufflers and glasses for protection of the workers at stone grinding facilities and similar facilities.

**Mitigation Measures to Water Impacts:** The Contractor will take the following measures to minimize the impacts from construction activities on water environment:

- Progress and organize the construction in a scientific way;
- Use only clean materials for backfill;
- Sludge layers should be dredged before foundation preparation or using the special construction methods. The discharge of pollutants into lakes is prohibited and pollutants are also no allowed to be used for backfill;
- Along the access into the sites and construction sites, zoning method should be applied like preparing fence with sand bags, clearing the flow to avoid erosion and floods;
- Strictly follow the drilling, piling techniques to avoid the infiltration into surface and ground;
- Strictly prohibit discharging of untreated wastewater. Wastewater from construction activities should be preliminary settled in settling basin before discharging into the environment to avoid accumulation in drainage system. At the suburban area where haven’t have the comprehensive infrastructure (West lake, Nhue River, To Lich river, etc), it requires to install removable toilet with settling tank and filtration of wastewater before discharge into water body. Especially, the construction of the piling foundation on Buoi- Cau Giay road, drilling wastewater and runoff will be preliminary settled and then discharged into storm water sewer along the channel before flowing into To Lich river.
- The sludge from septic tank will be regularly collected by URENCO or the sanitation services company according to the times of removing during construction period.
- Waste oil and fuel from machines and equipment must be discharge in dedicated bins and regularly transported outside for treating. Free discharge into the environment is not allowed.

To avoid local flood in the surrounding area, the following measures shall be applied when implementing of construction of roads and BRT stations:

- The drainage system of the roads is based on the whole catchments; Depth of the pipes on the roads is defined on the basis of the depth at the most disadvantageous points of the catchments. This is to secure the total amount of wastewater and storm water is collected into sewers on roads; At the locations where the roads cross the channels and based upon the major flow direction, sewers crossing roads are laid with the diameter
defined on the basis of the calculation of the highest flow at those location
Materials during construction are not allowed to locate in such places like storm water
inlets, which would block the flow. Natural gradient of the road should be follow and
construction method should not cause impacts to the flow on the roads.

- The construction level at the head terminals and end terminals is based on the existing
level of the areas, avoid the situation where the construction level is higher than the
existing level of the surrounding residential areas

**Mitigation Measures to Solid Waste Management:** The generated solid waste are from
construction of the roads will cause negative impacts to the quality of surface water,
underground water, soil and air environment. To mitigate these impacts the following
measures will be taken:

- Contractors will be requested to comply strictly apply first to TUPWS and Hanoi
Urban Environmental Company (URENCO) to receive appropriate approval and
permits and dispose the waste in designated areas.

- As per TCVN 6696-2000 stipulate that trucks loaded with bulk and loose materials and
waste must be loaded properly, covered and washed of their exterior before allowed on
the roads. Such trucks are not allowed to leak or cause air-borne of the materials loaded
during transportation and the transportation can only be made within the designated
time and along the designated routes.

- Waste materials which can be used again will be recycled;

- Temporary waste storage areas at the construction sites will be carefully selected to
avoid water front or causing traffic congestion, inconvenience to the pedestrians,
residents, and others in the nearby communities; and

- Transportation of construction waste will avoid peak hours, avoid sensitive areas, and
will use approved routes.

**Mitigation Measures to Urban Ecology:** The following measures will be taken to minimize
the impacts:

- Where possible, plants including trees, flowers, and bushes will be relocated to other
places or back to the project area following the completion of the construction, instead
cut and wasted;

- The construction activities will be limited within the red line area and not to occupy
farmland;

- Buildings under demolition will be surrounded with nylon cloth or metal sheets or wood
boards to minimize the visual impacts to the communities as well as for dust and safety
control;

- The project area will be landscaped and planted following the construction. The green
area will be no less than 20% of the total project area. The landscaping plan will result
in a net increase in green space in the project area.
Traffic Management: To mitigate impacts to the traffic on the existing roads, construction activities will be well planned in consultation with the local traffic police. The specific measures to be taken include the following:

- The most traffic affecting activities such as loading/unloading, beam lifting, and bulk materials transportation will be scheduled for the time when the traffic on the roads will be the lightest such as weekends, holidays mid-day around the noon time or evenings.
- No traffic affecting construction activities will be allowed during the rush hours in the morning and early evening;
- Public notices in the form of public boards at the construction sites will be provided to inform the road users of the time, length and type of traffic affecting construction activities and possible congestion.
- The public notice will also advise the road users of possible detoured roads identified by the traffic police as alternative routes to avoid the congestion on the roads affected by the project;
- No construction materials and debris will be allowed to store and pile on the roads or the pedestrian areas;
- Construction vehicles parking on the roads will not be allowed unless it is absolutely necessary. Such parking will be kept to the minimum and be removed as soon as it is possible; and
- During the loading/unloading, viaduct structural lifting and installation, the contractors will be requested to contact the traffic police to either have the police on site or have their own staff on-site to help direct the traffic, to minimize the traffic congestion and to ensure the safety.

Community: The following measures will be taken to mitigate the negative impacts on the community from the construction of the project.

- All of the roads under reconstruction in urban area will be constructed in half-closed manner and leave passages for the pedestrians, bicycles and buses.
- Build temporary roads and temporary bridge for the units and the residents along the line and set necessary safety measures to ensure the unit and the residents can go out conveniently and safely. At the same time, perform centralized construction and quicken the construction progress to reduce the impacts on the communities.
- As for the section where some schools are located, carry out construction in the summer holiday or in other holidays to reduce the impact on the going of the students.
- All of the construction materials will be stored on special yards by categories and types and kept by designated persons. The discarded materials will be removed out of the site to reduce space occupation and traffic inconvenience.
- As for the resident areas and the units that are separated due to being removed, rebuild the fence within one month after accomplishing removing to reduce the impacts from the external environment on the community security.
- During the construction of ramp of Buoi and Cau Giay interchange as well as Dam and
Nhue bridges, build safety passage and take safety measures to ensure the safety of the pedestrians.

- The hospital can anew establish its gate, so does the school; at the same time, set some facilities such as gangway and guard fence.
- Road construction will be carefully planned and implemented to avoid damages to underground utilities. Necessary protection measures will be taken for various underground pipelines, cables and other utilities.
- In road sections where traffic will remain, the street lighting will be maintained at the original levels. No damage or disruption of street lighting will be allowed.

**Others:** Other measures to be taken during the construction phase include:

- The contractor will be request to halt the all construction activities immediately if any archaeological or other cultural properties are found (chance finds) during excavation and to properly protect the site which such finds are uncovered. Cultural authority, as well as PMU and EA team, will be noticed promptly. Only after a thorough investigation by the cultural authority and specialists and a clearance is provided, will the contractor be allowed to resume their construction activities at the site.
- The contractor will be request to provide safety shelters at the construction sites, particularly overhead construction sites, to protect the public from any safety accidents. Warning signs will be provided to alert the public of potential safety hazards at and around the construction sites.
- The PMU recognizes that contractors working on the road component will be a key in environmental management, pollution control and impact mitigation during construction. A number of measures will be taken to ensure that the contractors will be aware of their responsibilities and obligations in environmental protection. All contractors and construction supervision will be required to participate in a mandatory environmental training program prior to the start of construction onsite. The above mitigation measures will be, where appropriate, included in the tendering documents for contractors and eventually in the construction contracts so that they will be the contractual requirements for contractors working on proposed road.

Table 5-5 summarized the proposed mitigation measures and the responsible organizations for implementation during the construction phase to minimize the potential adverse impacts.

<table>
<thead>
<tr>
<th>Concerns</th>
<th>Mitigation measures</th>
<th>Implementation organization</th>
</tr>
</thead>
<tbody>
<tr>
<td>Noise</td>
<td>Equipment with high noise is forbidden to use at night (22:00-6:00); machinery and equipment with low noise shall be used; installing the machinery and equipment with mufflers or sound-insulating cover; rationally arranging construction schedule and machinery and equipment; components of large-scale of structure shall be prefabricated outside the</td>
<td>Constructor and Project Management Units</td>
</tr>
</tbody>
</table>
## Mitigation measures

**Construction site**
- The construction sites and shortcuts shall be sprayed water regularly. The vehicles transporting cement, building materials and building refuse shall be covered by tarpaulin to reduce dispelling. Before the vehicles going out of the loading and unloading yards, their carriages and tyre shall be cleaned by water. The routes for the transport vehicles shall avoid passing through the downtown area and avoid the residential area and environmental sensitive receptors as far as possible. The cleaning work for the vehicles going in and out of the construction sites, the activities of disposition, transportation and piling up of engineering spoil, building refuse and building materials on the construction sites, and site recovery and hardening shall be managed strictly. According to the investigation on change of the concentration of PM$_{10}$ surrounding the construction sites, the distance between the material plant, mixing station and other temporary material plant for construction and the residential areas and environmental sensitive receptors shall not be less than 50 m. In the construction phase, the municipal traffic management departments shall do well the traffic dredging work. According to construction plan, set warning signs at the entrance to the city to remind the vehicles of traveling from the external roads around the city. Do well in traffic management on external roads to ensure the unblocking of the roads and prevent the traffic jar so as to reduce the influences from the waste gas of the vehicle on the environment and air. If the vehicles are blocked due to the road construction in urban area, the traffic management department can set down the instant vehicle traveling management method, for example, regulating the traveling route for the taxi with odd and even date, prohibiting turning left at the main crossing and setting one-way lane and so on.

**Water environment**
- Prohibit draining and flowing waste water from construction randomly. Clear the construction site in time. Only when the waste water from construction is treated in the temporary sand settlement bank can it be drained into the drains to prevent some little matters such as sands and some sundries such as some construction rubbish from being draining into drain pipeline. The toilet for constructors in construction site shall set temporary cesspool and the sewage will be drained into the drain after pretreatment in cesspool. Besides enforcing management on the drainage of living waste water, the contractor shall offer training to the constructor on basic environmental protection to improve the consciousness and responsibility of environmental protection.

**Recovery of vegetation**
- As for the green belt damaged by construction activities, if they can be planted in another place, take protective measures to plant them in another place after the construction. If it is necessary to cut them due to the construction need while they can not be planted in another places, they will be compensated according to the principle of "cutting one, compensating two". There will be 378 trees to be cut within the range of the project and 756 trees will be planted as the compensation after the project is accomplished.

<table>
<thead>
<tr>
<th>Concerns</th>
<th>Implementation organization</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Ambient air</strong></td>
<td>Constructor and Project Management Units; TUPWS</td>
</tr>
<tr>
<td><strong>Water environment</strong></td>
<td>Constructor and Project Management Units</td>
</tr>
<tr>
<td><strong>Recovery of vegetation</strong></td>
<td>Constructor and Project Management Units</td>
</tr>
</tbody>
</table>
## Mitigation measures

### Community

All of the roads under reconstruction in urban area will be constructed in half-closed manner. Build temporary roads and temporary bridge for the units and the residents along the line and set necessary safe measures to ensure the unit and the residents can go out conveniently and safely. As for the section where some schools are located, carry out construction in the summer holiday or in the holidays. All of the construction materials will be placed in the special sites in order according to the classification and type, clear and transport the waste from the construction in time to reduce the influences on the land occupied by the materials and the traffic. As for the resident areas and the units that are separated due to being removed, rebuild the fence within one month after accomplishing removing. During the construction of ramp of Dam River Bridge and the over cross at Hoang Quoc Viet Road, build safety passage and take safety measures to ensure the safety of the pedestrians.

### Traffic

When setting down road construction plan, pay attention to planning and reasonable arrangement; at the same time perform construction in different period to reduce the traffic jam due to the same direction of the vehicles. This project will be constructed in half-closed manner and allow the buses and the bicycles to travel while prohibit the traveling of the vehicles through the city to ensure the unblocking of the buses. In the busy section, the crossing of the road can not be constructed in fully closed manner, but in half-closed manner, at the same time set one-way street to ensure the unblocking of the bus. Enforce traffic management and organization. All of the vehicles through Hanoi shall travel along the external ring route and it is prohibited to cross the urban area to reduce the traffic pressure of the roads in urban area. Control the variation and the type of the passing vehicles, set lane on the special sections and increase the change circle of traffic indication light to try to reduce the traffic flow on the main truck. Organize circumambulating line and bicycle line. Perform scientific management and improve the quality of the traffic policemen to enforce traffic management ability; emphasize on improving the quality of the drivers to reduce the traffic jam due to the man-made factors. Set iron separation fence at both sides of the tracks of the roads for vehicles in main urban areas. Enforce the management on the anchoring vehicles on the road and make it leave as quickly as possible to avoid the influences on the normal passing of the vehicles so as to increase the passing ability of the traffic of the roads.

### Vibration

Where possible, columns will be installed using excavated holes and onsite casting. If steam, turbine or hammer style drilling machines must be used for column construction, the contractors must apply to PMO first and these drilling activities will be restricted to certain hours of the day (primarily morning and afternoon while evenings and nap time at noon will be strictly prohibited from using such drillers). Unless there is emergencies (emergent repair, emergent rescue), at night (22:00-6:00) we will not use any construction equipment with great vibration influences. The contractor must set signs at striking sites and give the telephone for complaint, names of the project, the contractor and the
5.4. Mitigation Measures during the Operation Phase

**Noise Control and Acoustic Environment Improvement:** The Hanoi Traffic Management Bureau of Hanoi together with Hanoi Environment Monitoring Station, is in charge of the regular inspection of the vehicle noise and monitoring of improvement of standard-exceeding vehicles. Vehicles that are far out of standard will be rejected. The noise-controlling plan and objectives of each vehicle will be established to reduce its noise values step by step. The department of traffic police is in charge of enforcing rules and regulations of urban traffic management, such as prohibiting overload or overlarge vehicle to travel on the viaduct and limiting the traveling speed of vehicle especially at night.

**Vibration Mitigation:** During operation, under the condition of unchanged ratio of vehicle type and speed, the vibration level at both sides of the road will increase with damage extent of the road surface day by day. If the condition of the road surface remains the same, the vibration level ascents with the increase ratio of the vehicle type (especially the ratio of large and mediate vehicles), and with the increase of traveling speed. If the road surface is more deeply damaged and the ratio of vehicle type (especially the proportion of large and mediate vehicles) and traveling speed increases, the vibration level at both sides of the road will also largely increase. To prevent and reduce the impacts on the vibration environment at both sides of the road during the operation and to make it be in accordance with the requirement of TCVN 6962-2001 Vibration Standards, it will be required to take the corresponding measures of traffic management.

<table>
<thead>
<tr>
<th>Concerns</th>
<th>Mitigation measures</th>
<th>Implementation organization</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Municipal facilities</strong></td>
<td>2 days before the construction, the contractor releases public notice on newspaper or television to the public to make preparations. If the water is cut off over 2 days, we'll use water supply truck to supply the influenced people with water. Stoppage of power, gas or water that may be caused by construction will be arranged at night 22:00–6:00 as much as possible.</td>
<td>PMU, Constructor</td>
</tr>
<tr>
<td><strong>Cultural relics and historical sites</strong></td>
<td>During the process of construction, the transport vehicles shall run with low speed in urban area to reduce vibration. All the construction plants shall conduct civilized construction. The transport vehicles shall be sealed during the process of construction to avoid flying dust. The route for vehicles going in and out the construction sites shall be sprayed water regularly. During the process of construction, the equipment with low noise shall be adopted as far as possible and corresponding noise reducing measures shall be adopted. Nighttime construction is forbidden. It is forbidden for the construction vehicles whistling to avoid it distributing the residents.</td>
<td>Constructor and Project Management Unit</td>
</tr>
</tbody>
</table>
Mitigation measure for air environment: As indicated in the EIA of this project, air quality in Hanoi is expected to improve towards 2020 due to anticipated modal shift to public transportation and tightened vehicular emission control. Hanoi has made very much progress in controlling the tail gas from vehicles, in the coming future it will continue to perform and enforce these measures to control the tail gas from the vehicle included:

- Enforce management on the sales of new-type vehicles and control the market entry, make sampling inspection regularly on all kinds of new ones in the market, and carry on the sale rules of standard tail gas emission.
- Reject the vehicle strictly according to the state Vehicle Rejection Standard. All of the rejected vehicles must be destroyed and mustn't be resold or transferred.
- Strengthen the emission control of the existing motor vehicles and implement the annual inspection and sampling inspection system. The standard-exceeding vehicles must be treated until up to standard with a specified time limit. From 2007 on, the dual idle emission inspection will be progressively implemented and then IM system.
- Control the increasing speed of the vehicle, especially the newly increasing taxis, motorbikes and mini motorbikes.

Besides these emission control measures, HUTDP will have an investment element in order to make sure the sustainable improvement of air quality in Hanoi. The Air Quality sub-component under the Institutional Development component of HUTDP will develop an air quality management system to reduce human exposure to vehicular air pollution and consequent health impact in Hanoi. Emphasis will be placed on motorcycles which are supposed to be the primary contributor to traffic emissions. The AQ sub-component will include the following key elements:

- Improvement of air quality monitoring network through the upgrading of existing 5 monitoring stations and establishment of 3 new monitoring stations;
- Pilot operation and demonstration of I/M for motorcycles including voluntary inspection of motorcycles, public awareness raising campaign, data analysis, and development of policy options; and,
- Technical Assistance for mobile sources emission inventory development and exposure and health impact assessment.

Improvement of Public Traffic: Establish the information management and dispatching system of urban public transit in Hanoi to improve the level of public transit management and service; Establish 6 public transit interchange stations, 3 bus terminals and depots, 46 public bus stop stations; take policy of placing public transit in priority. The implementation of these measures will effectively reduce the pollution of tail gas from vehicle in Hanoi and have positive significance in improving the environment and air quality of Hanoi.

Road Improvement: The ring road as well as traffic control and safety in this project aim at taking full advantage of road resources, improving road and traffic conditions, and increasing the flat level of the road surface through managing and engineering measures, such as establishing area traffic control system (ATC), cross sections, setting separate belt of vehicle
and non-vehicle. They also aim at decreasing vehicle start-stop frequency and increasing vehicle traveling speed. The implementation of these measures will largely mitigate the pollution of tail gas from vehicle in Hanoi.

**Landscape:** This project will protect the trees and green belts along the both sides of the road reconstructed and expanded to the utmost, as well as plant trees and grass by the two sides of the newly built road according to different structures of the roads. The work will be carried out by Hanoi Landscape Bureau. The principle of compensating the vegetation damaged due to this project is "cutting one, compensating two".

**Sunshine:** Continue to strictly control the height of the buildings by the two sides of the roads as well as the distance between the sunshine sensitive buildings and the red line on the road.

**Mitigation Measures to Water Impacts:** The mitigation measures for the impacts to water environment are below mentioned:

- There are public toilets near Hoan Kiem lake which can be used for Hoan Kiem interchange station. The other stations shall be installed with removable public toilets.
- Receiving bodies at proposed terminals are irrigation systems. As the pollution load here is rather higher, effluent standards applied column B, TCVN 5945 -2005.
- Public toilets shall be constructed with preliminary treatment facilities. Domestic waste water is primary treated in septic tanks before discharging into sewers/ The residual sludge is periodically pumped and transported to landfill by URENCO or used for composting.

**Solid Waste Management:** The quantity of solid waste from terminals, bus stops and interchanges with a quantity of 3.5 to 4.0 ton/day shall be stored in bins. The waste storage bins shall be located at bus stops, interchange stations as well as at bus terminals. Waste bins shall be designed with different colors for keeping the nice aesthetics. The collection and treatment methods for this waste shall be done by Hanoi URENCO under assigned and management of TUPWS.

**Road Improvement:** The two roads as well as traffic control and safety in this project aim at taking full advantage of road resources, improving road and traffic conditions, and increasing the flat level of the road surface through managing and engineering measures, such as establishing area traffic control system (ATC), intersection canalization, setting separate belt of vehicle and non-vehicle. They also aim at decreasing vehicle start-stop frequency and increasing vehicle traveling speed. The implementation of these measures will largely mitigate the pollution of tail gas from vehicle in Hanoi.

Table 5-6 summarizes the proposed measures and the responsible organizations for implementation during the operation phase to minimize the potential environmental
impacts.

### Table 5-6. Summary of Mitigation Measures in Operation Phase

<table>
<thead>
<tr>
<th>Concerns</th>
<th>Mitigation measures</th>
<th>Implementation organization</th>
</tr>
</thead>
<tbody>
<tr>
<td>Noise</td>
<td>Sustained improvement of noise standard of motor vehicles. Regular inspection of the vehicle noise and monitoring of improvement of vehicles out of standard. Vehicles that are far out of standard will be rejected. The noise-controlling plan and objectives of each vehicle will be established to reduce its noise values step by step. The department of traffic police is in charge of enforcing rules and regulations of urban traffic management. Maintaining the sound insulation (sound barrier) equipment regularly, repairing and maintaining the road surface.</td>
<td>Dept. for Natural Resources and Environmental (DONRE) Dept. of Transportation and Urban Public Works (TUPWS); Environnemental Monitoring Station (EMS); Urban Management Office (UMO)</td>
</tr>
<tr>
<td>Vibration</td>
<td>Establishing the urban road and traffic administration system. Maintaining the road according to the related regulations.</td>
<td>Dept. for Natural Resources and Environmental (DONRE) Dept. of Transportation and Urban Public Works (TUPWS); Environnemental Monitoring Station (EMS); Urban Management Office (UMO)</td>
</tr>
<tr>
<td>Ambient air</td>
<td>To constantly implement the existing motor vehicle tail gas control measures. Enforcing motor vehicle tail gas control. Improving public transit and road traffic management.</td>
<td>Dept. for Natural Resources and Environmental (DONRE) Dept. of Transportation and Urban Public Works (TUPWS); Environnemental Monitoring Station (EMS); Urban Management Office (UMO)</td>
</tr>
<tr>
<td>Landscape</td>
<td>Making compensation for the damaged green belts and trees. Planting trees and afforesting according to the urban planning.</td>
<td>Project Management Unit (PMU) Greens and Trees Company</td>
</tr>
<tr>
<td>Sunshine</td>
<td>Continue to strictly control the height of the buildings by the two sides of the roads as well as the distance between the sunlight sensitive buildings and the red line on the road.</td>
<td>Urban Planning Dept.</td>
</tr>
<tr>
<td>Water environment</td>
<td>Further improve the layout of drain pipe line all over the city, enforce the management on the sewage disposal equipment in the public transit terminals and head and end bus depots to make the discharge of sewage up to the standards.</td>
<td>Hanoi Sewerage and Drainage Company</td>
</tr>
</tbody>
</table>
VI. IMPLEMENTATION OF MITIGATION MEASURES

The main components are BRT, extension and new construction road in this Project are clearly described in "Hanoi Urban Transportation Development Plan". These are priorities which have been selected based on despondence to the socio-economy and demands of traffic and transportation needs, bringing the benefits to the City as well as improvement of urban environment.

The objectives of the BRT are to meet the demand of development process, improvement of traffic situation (reduction of traffic jam), and minimization of environmental pollution in urban areas. If quality of service improves and bus journey time decrease compared with other modes, and these conditions will attract passengers and increase bus and public transport demand and usage. These conditions also will serve as a deterrent to high usage of motorbikes. Safety and congestion are also factors affecting motorbike traffic. Also transport policy which encourages public transport and discourages motorbikes should play an important role for increased use of buses in the short range period. The new road component will be implemented basing on the Master Plan on City development and Hanoi Transportation Planning to the year 2020 aiming at improving transportation situation in urban areas.

The mitigation measures will be implemented at the same time with the project component implementation, following the following general principles:

- The mitigation measures of the different phases (design, construction and operation) will be implemented within their respective phases;
- Some mitigation measures have to be implemented prior to the occurrence of the potential impacts these measures suppose to address. For example, compensation to land and household owners must be completed prior to actual house demolition and land acquisition.
- Mitigation measures must have sufficient budget to ensure they can be implemented with needed resources.
- The organizations responsible for mitigation measure implementation will be advised of their duties ahead of time and training may be provided as may be needed.
- Mitigation measure implementation will be monitored to determine their effectiveness and adjusted/modified as may be needed.

Most of the main items of the project have been defined in the Planning, activities on development of areas on both sides of the roads have been monitored, mitigation measures have been proposed. The owner of project commits to implementing strictly the environmental mitigation measures that are presented in this report during project implementation period as well as the relevant environmental protection requirements promulgated by the Government.
VII. COMPARISON OF WITH AND WITHOUT THE PROJECT

The existing traffic conditions in Hanoi where a great number of motor bikes are used may not last for too long. In case no project is implemented, in the near future when more cars are used, the requirement on more space for cars in replacement of motor bikes would lead to the need for more roads or congestion resulting in the worsened traffic jam, safety for the city, reduced efficiency in urban transportation and worsened environmental quality.

Without implementation of this project would result in worse air quality compared with the scenario that this project is implemented. Along with the increased urbanization, urban population increase and enhanced standard of living of the residents, transportation needs are expected to increase. Without the project, the needs may be met by increased motorbike fleet and, as expected, passenger vehicle fleet increase. The increased motor vehicle fleet and motor vehicle traffic in the city, coupled with the increased traffic jams in the city center, will result in increased motor vehicle emissions and thus worsened ambient air quality. The increased motor vehicle traffic and traffic jams will also bring with it other adverse environmental and social impacts such as increased noise, safety concerns, and poor service in transportation.

The BRT system of the project would provide more frequent, quick and more convenient bus service, which will help attract public transport users and reduce the motorbike and passenger car traffic. This would in turn reduce of traffic jam especially at interchanges, and at rush hours; improving efficiency of transport by increased vehicle driving speed, less start/stop, and acceleration/deceleration and thus reduced emissions and improved air quality compared with the without the project scenario.

Without the project would affect further development of the city. Part of the urban which under the city’s master plan do not have roads or sufficient roads. In a more general context, the road infrastructure development which this project supports is a key precondition for achieving the city’s master plan, sustainable economic development and continued improvement of the standard of living for the citizens of Hanoi.

VIII. PUBLIC CONSULTATION

8.1. Objectives

Public consultation is a part of the EIA following the Environmental Protection Law as well as the World Bank safeguard policies. The public consultation has been carried out by CEETIA in coordination with engineers of MVA on technical, design aspects and corporation
of PMU which is under Department of Transportation and Public Works and the people in project area. Results from consultation activities are used for assessment of design options, development of mitigation measures and achievement of support from the communities during project implementation. The public consultation is a requirement to ensure the participation of all stakeholders to the process of establishment and implementation of the project.

The main purposes of public consultation are to better understand public opinions and concerns on the project, especially the directly affected population during contraction and operation of the project. On this basis, the public concerns would be reasonably settled and addressed in project preparation, selection of options, design and establishment of mitigation measures.

There were two rounds of public consultation based on the OP4.01 requirement, conducted as public meetings: The purposes of the first round of public consultation were to provide the concerned public a project description and to explain the potential impacts of the project to the environment and the communities and on this basis to receive public concerns on project design, construction and operation. The second round of public consultation conducted after the draft EA report was prepared and the objectives are to respond to public concerns raised from the first round of consultation, to explain the levels of the impacts based on the impact assessment and to inform the public the detail of mitigation measures and residual impacts following the mitigation.

8.2. Major Contents of Meetings

The project contents are presented by the PMU and MVA Consultant and potential impacts are presented by the EA team in the meetings. The presented contents and opinions are recorded in minutes of the meetings. The minute of meeting and list of participants are presented in annex of the main report.

The following major contents and opinions were raised in the meetings:
- Traffic and traffic management were one of the concerns in Hanoi City. For example, the construction of road system for BRT, traffic nodes in Cau Giay and Buoi Rd, Second Ring Road, etc;
- Standards for air and exhausted gas from vehicles have not met the standards;
- Expression of support to increase of public transport including more buses;
- Concerns about dust and noise during construction of the project;
- Recommended to use traffic lights with second counting;
- Require the close cooperation between sectors in the city and other agencies during construction and good cooperation with other infrastructure management agencies, especially water supply system, drainage system, power supply system;
- Improvement of noise, dust and wastewater pollution control;
Securing the safety for the people involving in traffic, especially where roads for busses pass through;
Most of the participants showed support to the project.

The participants of project-affected Town and Wards generally appreciated the PC meetings on the environmental impacts. In virtual all PC meetings, especially the PC meeting at Tu Liem District and Xuan La Ward, attending participants favored the road project, noting that improved and constructed new roads would promote economic development, growth of businesses and better access to transportation systems. Although respondents were supportive of the road and BRT project, they addressed the need for project’ works to be completed in a timely manner to limit disruption to their daily lives and economic activities and to allow them to return to their normal lives as quickly as possible. Participants also recommended that design and construction be well planned so that road and utility construction will be coordinated and will not need to be repeated and thus avoid further impacts to the environment and community in the future.

The EA team sent questionairs on Hanoi Urban Transportation Development Project to relevant areas in Hanoi city from August 1st to 28th 2005. Total number of 700 questionair papers were sent and 604 replied. The result of and main concerns raised in the questionnaire survey were:
- There were 58.63% of the opinion that Hanoi transportation is normal and should be improved, a rather high ratio of 30.52 of the opinions that the current situation of transport in Hanoi is bad;
- Being asked about the measures for transportation improvement, 27.04% of the people answers that transportation planning should be pushed up; 26.65% shoed the need to decrease the number of motorbikes in the city; 26.07% of the people said that new road should be provided and the rest of 20.23% presented the need on increase of public transport means;
- Most of the opinions agreed with the major environmental issues during construction and operation of the project which are dust and exhausted gas pollution which is 36.06% and 36.17% correspondingly. Attention should be paid to mitigation measures to pollution like dust decrease and regular watering and 52.59% of the replies agreed with this solution;
- 41.52% of the opinion showed the need for implementation of mitigation measures to noise pollution by tree planting along road sides;
- 61.47% of the replies there are solutions to avoid impacts to plants and domestic animals;
- The answers to the fact that project area cover the sensitive targets like cemeteries, schools, the opinion to agree on removal and compensation accounts for 40.87% of the total replies;
- The awareness of the interviewed people on Hanoi Urban Transportation Development
Project are rather equal with 34.63% of the people who thinks the project implementation would contribute to the improvement of current transportation situation and socio-economic improvement of Hanoi Capital; 34.02% of the replies agreed that the project would contribute to creation of convenience in transportation within the cities and 28.48% of the replied agreed that the project would help to make the city more beautiful;

- 96.43% of the replies showed support to the project implementation

8.3. Public Consultation Summary

The public consultation (PC) meetings have reflected the active interests of government officials and road are residents in all of the potential impacts of the HUTDP. The PC participants are aware of existing social and environmental conditions in the areas along the HUTDP and appear to be well informed regarding the proposed construction activities. In general, participants agree with the mitigation measures laid out in the EIA and EMP.

In PC meetings, residents are recommended to review the effectiveness, implementation and enforcement of agreed mitigation measures, the extent to which they address their initial concerns as well as to address new that may arise. By fostering the active interest and involvement of the stakeholders throughout the entire road works program, the PC process will ultimately increase the effective progress and development of the HUTDP. Finally, the delegates hoped that the mitigation measures must be implemented seriously.

IX. ENVIRONMENTAL MANAGEMENT PLAN

A stand alone document has been prepared as environmental management plan (EMP) which contains details of the mitigation measures for different environmental impacts, environmental management, supervision, institutional strengthening and environmental monitoring. Thus, the EMP can be used as a guidance document for the implementation of the above-mentioned activities.

Overall objective of the EMP is to maintain the sustainability of the urban social economic and environmental development, control the urban environmental quality, and minimize and reduce or otherwise compensate adverse impacts to the communities and the environment during the project construction and operation. More specifically, the EMP is to

- Define environmental mitigation measures for the impacted targets. The Project Management Office, environmental assessment team and design institute have made on-the-spot investigation and confirmation for the impacted sensitive receptors of this project. On this basis, effective mitigation measures have been developed collectively. These mitigation measures have been incorporated into the engineering design of this
project to ensure their implementation.

- Provide an environmental management guidance. The EMP, after being reviewed by the World Bank, will be the environmental document that will be provided to PMU, the construction supervision unit, environmental supervision unit, contractors and other project-related institutions during the construction and operation phases.
- Define of roles and responsibilities of relevant institutions. The roles and responsibilities of the relevant functional organizations and administrative institutions are defined. The approaches for communications and exchanges between different institutions are also proposed.
- Develop programs for environmental monitoring in construction and operation phases. EMP has developed the environmental monitoring programs for the construction and operation phased, so as to guarantee the effective implementation of the environmental mitigation measures and to handle the unpredictable environmental problems or contingency at the earliest time possible.

*Environmental Management Organizations* A number of organizations will be involved in environmental management during the project construction and operation. These include relevant government agencies, project owners, and other project participants such as contractors. The environmental management organizations involve in and their interrelation are presented in an organizational charge. The functions of each organization are summarized in Table 9-1.

<table>
<thead>
<tr>
<th>Organizations</th>
<th>Responsibilities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hanoi TUPWS and Hanoi CPC</td>
<td>The ultimate decision making body for all matters related to environmental management</td>
</tr>
</tbody>
</table>
| Hanoi DONRE | • Law and regulations enforcement  
• Environmental policy/program implementation  
• Setting up and enforcing discharge standards  
• Provide guidance on environmental matters  
• Review environmental reports  
• Handling environmental emergency |
| PMU | • Project proponent and executing agency  
• Day to day operation during construction including environmental matters  
• Will have two full time environmental specialists  
• Prepare contractual requirements and specification for environmental performance for contractors and construction supervision  
• Implement environmental mitigation measures  
• Review and respond with new mitigation as may be necessary to environmental monitoring reports. |
| Environmental Monitoring Stations | • Conduct environmental monitoring for both construction and operation stages  
• Provide monitoring reports  
• Recommend corrective actions |
Environmental monitoring plan: Environmental monitoring will be carried out in both the construction and operation stages. In the construction stage, the monitoring will be done in two levels: daily and regular monitoring, to be carried out by contractors and construction supervision companies. At the same time, in addition to the daily monitoring by contractors a formal environmental monitoring program will also be carried out during the construction, as well as operation phase. This program will be conducted by professional environmental monitoring program with main objective to provide official records on environmental and regulatory compliance status. The formal environmental monitoring plan for both construction and operation stages is presented in Table 9-2 and the cost of the monitoring program is presented in Table 9-3.

<table>
<thead>
<tr>
<th>Environment</th>
<th>Item</th>
<th>Contents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Air</td>
<td>Parameter</td>
<td>NO₂, CO, TSP, PM₁₀</td>
</tr>
<tr>
<td></td>
<td>Length</td>
<td>1 year for construction and first 2 years in operation</td>
</tr>
<tr>
<td></td>
<td>Frequency</td>
<td>Once a quarter and 5 continuously monitoring each time</td>
</tr>
<tr>
<td></td>
<td>Time</td>
<td>6:00, 10:00, 14:00, 18:00 (TSP and NO₂)</td>
</tr>
<tr>
<td></td>
<td>Location</td>
<td>BRT: Nguyen Thai Hoc (Phan Chu Trinh Primary school, Sanhpon Hospital. Bach Mai Hospital – Gia Phong Rd. Terminal Quang Lai, Bala- Depot: Trung van- Van Dien Road: Buoi Interchange: Residential area Cau giay Interchange: Residential areas Phu Dien kindergarten</td>
</tr>
<tr>
<td>Noise</td>
<td>Parameter</td>
<td>Noise level equivalent (Leq)</td>
</tr>
<tr>
<td></td>
<td>Length</td>
<td>1 year for construction and first 2 years in operation</td>
</tr>
<tr>
<td></td>
<td>Frequency</td>
<td>Once a quarter and one day each time</td>
</tr>
<tr>
<td></td>
<td>Time</td>
<td>One during the day and one at night</td>
</tr>
<tr>
<td></td>
<td>Location</td>
<td>As same as for air</td>
</tr>
<tr>
<td>Water</td>
<td>Parameter</td>
<td>Surface water: pH, SS, BOD, ΣN, ΣP, Coliform Underground water: SS, Fe,Mg,Oil, NH₄, NO₃, Coliform</td>
</tr>
<tr>
<td></td>
<td>Length</td>
<td>1 year for construction and first 2 years in operation</td>
</tr>
<tr>
<td></td>
<td>Frequency</td>
<td>3 months/time (construction phase) 6 months/time (operation phase)</td>
</tr>
<tr>
<td></td>
<td>Time</td>
<td>Day time</td>
</tr>
</tbody>
</table>
Table 9-3. Cost for Monitoring Works

<table>
<thead>
<tr>
<th>No</th>
<th>Items</th>
<th>Cost (1000, VND/year)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Air monitoring</td>
<td>99,280</td>
</tr>
<tr>
<td>2</td>
<td>Noise monitoring</td>
<td>10,000</td>
</tr>
<tr>
<td>3</td>
<td>Water monitoring</td>
<td>11,840</td>
</tr>
<tr>
<td>4</td>
<td>Subtotal</td>
<td>121,120</td>
</tr>
<tr>
<td>5</td>
<td>VAT (5%)</td>
<td>6056</td>
</tr>
<tr>
<td>6</td>
<td>Management fee</td>
<td>3634</td>
</tr>
<tr>
<td>7</td>
<td>Grand total</td>
<td>130,810</td>
</tr>
</tbody>
</table>

**Personnel Training:** Personnel training is a key part of the institutional strengthening and will be provided in different stages of project implementation. At the construction stage, heads and environmental staff from winning contractors and construction supervision companies will be requested to participate in a mandatory environmental training program. This request will be included in the construction tendering documents to be issued to the pre-qualified bidders who will be invited to bid. At the operation stage, training will be provided to project owners and operators (bus company, terminal management, urban transportation department) to raise the environmental awareness, environmental policies, impact mitigation implementation and environmental monitoring and reporting procedures.

X. ENVIRONMENTAL ASSESSMENT FOR RESETTLEMENT SITE

10.1. Site Planning and Baseline Conditions

The CT1 resettlement site is located northwest of Hanoi city center and will occupy 2.09 ha of land with a 0.48 ha of construction area. Current land use is seasonal crop plantation and no protected flora and fauna and valuable natural habitats were found. Also there are no cultural and historical relics in this area. CT1 is a land plot in a 100 ha of land zone which has been planned for a new city urbanized zone in Tu Liem District – Hanoi since 1996. Baseline monitoring results showed that nearby canals were polluted with domestic wastewater, and the air quality was relatively good.

Basic features for planning CT1 site are as listed below:
Total land area: 20,900.00 m²
Construction area: 4,810.00 m²
Total floor area: 88,616.00 m²
Construction density: 18.7%
Number of floors in average: 18.42 Floors

10.2. Environmental Impacts and Mitigation Measures

Major environmental impacts would be limited to dust and noise during construction and water pollution due to domestic wastewater. Since there are few residents near the construction site, the impacts of construction dust and noise are very limited. In order to address domestic wastewater generated from the resettled residents, a wastewater collection and treatment system will be completed before the project site comes into operation.

10.3. Environmental Management Program

PMU is responsible for the implementation of the EMP. Air, water and noise monitoring will be carried out by an independent environmental monitoring institution. The cost of implementing environmental supervision and monitoring is estimated VND 60 million per year in the construction phase and 20 million per year in the operation phase.

Content of monitoring program

- Quality of the air and noise during the construction and operation phase
- Quality of water including surface water, underground water and waste water during the construction and operation phase
- Supervise the collection, classification, and treatment of solid waste in the construction and operation phase

Institutional arrangement for environmental management

The worst impact of the project is expected in the construction period, mainly due to the site clearance, earth works and building of infrastructure network. PMU will include mitigation measures as proposed in the EIA report in the contract with construction contractors. In the construction phase, construction contractors have responsibility in the implementation of environmental protection measures and monitoring requirements. PMU will appoint a specialist to inspect and supervise the implementation of EMP to ensure that the mitigation measures and environmental monitoring requirement are appropriately executed.
10.4. Public Consultation

Public consultation was conducted by means of two times of public consultation meetings in August 2005 and September 2006 and a questionnaire survey in May/June 2006. The main concerns expressed included environmental pollution and life disturbance during construction and their concerns were addressed in the EMP.

XI. CONCLUSIONS

Hanoi Urban Transport and Development Project is a project with multi-objectives on improvement and upgrading the transportation system for the national capital Hanoi. The project which consists mainly of a new road component and bus rapid transit (BRT) component will bring the following benefits:

*From BRT Component:* The establishment of BRT system in Hanoi City will contribute to improve the level of public traffic management and service and ensure the priority of public transportation.

BRT system will also significantly contribute to reduce number of individual vehicles such as motorbikes and cars due to the people use the public buses thus the traffic volumes and traffic jams. As such The implementation of BRT system will effectively reduce the pollution of motor vehicle emissions, especially reduce the emitted gases from motorcycles and contribute significant improvement for the environment and air quality of Hanoi city. The improved public transport system in general and BRT in particular will contribute to poverty reduction of the city due to the affordable transportation, help the city’s competitiveness and make the city a more livable place.

*From Road Component:* Ring Road N°2 will also help contribute to reducing traffic jams and improving air quality. The road component will greatly improve the city’s infrastructure and road network and as such improve the transportation efficiency. The new road and
extension road will create more advantages for transportation activities, increase the urbanization and indirect profits such as community and economic development.

**Adverse impacts:** The implementation of the project is expected to also bring a certain adverse impacts to the social and natural environments in the city. These include mainly the land acquisition and resettlement, increased noise levels, increased traffic and thus air emissions along the new project roads, etc. Detailed mitigation measures and an environmental management plan have been developed. Once the mitigation and EMP are appropriately implemented, the adverse impacts will be reduced to acceptable levels.